BusConnects Galway: Cross-City Link (University Road to Dublin Road)

August 2022

Environmental Impact Assessment Report

Volume 4

Appendices

BUS CONNECTS GALWAY

SUSTAINABLE TRANSPORT FOR A BETTER CITY.

Preface

The structure of this Environmental Impact Assessment Report (EIAR) for the BusConnects Galway: Cross-City Link (University Road to Dublin Road) (hereafter referred to as the Proposed Scheme) is summarised as follows:

Volume 1: Non-Technical Summary

Volume 1 provides a non-technical summary of the information contained in Volume 2 of the EIAR.

Volume 2: Main Environmental Impact Assessment Report

Volume 2 provides a general introduction, outlines the environmental impact assessment process, describes the scope of the Proposed Scheme, presents the consideration of reasonable alternatives and describes the environmental impacts specific to the Proposed Scheme.

Volume 3: Figures

Volume 3 provides drawings and large format images (labelled as ‘Figures’) that illustrate the information detailed in Volume 2 of the EIAR.

Volume 4: Appendices

Volume 4 provides documentation and data that is supplemental to the information provided in Volume 2 of the EIAR.

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(Proposed Scheme Description) Appendices

Galway City Council

BusConnects Galway: Cross-City Link Scheme

Drainage Preliminary Design Report

Issue | August 2022

Job number 253352-00

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Contents

1 Introduction, Description and Project Background

BusConnects is the National Transport Authority's (NTA) programme to improve bus and sustainable transport services. It is a key part of the Government's policies to improve public transport and address climate change.

BusConnects Galway Cross-City Link (CCL) is associated with the Galway Transport Strategy (GTS), Bus Connects Infrastructure Program and Project Ireland 2040.

The Cross-City Link provides dedicated space to serve all proposed city bus services, by providing bus priority through the city centre core. The objective of the Cross-City Link is to prioritise walking, cycling and public transport along its length, whilst facilitating essential private traffic on appropriate alternative routes.

The GTS identified the proposed improvements to the city transport network including the 'Cross-City Link', 'City Centre Access Network', and 'Inner City Access Route'. These three elements are illustrated below in Figure 1.

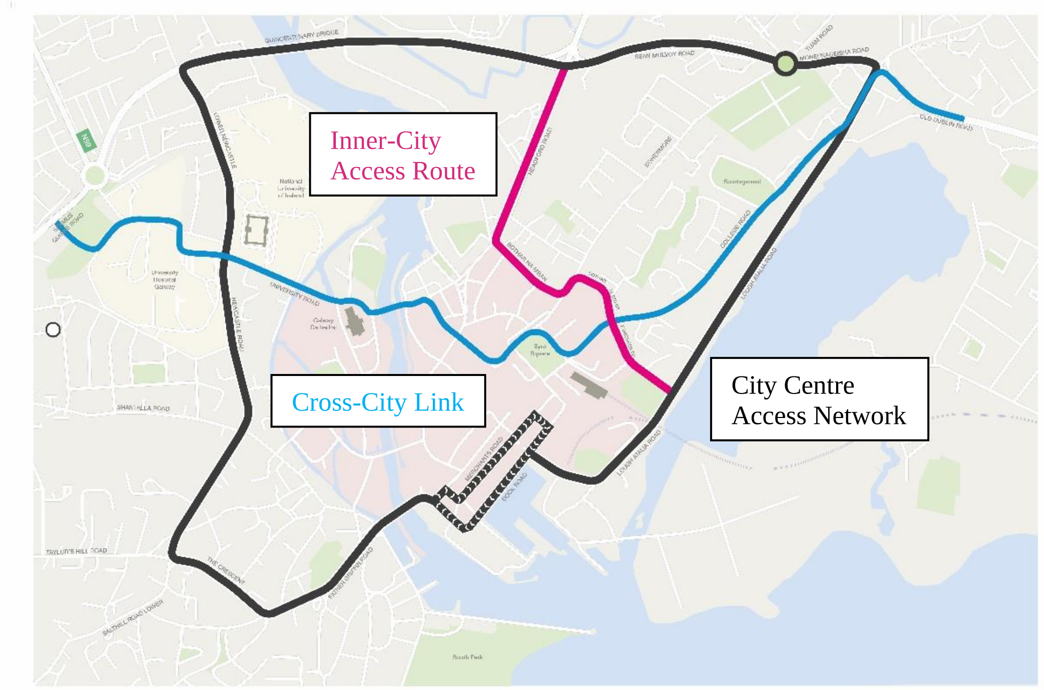

Figure 1: Cross-City Link, City Centre Access Network and Inner-City Access Route (source: Galway Transport Strategy)

2 Purpose of the Drainage Preliminary Design Report

The Drainage preliminary Design Report sets out the principal objectives, preliminary strategy and design criteria to be used as part of the Drainage Design of BusConnects Galway Cross-City Link Scheme.

The report runs through the existing watercourses and culverts, existing drainage networks, proposed drainage works, preliminary drainage design and summary of the surface water drainage including attenuation features, Sustainable Drainage Systems (SuDS) and Outfalls.

2.1 Overview of Drainage Strategy

The drainage preliminary design was developed following consultation with Galway City Council. The strategy and design parameters to be adopted throughout the Proposed Scheme is summarised in the Design Basis Statement Document No 253352-00 Drainage Design Basis included in Sub-Appendix 4.1A. The design basis statement was developed taking account of the Greater Dublin Strategic Drainage Study (GDSDS), Planning requirements of Galway City Council, Transport Infrastructure Ireland (TII) requirements and international best practices such as CIRIA The SuDS Manual (C753).

The principal objectives of drainage design are as follows:

- To drain surface water from existing and proposed pavement areas throughout the Proposed Scheme and maintain the existing standard of service.
- To maintain existing run-off rates from existing and newly paved surfaces using Sustainable Urban Drainage Systems (SuDS).
- To minimise the impact of the runoff from the carriageway on the surrounding environment using SuDS and/or silt traps.

No drainage features like gullies or manholes will be located at, or any ponding will be allowed to occur at, pedestrian cross-walk locations or at bus-stop locations. Drainage of newly paved areas includes SuDS measures to treat and attenuate any additional run-off where possible. These measures ensure that there is:

- No increase in existing run-off rates from newly paved areas; and
- Appropriate treatment to ensure run-off quality.

A hierarchical approach to the selection of SuDS measures has been adopted with ‘Source’ type measures e.g. Tree pits implemented in preference to catchment type measures e.g. attenuation tanks. Further details of the SuDS hierarchy are provided in the Drainage Design Basis Statement in Sub-Appendix 4.1A.

2.2 Existing Watercourses and culverts

All watercourse and crossing details in the vicinity of the Proposed Scheme have been identified as shown in Table 1 below. A Stage 1 Flood Risk Assessment (FRA) has been completed on the Preliminary Design and is summarised in Appendix 13.1.

The location of existing watercourses and culverts has been identified using OS Mapping (www.osi.ie) and The Galway Waterways Foundation (www.galwaywaterways.ie). The Proposed Scheme crosses the following watercourses:

Table 1: Location of Existing Watercourses

Watercourse	Crossing Detail
Eglinton Canal	Bridge
Gaol River	Bridge
Distillery River	Bridge
River Corrib	Bridge
Friar’s River	Bridge

2.3 Existing Drainage Description

Based on the information received from Irish Water and Galway City Council, the Proposed Scheme is serviced by surface water and combined drainage networks. The surface water drainage system is managed by the Local Authority, whilst combined sewer systems are managed by Irish Water. Flows are typically collected in standard gully grates and routed via a gravity network to outfall points. There are no SuDS/attenuation measures on the existing drainage networks to treat or attenuate run-off from the existing carriageways.

The existing drainage network along the scheme can be split into 17 catchment areas based on topography and the existing pipe network details supplied by Irish Water and Galway City Council. The approximate catchment areas, existing sewer networks, outfalls and watercourses are shown on the existing catchment drawings, refer to drawing BCG-DN-01-01. The catchments are summarised in Table 2.

Table 2: Summary of Existing Catchments

Existing Catchment Reference	Approx. Drainage Catchment Area (km^2)	Existing Network Type	Existing Outfalls
Catchment 1	0.3399	Combined Sewer	Network outfalls to Mutton Island Wastewater Treatment Plant.
Catchment 2	0.0089	Combined Sewer	Network outfalls to Mutton Island Wastewater Treatment Plant.
Catchment 3	0.0093	Surface Water (Storm)	Network outfalls to the Distillery River.

Existing Catchment Reference	**Approx. Drainage Catchment Area (km^2)**	**Existing Network Type**	**Existing Outfalls**
Catchment 4	0.0121	Surface Water (Storm)	Network outfalls to the Distillery River.
Catchment 5	0.2280	Combined Sewer	Network outfalls to Mutton Island Wastewater Treatment Plant.
Catchment 6	0.0013	Surface Water (Storm)	Network outfalls to Friar’s River.
Catchment 7	0.0068	Surface Water (Storm)	Network outfalls to the River Corrib.
Catchment 8	0.0181	Combined Sewer	Network outfalls to Mutton Island Wastewater Treatment Plant.
Catchment 9	0.3987	Surface Water (Storm) and Combined Sewer	Network outfalls to Mutton Island Wastewater Treatment Plant and to Galway Bay.
Catchment 10	0.0130	Surface Water (Storm)	Network outfalls to Lough Atalia.
Catchment 11	0.0356	Surface Water (Storm)	Network outfalls to Lough Atalia.
Catchment 12	0.0558	Combined Sewer	Network outfalls to Lough Atalia Pumping Station, then to Mutton Island Wastewater Treatment Plant.
Catchment 13	0.0093	Surface Water (Storm)	Network outfalls to Lough Atalia.
Catchment 14	0.0964	Surface Water (Storm)	Network outfalls to Lough Atalia.
Catchment 15	0.0008	Surface Water (Storm)	Network outfalls to Lough Atalia.
Catchment 16	0.0136	Surface Water (Storm)	Network outfalls to Lough Atalia.
Catchment 17	0.0065	Surface Water (Storm)	Network outfalls to Lough Atalia.

2.4 Overview of Impacts of Proposed Works on Drainage / Runoff

Whilst in some areas the Proposed Scheme increases the impermeable areas, additional permeable areas are also provided by the softening of public realm along the routes. The drainage design aims to sustain flow levels within the existing pipe network after a rainfall event by controlling discharge rates within each catchment. Flows are being controlled by the implementation of SuDS techniques. One of the principal objectives of the road drainage system is to minimise the impact of the run-off from the carriageway on the surrounding environment via the positioning of: filter drains, swales, bio retention areas, Tree pits, silt traps and attenuation features if necessary.

The proposed surface water drainage works are shown on the drawings BCG-DN-00.

Error! Reference source not found. 3 provides information of the proposed additional catchments (new paved areas) against the proposed permeable areas (current paved areas to become grassed).

Table 3: Summary of Increased Permeable and Impermeable Areas

Existing Catchment Reference	Road Corridor Area (m^2)	Change of use to Impermeable areas (m^2)	Change of use to Permeable areas (m^2)	Net Change (m^2)	Percentage Change (%)
Catchment 1	5675	0	333	-333	-5.9%
Catchment 2	2244	0	81	-81	-3.6%
Catchment 3	9185	19	693	-674	-7.3%
Catchment 4	3079	12	302	-290	-9.4%
Catchment 5	19894	16	830	-814	-4.1%
Catchment 6	323	0	21	-21	-6.5%
Catchment 7	2753	344	152	192	7.0%
Catchment 8	8109	0	405	-405	-5.0%
Catchment 9	27618	7	597	-590	-2.1%
Catchment 10	3182	0	37	-37	-1.2%
Catchment 11	8979	0	89	-89	-1.0%
Catchment 12	1116	276	87	189	16.9%
Catchment 13	3031	333	386	-53	-1.7%
Catchment 14	12356	1366	142	1224	9.9%
Catchment 15	830	6	29	-23	-2.8%
Catchment 16	501	35	0	35	7.0%
Catchment 17	523	0	0	0	0.0%

2.5 Preliminary drainage design

The existing drainage network is being maintained and used as the main discharge point for the new drainage system. The design aims to replicate the existing situation. Where new multiple gully connections discharging to a combined sewer are required, a new surface water pipe is being provided where possible and connected to the combined sewer as per Irish Water requirements.

The following drainage systems were considered for the Proposed Scheme where new paved areas are proposed:

- **Sealed drainage (SD)** comprises side entry gullies and sealed pipes. They collect, convey and discharge run-off. The side entry gullies are being located within the kerbline mostly between the cycle track and bus lane, and/or the footpath and the cycle track, depending on the carriageway profile.
- **Grass Surface Water Channels, Swales and bio-retention areas/rain gardens (SW/RG)** are provided as road edge/footpath edge drainage collection systems. They provide treatment and will provide attenuation if required. A filter drain can be laid under the bio-retention areas to keep them dry during low return period rainfall events.
- **Filter Drains (FD)** are provided as road edge channels. These comprise a perforated pipe with granular surround and are designed to convey, attenuate and treat run-off prior to discharge.
- **Tree pits (TP)** are provided in close proximity to the carriageway, where practicable. These receive flows from the sealed pipe network and from footpaths, and are designed to convey, attenuate and treat run-off prior to discharge.
- **Attenuation Tanks/oversize pipes (AT/OSP)** – Where there is insufficient attenuation volume provided by the proposed SuDS drainage measures, hard attenuation measures such as concrete attenuation tanks and/or oversize pipes are provided to meet the required attenuation volume.
- **Petrol Interceptors (PI)** are typically provided in areas where surface water is collected from trafficked roads, where a risk of oil entering the drainage network exists. They separate the oil prior to the surface water being discharged from the network.

2.5.1 Summary of Surface Water Drainage

The proposed drainage types for the Proposed Scheme are listed on **Table 4**.

Table 4: Summary of Proposed Surface Water Infrastructure

Catchment	Chainage	Drainage Type
Asset Owner/Location: Galway City Council		
Catchment 01	Canal Road Upper, discharging into the Eglington Canal	Sealed pipe network and petrol interceptor
Catchment 07	Dyke Road	Oversized pipe
Catchment 11/12	College Road, discharging to Lough Atalia	Sealed pipe network, petrol interceptor, tree pits and attenuation tank
Catchment 13/14	College Road, discharging to existing surface water sewer.	Oversized pipe and petrol interceptor

Catchment	**Chainage**	**Drainage Type**
Catchment 14	College Road, discharging to existing surface water sewer.	Oversized pipe and petrol interceptor
Catchment 14	Dublin Road, discharging to existing surface water sewer.	Oversized pipe and petrol interceptor
Catchment 14	Dublin Road, discharging to existing surface water sewer.	Oversized pipe and petrol interceptor
Catchment 14	Moneenageisha Court, discharging to existing surface water sewer.	Permeable paving
Catchment 14/16	Dublin Road, discharging to existing surface water sewer.	Oversized pipe and petrol interceptor
Asset Owner/Location: Irish Water		
Catchment 01	University Road, discharge into combined sewer network at junction with Canal Road Upper.	Sealed pipe network
Catchment 05	Junction of Headford Road and St. Brendan's Avenue to the junction of Eyre Street and Woodquay Street. Discharging to existing combined sewer network.	Sealed pipe network
Catchment 09	Merchant's Road and Forthill Street, discharging to existing combined sewer.	Sealed pipe network

2.5.2 Summary of Attenuation Features, SuDS and Outfalls

Where practicable, and in new areas of public realm gained as part of the design, a sustainable drainage system is considered in the form of rain gardens, bioretention areas, filter drains, swales, tree pits, permeable paving etc. SuDS are also being considered in existing areas, where practicable and possible.

The proposed attenuation measures from the Proposed Scheme is summarised for each proposed catchment. Refer to Table 5. Locations not shown in the table below do not require attenuation or SuDS.

Table 5: Summary of Proposed SuDS, Attenuation Features and Outfall Locations

Location	**Approx. Impermeable Surface Area**		**Permitted Discharge (l/s)**	**Possible SuDS solution/ attenuation measure**	**Catchment Outfall**
	Existing (m^2)	**Change (m^2)**			
Asset owner: Galway City Council					
Dyke Road	1,255	324	19.5	39m of 300mm OSP	Existing SW in Dyke Road
College Road	1,790	465	27.6	47m of 300mm OSP	Existing SW in College Road
College Road	1,666	421	26	64m of 300mm OSP	Existing SW in College Road

College Road	11,927	0	Tidally influenced receptor.*	279m^3 attenuation tank	Lough Atalia
Dublin Road	1,570	96	30.7	44m of 300mm OSP	Existing SW in Dublin Road
Dublin Road	2,330	255	43.3	51m of 300mm OSP	Existing SW in Dublin Road
Dublin Road	1,836	232	28.0	76m of 300 OSP	Exiting SW in Dublin Road

(*) With the exception of a small number of junctions with adjacent roads, the existing catchment from the start of College Road is predominantly draining downhill to existing gullies at the bottom of the road, close to the Abbey Lodge Guesthouse. A 150mmØ pipe collects the gullies and discharges to Lough Atalia, without any known attenuation or treatment. The existing pipe also collects surface water from a small residential section of Loyola Park Road, and it is expected to collect an overflow of up to 2l/s from the Galway Greyhound Stadium once planned upgrade works are complete. A new surface water pipe has been proposed to collect possible additional gullies and slot drains or aco channels expected in College Road as a result of geometry changes and footpath widenings. In order to replicate the existing situation a 150mm Ø orifice has been proposed downstream of the catchment in addition to an attenuation tank to avoid flooding in a 1 in 30 year rainfall event and a 20% climate change allowance. A petrol interceptor has been provided downstream of the orifice, as well as tree pits and catchpits to contribute to an additional level of treatment. The proposed new surface water pipe would collect the same flow as the existing 150mmØ pipe, and therefore the flows to Lough Atalia would not be altered. The existing 150mmØ will be retained.

2.6 Drainage at New Bridge Structures

There are no new bridge structures in the Proposed Scheme that require special surface water management techniques.

Galway City Council

BusConnects Galway: Cross-City Link

Drainage Design Basis

253352-00 Drainage Design Basis

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Contents

1 Introduction

1.1 Purpose of the report

The aim of this report is to establish the drainage strategy and design criteria to be used as part of the Drainage Design of the BusConnects: Galway-Cross-City Link Scheme.

1.2 Background and Overview of the Project

BusConnects is the National Transport Authority’s (NTA) programme to improve bus and sustainable transport services. It is a key part of the Government’s policies to improve public transport and address climate change.

BusConnects Galway Cross City Link (CCL) is associated with the Galway Transport Strategy (GTS), Bus Connects Infrastructure Program and Project Ireland 2040.

The aim of the BusConnects programme is to transform Galway City’s bus system, with the Cross-City Link scheme providing dedicated space to serve all proposed city bus services, by providing bus priority through the city centre core. The objective of the Cross-City link is to prioritise walking, cycling and public transport along its length, whilst facilitating essential private traffic on appropriate alternatives. This project is fundamental to addressing the congestion issues in the Galway City region with the population due to grow by 50-60% by 2040, an increase of up to 50,000 more people.

The scheme aims to implement an optimum project cross-section to include footpaths and bus lanes on both sides of the road throughout the scheme network where feasible. Cycle Tracks will also be introduced, where feasible. In some instances, this will necessitate a Compulsory Purchase Order (CPO) process to include portions of private land to achieve the project objectives.

1.3 General principles of drainage design

The main general principles considered as part of the drainage design are as follow:

- The existing drainage network will be maintained and used as the main discharge point for the new drainage system. The idea of the design is replicating the existing situation. Where new multiple gully connections discharging to a combined sewer are required, a new surface water pipe is being provided where possible and connected to the combined sewer. This is applicable in areas where kerbs are changing, and gullies are being relocated as a result.
- One of the principal objectives of the road drainage system is to minimise the impact of the runoff from the roadways on the surrounding environment via the provision of Sustainable Drainage Systems (SuDS).

SuDS are being proposed as a first preference and in accordance with the SuDS hierarchy. Please refer to Section 3.

- At planning stage, the design is being developed based on assessment of existing drainage records, topographical survey and google street view and aerial imagery, along with some specific targeted surveys if required. If available, additional information from Galway City Council (GCC) or Irish Water (IW) will be reviewed and considered where relevant.
- Permeability tests are not being carried out and thus at Planning Stage infiltration rates are not being considered within the calculations. The use of measures such as bioswales/rain gardens or tree pits are being promoted where appropriate.
- The design is based on not increasing the flows to the existing network. In areas where impermeable areas increase, SuDS and attenuation are being provided. Where spatial or other constraints make the use of SuDS impractical, or when SuDS do not provide enough attenuation, oversized pipes or attenuation tanks are being provided. The choice of SuDS options to be considered are shown in Section 3.
- Existing services & utility information are being reviewed to support design and proposed location of the various drainage elements within the BusConnects corridors. There is limited information available of vertical alignment of existing services and utilities. The potential risk from clash of service with the proposed drainage will need to be assessed at the detailed design stage of the project.
- Narrow filter drains or fin drains are not proposed for inner city roads.
- Existing drainage gullies located in the bus lane are proposed to be removed when necessary and reused where possible. Side-entry kerb drainage/side-entry gullies are being proposed where practical, especially along bus lanes to be shared with cyclists. Conventional road gullies will be likely required in some areas, such as in recessed areas like loading bays. Other areas will be determined on a case-by-case basis.
- Exact location and type of gullies will be determined at the detailed design stage when the vertical geometry for the scheme is complete.

2 Proposed Drainage Strategy

2.1 Relevant Standards and Guidance

It is noted that the purpose of this report is to complement, and not supersede, existing guidance documents relating to the design of drainage in Galway City. Consultation with representatives of Galway City Council has highlighted that there are no strict standards for drainage publicly available. However, it was noted that the Greater Dublin Strategic Drainage Study was a commonly used best practice document on which internally available standards had been based. As a result, the proposed drainage strategy uses the guidance contained in this document in conjunction with the other documents listed. A non-exhaustive list of these guidelines is outlined below:

- TII Drainage Documents
- Greater Dublin Strategic Drainage Study (GDSDS)
- The SuDS MANUAL (C753) - CIRIA
- Galway City Council Planning Advisory Note 030308

2.2 Storm Water Drainage Design

The proposed scheme generally follows the existing road alignments and therefore catchment areas draining to the existing systems will mostly remain unchanged. However, there will be some areas where the existing road section will be widened to accommodate new bus lanes and cycle tracks. Specific requirements are outlined below for areas where additional catchments are proposed as part of the scheme.

The drainage design aims to sustain flow levels within the existing pipe network after a rainfall event by controlling the discharge rate within each catchment. Flows will be controlled by the implementation of SuDS techniques, where practicable

Each catchment is being broken down into sub-catchments to define the change in impermeable surface area as a result of the proposed scheme. The extra impermeable areas associated with scheme interventions is being attenuated before discharging to the existing drainage system. According to the available data, not all networks can be characterised. Therefore, allowable discharge rates can be assumed as a combination of a flow associated to a 1 in 5-years return period for the existing paved areas plus 2l/s/ha for existing greenfield areas to be paved (additional catchment areas). To achieve this, some SuDS and/or other attenuation facilities such as oversized pipes are being implemented with an outflow control equal to the allowable discharge rate. As a final step to the design process, it has been checked that no flooding occurs in the proposed infrastructure for a 1 in 30-year event plus a 20% of climate change allowance. A summary of these design standards is provided in Table 1.

Table 1: Design Standards

Parameter & Feature	Allowable Discharge Rate
Permitted Discharge Rates	
Combined New/Existing Paved Catchment Areas	Existing runoff rates maintained on the basis of: - the existing paved areas to **1 in 5-year flow,** plus - **2l/s/ha** for the existing grassed areas catchments to be paved (additional catchments). According to GDSDS Volume 2 Section 6.2, the minimum level of service for the existing network is a 1 in 5-years return period. Given that the scheme is in a fully urbanised area, it is assumed that the existing network was designed following these criteria. For operational purposes, it is recommended that the minimum throttle size for a pipe should be 75mm and the minimum allowable flow rate should be 2l/s.
Attenuation / SuDS Measures	
Combined new/existing paved areas	Attenuation/SuDS measures sized to contain the **1 in 30-year storm** with a 20% allowance for future climate change

In areas where the catchment remains unchanged which implies that no additional impermeable areas are proposed, the design consists of relocating the gullies to a suitable location. This location is based on the water pathway that will depend on the vertical alignment and tie-in requirements. The exact location and number of gullies will be determined in the detailed design stage of the project.

2.3 Pipeline Network Design Criteria

The following inputs sourced mainly from Met Éireann and GDSDS Volume 2 are used in the development of the drainage design for new catchment areas. Table 2 below shows Rainfall Design Criteria Variables.

Table 2: Rainfall Design Criteria Variables

Variable	Value
Region	Scotland/Ireland
Return Period (GDSDS Volume 2, Section 6.2 and Drainage Requirements for Planning Applications)	Drainage Network: 1 in 1 no surcharge, Drainage System: 1 in 30 years no flooding for extending urban areas
M5-60	15.4

Variable	**Value**
(Met Eireann. Return Period Rainfall Depths for sliding Durations. Irish Grid: Easting 129944, Northing: 225289. Values derived from a Depth Duration Frequency Model)	
Ratio R (Met Eireann. Return Period Rainfall Depths for sliding Durations. Irish Grid: Easting 129944, Northing: 225289. Values derived from a Depth Duration Frequency Model)	0.326
Minimum Global Time of Entry (Recommendation for Site Development Works for Housing Areas)	4 minutes
Max. Rainfall (Calculated using localised Met Eireann data)	75 mm/hr
Max. Time of Concentration (Wallingford Procedure States the Modified Rational Method has only been tested for time of concentration not greater than 30 minutes)	30 minutes
Climate Change (TII and Galway City Council consultation)	20%

Table 3 below summarises permeability factors to be used in the design and to be applied to the paved and grassed areas.

Table 3: Runoff Permeability Factors

Runoff Permeability Factors	
Location	Value
Grassed Areas (Based on Dublin soil type 2)	0.3
Paved	1

Table 4 below summarizes the Surface Water Drainage Pipes Design Criteria which states minimum pipe sizes, minimum depth of cover, minimum velocity, roughness coefficient and minimum slope.

Table 4: Surface Water Drainage Pipes Design Criteria

Parameter	**Surface Water Sewers**
Minimum depth (of cover)	0.6m under grassed areas 0.9m under footpaths 1.2m under carriageways 0.75m under carriageways (with concrete surround)
Maximum depth (of cover)	6m

Minimum sewer size	225mm, or 150mm for gully connections.
Minimum velocity (pipe full)	1m/s for a 1 in 1 year storm
Flooding	Must accommodate a one-year storm in-bore without surcharge (TII) Design must be checked against a five-year storm intensity to ensure that surcharge levels do not exceed the levels of chamber covers.
Roughness – ks	0.6mm for carrier drains 1.5mm for filter drains
Minimum slope	1 in 500 or steeper. Self-cleansing velocity will take preference.

In accordance with TII, Volume 4, Section 2, Part 3, NRA HD 33/15 Drainage Systems for National Roads the length of pipework from manhole to manhole should not exceed 100 metres.

2.4 Galway Bay Complex Special Area of Conservation

Galway Bay Complex is designated as a Special Area of Conservation (SAC) which forms part of the European Union (EU) wide Natura 2000 network. The SAC was designated to maintain or restore the favourable conservation status of the habitats and species present, as per the Habitats Directive. The SAC measures approximately 14,403 hectares, with a maritime area of approximately 89.6%.

The River Corrib and Eglinton Canal both flow from Galway City into the SAC. To the east, Lough Atalia forms part of the SAC. These bodies of water currently have surface water pipes discharging directly into them from urbanised areas of Galway City. Additionally, overflow pipes from the combined sewer networks currently discharge into both the River Corrib and Lough Atalia, representing a potential source of pollution in the existing scenario to the SAC.

Where impermeable areas are to be increased, SuDS and attenuation systems will be introduced to incorporate a variety of pollution control measures which will provide a level of treatment to surface waters, prior to their discharge into water bodies leading to the SAC. Petrol interceptors will be provided, where possible, prior to discharging into the existing network for catchments draining to the existing water bodies. This will ensure that the Proposed Scheme does not negatively impact on the SAC's water quality.

It is noted that most of the increase to Average Annual Daily Traffic (AADT) because of the proposed scheme is <1,000. Certain roads (lower section of College Road, Lough Atalia Road and various other roads) have displaced traffic <5,000. A notable increase (i.e., <10,000) is on Newcastle Road. However, the drainage system is connected to a separate system and outside of the study area. As such, no significant impact on receptors are considered likely.

3 Sustainable Drainage Systems (SuDS) Eligibility

3.1 Introduction

The drainage system design must manage on site the quality of runoff to prevent pollution in receiving waters and groundwaters. The types of SuDS features are chosen to achieve water quality targets.

Where possible and in new areas of public realm gained as part of the scheme, sustainable drainage systems should be considered in the form of rain gardens, bioretention areas, filter drains, swales, tree pits, etc.

3.2 SuDS Proposals

This section explores the range of SuDS solutions which will be considered for the Proposed Scheme. The eligibility of the choice of SuDS measure will be based on spatial constraints and likely pollution sources present.

3.2.1 Filter Drains

According to CIRIA SuDS Manual 2015, filter drains are shallow trenches filled with stone/gravel that create temporary subsurface storage for the attenuation, conveyance, and filtration of surface water runoff. A perforated pipe should be provided above the base of the filter drain to collect and convey water to downstream drainage component. Runoff flows slowly through the granular material, trapping sediments and providing attenuation.

Examples are shown in Figure 1 and Figure 2 below.

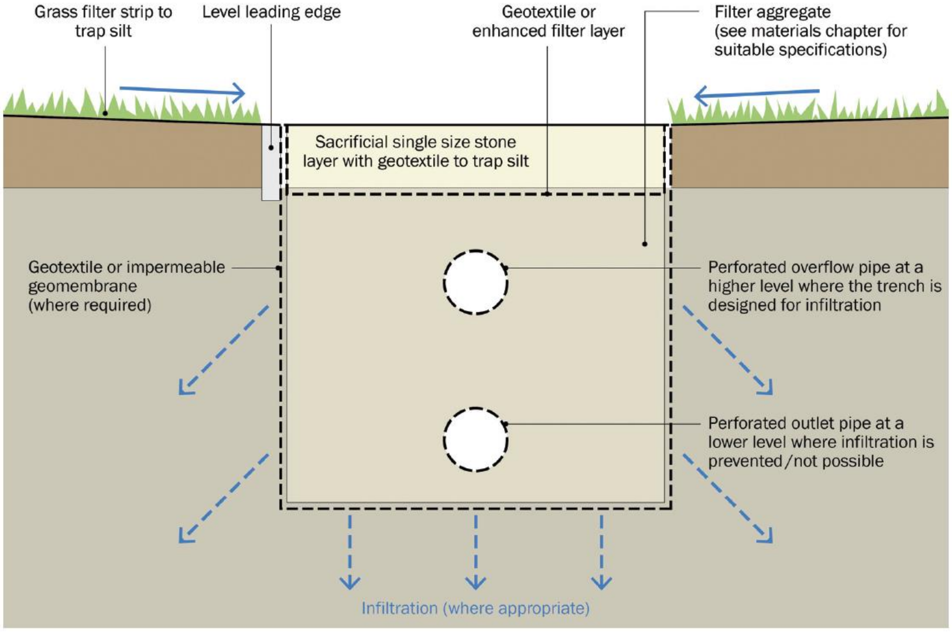


Figure 1: Filter Drain Schematic. Source: CIRIA SuDS Manual 2015 (Chapter 16, Figure 16.2)

Figure 2: Examples of Filter Drains. Source: CIRIA SuDS Manual 2015

3.2.2 Rain gardens

According to CIRIA SuDS Manual 2015, bioretention systems, such as rain gardens, are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution through the use of engineered soils and vegetation. They are particularly effective in delivering interception. Runoff collected by the systems ponds temporarily on the surface and then filters through the vegetation and underlying soils. There are many different approaches to the design of bioretention systems and rain gardens; however, the main components that are usually provided in a bioretention systems are shown in Figure 3.

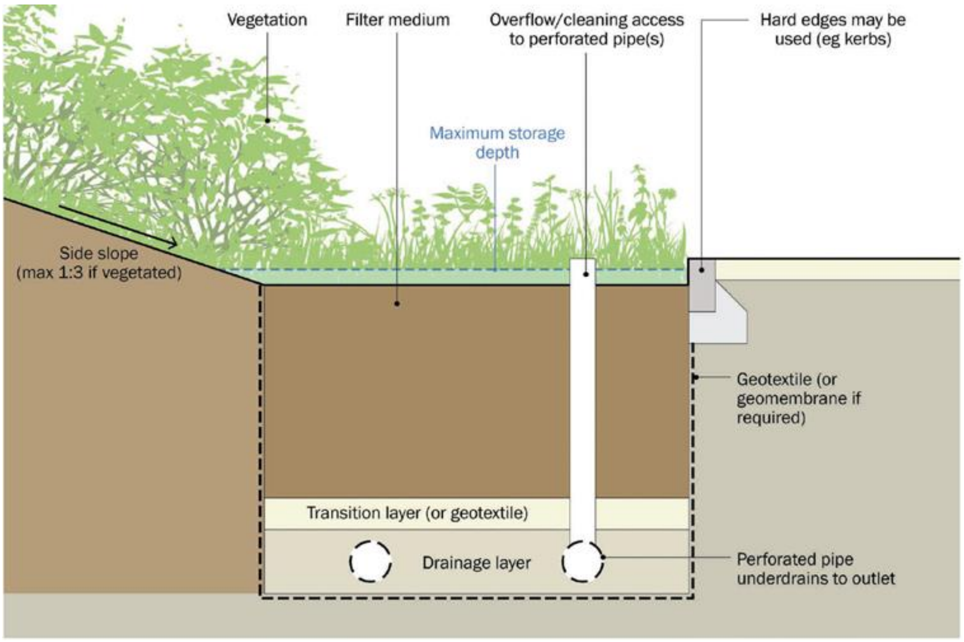


Figure 3: Bioretention System. Source: CIRIA SuDS Manual 2015 (Chapter 18, Figure 18.1)

3.2.3 Tree pits

Trees contribute to effective surface water management strategies. They also reduce annual building energy consumption by moderating the local climate, filter harmful pollutants from the air, and absorb and store atmospheric carbon dioxide (carbon sequestration). In the process of drawing water from the soil, trees also take up trace amounts of harmful chemicals, including metals, organic compounds, fuels and solvents that are present in the soil. Inside the tree, these chemicals can be transformed into less harmful substances, used as nutrients and/or stored in roots, stems, and leaves.

3.3 SuDS Selection Hierarchy

A hierarchical approach to selecting SuDS drainage solutions for the Proposed Scheme has been adopted. This draws upon the management train approach in the CIRIA SuDS Manual Hierarchy and consultation with Galway City Council.

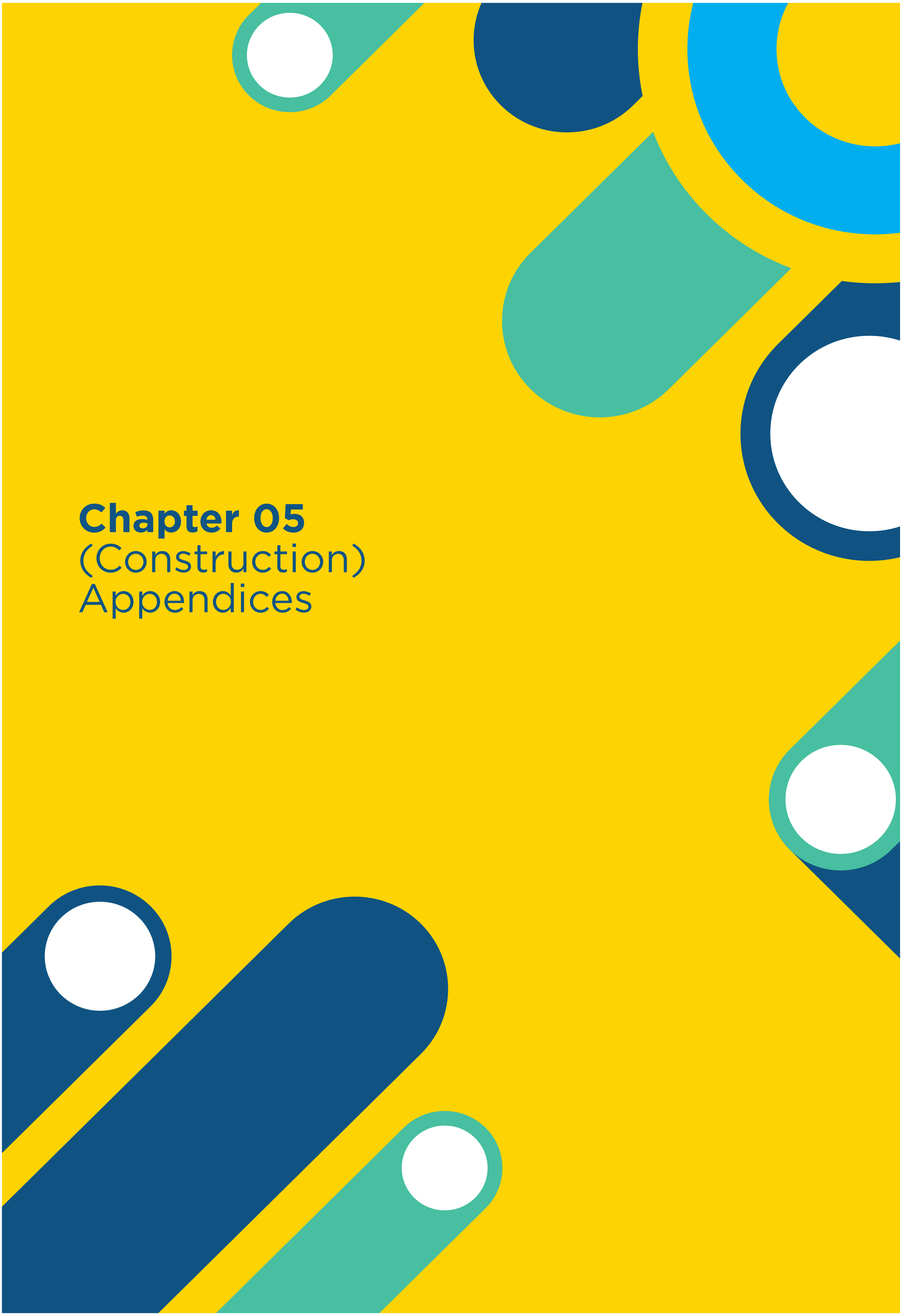
Our approach to selecting appropriate SuDS solutions on the project recognises wider scheme constraints, principally land availability, to ensure proposed measures are proportionate and will not unduly impact on private lands and the SAC. We have followed a 5-stepped approach with Step 1 being the most preferable option and Step 5 being the least and option of last resort.

The SuDS measures aim to maximise the potential for runoff quality improvements. On this basis, 'Source' type measures are preferred as they provide early interception, treatment, and attenuation. Oversized pipes or attenuation tanks are only considered as a last resort, where no other measure is achievable. These are to be supplemented with source type measures where feasible.

The selection process is shown in Table 5 below.

Table 5: SuDS Selection Hierarchy

Step	Question	Action
1	Can a raingarden, Filter Drain, Swale/Bioretention area, Tree Pit or other Source Control type SuDS solution be implemented within the redline boundary?	Yes – Stop, preferred approach
		No – Move to Step 2
2	Can the redline boundary be extended into low impact lands e.g. public green space to accommodate a Raingarden, Filter Drain, Swale/Bioretention area, Tree pit or other Source Control type SuDS solution?	Yes – Stop, preferred approach. Use in combination with Step 1 if appropriate.
		No – Move to Step 3
3	Can a Site Control measure (e.g. Dry Detention Basin) be implemented in addition to Source Control within the redline boundary?	Yes – Stop, preferred approach, seek to maximise source control measures and minimise size of Site Control measures.
		No – Move to Step 4
4	Can the redline boundary be extended into low impact lands e.g. public green space to accommodate a Site Control measure (e.g. Dry Detention Basin) supplemented, where possible by a Raingarden, Filter Drain, Swale/Bioretention area, Tree Pit or other Source Control type SuDS solution?	Yes – Stop, preferred approach, seek to maximise source control measures and minimise size of Site Control measures.
		No – Move to Step 5
5	Can oversized pipes and/or an attenuation tank be used to ensure no increase in runoff?	Yes – Note option of last resort and source/site measures should be used in addition where possible. Any extension of the redline boundary is to be in low impact lands only.



Chapter 05

(Construction) Appendices

Appendix 5.1

5.1: Construction and Environmental Management Plan

Contents

5.1 Construction Environmental Management Plan

5.1.1 Introduction

This document is the Construction Environmental Management Plan (CEMP) for the BusConnects Galway – Cross-City Link (University Road to Dublin Road) Scheme, hereafter referred to as the Proposed Scheme.

The CEMP will be updated by Galway City Council (GCC) (the Employer for the construction works) prior to the commencement of the Construction Phase, so as to include any additional measures required pursuant to conditions attached to any decision to grant approval. GCC shall set out the Employer's Requirements in the Construction Contract including all applicable mitigation measures identified in this EIAR, as well as additional measures required pursuant to conditions attached to any decision to grant approval.

The CEMP comprises the construction mitigation measures, which are set out in the Environmental Impact Assessment Report (EIAR), and the Nature Impact Statement (NIS), and will be updated to include any additional measures required pursuant to conditions attached to An Bord Pleanála's decision.

The CEMP will need to be altered during the lifecycle of the Construction Phase to take account of monitoring results, permits, legislative changes, outcomes of third-party consultations etc. The appointed contractor will ensure that the CEMP remains up to date for the duration of the Construction Phase. The appointed contractor may propose modifications to the CEMP, however any such modifications, will not give rise to any impacts which are more significant than those already identified and assessed in the EIAR or NIS.

All of the measures set out in this CEMP will be implemented in full by the appointed contractor and its finalisation will not affect the robustness and adequacy of the information presented and relied upon in the EIAR and NIS.

5.1.2 Purpose

The purpose of the CEMP is to set out the management framework for the delivery of the proposed construction works and to illustrate how the Proposed Scheme could be delivered in a logical, sensible, and safe sequence with the incorporation of specific Environmental Commitments, as set out in Section 5.1.9.

The CEMP will be used by the appointed contractor, and the appointed contractor personnel as a guidance document for the Construction Phase of the Proposed Scheme outlining procedures for the delivery of environmental mitigation measures and for addressing general day-to-day environmental issues that could arise during the Construction Phase of the Proposed Scheme.

5.1.3 Reference Documents

The CEMP has been prepared as part of the EIAR and the NIS, and should be read in conjunction with the following Proposed Scheme specific documents:

- The EIAR, with particular reference to Chapter 5 (Construction) of this EIAR;
- The NIS;
- The Construction Contract; and
- Copies of An Bord Pleanála’s Order, Inspector’s Report and associated documentation.

The appointed contractor will need to comply with all relevant environmental legislation and take account of published standards, accepted industry practice, national guidelines, and codes of best practice appropriate to the Proposed Scheme. The CEMP has been prepared in accordance with the following industry best practice guidance:

- TII’s Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan (TII 2007), hereafter referred to as the TII Guidelines; and
- Construction Industry Research and Information Association (CIRIA) in the UK, Environmental Good Practice on Site Guide, 4th Edition (CIRIA 2015).

5.1.4 Scope

This CEMP defines the approach to environmental management implementation. Compliance with the CEMP, the procedures, work practices and controls will be adhered to by all personnel employed during the Construction Phase of the Proposed Scheme.

Table 5.1 provides the contents of the CEMP, and where details can be found in this document.

Table 5.1: CEMP Contents

Content	Section of CEMP
Introduction	5.1.1
Purpose	5.1.2
Reference Documents	5.1.3
Scope	5.1.4
Proposed Scheme Details	5.1.5
Planning Consent	5.16
Contact Sheets	5.1.7
Roles and Responsibilities	5.1.8
Communications	5.1.9
Environmental Awareness Training	5.1.10
Compliance and Review	5.1.11
Environmental Commitments	5.1.12
Mitigation and Monitoring Schedule	5.1.13

Content	Section of CEMP
Construction Traffic Management Plan	5.2
Invasive Species Management Plan	5.3
Surface Water Management Plan	5.4
Construction and Demolition Resource and Waste Management Plan	5.5
Environmental Incident Response Plan	5.6

5.1.5 Proposed Scheme Details

Information on the Proposed Scheme will be included in this section of the CEMP. This information will assist those without detailed knowledge of the Proposed Scheme in quickly familiarising themselves with the key elements of the Proposed Scheme and will also assist those who have a need to examine, review or audit the CEMP.

Details will include a description of the key elements of the Proposed Scheme, an overview of the main works required at each section, the construction programme, construction methodology, construction plant and equipment requirements, details on the Construction Compounds, construction traffic management measures, and interfaces with other projects.

[GCC / appointed contractor shall insert Proposed Scheme details].

5.1.6 Planning Consent

If planning permission is granted for the Proposed Scheme, the entire contents of the planning consent will be inserted at this location.

[GCC / appointed contractor shall insert planning consent details].

5.1.7 Contact Sheets

Contact details of relevant personnel are required to ensure the efficient reporting of environmental incidents. It is essential that these contact details be frequently reviewed to ensure they are up to date. Contact details will include the organisation, position title, name, mobile phone number and email address of relevant personnel.

[GCC / appointed contractor shall insert contact details for the relevant personnel].

5.1.8 Roles and Responsibilities

Procurement of the appointed contractor by GCC (the Employer for the construction works), will involve the determination that the appointed contractor is competent to carry out the works, including the effective implementation of the mitigation measures. The appointed contractor will be required to plan and construct the Proposed Scheme construction works in accordance with the Employer’s Requirements, and GCC will employ an Employer’s Representative team with appropriate competence to administer and monitor the Construction Contract for compliance with the Employer’s Requirements.

Information on the appointed contractor’s organisational structure / duties and responsibilities will be provided in this section in the CEMP.

The assignment and communication of duties and responsibilities to individual named members will help ensure the successful implementation of the CEMP.

The TII Guidelines outline a typical organisational structure / roles that may be adopted. It is recognised that the actual titles used by the appointed contractor may vary, however, the appointed contractor should assign relevant duties and responsibilities to the appropriate equivalent person.

One of the roles identified in the TII Guidelines is that of an Environmental Manager (EM). The EM, or equivalent, will be suitably qualified, with sufficient training, experience and knowledge appropriate to the nature of the task to be undertaken. The EM will be responsible for co-ordinating the day-to-day management of environmental impacts during the Construction Phase and for assisting and advising the appointed contractor when programming construction activities and devising methodologies, taking cognisance of the Environmental Commitments. The EM will be responsible for performing inspections as deemed necessary. In addition, the EM will deal with licencing and permit issues, keep up to date with relevant environmental best practice and legislative changes, engage in personnel training, manage responses to environmental incidents and engage environmental contractors as and when required.

[GCC / appointed contractor shall insert the appointed contractor’s organisational structure / duties and responsibilities].

5.1.9 Communications

The procedures adopted for internal and external communication of information regarding the specific elements of the Proposed Scheme will be agreed between GCC and the appointed contractor prior to construction as set out in the Construction Contract.

The appointed contractor will put in place a Communications Plan in accordance with the Employer’s Requirements. The Plan will provide a mechanism for members of the public to communicate with GCC and the appointed contractor, and for GCC and the appointed contractor to communicate important information on various aspects of the Proposed Scheme to the public. The Plan will include procedures to inform members of the community directly affected by the Construction Phase on schedules for any activity of a particularly disruptive nature which is likely to impinge on their property such as boundary works, road closures and diversions, and any mitigating actions that are being taken to minimise such disruption.

5.1.10 Environmental Awareness Training

Copies of the CEMP will be made available to all personnel. All appointed contractor personnel will receive relevant and appropriate training to ensure that they have the appropriate knowledge to successfully implement the CEMP.

Where a specific management plan has been devised for a works activity (e.g., working in an area where invasive species are present), all appointed contractor personnel involved in that activity will be given a toolbox talk outlining the relevant Environmental Commitments.

5.1.11 Compliance and Review

The EM or equivalent, will carry out environmental inspections at appropriate intervals throughout the Construction Phase.

The environmental inspections will ensure that the works are undertaken in compliance with the CEMP and all other planning application documents. Where appropriate and if required, the EM may arrange to be accompanied on these environmental inspections by suitably qualified professionals (e.g., arborist, ecologist, archaeologist). The CEMP will be developed further by the appointed contractor to include further details of inspection procedures.

The Construction Contract documents will require the appointed contractor to further develop the CEMP within 28 days after receiving notice of Commencement of Works from GCC. The EM, and GCC will carry out audits of the CEMP at designated intervals, to determine whether the CEMP is effective in ensuring that the appointed contractor meets all the Environmental Commitments. All changes to the CEMP will be made by the EM and approved by GCC.

5.1.12 Environmental Commitments

The Schedule of Environmental Commitments will comprise the following:

- The Construction Phase mitigation and monitoring measures as outlined in Chapter 6 (Traffic & Transport) to Chapter 20 (Cumulative Impacts & Environmental Interactions) of this EIAR, summarised in Chapter 21 (Summary of Mitigation & Monitoring Measures) of this EIAR, and in Table 5.2;
- Any commitments arising during the statutory planning process up to and including the Oral Hearing;
- Any commitments set out in the Construction Contract documents; and
- Any conditions and / or modifications imposed by An Bord Pleanála, should they grant approval for the Proposed Scheme.

The CEMP will include the Schedule of Environmental Commitments together with the relative specification, evidence, and responsibilities of how each commitment will be met where necessary. The appointed contractor will be required to comply with all Environmental Commitments, and all applicable legislation, including relevant standards, codes of best practice and guidelines.

5.1.13 Mitigation and Monitoring Schedule

Table 5.2 summarises the Construction Phase mitigation (i.e., which the appointed contractor will implement), outlined in the relevant EIAR technical assessment chapters. Table 5.2 should be read in conjunction with the relevant technical assessment chapter.

Where appropriate, the specific location to which the mitigation relates to is identified and where the mitigation measure may be applicable along the extent of the Proposed Scheme, the location is given as ‘Throughout (as required)’. Note that in certain instances, a mitigation measure may be relevant to more than one environmental aspect.

Table 5.2: Mitigation and Monitoring Measures (Construction Phase)

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
Chapter 6 (Traffic & Transport)	TT1	6.6	Throughout (as required)	The CEMP will be implemented (and developed further as required) by the appointed contractor. A detailed Construction Traffic Management Plan has been prepared and will subsequently be updated by the contractor prior to construction, including Temporary Traffic Management arrangement prepared in accordance with Department of Transport's 'Traffic Signs Manual, Chapter 8 Temporary Traffic Measures and Signs for Roadworks'. The plan will be agreed with GCC and will include measures to minimise the impacts associated with the Construction Phase upon the peak periods of the day.
Chapter 7 (Air Quality)	AQ1	7.5.1	Construction Compound and throughout (as required)	A series of mitigation measures will be implemented by the appointed contractor to reduce the dust nuisance impacts: • Fully enclose structures with screens during demolition to minimise dust dispersion; • Public roads outside the Proposed Scheme will be regularly inspected for cleanliness and cleaned as necessary; • Material handling systems and stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays (or similar dust suppression methods) will be used as required if particularly dusty activities associated with the construction contract are necessary during dry or windy periods; • During movement of dust generating materials both on and off-site, trucks will be covered with tarpaulin and before entrance onto public roads, trucks will be checked to ensure the tarpaulins are properly in place; • The appointed contractor will provide a site hoarding of 2.4m height along boundaries where works are taking place adjacent to ecological sensitive receptors(Lough Atalia and Lough Corrib) and at the Harbour Construction Compounds, which will assist in minimising the potential for dust impacts off-site. The appointed contractor will keep the effectiveness of the mitigation measures under review and revise them as necessary. In the event of dust nuisance occurring outside the works boundary associated with the Proposed Scheme occurring outside the works boundary, movements of materials likely to raise dust will be curtailed and satisfactory procedures implemented to rectify the problem.
	AQ2	7.5.1.2	Throughout (as required)	The following monitoring measures, will be implemented for the construction phase of the proposed development: • The contractor will undertake on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to Galway City Council on

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				request. The frequency of the inspections will be increased during site activities with a high potential to produce dust are being carried out. • Dust monitoring will be undertaken at the three nearest sensitive receptors (with agreement from the landowner) to the works during the construction phase. The TA Luft dust deposition limit values of 350 mg/m^2/day applied as a 30-day average.
Chapter 8 (Climate)	CL1	8.6.1	Throughout (as required)	A series of mitigation measures have been incorporated into the Proposed Scheme with the goal of reducing the embodied carbon associated with the Construction Phase. These mitigation measures include: • The replacement, where feasible, of concrete containing Portland cement with concrete containing ground granulated blast furnace slag (GGBS); • The Proposed Scheme will minimise wastage of materials due to poor timing or over ordering on site thus helping to minimise the embodied carbon footprint of the Proposed Scheme; • Where practicable, opportunities for materials reuse will be incorporated within the extent of the Proposed Scheme including the use of reclaimed asphalt and recycled aggregate; and • Where practicable, materials will be sourced locally to reduce the embodied emissions associated with transport.
Chapter 9 (Noise & Vibration)	NV1	9.5.1.1	Throughout (as required)	The appointed contractor will be required to take specific noise abatement measures to the extent required and comply with the recommendations of BS 5228–1 (BSI 2014a) and European Communities Noise Emissions by Equipment for Use Outdoors (Amendment) Regulations 2006 (S.I. No 241/2006). The mitigation measures outlined below for the Construction Phase have also been included in the Construction and Environmental Management Plan (Appendix 5.1 in Volume 4 of this EIAR). These measures will ensure that: • During the Construction Phase, the appointed contractor will be required to manage the works to comply with the limits detailed in Section 9.2.4.1 in 0of this EIAR using methods outlined in BS 5228–1 (BSI 2014a); • The best means practicable, including proper maintenance of plant and equipment, will be employed to minimise the noise produced by on site operations.
	NV2	9.5.1.1	Throughout (as required)	The appointed contractor will put in place the most appropriate noise control measures depending on the level of noise reduction required at individual working areas i.e., based on the construction threshold values for noise and vibration set out in Table 9.5 and Table 9.8 in Chapter 9 of this EIAR. Reference to Table 9.25 in

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				Chapter 9 of this EIAR indicates that intrusive works occurring within 70 m of NSLs will need specific noise control measures to reduce impacts depending on time period over which they will occur, i.e. daytime or evening.
	NV3	9.5.1.1	Throughout (as required)	The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item of plant will be selected wherever practicable. Should a particular item of plant already on the site be found to generate unexpectedly high noise levels, the first action will be to identify whether or not the item can be replaced with a quieter alternative. For static plant such as compressors and generators used at work areas such as Construction Compounds etc., the units will be supplied with manufacturers' proprietary acoustic enclosures where practicable. The contractor will evaluate the choice of excavation, breaking or other working method taking into account various ground conditions and site constraints. Where possible, where alternative lower noise generating equipment are available that will provide structural / excavation / breaking results, these will be selected to minimise potential disturbance.
	NV4	9.5.1.1	Construction Compound and throughout (as required)	The following measures will be implemented by the appointed contractor to control noise levels at source in order to remain below the threshold values for noise set out in Table 9.5 in Chapter 9 (Noise and Vibration) of Volume 2 of this EIAR, which relate to specific site considerations: • For mobile plant items such as dump trucks, planers, excavators and loaders, the installation of an acoustic exhaust, utilising an acoustic canopy to replace the normal engine cover and/or maintaining enclosure panels closed during operation can reduce noise levels by up to 10 dB; • For percussive tools such as pneumatic concrete breakers and tools a number of noise control measures include fitting muffler or sound reducing equipment to the breaker 'tool' and ensuring any leaks in the air lines are sealed; • Construction Compounds are located in close proximity to NSLs (refer to Table 9.24 in Chapter 9 (Noise and Vibration) of Volume 2 of this EIAR) and will therefore incorporate a strict noise control policy relating to materials handling. Noisy items of plant will be sited away from noise sensitive boundaries. • Where compressors, generators and pumps are located in proximity to NSLs and have potential to exceed the construction noise thresholds, these will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation; and • Resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds, while other noise nuisance can be controlled by fixing resilient materials in between the surfaces in contact.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
	NV5	9.5.1.1	Throughout (as required)	Erection of localised demountable enclosures or screens will be used around breakers or drill bits, as required, when in operation in proximity to NSLs boundaries with the potential to exceed the construction noise thresholds. Annex B of BS 5228–1 (BSI 2014a) (Figures B1, B2 and B3) provide typical details for temporary and mobile acoustic screens, sheds and enclosures that can be constructed on site from standard materials.
	NV6	9.5.1.1	Construction Compound	The appointed contractor will provide a site hoarding of 2.4m height along noise sensitive boundaries, at a minimum, at the Construction Compounds.
	NV7	9.5.1.1	Construction Compound	Careful planning of the Construction Compounds including the placement of site buildings such as offices and stores between the site and noise sensitive locations will also be considered by the appointed contractor.
	NV8	9.5.1.1	Throughout (as required)	It is generally envisaged that construction working hours will be between 07:00hr and 19:00hrs on weekdays. Night-time, Saturday and Sunday working will be required during certain periods in order to minimise the impact on road traffic movement during the daytime. The planning of such works will take consideration of sensitive receptors, in particular any nearby residential areas.
	NV9	9.5.1.1	Throughout (as required)	Construction activities will be scheduled in a manner that reflects the location of the site and the nature of neighbouring properties. Construction activities / plant items will be considered with respect to their potential to exceed construction noise thresholds at NSLs and will be scheduled according to their noise level, proximity to sensitive locations and possible options for noise control. In situations where an activity with potential for exceedance of construction noise thresholds is scheduled (e.g. road widening and utility diversions or activities with similar noise levels identified in Table 9.25 in Chapter 9 of this EIAR) other construction activities will be scheduled to not result in significant cumulative noise levels.
	NV10	9.5.1.1	Throughout (as required)	GCC will establish clear forms of communication that will involve the appointed contractor and NSLs in proximity to the works so that residents or building occupants are aware of the likely duration of activities likely to generate noise or vibration that are potentially significant as set out in Table 9.5 and Table 9.8 in Chapter 9 (Noise and Vibration) of this EIAR.
	NV11	9.5.1.1	Throughout (as required)	During the Construction Phase noise monitoring will be undertaken at representative NSLs to evaluate and inform the requirement and/ or implementation of noise management measures. Noise monitoring will be conducted in accordance with ISO 1996–1 (ISO 2016) and ISO 1996–2 (ISO 2017). The selection of monitoring locations will be based on the nearest representative NSLs to the working area which will progress along the length of the Proposed Scheme.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
	NV12	9.5.1.2	Throughout (as required)	In the case of vibration levels giving rise to human discomfort, to minimise such impacts the appointed contractor will implement the following mitigation measures during the Construction Phase: • A clear communication programme will be established by GCC to inform adjacent building occupants in advance of any potential intrusive works which may give rise to vibration levels likely to result in significant effects as per Table 9.9 in Chapter 9 of this EIAR; • Activities capable of generating significant vibration effects with respect to human response (as per Table 9.9 in Chapter 9 this EIAR) will be restricted to daytime hours only, as far as practicable; and • Appropriate vibration isolation shall be applied to plant (such as resilient mounts to pumps and generators), where required and where feasible.
Chapter 11 (Human Health)	HH1	11.5	Throughout (as required)	Any mitigation or monitoring requirements in relation to effects on human health are properly addressed by the measures set out in the chapters which assess effects on the vectors through which the scheme has potential to cause likely and significant effects on human health.
Chapter 12 (Biodiversity)	BD1	12.6.1	Through (as required)	The Contractor will be required to enforce the CEMP which will include the following construction management measures. An Ecological Clerk of Works (EcOW) will be employed to maintain a watching brief on the proposed mitigation measures included for the protection of European sites.
	BD2	12.6.1.1	Throughout (as required)	**Environmental Incident Response Plan** In the event of an environmental emergency, all personnel will react quickly and adhere to the Environmental Incident Response Plan procedure, refer to Section 5.6. The following outlines the information on the types of emergencies which must be communicated to site staff: • Release of hazardous substance – fuel or oil spill. • Concrete spill or release of concrete. • Flood event – extreme rainfall or rising river level event. • Environmental buffers and exclusion zones breach. • Housekeeping of materials and waste storage areas breach. • Stop work orders due to environmental issue or concern (e.g. threat to ecological feature).
	BD3	12.6.1.2	Throughout (as required)	**Invasive Species Management Plan**

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				Refer to the CEMP (Appendix 5.1 of Volume 4 this EIAR) for full details on the management of the potential for invasive species.
	BD4	12.6.1.3	Throughout (as required)	**Habitats & Flora** In general, with regard to biodiversity any felling of trees will take place outside the Bird nesting season March 1st to August 31st.
	BD5	12.6.1.4	Construction Compounds and throughout (as required)	**Habitat Degradation – Surface Water Quality** This CEMP includes specific management measures for the prevention of the pollution of water courses from dust, suspended solids or chemicals are proposed. These measures accord with the principles set out in industry guidelines including CIRIA's report 'C532: Control of water pollution from construction sites'. The following mitigation measures will be employed: **River Corrib at Salmon Weir Bridge** • As a precaution, the control of dust emissions will be enforced by providing a suitable barrier to prevent dust entering the River Corrib at the Salmon Weir Bridge for the length of the Scheme required to prevent emissions to Persse's Distillery River, the main channel of the river and Friar's River at Newtownsmith from the proposed disturbance area. The barrier will be inspected on a weekly basis for gaps or displacement and reinstated when required. • A record of inspection and efficacy of the barrier will be noted in the printed version of the CEMP as an inspection sheet. The record of inspections will be maintained on site and will be available upon request by relevant authorities. • Details of the dust minimisation measures are included in a Construction and Demolition Resource and Waste Management Plan, as described in this CEMP. **University Road at Ward's Shop** • The control of surface water discharge will be enforced by providing a suitable barrier to prevent surface water entering the Eglinton Canal at gaps in the boundary wall leading to the canal and for the length of canal required to prevent drainage to the canal from the proposed disturbance area. The barrier will comprise a silt fence placed with sand bags or a suitable supporting frame. The silt fence will be inspected on a weekly basis for gaps or displacement and reinstated when required.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				• A record of inspection and efficacy of the barrier will be noted in the printed version of the CEMP as an inspection sheet. The record of inspections will be maintained on site and will be available upon request by relevant authorities. **Lough Atalia Playground Outfall** • The works at Lough Atalia Playground will avoid potential disturbance to wintering birds by undertaking the works outside the Winter bird period October to March. • The works at Lough Atalia Playground will be timed to avoid 'spring' high water times and inclement weather (southerly/south-westerly winds) in order to avoid washing of surface water to the sea. Tide times are available from several websites. The delay time for the ebb and flow time to Lough Atalia will be determined by the Contractor or representative Resident Engineer. • The control of surface water discharge will be enforced by firstly providing a temporary sandbag dam at the headwall of the proposed outfall prior to work commencing in this area at low tide. The temporary dam will comprise 1 tonne bags (or similar suitable size) placed at low tide at the foot of the rock armour berm in this area. A silt fence or suitable geotextile barrier will be placed inside the dam and secured using smaller sandbags as required to form an impermeable barrier to prevent hydrocarbon and contaminated surface water runoff to Lough Atalia. • The control of surface water discharge will be enforced by providing a suitable barrier to prevent surface water entering Lough Atalia in the proposed trench leading to the outfall. The barrier will comprise a silt fence placed with sand bags or a suitable supporting frame. A typical silt fence consists of a piece of synthetic filter fabric (also called a geotextile) stretched between a series of wooden or metal fence stakes along a horizontal contour level, (see Diagram 12.12 in Chapter 12 of the EIAR) for sample details. The stakes will be installed on the downhill side of the fence, and the bottom edge of the fabric will be trenched into the soil and backfilled on the uphill side. The fence will be installed on a site before soil disturbance begins and is placed down-slope from the disturbance area. The design/placement of the silt fence will create a pooling of runoff, which then allows sedimentation to occur. The silt fence fabric becomes "blocked off" with fine soil particles and clean water can seep through the fabric. The silt fence will be inspected on a weekly basis for gaps or displacement and reinstated when required. • A record of inspection and efficacy will be noted in the printed version of the CEMP as an inspection sheet. The record of inspections will be maintained on site and will be available upon request by relevant authorities.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				Lough Atalia adjacent to the Dublin Road • The works at the Lough Atalia Dublin Road area will be timed to avoid 'spring' high water times and inclement weather (southerly/south-westerly winds) in order to avoid washing of surface water to the sea. Tide times are available from several websites. The delay time for the ebb and flow time to Lough Atalia will be determined by the Contractor or representative Resident Engineer. • The control of surface water discharge will be enforced by providing a suitable barrier to prevent surface water entering Lough Atalia. The barrier will comprise a silt fence placed with sand bags or a suitable supporting frame such as a staked fence. A typical silt fence consists of a piece of synthetic filter fabric (also called a geotextile) stretched between a series of wooden or metal fence stakes along a horizontal contour level, (see Diagram 12.12 in Chapter 12 of the EIAR) for sample details. The stakes will be installed on the downhill side of the fence, and the bottom edge of the fabric can be trenched into the soil and backfilled on the uphill side. The fence will be installed on a site before soil disturbance begins and is placed down-slope from the disturbance area. The design/placement of the silt fence should create a pooling of runoff, which then allows sedimentation to occur. The silt fence fabric becomes "blocked off" with fine soil particles and clean water can seep through the fabric. • The silt fence will be inspected on a weekly basis for gaps or displacement and reinstated when required. • A record of inspection and efficacy will be noted in the printed version of the CEMP as an inspection sheet. The record of inspections will be maintained on site and will be available upon request by relevant authorities. **All Working Areas adjacent to water courses/water bodies** • Tools and equipment will not be cleaned in grassland or aquatic areas. • Chemicals used will be stored in sealed containers. • Chemicals shall be applied in such a way as to avoid any spillage or leakage. • All refuelling, oiling and greasing will take place above drip trays or on an impermeable surface which provides protection to underground strata and away from grassland as far as reasonably practicable. Vehicles will not be left unattended during refuelling. • All plant shall be well maintained with any fuel or oil drips attended to on an ongoing basis. • Any minor spillage during this process will be cleaned up immediately. • Best practice in bulk-liquid concrete management addressing pouring and handling, secure shuttering / form-work, adequate curing times will be implemented.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				• Wash water from cleaning ready mix concrete lorries and mixers may be contaminated with cement and is therefore highly alkaline, therefore, washing will not be permitted on site. • Disposal of raw or uncured waste concrete will be controlled to ensure that the aquatic environment will not be impacted. For the management of excavation and spoil, the Contractor will: • Ensure all spoil and excavated materials will be stored in the construction compound or removed to an appropriate waste facility; • Ensure stockpiles and adjacent features of drainage infrastructure will be monitored and maintained appropriately; • Erect all protective fencing; • Implement the Surface Water Management Plan (including the installation of drainage infrastructure) as detailed in the CEMP (Appendix 5.1 in Volume 4 of this EIAR) prior to excavation and include areas dedicated to spoil storage with the drainage infrastructure; and • The Construction and Demolition Resource and Waste Management Plan, as described in the CEMP (Appendix 5.1 in Volume 4 of this EIAR) identifies any material such as dust, sand, rubble, concrete that may be generated during demolition works and address its storage and appropriate removal from the site to avoid pathways identified as having connectivity with the River Corrib. Site personnel will be trained in the importance of preventing pollution and the mitigation measures described here to ensure same. A record of this training will be maintained. The Construction Environmental Management Plan will be read and signed by the Contractor/Site Foreman and made available to the EcOW.
	BD6	12.6.1.5	Throughout (as required)	**Otters** A worst-case scenario may be considered where a pollution event would indirectly affect otters or food availability to otters. The Construction Environmental Management Plan which includes specific management measures for the prevention of the pollution of water courses from suspended solids or chemicals.
	BD7	12.6.1.5	Throughout (as required)	**Bats** Ground level potential roost feature surveys conducted on trees within the study did not reveal any roosting bats. There are no further requirements for mitigation for bats.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				The roofs of buildings at the Headford Road and St. Brendan's Avenue are relatively recently upgraded and well-sealed with limited access for bats. However, as a precaution, an internal inspection of the attic spaces will be undertaken at an appropriate time prior to demolition in order to rule out the presence of bats. If any are recorded, specific mitigation measures which may require a derogation license from the NPWS will be implemented.
	BD8	12.6.1.5	Throughout (as required)	**Seals** A worst-case scenario may be considered where a pollution event would indirectly affect otters of food availability to seals. This Construction Environmental Management Plan includes specific management measures for the prevention of the pollution of water courses from suspended solids or chemicals.
	BD9	12.6.1.5	Throughout (as required)	**Salmonids** A worst-case scenario may be considered where a pollution event would affect water quality and threaten salmonids. This Construction Environmental Management includes specific management measures for the prevention of the pollution of water courses from suspended solids or chemicals.
	BD10	12.6.1.5	Throughout (as required)	**Lamprey** A worst-case scenario may be considered where a pollution event would indirectly affect lampreys. This CEMP includes specific management measures for the prevention of the pollution of water courses from suspended solids or chemicals.
	BD11	12.6.1.5	Lough Atalia Playground	**Birds** Disturbance / Displacement Any felling, clearing or pruning of vegetation will take place outside the Bird nesting season March 1st to August 31st. The proposed works at the outfall at Lough Atalia Playground have the potential to disturb wintering birds in these areas. Potential impacts will be avoided by undertaking the works at Lough Atalia Playground outside the Winter bird period October to March.
	BD13	12.6.3.1	Throughout (as required)	An initial site environmental induction and ongoing training will be provided to communicate the main provisions of this environmental plan to all site personnel.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				Two-way communication will be encouraged to promote a culture of environmental protection. The following outlines the information which must be communicated to site staff: • Environmental procedures of the CEMP; • Environmental buffers and exclusion zones; • Housekeeping of materials and waste storage areas; and • Environmental emergency response plan. Prior to any works, all personnel will receive an on-site induction relating to operations adjacent to watercourses and the environmentally sensitive nature of the River Corrib and to re-emphasise the precautions that are required as well as the construction management measures to be implemented. Galway City Council will also ensure that the engineer setting out the works is fully aware of the ecological constraints and construction management requirements.
Chapter 13 (Water)	WT1	13.5	Throughout as required	Construction works will take place in accordance with this CEMP. The outline Surface Water Management Plan (SWMP), which will form part of the CEMP sets out the mitigation measures that are in place to minimise pollution discharge into local water courses.
	WT2	13.5.1	Throughout (as required)	The mitigation measures proposed for management of surface runoff are generally contained in good practice guidance documents that should be adhered to during the construction over or near water bodies. Some of the relevant guidance documents include: • Guidelines on Protection of Fisheries During Construction Works in and adjacent to Waters - Inland Fisheries Ireland, 2016; • CIRIA C532 Control of Water Pollution from Construction Sites Guidance for Consultants and Contractors; and • CIRIA C648 Control of Water Pollution from Constructional Sites Following on from the above guidelines, the following general and specific mitigation measures are outlined: • Appropriate timing of the works to avoid flooding seasons and water pollution incidents; • A sit boundary fence should be constructed around the construction footprint with adequate vegetation buffer to prevent unintentional discharge to adjacent watercourse;

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				• A silt fence must be used during construction at the outfall at Lough Atalia where sediment laden runoff is likely to be generated; • While working near water bodies (Corrib River and Lough Atalia), it is required to capture and treat all surface runoff before discharging to these water bodies; and • Sampling and monitoring of storm water discharges from construction sites, the location and frequency as determined by the Environmental Clerk of Works (ECoW). Parameters of interest may include Turbidity (or TSS), pH, and hydrocarbons. A SWMP is provided as part of the CEMP. This includes an outline of generic mitigation measures for the Construction Phase. Key management measures included: • A requirement for an Emergency Incident Response Plan (PIRP); • Construction Compounds management including the storage of fuels and materials; • Control of sediment generation and discharge; • Provision of SUDs (attenuation pond and petrol interceptor) should be implemented before discharge to the receiving waters; • Use of pre cast concrete where possible or construction method to approved by ECoW; and • Management of vehicles and plant including refuelling and wheel wash facilities -spills and discharge are contained and prevented from entering the surface water receptor.
	WT3	13.5.1	Throughout (as required)	As outlined in the SWMP, the Appointed Contractor shall carry out visual monitoring of surface water control measures (settlement tanks, silt fences, fuel storage areas etc.) on a daily basis. In addition, weekly visual inspections of the water bodies in proximity to Proposed Scheme will be carried out by the Appointed Contractor.
Chapter 14 (Land, Soils, Geology &Hydrogeology)	LSGH1	14.5.1.1	Throughout (as required)	<u>Loss or Damage of Topsoil</u> The appointed contractor will ensure that excavations shall be kept to a minimum, using shoring or trench boxes where appropriate. For more extensive excavations, a temporary works designer shall be appointed by the appointed contractor to design excavation support measures in accordance with all relevant guidelines that minimise the excavation of contaminated ground.
	LSGH2	14.5.1.1	Throughout (as required)	<u>Loss or Damage of Topsoil</u> The appointed contractor will be responsible for regular testing of excavated soils to monitor the suitability of the soil for reuse.

EIAR Chapter	**Mitigation Number**	**EIAR Section Reference**	**Location**	**Description of Mitigation or Monitoring Measure / Environmental Commitment**
	LSGH3	14.5.1.1	Throughout (as required)	Loss or Damage of Topsoil Samples of ground suspected of contamination will be tested for contamination by the appointed contractor during the ground investigation and ground excavated from these areas will be disposed of to a suitably licensed or permitted site in accordance with the current Irish waste management legislation.
	LSGH4	14.5.1.1	Throughout (as required)	Loss or Damage of Topsoil Any dewatering in areas of contaminated ground will be designed by the appointed contractor to minimise the mobilisation of contaminants into the surrounding environment.
	LSGH5	14.5.1.2	Throughout (as required)	Pollution of Soil and Groundwater Good construction management practices, as outlined in the CIRIA guidance, Control of Water Pollution from Construction Sites – Guidance for consultants and contractors (Masters-Williams *et al*., 2001), will be employed by the appointed contractor to minimise the risk of transmission of hazardous materials as well as pollution of adjacent watercourses and groundwater.
	LSGH6	14.5.1.2	Throughout (as required)	Pollution of Soil and Groundwater The construction management of the site by the appointed contractor will take account of the recommendations of the CIRIA guidance Control of Water Pollution from Construction Sites – Guidance for consultants and contractors (Masters-Williams et al., 2001) to minimise as far as possible the risk of soil, groundwater and surface water contamination.
	LSGH7	14.5.1.2	Construction Compounds and throughout (as required)	Pollution of Soil and Groundwater Measures to be implemented by the appointed contractor to minimise the risk of spills and contamination of soils and waters include: • Employing only competent and experienced workforce, and site-specific training in pollution risks and preventative measures for site managers, foremen and workforce, including all sub-contractors,; • Ensure that all areas where liquids (including fuel) are stored, or cleaning is carried out, are in designated impermeable areas that are isolated from the surrounding area and within a secondary containment system, e.g. by a roll-over bund, raised kerb, ramps or stepped access; • The location of any fuel storage facilities shall be considered in the design of the Construction Compounds. These are to be designed in accordance with relevant guidelines and codes of best practice and will be fully bunded; • Good housekeeping at the site (daily site clean-ups, use of disposal bins, etc.) during the entire Construction Phase;

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				• All concrete mixing and batching activities will be located in areas away from watercourse and drains; • Potential pollutants to be adequately secured against vandalism; • Provision of proper containment of potential pollutants according to codes of best practice; • Thorough control during the entire Construction Phase to ensure that any spillage is identified at early stage and subsequently effectively contained and managed; and • Spill kits will be provided and kept close to the storage area. Staff to be trained on how to use spill kits correctly.
	LSGH8	14.5.1.2	Throughout (as required)	An Environmental Incident Response Plan will be implemented by the appointed contractor, which will identify the actions to be taken in the event of a pollution incident. It will address such aspects as containment measures, emergency discharge routes, a list of appropriate equipment and clean-up materials and notification procedures to inform the relevant environmental protection authority.
	LSGH9	14.5.1.2	Throughout (as required)	Sediment control methods are outlined in the Surface Water Management Plan and these will be implemented by the appointed contractor.
	LSGH10	14.5.1.4	Lough Atalia	<u>Pollution of Soil and Groundwater</u> As detailed in the Land Contamination Remedial Strategy (Appendix 14.5) a risk assessment shall be carried out by the designer to establish a concentration of cadmium in the soil that does not present a risk to the quality of water entering Lough Atalia. Soil, groundwater and surface water verification testing shall be carried out by the contractor during the construction stage to confirm the findings of the risk assessment.
Chapter 15 (Archaeological, Cultural Heritage & Architectural Heritage)	ACHAH1	n/a	Throughout (as required)	GCC will procure the services of a suitably-qualified archaeologist as part of its Employer’s Representative team administering and monitoring the works.
	ACHAH2	15.6.1.1	Throughout (as required)	Works impacting the sites of the National Monument, comprising Galway Town Defences (AH13/BH75), will require Ministerial Consent. A wade survey and underwater archaeological assessment of the area surrounding the new outfall towards the northern end of Lough Atalia will be carried out by a suitably qualified archaeologist under licence to the DoHLGH. If any features of archaeological potential are identified by the survey and assessment further archaeological mitigation may be required, such as preservation in-situ or by record All ground disturbances associated with the Proposed Scheme will be monitored by a suitably qualified archaeologist. If any features of archaeological potential are discovered during the course of the works further

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				archaeological mitigation may be required, such as preservation in-situ or by record. Any further mitigation will require approval from the National Monuments Service of the DHLGH.
	ACHAH3	15.6.1.2	Throughout (as required)	Works impacting the National Monument comprising Galway Town Defences (AH13/BH75) will require Ministerial Consent All statues/historic street furniture (BH44, BH52, BH67) and works along historic bridges, which fall within the Proposed Scheme area will require hoarding during construction to protect from potential damage during ground disturbances. If hoarding in-situ is not possible, statues/street furniture will require careful removal by a conservation specialist to be stored securely and re-installed at an appropriate location, in consultation with the Galway Heritage Officer.
	ACHAH4	15.6.1.2	Throughout (as required)	Grave monument BH65 falls wholly within the Proposed Scheme area and will require hoarding to prevent damage during groundworks.
	ACHAH5	15.6.1.2	Throughout (as required)	BH47 (Ceannt Station – a short section of retaining wall). To be subject to a full written and measured survey prior to construction going ahead.
	ACHAH6	15.6.1.3	Throughout (as required)	Where cultural heritage sites such as statues/historic street furniture (CH03, CH04, CH05) fall within the Proposed Scheme area they will require hoarding during works to protect from potential damage during ground disturbances. If hoarding in-situ is not possible, the items will require careful removal by a conservation specialist to be stored securely and re-installed at an appropriate location, in consultation with the Galway Heritage Officer.
	ACHAH7	15.6.1.3	Throughout (as required)	A cobbled road surface to the front of Town Hall Theatre and historic paving/kerbing and bollards along St Vincent’s Street/Waterside/Courthouse Square (CH11) fall within the Proposed Scheme area. These features will be recorded and photographed before being lifted under supervision of a suitably qualified conservation specialist, for secure storage and re-use (where appropriate), in consultation with the Galway Heritage Officer. A full written and photographic record will be made of Eyre Square (CH10) and its current character and landscape layout. This will be carried out by a suitably qualified professional. Lough Atlia dock walls (CH12) will be hoarded off during construction and all excavation works to the rear of the wall supervised by an archaeologist. The methodology for repair of the dock wall will be agreed in advance with Galway Heritage Officer.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
Chapter 16 (Landscape (Townscape) & Visual)	LV1	16.5.1.1	Throughout (as required)	Prior to the commencement of works, the appointed contractor will prepare a detailed CEMP.
	LV2	16.5.1.1	Throughout (as required)	In addition to the management of all construction works in accordance with best methodologies and practice, the following measures are proposed for the mitigation of landscape/townscape and visual impacts: • Retained existing trees, planting, features etc. will be protected with temporary protective fencing at the boundary of proposed works areas. Existing trees along will be protected with fencing in accordance with BS5837:2012: Trees in relation to Construction and TII's Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub. • Where existing trees, hedges, and/or plantings are removed from temporary acquisition areas, new planting and paving will be provided in replacement of those removed. In general, unless not feasible or practicable, new plant species will match that of those removed. Replacement plant sizes will be that readily available and therefore, is unlikely to match the maturity of plants removed (especially in the case of trees or larger plants). However, being of the same or similar species, maturity similar to that of the existing can be achieved in time. • New boundaries to match the existing will be established on the setback line to match the existing boundary. The construction and provision of the new boundaries is to take account of the location of existing trees, other plantings, gradients, drainage, property features and access arrangements so as to minimise additional indirect effects. • The Proposed Scheme will provide for the planting of new street trees both for mitigation of tree removal and for overall enhancement of streetscape environment. Species selected shall be appropriate to the urban street environment and to the characteristics of the specific location. This measure is applied along the full length of the Proposed Scheme. Proposals for the treatment of the public realm within the streetscape effected by the Proposed Scheme will have regard to the existing character of the street or location, Galway Public Realm Strategy and to opportunities for enhancement of the public realm and the streetscape. Proposals will have regard to historic details and features, to the quality of existing and proposed materials, to the reduction of clutter, ease of legibility, and management and maintenance requirements.
	LV4	16.5.1.3	Throughout (as required)	The works will have continuous monitoring under the Construction Environmental Management Plan to ensure adequate protection of trees, built heritage features., amenity and public realm areas outside of the construction works.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
	LV5	16.5.1.3	Throughout (as required)	Any construction within close proximity to the retained trees will be undertaken in accordance with approved method statements prepared by the construction contractor under the direct supervision of a suitably qualified consultant Arboriculturist. Therefore, during the construction works, a professionally qualified Arboriculturist is proposed to be retained by the principal contractor or site manager to monitor and advice on any works within the root protection area (RPA) of retained trees to ensure successful retention and planning compliance.
	LV6	16.5.1.3	Throughout (as required)	On the completion of the construction works, all trees and vegetation retained is to be reviewed by the project Arboriculturist and any necessary remedial tree surgery works required to promote health and safety are to be implemented.
Chapter 17 (Waste & Resources)	WR1	17.5.1	Throughout (as required)	A Construction and Demolition Resource and Waste Management Plan (CDRWMP) has been prepared and this will be implemented (and updated as necessary) by the appointed contractor.
	WR2	17.5.1	Throughout (as required)	The following measures will be implemented during construction, where practicable, by the appointed contractor, to ensure the maximum quantity of material is reused on the Proposed Scheme and to contribute to achieving the objectives set out in the National Waste Action Plan as follows: • Stockpiling of existing sub-base, capping layer and topsoil material generated on-site for direct reuse in the Proposed Scheme where practicable in the proposed construction compounds (subject to material quality testing to ensure it is suitable for its proposed end use); and • Recycled aggregates and reclaimed asphalt will be specified in the Proposed Scheme, where practicable.
	WR3	17.5.1	Throughout (as required)	The following management measures will be implemented in so far as reasonably practicable: • Where waste generation cannot be avoided, waste disposal will be minimised; • Opportunities for reuse of materials, by-products and wastes will be sought throughout the Construction Phase of the Proposed Scheme; • Possibilities for reuse of clean non-hazardous excavation material as fill on the site or in landscaping works will be considered following appropriate testing to ensure material is suitable for its proposed end use; • Where excavated material cannot be reused within the Proposed Scheme works, material will be sent for recovery or recycling; • Source segregation: Metal, timber, glass and other recyclable material will be segregated (and waste stream colour-coding will be used) during construction works and removed off site to a permitted / licensed facility for recycling; • Material management: ‘Just-in-time’ delivery, where practicable, will be used to minimise material wastage;

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				• General construction waste and by-products will01 be reused within the Proposed Scheme, where practicable, or appropriately reused (in accordance with Article 27 of the Waste Directive Regulations), recovered, recycled or disposed of off-site, as arranged by the appointed contractor; and • Any hazardous waste arising will be managed by the appointed contractor in accordance with the applicable legislation. • Waste Auditing: The quantity and types of waste and materials leaving site during the Construction Phase will be recorded by the appointed contractor. The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity to each facility. Records will show which material is recovered, which is recycled and which is disposed of. • Where Article 27 notifications are required in relation to the Proposed Scheme, the appointed contractor will complete and submit these Article 27 notifications to the EPA for by-product reuse. • Any off-site interim storage or waste management facilities for excavated material will have the appropriate EPA licence, Waste Facility Permit or Certificate of Registration, as appropriate, in place. • The relevant appropriate waste authorisation will be in place for all facilities that wastes are delivered to (i.e., EPA Licence, Waste Facility Permit or Certificate of Registration).
Chapter 18 (Material Assets)	MA1	18.6.1	Throughout (as required)	Where there are interfaces with existing utility infrastructure, protection in place or diversion as necessary is proposed to prevent long-term interruption to the provision of the affected services.
	MA2	18.6.1	Throughout (as required)	All possible precautions will be taken by the appointed contractor to avoid unplanned interruptions to any services during the Construction Phase of the Proposed Scheme. This will include appropriate investigation by the appointed contractor to identify the location of all utility infrastructure within the working areas prior to the commencement of excavation works. Where works are required in and around utility infrastructure, precautions will be implemented by the appointed contractor to protect the infrastructure from damage in accordance with best practice methodologies and the requirements of the utility companies where practicable. Protection measures during construction will include warning signs and markings indicating the location of utility infrastructure, safe digging techniques in the vicinity of known utilities, and in certain circumstances where possible, isolation of the section of infrastructure during works in the immediate vicinity.
	MA3	18.6.1	Throughout (as required)	All utility companies for which diversions are proposed will continue to be consulted when designing any diversions to ensure that proposed diversions conform to the utility provider’s requirements, where practicable, and to ensure that service interruptions are kept to a minimum.
	MA4	18.6.1	Throughout (as required)	Where diversions or modifications are required to utility infrastructure, service interruptions and disturbance to the surrounding residential, commercial and/or community property may be unavoidable.

EIAR Chapter	Mitigation Number	EIAR Section Reference	Location	Description of Mitigation or Monitoring Measure / Environmental Commitment
				Where this is the case, it will be planned in by the appointed contractor in consultation with each utility provider, as relevant. Required service interruptions will generally only occur for a set period of time per day (a set number of hours not exceeding eight hours where reasonably practicable) and will generally not be continuous for full days at a time. Prior notification will be given to all impacted properties. This notification will include information on when interruptions and works are scheduled to occur and the duration of such interruption. Any required works will be carefully planned by the appointed contractor to ensure that the duration of interruption is minimised in so far as is practicable.
	MA5	18.6.2	Throughout (as required)	Consideration will be given to the sustainability of material being sourced for the construction of the Proposed Scheme by the appointed contractor. In so far as is reasonably practicable, materials required for the construction of the Proposed Scheme will be sourced locally to reduce the amount of travelling required to get the material to the site. Key issues to be considered when sourcing materials for the Construction Phase will include the source, the material specification, production and transport costs, and the availability of the material. Only quarries which are included in local authority quarry registers will be used by the appointed contractor to source any quarried material.
	MA6	18.6.2	Throughout (as required)	Construction materials will be managed on site by the appointed contractor in such a way as to prevent over-ordering and waste. Materials will be stored in appropriate storage areas or receptacles to reduce the potential for damage requiring replacement. “Just In Time” ordering principles will be implemented by the appointed contractor where practicable in order to reduce over-ordering.
Chapter 20 (Cumulative Impacts & Environmental Interactions)	CI&EI1	20.5.1	Throughout (as required)	Other infrastructure projects could directly interface with the construction of the Proposed Scheme. Interface liaison will take place on a case-by-case basis through GCC, as will be set out in the Construction Contract, to ensure that there is coordination between projects, that construction access locations remain unobstructed by the Proposed Scheme works and that any additional construction traffic mitigation measures required to deal with cumulative impacts are managed appropriately.

5.2 Construction Traffic Management Plan

5.2.1 Introduction

The Construction Traffic Management Plan (hereafter referred to as the CTMP) has been prepared to demonstrate the manner in which the interface between the public and construction-related traffic will be managed and how vehicular movement will be controlled.

5.2.1.1 Purpose

The purpose of this CTMP is to demonstrate that the residual impacts to the public road network during the Construction Phase of the Proposed Scheme which have been identified in the application documentation can be minimised and that transport related activities are carried out as safely as possible and with the minimum disruption to other road users. The CTMP has also been prepared for the purpose of identifying feasible, appropriate and safe methods of access for construction traffic to the Proposed Scheme.

5.2.1.2 Objectives

The objectives of the CTMP are to:

- Outline minimum road safety measures to be undertaken, including site access / egress locations, during the works;
- Provide measures that respond to all road user needs including public transport, pedestrians, cyclists and vehicular traffic;
- Ensure disruption is minimised, with access to houses and businesses maintained as is reasonably practicable in delivering the Proposed Scheme;
- Demonstrate to GCC, the appointed contractor, and suppliers the need to adhere to the relevant guidance documentation for such works; and
- Identify objectives and measures for inclusion in the management, design and construction of the Proposed Scheme to control the traffic impacts of construction insofar as it may affect the environment, local residents and the public in the vicinity of the construction works.

5.2.1.3 Scope

This CTMP illustrates a traffic management design for the transportation of construction materials, equipment and personnel along the public road network to facilitate the construction of the Proposed Scheme. Light vehicles, such as cars and vans, are used by operatives travelling to and from the works areas. Lorries deliver general construction materials, such as concrete, to, from and around the works areas.

The appointed contractor will develop the CTMP in the event An Bord Pleanála decides to grant approval for the Proposed Scheme.

The CTMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by An Bord Pleanála.

The CTMP should be read in conjunction with Chapter 5 (Construction) of this EIAR.

5.2.2 Proposed Construction Activities

5.2.2.1 Overview

Construction activities to be carried out as part of the Proposed Scheme are illustrated in Chapter 5 (Construction) of this EIAR. Pavement operations are expected to be a key activity on the Proposed Scheme, and shall include planning, excavation, temporary stockpiling (if required), installing, disposal, import and haulage. The Construction Phase of the Proposed Scheme shall require movements of materials to, from and around the works areas. Most of the materials leaving the works areas will consist of road plannings.

Due to the dispersed nature of the scheme, it is anticipated that the construction works will be carried out at a minimum of three locations simultaneously at any given time. The scheme has therefore been split into three sections as detailed below and shown on Image 5.1:

- Section A – University Road to Eyre Square, Woodquay and Headford Road;
- Section B – Eyre Square, Forster Street, Dock Road, Bothar na Mban, Bothar Ui hEithir and Fairgreen Road
- Section C – College Road to Dublin Road.

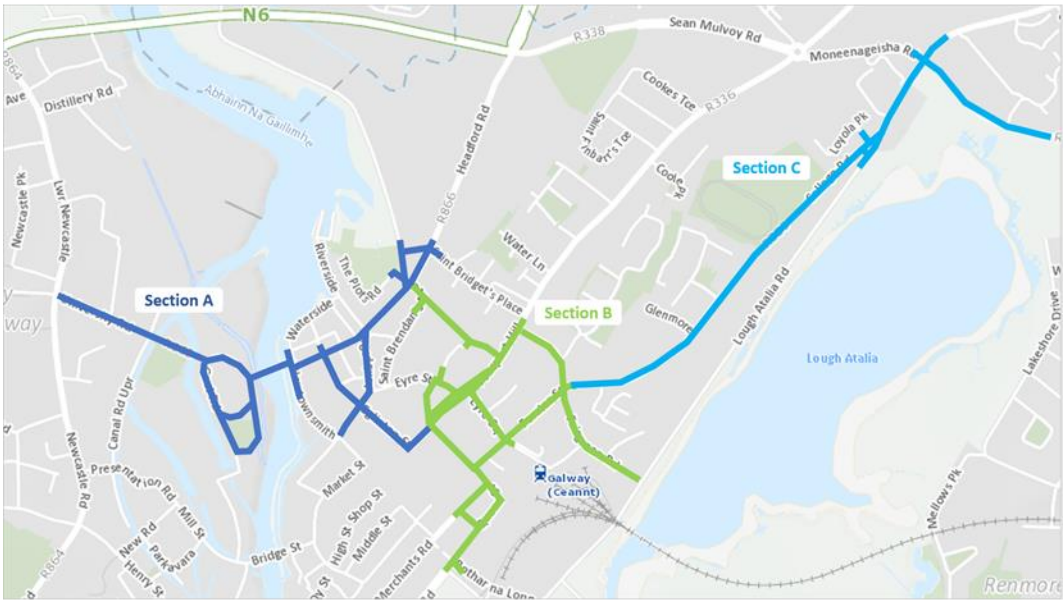


Image 5.1 Bus Connects Galway Cross-City Link

5.2.2.2 Construction Programme

A programme for the Proposed Scheme is provided in Section 5.4 in Chapter 5 (Construction) of this EIAR. The total Construction Phase duration for the overall Proposed Scheme is estimated at approximately 18 to 20 months. However, construction activities in individual sections will have shorter durations. The programme identifies the approximate duration of works at each section. The appointed contractor will be responsible for determining the final programme.

In order to achieve the overall programme duration, it will be necessary to work on more than one section / sub-section at any one time. The programme has been prepared with a view to providing as much separation as practicable between sections under construction at any given time. This has been done in order to minimise traffic disruption and facilitate the ease of movement of sustainable modes, bus services and goods along the Proposed Scheme.

The staging of construction and associated temporary traffic management measures has considered the receiving environment when developing the schedule of works.

5.2.2.3 Temporary Traffic Management Designs

In the event An Bord Pleanála decides to grant approval for the Proposed Scheme, Temporary Traffic Management designs (drawings and method statements) will be prepared by the appointed contractor in compliance with the Department of Transport's Traffic Signs Manual, Chapter 8, Temporary Traffic Measures and Signs for Roadworks (DTTS 2019a), hereafter referred to as the Traffic Signs Manual, to facilitate the safe and efficient construction of the Proposed Scheme.

Temporary construction traffic management provisions are provided in Section 5.8 in Chapter 5 (Construction) of this EIAR. These provisions have been developed using works areas for the purpose of safety, to minimise disruption and to facilitate the smooth operation of construction activities. The roads and streets along the Proposed Scheme, will remain open to general traffic wherever practicable during the Construction Phase, however lane closures, road closures and diversions will be necessary to facilitate construction. Traffic management provisions for each section / sub-section are included in Table 5.3.

Table 5.3: Traffic Management Provisions at each Section / Sub-Section

Section No.	Estimated Construction Duration	Traffic Management Provisions
Section A1	8 weeks	Phased lane closures as required. Close off the Canal Road Upper for 3 days
Section A2	16 weeks	Gaol Road converted into a two-way traffic route Gaol Road (east of the cathedral) will be closed to traffic.
Section A3	4 weeks	Phased lane closures as required. Resurfacing of the bridge will require the closure of the bridge to vehicular traffic for a night.
Section A4	8 weeks	Closure of Waterside, between Courthouse Square and St. Vincent's Ave. Closure of Newtownsmith, between access to the river walk and St. Vincent's Ave.

Section No.	Estimated Construction Duration	Traffic Management Provisions
Section A5	6 weeks	Phased lane closures as required.
Section A6	10 weeks	Closure of the road connecting Dyke Road to Headford Road adjacent to the Dyke Road carpark Phased lane closures as required.
Section A7	8 weeks	Phased lane closures as required.
Section A8	12 weeks	One lane of traffic in either direction will be maintained Phased lane closures as required.
Section B1	20 weeks	One lane of traffic in either direction will be maintained Phased lane closures as required.
Section B2	8 weeks	Phased lane closures as required.
Section B3	20 weeks	Phased lane closures as required. Works on Eyre Square North, with the existing access road closed to all traffic. Works on Rosemary Avenue and Eyre Street, with roads to be closed to vehicular access for the duration of the works.
Section B4	6 weeks	Phased lane closures as required. Overnight closure of Merchants Road (Forthill Street to Queen Street) and Queen Street to Dock Road, for the installation of raised tables.
Section B5	4 weeks	Phased lane closures as required.
Section B6	10 weeks	Phased lane closures as required. Overnight junction closure to facilitate surfacing works.
Section B7	4 weeks	Phased lane closures as required.
Section B8	3 weeks	Phased lane closures as required.
Section C1	6 weeks	Phased lane closures as required.
Section C2	12 weeks	Existing traffic operation maintained.
Section C3	20 weeks	One lane of traffic in either direction will be maintained.
Section C4	10 weeks	One lane of traffic in either direction will be maintained Road surfacing - full junction closure over 2 -3 consecutive nights.
Section C5	16 weeks	Traffic reduced to three lanes on the Dublin Road and realigned in narrow lanes.

Section No.	Estimated Construction Duration	Traffic Management Provisions
		One lane of traffic in either direction will be maintained.

5.2.2.4 Envisaged Construction Traffic Generation

Traffic will be generated during the Construction Phase of the Proposed Scheme. Construction traffic can be expected to comprise of trips for the following purposes:

- Journeys by construction personnel to and from the Proposed Scheme; and
- Delivery and removal of materials to and from the Proposed Scheme:
    - Clearance of existing material and waste;
    - Deliveries of construction material; and
    - Removal of construction waste material.

Construction activities associated with the Proposed Scheme typically follow a work sequence that is repeated in smaller works areas. The movement of construction vehicles to and from the Proposed Scheme is determined by this work sequence; materials either being ‘removed from’ or ‘delivered to’ site. There is also stationary dwell time as material is being unloaded or loaded at either end of a journey. Lorry movements for typical construction activity cycles are shown in Image 5.2 and Image 5.3.

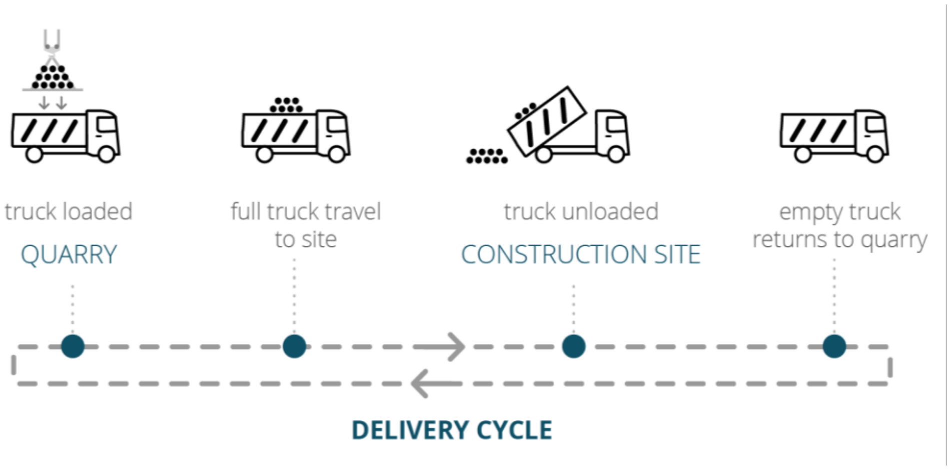


Image 5.2: Lorry Movements for 'Removal' of Materials

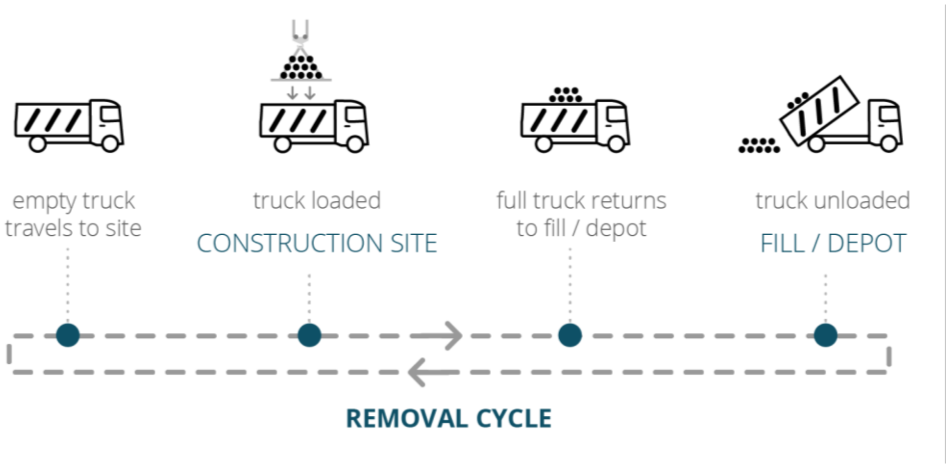


Image 5.3: Lorry Movements for ‘Delivery’ of Materials

Pavement operations are expected to be a key activity on the Proposed Scheme where this sequence will take place. This activity shall involve some or all of the following steps including planning, excavation, temporary stockpiling (if required), installing, disposal, import and haulage. Other activities such as traffic signal installation, signage and line marking, do not require lorry movements. Lorries are not always required to facilitate construction activities.

Likely traffic generation associated with construction site activities is described further in Section 5.2.2.4.1 and Section 5.2.2.4.2.

5.2.2.4.1 Removal and Delivery of Materials

An estimate of construction plant and equipment that will be necessary to construct the Proposed Scheme is provided in Section 5.6 in Chapter 5 (Construction) of this EIAR. Of the plant and equipment in operation during construction, lorries use the public road network for delivery and removal of materials to and from the Proposed Scheme.

Based on construction activities taking place, lorries are typically in operation 40% of the time.

This reflects the varied nature of works; whereby lorry movements are not necessary to execute certain construction activities and dwell time is experienced at either end of journeys. The number of lorries estimated to be in operation across the Proposed Scheme is shown in Table 5.4 for Section A1 to Section B7, and Table 5.5 for Section B8 to Section C5, as expanded on in Section 5.6 in Chapter 5 (Construction) of this EIAR.

Table 5.4: Estimated Peak Daily Lorry Numbers Across the Proposed Scheme (Section A1 to Section B7)

Plant / Equipment	**Section**														
Type	A1	A2	A3	A4	A5	A6	A7	A8	B1	B2	B3	B4	B5	B6	B7
Lorry	4	8	2	4	4	4	4	8	10	8	8	4	4	8	4

Table 5.5: Estimated Peak Daily Lorry Numbers Across the Proposed Scheme (Section B8 to Section C5)

Plant / Equipment	**Section**					
Type	B8	C1	C2	C3	C4	C5
Lorry	4	6	8	12	8	12

Lorry movements will be managed during the periods of 07:00 to 09:00 and 17:00 to 19:00 to minimise the impact of construction related traffic on peak-hour general traffic.

Construction vehicles will be directed to access work sections via the Proposed Scheme and dedicated routes on the National and Regional Road Network where practicable, to minimise use of the Local Road Network. The routes are outlined in Section 5.2.3.3 of this CTMP.

5.2.2.4.2 Journeys by Construction Personnel to and From the Proposed Scheme

Personnel numbers for the Proposed Scheme are illustrated in Section 5.10 in Chapter 5 (Construction) of this EIAR. Throughout the Construction Phase there will be some variation in the numbers of personnel working on site. It is anticipated there will be approximately 250 personnel directly employed across the Proposed Scheme, rising to 300 personnel at peak construction.

The appointed contractor will prepare a Construction Stage Mobility Management Plan (CSMMP) to actively discourage personnel from using private vehicles to travel to the Proposed Scheme. The CSMMP will promote the use of public transport, cycling and walking by personnel. Private parking at the Construction Compounds will be limited. Vehicle-sharing will be encouraged, subject to public health guidelines, where travel by private vehicle is a necessity e.g., for transporting heavy equipment.

Typical work hours are envisaged between 07:00 and 23:00 with personnel working across early and late shifts. The adopted shift patterns help minimise travel by personnel during the peak hour periods of 08:00 to 09:00 and 17:00 to 18:00.

A combination of CSMMP measures, as well as work shift patterns, means fewer than 10 trips by private vehicle are envisaged to and from site during peak periods.

5.2.3 Construction Traffic Management Plan Contents

The appointed contractor shall be responsible for developing a CTMP to effectively manage traffic and transport during the construction stage of the project. The appointed contractor shall address the following aspects, in addition to any other aspects identified by the appointed contractor during the preparation of the CTMP;

- Access and egress;
- Construction Compounds;

- Routing of construction vehicles;
- Pedestrian (including able-bodied pedestrians, wheel-chair users, mobility impaired pedestrians, pushchair users etc.) and cyclist provisions;
- Public transport provisions;
- Parking and access;
- Lighting;
- Construction Stage Mobility Management Plan (CSMMP);
- Traffic management signage;
- Timings of material deliveries;
- Traffic management speed limits;
- Vehicle cleaning;
- Road cleaning;
- Road condition;
- Road closures and diversions;
- Enforcement of Construction Traffic Management Plan;
- Interface with other projects;
- Emergency procedures during construction; and
- Communication.

Further details on issues to be addressed are provided in Section 5.2.3.1 to Section 5.2.3.19.

5.2.3.1 Access and Egress

The appointed contractor shall provide advanced warning signs, in accordance with the Traffic Signs Manual, on approach to the proposed access locations, entry and exit points throughout the live working area.

When roads and streets are being upgraded, there will be some temporary disruption / alterations to on-street and off-street parking provision, and access to premises in certain locations along the Proposed Scheme. Local arrangements will be made on a case-by-case basis to maintain continued access to homes and businesses affected by the works, at all times, where practicable. Details regarding temporary access provisions will be discussed with homes and businesses prior to construction starting in the area.

5.2.3.2 Construction Compounds

It is anticipated that three construction compounds will be utilised during the construction of the Cross-City Link, two main compounds located at Galway Harbour Enterprise Park, within Galway Docks and a satellite compound at Galway Cathedral Car-Park.

Construction Compound requirements to facilitate the Construction Phase of the Proposed Scheme are illustrated in Section 5.7 in Chapter 5 (Construction) of this EIAR. The Construction Compound locations have been selected due to the amount of available space at this location, its location near the majority of the Proposed Scheme major works and its access to the National and Regional Road network.

The appointed contractor's CTMP shall include measures for managing traffic accessing and egressing the Construction Compounds. The Construction Compounds will contain a site office, and welfare facilities for GCC personnel and contractor personnel. Limited car parking will be allowed at the Construction Compounds, in line with the principles of the Construction Stage Mobility Management Plan (CSMMP). Materials such as topsoil, subsoil, concrete, rock etc., will be stored at the Construction Compounds for reuse as necessary. Items of plant and equipment will also be stored within the Construction Compounds.

5.2.3.3 Routing of Construction Vehicles

Access to and egress from the Construction Compounds is envisaged to be along dedicated construction vehicle routes. It is assumed that all national roads and regional roads in the immediate vicinity of the Proposed Scheme would be used by construction vehicles.

The following national roads are expected to be used as construction vehicle access routes during the Construction Phase of the Proposed Scheme:

- N3, Navan Road; and
- M50 Motorway.

The following regional roads are expected to be used as construction vehicle access routes during the Construction Phase of the Proposed Scheme:

- R147;
- R804; and
- R805.

Assumed construction vehicle access routes for the Proposed Scheme are shown in Image 5.4.

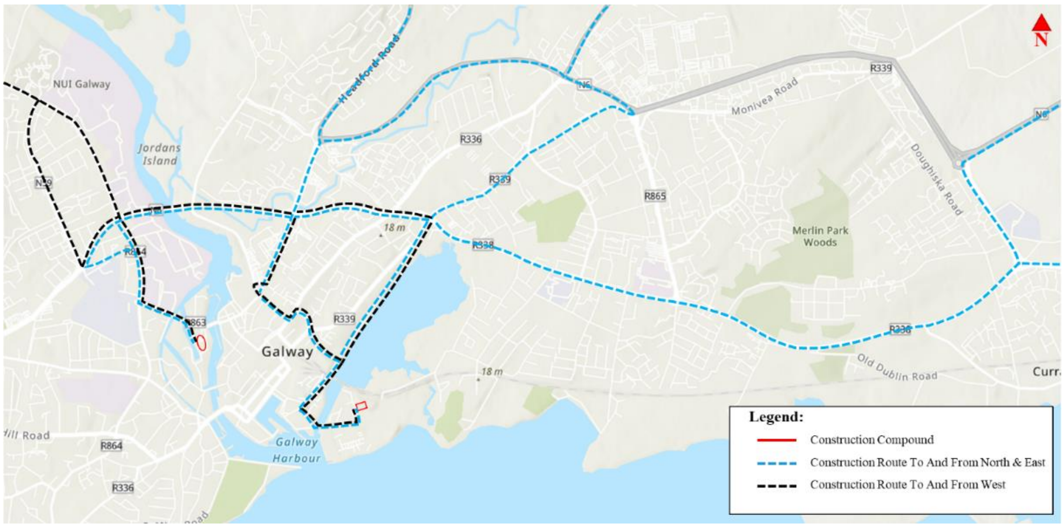


Image 5.4: Construction Vehicle Access Routes

5.2.3.4 Pedestrian and Cyclist Provisions

The measures set out in Section 8.2.8 of the Traffic Signs Manual will be implemented, wherever practicable, to ensure the safety of all road users, in particular pedestrians (including able-bodied pedestrians, wheel-chair users, mobility impaired pedestrians, pushchair users) and cyclists. Therefore, where footpaths or cycle tracks are affected by construction, a safe route will be provided past the work area, and where practicable, provisions for matching existing facilities for pedestrians and cyclists will be made.

5.2.3.5 Public Transport Provisions

Existing public transport routes will be maintained throughout the duration of the Construction Phase of the Proposed Scheme (notwithstanding potential for occasional road closures / diversions as discussed in Section 5.2.3.15). Wherever practicable, bus services will be prioritised over general traffic. However, the temporary closure of sections of existing dedicated bus lanes will be required to facilitate the construction of new bus priority infrastructure that is being developed as part of the Proposed Scheme. Some existing bus stop locations will need to be temporarily relocated to accommodate the works. In such cases, bus stops will be safely accessible to all users and all temporary impacts on bus services will be determined in consultation with GCC and the service providers.

5.2.3.6 Parking and Access

When roads and streets are being upgraded, there will be some temporary disruption / alterations to on-street and off-street parking provision, and access to premises in certain locations along the Proposed Scheme. Local arrangements will be made on a case-by-case basis to maintain continued access to homes and businesses affected by the works, at all times, where practicable. Details regarding temporary access provisions will be discussed with homes and businesses prior to construction starting in the area. The duration of the works will vary from property to property, but access and egress will be maintained at all times.

5.2.3.7 Lighting

The majority of the Proposed Scheme is already artificially lit, however temporary lighting will be required at times along the Proposed Scheme at certain locations during the Construction Phase, where necessary. Where it is necessary to disconnect public lighting during the construction works or to undertake works outside of daylight hours where the existing lighting is low, appropriate temporary lighting will be provided. Temporary lighting will also be installed at the Construction Compounds for the duration of the Construction Phase.

The standard of temporary lighting installed during the Construction Phase will meet the standard of the existing carriageway and will be appropriate to the speed and volume of traffic during construction. Temporary construction lighting will generally be provided by tower mounted floodlights, which will be cowled and angled downwards to minimise spillage of light from the site.

5.2.3.8 Construction Stage Mobility Management Plan (CSMMP)

The appointed contractor will prepare a CSMMP. The CSMMP will be used to encourage personnel to commute by means other than private car. The CSMMP may comprise the following topics, as well as other relevant topics identified by the appointed contractor:

- Introduction;
- Objectives and targets;
- Strategy of travel;
- Construction phase specific measures;
- Access and surrounding road network;
- Opportunities for car sharing;
- Implementation and co-ordination;
- Monitoring; and
- Adherence to public health guidelines.

5.2.3.9 Traffic Management Signage

Temporary traffic management signage will be put in place in accordance with the requirements of the Department of Transport's Traffic Signs Manual, Chapter 8, Temporary Traffic Measures and Signs for Roadworks (DTTS 2019a) to warn road users of the works ahead and to advise of any changes to the carriageway layout. In addition to temporary traffic management signage, requirements may include;

- Provision of temporary signage indicating access route and locations for the appointed contractor and associated suppliers; and
- Provision of general information signage to inform road users and local communities of the nature and locations of the works, including contact details.

5.2.3.10 Timings of Material Deliveries

The appointed contractor will seek to reduce the impact of material deliveries on local communities and residents adjacent to the Proposed Scheme during the Construction Phase, where practicable.

5.2.3.11 Traffic Management Speed Limits

Adherence to posted / legal speed limits will be emphasised to all personnel / suppliers by the appointed contractor during induction training. The use of special speed limits for construction traffic in sensitive areas will be considered, such as 30km/hr at school locations. Recommended speed limits would only apply to construction traffic and not to general traffic. The sign posting of such speed limits is not expected in the interest of clarity for local road users.

5.2.3.12 Vehicle Cleaning

Details and information on vehicle cleaning to be carried out during the Construction Phase of the Proposed Scheme is provided in Section 5.4.3.12.

5.2.3.13 Road Cleaning

Roads being used for dedicated construction vehicle access routes shall be regularly inspected for cleanliness.

The appointed contractor will monitor for mud and debris on the roads as a result of the Construction Phase works and use a road sweeping vehicle for cleanliness if needed. The use of road cleaning sweepers should be considered as a last resort with prevention being the main objective.

5.2.3.14 Road Condition

The extent of the lorry traffic movements and the nature of the payload may create problems of:

- Fugitive losses from wheels, trailers, or tailgates; and
- Localised areas of subgrade and wearing surface failure.

Activities which may reduce the impact on road condition are outlined below. They should be incorporated into the CTMP by the appointed contractor where practicable;

- Loads of materials leaving each works area will be evaluated and covered if considered necessary to minimise potential dust impacts during transportation;
- Take all reasonable measures while transporting waste or any other materials likely to cause fugitive losses from a vehicle during transportation to and from the works areas, including but not limited to;
  - Covering of all waste or material with suitably secured tarpaulin / covers to prevent loss; and
  - Utilisation of enclosed units to prevent loss.
- Undertake pavement condition surveys along roads forming part of the construction traffic route, based on consultation with GCC and professional judgement regarding the condition of the route pre-construction. These record the baseline structural condition of the road being surveyed immediately prior to construction; and
- Throughout the course of construction of the Proposed Scheme, undertake on-going visual inspections and monitoring of the construction traffic routes to ensure any damage caused by construction traffic is recorded. Arrangements can then be made to repair any such damage to an appropriate standard in a timely manner such that any disruption is minimised.

Upon completion of construction of the Proposed Scheme, the surveys carried out pre-construction shall be repeated, and a comparison of the pre-construction and post-construction surveys carried out.

5.2.3.15 Road Closures and Diversions

Road closures and diversions will need to be carried out during the Construction Phase of the Proposed Scheme; however, these measures will be minimised wherever possible. Where necessary, road closures and diversions will take into consideration the impact on road users, residents, businesses etc. Road closures and diversions will be carried out with regard to the Traffic Signs Manual. All road closures and diversions will be determined by GCC, in consultation with the local authority and An Garda Siochána, as necessary.

Access will be maintained for emergency vehicles along the Proposed Scheme, throughout the Construction Phase.

5.2.3.16 Enforcement of Construction Traffic Management Plan

The appointed contractor shall develop the CTMP for use throughout the Construction Phase. All personnel and material suppliers shall be required to adhere to the CTMP. The appointed contractor shall agree and implement monitoring measures to confirm the effectiveness of the CTMP and compliance shall be monitored by GCC. Regular inspections / spot checks shall be carried out to ensure that all personnel and material supplies follow the agreed measures adopted in the CTMP.

5.2.3.17 Interface with Other Projects

The likely timelines of the Proposed Scheme construction works have considered the potential for simultaneous construction of, and cumulative impacts with other infrastructure projects and developments which are proposed along, or in the vicinity, of the Proposed Scheme. The likely significant cumulative impacts caused by the Proposed Scheme in combination with other existing or planned projects are identified and assessed in Chapter 20 (Cumulative Impacts & Environmental Interactions) of this EIAR.

Interface liaison will take place on a case-by-case basis through GCC, as will be set out in the Construction Contract, to ensure that there is coordination between projects, that construction access locations remain unobstructed by the Proposed Scheme works and that any additional construction traffic mitigation measures required to deal with cumulative impacts are managed appropriately.

5.2.3.18 Emergency Procedures During Construction

The appointed contractor shall ensure that unobstructed access is provided to all emergency vehicles along all routes and accesses. GCC shall provide to the local authorities and emergency services, contact details of the appointed contractor personnel responsible for construction traffic management.

In the case of a construction traffic related emergency, the following procedure shall be followed:

- Emergency Services will be contacted immediately by dialling 112;

- Exact details of the emergency / incident will be given by the caller to the emergency line operator to allow them to assess the situation and respond in an adequate manner;
- The emergency will then be reported to the appointed contractor;
- All construction traffic shall be notified of the incident (where such occurs off site);
- Where required, appointed first aiders will attend the emergency immediately; and
- The appointed contractor will ensure that the emergency services are directed to and arrive at the emergency location.

5.2.3.19 Communication

The appointed contractor shall, through GCC, ensure that close communication with the relevant local authorities and the emergency services shall be maintained throughout the Construction Phase.

As discussed in Section 5.1.6, the appointed contractor shall, through GCC, also ensure that the local community, landowners, and strategic stakeholders are appropriately informed of proposed traffic management measures in advance of their implementation. Contact information for key points of contact will be provided for members of the public to obtain additional information and to provide additional knowledge such as local events, sports fixtures etc. which may conflict with proposed traffic management measures. The appointed contractor will liaise with landowners through the Communication Plan agreed with GCC, where access to their property is temporarily affected by works.

5.3 Invasive Species Management Plan

5.3.1 Introduction

This Invasive Species Management Plan (hereafter referred to as the ISMP) for the Proposed Scheme contains management recommendations in respect of preventing the spread of and managing a range of non-native invasive species along the Proposed Scheme. Invasive Species (IS), Invasive Alien Species (IAS) or Invasive Alien Plant Species (IAPS) are terms sometimes referenced in legislation and or guidance. They are referred to as non-native invasive species in this report but are interchangeable.

The ISMP describes the options available to manage and prevent the spread of Third Schedule, non-native invasive plant species identified in the vicinity of the Proposed Scheme. Only non-native invasive species listed on the Third Schedule of the Birds and Natural Habitats Regulations 2011 - S.I. No. 477 of 2011 (hereafter referred to as the Birds and Natural Habitats Regulations) are dealt with in this ISMP.

The ISMP will be developed prior to the commencement of any on-site works for the Proposed Scheme. Construction works can disturb stands of Third Schedule non-native invasive plants and / or soils contaminated with non-native invasive plant material, as well as potentially lead to a new infestation. Therefore, management measures which will be contained in the ISMP will be implemented to avoid any direct or indirect impacts to habitats and species contained within the locality or as a result of its introduction to the area.

5.3.1.1 Legislative Context

The Birds and Natural Habitats Regulations contain specific provisions that govern control of listed invasive species. It is an offence to release or allow to disperse or escape, to breed, propagate, import, transport, sell or advertise species listed on Schedule 3 of the Birds and Natural Habitats Regulations without a Licence. The two regulations that deal specifically with this scheduled list of species are:

- Regulation 49: Prohibition of introduction and dispersal of certain species;
- and
- Regulation 50: Prohibition on dealing in and keeping certain species.

Following on from that the following are strictly prohibited:

- Dumping invasive species cuttings in anywhere other than in facilities licensed to accept them;
- Planting or otherwise causing to grow in the wild, hence the landowner (in respect of the Proposed Scheme this being GCC and the appointed contractor) should be careful not to cause further spread);
- Disposing of invasive species at a landfill site without first informing the landfill site (that is licensed under the Waste Act to take such Third Schedule material - plant or soil) that the waste contains invasive species material (this action requires an appropriate licence);
- Moving soil which contains Third Schedule-specific non-native invasive species in the Republic of Ireland, unless under licence from the National Parks and Wildlife Service (NPWS) (this licence is separate from and does not discharge any person being in receipt of other necessary waste permits / licences etc.); and
- European Parliament and of the Council (Invasive Alien Species) Regulation 2014 (1143 of 2014) (hereafter referred to as the IAS Regulation) lists specific Species of Union Concern, some of which overlap with the Third Schedule species.

The IAS Regulation conveys the rules to prevent, minimise and mitigate the adverse impacts of the introduction and spread (both with and without intention) of invasive alien species on biodiversity and the related ecosystem services, as well as other adverse impacts on human health or the economy. Target 4.4 of Ireland’s third National Biodiversity Action Plan 2017-2021 (Department of Culture, Heritage and the Gaeltacht 2017) requires that “harmful invasive alien species are controlled and there is reduced risk of introduction and / or spread of new species”.

5.3.1.2 Limitations

It should be noted that any decision on efficacy of chemical treatments can only be provided by registered pesticides advisor. A suitably qualified specialist will be appointed by the contractor to monitor the treatment of non-native invasive species. This ISMP shall be updated as necessary by the specialist.

5.3.2 Methodology

5.3.2.1 Guidance

This ISMP and the mitigation strategies that are discussed relating to invasive plant species have been prepared with regard to the following guidance documents, where relevant:

- The Management of Invasive Alien Plant Species on National Roads – Technical Guidance (Transport Infrastructure Ireland (TII) 2020a)
- The Management of Invasive Alien Plant Species on National Roads – Standard (TII 2020b)
- Managing Japanese knotweed on Development Sites (Version 3, amended in 2013, withdrawn from online publication in 2016): The Knotweed Code of Practice (Environment Agency (EA) 2013) (This document, although no longer supported by the EA, is nonetheless a practical document in determining the approach and control mechanisms for Japanese knotweed);
- Managing Invasive Non-Native Plants in or near Freshwater (EA 2010);
- Best Practice Management Guidelines for Japanese knotweed (Invasive Species Ireland (ISS) 2008a);
- Best Practice Management Guidelines for Himalayan balsam (ISS 2008b);
- Best Practice Management Guidelines for Giant hogweed (ISS 2008c);
- *Allium triquetrum* (Three-cornered garlic) Great Britain Non-Native Organism (Non-Native Species Secretariat (NNSS) 2018);
- Countryside Management Publications, Giant hogweed (Department of Agriculture and Rural Development (Northern Ireland) (2016);
- Good Practice management, New Zealand pygmyweed (*Crassula helmsii*) Version 1, August 2018 (Animal and Plant Health Agency et al. 2018);
- Management Measures for Widely Spread Species (WSS) in Northern Ireland Nuttall’s waterweed (*Elodea nutallii*) (Northern Ireland Environment Agency 2021);
- Aquatic and Riparian Plant Management: Controls for Vegetation in Watercourses, Technical Guide (EA 2014); and
- Biosecurity Protocol for Field Survey Work (Inland Fisheries Ireland 2010).

5.3.2.2 Surveys

Following on from a desk study review of the National Biodiversity Data Centre (NBDC) records, non-native invasive species surveys were undertaken for the Proposed Scheme in 2019, 2020, 2021 and 2022 within the appropriate botanical season (April to September) when species are readily observable and identifiable.

Non-native invasive species listed on the Third Schedule of the Birds and Natural Habitats Regulations were searched for within and adjacent to the Proposed Scheme. Surveys were carried out by the EIAR ecologists, however, non-native invasive species were not detected along the Proposed Scheme, however Japanese Knotweed was detected approximately 32m from the site boundary at the Galway Harbour Enterprise Park. Full details of the surveys are included in Chapter 12 (Biodiversity) in Volume 2 of this EIAR.

5.3.3 General Measures to Control and Prevent the Spread of Non-Native Invasive Plant Species

5.3.3.1 Pre-Construction Survey

During the interim between the original non-native invasive species surveys and commencement of construction following grant of planning permission, it is possible that the existing stands of Third Schedule non-native invasive species may have expanded (if unmanaged) or decreased (if active management regime in place), or that newly established Third Schedule non-native Invasive species may have become established within the footprint of the Proposed Scheme.

A confirmatory pre-construction invasive species survey will be undertaken by a suitably qualified specialist, arranged by GCC, to confirm the absence, presence and / or extent of all Third Schedule non-native invasive species within the footprint of the Proposed Scheme. Where an infestation is confirmed / identified within the footprint of the Proposed Scheme, this will require the implementation of the ISMP.

Data collected as part of the pre-construction invasive species survey will include a detailed description of the infestation including the approximate area of the respective colonies (m^2), where feasible, approximate total number of stems, pattern of growth and information on other vegetation present). This information will enable calculations of volumes of infested soils to be excavated where necessary, as part of the measures outlined below.

Following on from the pre-construction invasive species survey, the ISMP will be updated, as advised by a suitably qualified specialist, with regard to the Management of Invasive Alien Plant Species on National Roads - Technical Guidance (TII 2020a) and Standard (TII 2020b) and other species-specific guidance documents including those listed in the ISMP, as necessary. The updated ISMP will detail the strategy that will be adopted during the Construction (and Operational) Phase in order to manage and prevent the spread of invasive plant species, and where a Third Schedule non-native invasive species are encountered directly in the works area, the method of treatment / eradication.

5.3.3.2 Invasive Species Management Plan (ISMP)

Following on from the pre-construction invasive species survey, the ISMP will be updated to detail the exact measures for any non-native invasive species population present within the footprint of the Proposed Scheme. Depending on the extent and nature of the works, a number of approaches / treatments may be approved, all following on from the measures in the ISMP.

GCC will ensure that all control measures specified in the ISMP shall be implemented by a suitably qualified and licenced specialist prior to the Construction Phase of the Proposed Scheme to control the spread of newly established non-native invasive species within the footprint of the Proposed Scheme.

Furthermore, the appointed contractor will adhere to control measures specified within the ISMP throughout the Construction Phase of the Proposed Scheme. The site will be monitored by the appointed contractor after control measures have been implemented. Any re-growth will be subsequently treated.

All measures that are prescribed in the ISMP shall be equally applicable to advance works as to construction works. In the operational phase the management of the infrastructure will be the responsibility of the local authority and the control of invasive species will be as per their plans and procedures, and responsibilities under The Birds and Natural Habitats Regulations.

5.3.3.3 General Measures to Avoid the Spread of Non-Native Invasive Species

The unintentional spread of non-native invasive species during construction works (within a construction site or unwittingly from outside of a site, such as through the importation of materials or poor biosecurity practices regarding plant and machinery) can be a significant issue, and if not managed properly, can result in the spread of non-native invasive species to uninfested areas (within or adjacent to works areas), which would increase the future cost and effort required to control the species and could pose further public health and safety risks (Japanese knotweed can cause damage to weaknesses in built environment, whilst Giant hogweed is an environmental public health hazard).

The most common ways that invasive species can be spread is:

- Site and vegetation clearance, mowing, hedge-cutting or other landscaping activities;
- Spread of seeds or plant fragments during the movement or transport of soil;
- Spread of seeds or plant fragments through the local surface water and drainage network;
- Contamination of vehicles or equipment with seeds or plant fragments which are then transported to other areas;
- Importation of soil from off-site sources contaminated with invasive species plant material; and
- Leaving riparian corridors bare of vegetation thus allowing establishment of seed material from outside the site.

5.3.3.3.1 Site Establishment

During advance works and prior to commencement of construction, any areas where Third Schedule non-native invasive species have been recorded by the pre-construction surveys must be clearly fenced off prior to and during construction (in order to avoid spreading seeds or plant fragments around or off the construction site) until such time that the mitigation measures are implemented and treatment has been completed, or that works in these areas are monitored in accordance with the requirements of the ISMP.

This includes the Construction Compounds and the entirety of the Proposed Scheme footprint. Earthworks or machinery movement must be avoided in any areas where non-native invasive species have been identified during the pre-construction surveys, until the relevant stands have been eradicated.

5.3.3.3.2 Biosecurity and Site Hygiene

It is important to ensure that the spread of non-native invasive species, where present, is curtailed. It is also necessary to ensure that in areas where non-native invasive species are not present, that they are not unintentionally spread e.g., through the importation of contaminated material being brought onto the site.

Unwashed construction equipment, plant, vehicles, and footwear can provide a vector for the spread of non-native invasive species within the Proposed Scheme and from areas outside the Proposed Scheme, where infestation is present or where vector material potentially containing seed / root material is attached to plant. The following hygiene measures shall be undertaken for the Proposed Scheme.

- Known or potentially infested areas within the working area of the Proposed Scheme shall be clearly fenced off in advance of works and access restricted until such time that treatment has commenced and / or construction works are monitored in accordance with the ISMP in the area. In relation to Japanese knotweed, the guidance recommends an exclusion buffer of 7m (metres) in all directions (within the works area and 3m vertically underground);
- Erection of clear signage at the Construction Compounds etc. and inclusion of detail during tool-box talks or similar (environmental induction) for construction staff in respect of the management of Third Schedule non-native invasive species. The signage and notification should be easily understood so that users are aware of the measures to be taken for known non-native invasive species, or what they should do in the case of suspected non-native invasive species identified. In particular the potential health risks posed by Giant hogweed, where it is recorded from within or adjacent to a Proposed Scheme should be clearly notified to personnel;
- Identify dedicated access points into and out of fenced off areas. These shall not be breached until such time that eradication / removal of non-native invasive species is confirmed or monitoring of the treatment / eradication process is commenced;
- Where possible, the locations of dedicated footwear and wheel wash facilities should be identified in the ISMP. Where a dedicated / bespoke wheel wash cannot be installed owing to space limitations, the appointed contractor will

ensure that no excavated loose material is allowed offsite from within an exclusion zone. Similarly, where plant that is used to excavate soils, it shall be visually checked for loose soil before movement to another part of site (where possible, the movements of tracked machinery should be restricted within the non-native invasive species exclusion zone. Loose soil shall be scraped off and disposed of, and a solution of Virkon© (or similar approved disinfectant) applied to machinery to ensure that no obscured seed / root material remains viable;

- Vehicular movements within the exclusion area shall be minimised as far as is practical;
- Machinery which has been used for the transport and / or excavation of infected / suspected infected vector material shall be thoroughly washed down, and the washings captured for disposal. All such machinery / plant shall not be permitted to commence work elsewhere on or off-site until written confirmation of same has been undertaken;
- Dedicated wash down and solution capture should be set up in the Construction Compounds.

  All washings should be stored in a quarantined bunded container that is rated for such storage until such time that they are removed offsite for disposal and a facility that is authorised to accept such waste;
- Except in very particular circumstances, under the guidance of the specialist, there shall be no temporary storage of infected / suspected infected soils on-site. They must be removed offsite as per guidance in Section 5.3.3.2.3; and
- Where small volumes e.g., volume capable of being double bagged in quarantine bags such as cut plants, bulbs or loose soil occur, it may be practical to bag the material and bring it to a clearly demarcated and dedicated quarantine area within the Construction Compounds until such time that the material is disposed of to an authorised facility, similar to the process of disposing of bulk excavated infected soil.

5.3.3.3.3 Soil Excavation

No excavations within a clearly demarcated and fenced off buffer zone shall be permitted. For Japanese knotweed, guidance recommends a horizontal distance of up to 7m from the outside of the stand. This could include under built ground, should suitable areas of weakness or uncompacted ground be encountered by the plants' rhizomes. For other species there will be different buffer zones as guided by the specialist.

Where the excavation of soil containing Third Schedule non-native invasive species (vector material) is the preferred option, the operation shall be monitored for its entirety until the risk of spread of Third Schedule non-native invasive species is negated.

There should be no temporary storage on-site of bulk excavated infected material. Where the ISMP calls for shallow / deep burial, this material shall be removed from the excavated area and transported immediately to approved receptor area on site. Furthermore, the temporary storage of uninfected material should not occur within a European or National site nor within 10m of any watercourse and any land within an identified flood zone. Where temporary stockpiles of infected material cannot for practical limitations, be situated away from a potential flood risk area, the appointed contractor will be required to include a flood response plan within the Environmental Incident Response Plan (see Section 5.6) to ensure that any inundation of Construction Compounds does not result in a pollution event to nearby water bodies.

Plant and machinery used in the control, excavation and transport of invasive material shall also be subject to the recommendations described in Section 5.3.3.2.2.

The installation of industry-rated non-native invasive species-proof membrane before infilling construction of road / paths surface may be required. All waste arising out of this process which has been in contact with the excavated ground shall be treated as infected waste and disposed of at a facility that is authorised to accept such waste (See Section 5.3.3.2.4).

Where the movement of any Third Schedule non-native invasive species is required off-site, a licence will be required from NPWS in advance of any movement to a site/facility licensed to accept such waste, as per the Birds and Natural Habitats Regulation. This licence is separate to; and does not negate the need for licences / permits / authorisations required under waste legislation.

5.3.3.3.4 Disposal of Material

Where any non-native invasive plant material is collected (e.g., by hand-pulling or mowing), it is important that its disposal does not result in a risk of further spread. The movement of invasive plant material, offsite, requires a licence from the NPWS, as per the Birds and Natural Habitats Regulations. Invasive species (particularly roots, flower heads or seeds) must be disposed of at licensed waste facilities or composting sites, appropriately buried, or incinerated having regard to relevant legislation, e.g., Waste Management Act 1996, as amended – S.I. No. 10 of 1996 (hereafter referred to as the Waste Management Act); Section 4 of the Air Pollution Act 1987 – No. 6 of 1987; relevant local authority byelaws and any other relevant legislation. All disposals must be carried out in accordance with the relevant waste management legislation, as per guidance from the Transport Infrastructure Ireland (TII) Guidelines for the Management of Waste from National Road Construction Projects (TII 2017).

It should be noted that some invasive species plant material or soil (vector material) containing residual herbicides may be classified as either ‘hazardous waste’ or ‘non-hazardous waste’ under the terms of the Waste Management Act, and both categories may require special disposal procedures or permissions. Advice should be sought from a suitably qualified waste expert regarding the classification of waste and the suitability of different disposal measures.

5.3.3.3.5 Measures to be Implemented during the Application of Herbicides

Some of the control options may require the use of herbicides, which can pose a risk to human health, to non-target plants or to wildlife. In order to ensure the safety of herbicide applicators and of other public users of the site, a suitably qualified pesticides advisor, registered with the DAFM must be employed.

The appointed contractor is required to refer to appropriate guidance documents, including but not limited to those listed in Section 5.3.2.1, which provide detailed recommendations for the control of invasive species and noxious weeds.

These documents include measures to aid the identification of relevant species, with details for the timing, chemicals and methodology for chemical control (if applicable), and for measures to avoid environmental damage during the use of herbicides. The appointed contractor (or the specialist as appropriate) will update the ISMP in accordance with the relevant guidelines before commencing works.

It should be noted that where a chemical treatment is to be used, there is a risk of contaminating a watercourse. The choice of herbicide is typically limited to formulations of Glyphosate or 2,4-D amine that are approved for use near water.

Full details of any chemical used, where required and as advised by a registered pesticides advisor, will be included in the ISMP prepared in advance of construction of the Proposed Scheme.

5.3.3.2.6 Importation of Soil and Other Material

The bulk importation of material from offsite could potentially result in the accidental spread of Third Schedule non-native invasive species, as it is uncertain if these site(s) are free from non-native invasive species. This is likely to be less of an issue for road building material. However, in terms of landscaping, if soil is imported to the site for landscaping, infilling or embankments, the appointed contractor shall seek documentation from suppliers confirming that the material is free from invasive species.

5.3.3.4 Post-Construction Monitoring

Following the construction of the Proposed Scheme, there may be ongoing treatment programmes which extend for a number of years into the Operational Phase. In the operational phase the management of the infrastructure will be the responsibility of the local authority and the control of invasive species will be as per their plans and procedures, and responsibilities under The Birds and Natural Habitats Regulations.

The above measures are important for all Third Schedule non-native invasive species, and in particular Japanese knotweed, where it occurs, as maintenance works associated with landscaping, such as mowing and hedge cutting have the potential to spread this plant via the dispersal of very small amounts of shredded plant material. If invasive plants are found, then they shall be treated as per the measures outlined in the ISMP and any species-specific guidelines.

5.3.4 Assessment of Management Options for Third Schedule Non-Native Invasive Species

The general measures included in Section 5.3.4 are required to ensure good on-site practices in respect of known or potential Third Schedule non-native invasive species.

Sections 5.3.4.1 to Section 5.3.4.5 further identify practical management controls. The colour scheme shown is a qualitative tool intended to assist the reader to focus on the most likely practical solutions. It is acknowledged that more than one potential control measure exists and that a single or combination of measures may be required. The recommendations presented in this ISMP provide the minimum requirements for the likely control measures and the measures outlined in this ISMP shall be developed (with further detail on methodology used at each location, timing, practical management etc.) by the appointed contractor (or the specialist as appropriate).

The use of chemical treatments is recognised as a potential treatment option. However, the services of a registered pesticide advisor must be employed in the specifying named chemicals including those rated for use adjacent to aquatic environments where required, treatment type, dosage, and timing etc., and / or use of pesticides in the management of potential Third Schedule non-native invasive species within the Proposed Scheme.

The selected management control to be defined for each non-native invasive species stand within the Proposed Scheme will depend on:

- Results of the pre-construction survey; and,
- Construction requirements – timing of works at specific locations, level of infestation and practical considerations such as reducing disturbance to road users / homeowners.

The ISMP, which will be updated following on from the pre-construction surveys, may require the utilisation of a number of controls that are described and assessed below.

5.3.4.1 Japanese knotweed (*Reynoutria japonica*)

Japanese knotweed is high impact non-native invasive species that is particularly effective at colonising disturbed ground (e.g., construction sites) and can spread by the re-growth of cut fragments or root material, so if it is broken up during site clearance or other earthworks it can readily re-grow in new areas to which soil is moved. Japanese knotweed readily reproduces asexually (in Ireland, at least, as only Female plants have been recorded) and regrowth can occur from plant material weighing as little as 0.7g (grams) of viable material. It is acknowledged to be very difficult to effectively control and an even more difficult weed to fully eradicate.

Given the nature of Japanese knotweed, chemical treatments are often preferred over physical methods as they can, if implemented properly reduce the disturbance of the plant / population thus reducing the chances of its spread. If herbicide is applied as the treatment option, it will need to be reapplied for up to five years after the first application to ensure the plant control measures have been effective; or monitored for a minimum of two years during which no regrowth is recorded.

Table 5.6 presents an assessment of potential treatment options available for the treatment of Japanese knotweed. The various methods are analysed and described in further detail as necessary. It should be noted that where it might occur within a Proposed Scheme, that a number of the measures described below may be applicable, depending on the nature of works, the timing etc. These will be fully detailed in the ISMP after the recommended pre-construction survey of the Proposed Scheme.

Table 5.6: Assessment of Management Methods for Japanese knotweed

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
Physical	Dig and dispose offsite, under license	This option requires that all plant material (above and below ground) is excavated along with soil and disposed of to a facility authorized to accept it. In addition to waste permits / authorizations, a wildlife license issued by NPWS is required for the transport of Third Schedule non-native invasive species offsite. Depending on the nature of the excavation the proximity of services etc., the use of root barrier membrane (Section 5.3.1.1) could be required.	Likely – given the nature of the schemes, there may be a need to excavate soil and plant material to enable construction works to go ahead in timely manner.
	Dig and dispose onsite. - Shallow burial - Deep burial	A wildlife license from NPWS is not ordinarily required if the burial of collected material is proposed for within the consented development site. Shallow burial in a constructed cell such as a dedicated sealed cell within a constructed berm will allow for periodic monitoring and of easy chemical treatment of any regrowth. Deep burial entails a dedicated sealed cell within a constructed excavation, that is at least 2m below the surface of the ground. The landscaping regime should not specify trees or scrub to be planted above. Either shallow or deep option could require the use of root barrier membrane (Section 5.3.4.1.1). The use of chemical pre-treatment of deep/shallow cells could also be required.	Unlikely – given the lack of suitable lands within the largely developed metropolitan area.
	Screen on site – remove fragments offsite & reuse soil.	A control option that can be used to reduce the volume of soil / sediment to be moved elsewhere for burial, this option requires suitable plant, adequate space and volumes of soil to make the operation at a location cost effective. This option often requires the use of root barrier membrane (Section 5.3.4.1.1) owing to reuse of screened soil. The use of chemical pre-treatment	Possible but unlikely given the space requirements for a screener (unless a bespoke small-scale screener is available).

Approach	**Treatment Options**	**Comment**	**Potential for Implementation on the Proposed Scheme**
		of deep / shallow cells could also be required.	
	Cutting and / or Strimming	Not recommended and does not apparently diminish vigour of plants over time. Largely cosmetic and can result in considerable spread of viable vegetative material that can readily regenerate on suitable conditions.	Not Recommended.
Chemical	Spot	Used for isolated plants – knapsack or weep sprayers. Chemical treatments for infestations near water should be rated for use near aquatic locations.	Chemical treatments are often a preferred option for treating Japanese knotweed, but the process can take between 3 to 5 years before eradication can be guaranteed and requires at least 2-year post implementation monitoring. However, given the nature of the Proposed Scheme, the use of chemical treatment alone is unlikely to be adequate unless treatment regime begins a number of years before construction commencement.
	Spray	Used for isolated plants or large populations using knapsack or weep sprayers. In accessible areas including along riverbanks, lance sprayers can be used. Chemical treatments for infestations near water should be rated for use at or near aquatic locations. Can result in chemical drift.	
	Stem Injection	This method is considered very effective, if the injection is timed appropriately for growth phase. However, it is labour-intensive (sometimes) requiring some cutting and is usually only carried out on small/isolated populations. Chemical treatments for infestations near water should be rated for use at or near aquatic locations.	Possible and requires specialist equipment to enable working alongside the biohazardous plant. Some advantages over other conventional chemical treatments e.g., reduces drift, not weather dependent.

5.3.4.1.1 Root Barrier Membrane

Following on from the excavation of Japanese knotweed, there may be a need to install a root barrier membrane. These are specialised products that can provide protection to structures / services etc. from regrowth from within or outside a site if suitably rated and properly installed. Thereafter, any small adjacent infestation can be more readily treated with chemical treatment for example.

5.3.4.1.2 Reseeding Following Eradication

This is not strictly a control method. However, where treated ground is not being built upon, planting or resowing mixtures of native grass species helps to restore the original vegetation and aids post control management of affected sites. A grass sward established in autumn will compete with germinating Japanese knotweed seedlings in the following spring.

5.3.4.2 Giant hogweed (*Heracleum mantegazzianum*)

This is a high-risk invasive species, that is also a biohazard in that it can pose a threat to humans. The chemistry of its sap is such that exposure to it on skin can result in prolonged photosensitizing reactions with blistering. Thus, a clearly demarcated exclusion buffer, in excess of 4m, is recommend for any individual / populations of this species before commencing works.

It spreads via heavy seeds which can easily be transported by water; hence it is often found along river corridors. While the plant favours riverbanks, it is known to be found on waste / derelict ground as well as railway lines for instance. Its presence can impact local biodiversity and undermine bankside integrity. The seedling stage is the most vulnerable. Mortality of seedlings is comparable to many other plants and its seed bank is considered to be persistent for a short number of years only. Since Giant hogweed can only reproduce via seed, control measures applied before flowering and fruit set will limit subsequent generations (and even then, only with favourable conditions). The ideal time to control Giant hogweed via chemical treatment is April, with follow on monthly applications targeting regrowth, although for this treatment options, it can require up to five years before successful eradication.

Table 5.7 presents an assessment of potential treatment options available for the treatment of Giant hogweed. The various methods are analysed and described in further detail as necessary.

Table 5.7: Assessment of Management Methods for Giant hogweed

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
Physical	Above ground Cutting	Not recommended. Largely cosmetic and prolongs flowering until such time that control halted. However, if digging is used, it is recommended that the removal be attempted in April /early May when the plant is usually less than 30cm tall. However, the root must be captured also.	Unlikely - requires specialist equipment to enable working alongside the biohazardous plant
	Root cutting	Individual plants may be killed by cutting at a 45-degree angle 15cm below ground level with a spade in April or May.	Given the nature of the project, could be used to remove biohazard plant and thereafter allow for chemical control against any regrowth.

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
		Can be laborious unless small/isolated stands. Can be effective if combined with chemical treatment over four to five years repeat treatment	Requires specialist equipment to enable working alongside the biohazardous plant
	Strimming	Not recommended owing to spread of sap.	Not Recommended.
	Ploughing	Can provide total control where seedlings and young plants encroach onto agricultural land. However not practical in metropolitan areas and isolated stand along riverbanks.	Unlikely given the locations that Giant hogweed is often found in.
	Grazing	Grazing should begin when early foliage appears in April and should continue until early autumn when re-sprouting stops. Eradication can take between 5-10 years so that seed bank and root stock is fully depleted of resources.	Not possible in metropolitan area
	Pulling	Hand pulling is only suitable for small/immature plants (and with suitable PPE to protect exposure of bare skin). Potential remains for tap root to remain underground and regenerate.	Unlikely for mature plants. Requires specialist equipment to enable working alongside the biohazardous small/immature plants
	Biological Control	Other than natural soil biota, it is not currently permitted to introduce any organisms to areas to deal with Giant hogweed. Research ongoing which would require permitting thereafter.	Not possible at present.
	Dig and dispose offsite, under license	This option requires that all plant material (above and below ground) is excavated along with soil and disposed of to a facility authorized to accept it. Given the phytotoxic nature of the plant, it should not be buried onsite nor disposed of with general C&D waste. In addition to waste permits / authorisations, a wildlife license issued by NPWS is required for the transport of Third Schedule non-native invasive species offsite.	Possible and depending on location may be required.

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
Chemical	Spot Treatment	Used for isolated plants – knapsack or weep sprayers. Chemical treatments for infestations near water should be rated for use near aquatic locations.	Most widely used method, but to be wholly effective, requires total control over ~5 years of treatments within a river catchment or the isolated location. Is weather dependent and can result in chemical drift to adjacent vegetation or watercourses.
	Spray	More suitable for large stands, where machine-mounted blanket sprays are used. Chemical treatments for infestations near water should be rated for use near aquatic locations.	Possible but unlikely owing to nature and size of population recorded on scheme.
	Stem Injection	Can only be carried out on young stems. Due to difficulties with the timing of application and the potential safety risk of contact with the large leaves this method requires specialist safety equipment.	Possible and requires specialist equipment to enable working alongside the biohazardous plant – Despite some advantages over other conventional chemical treatments e.g., reduces drift, not weather dependent.

5.3.4.2.1 Temporary Storage of Collected Material

Given the phytotoxic nature of Giant hogweed, cut material should not be discarded. Ideally it should be disposed of immediately with similar non-native invasive species waste to a facility authorised to accept such waste.

However, given the nature and relative sizes of Giant hogweed infestations it may be suitable to collect cut biomass (where not disposed of immediately to a facility authorised to accept such waste), and to double bag it for transport to dedicated quarantine area (location to be approved as part of the ISMP to decompose before disposal with similar non-native invasive species waste in a facility authorised to accept such waste.

The locations of areas for which Giant hogweed has been eradicated should be notified to the local authority, so that any future public health issue involving similar symptoms can be tracked.

5.3.4.2.2 Reseeding Following Eradication

This is not strictly a control method. However, where treated ground is not being built upon, planting or resowing mixtures of native grass species helps to restore the original vegetation and aids post control management of affected sites. A grass sward established in autumn will compete with germinating Giant hogweed seedlings in the following spring and retard its establishment.

5.3.4.3 Himalayan balsam (*Impatiens glandulifera*)

This high-risk invasive species is easily disturbed, particularly if in flower and readily becomes re-established along riparian corridors, which are annually subject to alluvial flooding. Unlike Japanese knotweed though, it does not reproduce asexually. Plants can produce in excess of 6000 seeds, and it aggressively colonises bare ground along riverbanks - including wet woodlands as well as waste ground where suitable conditions exist. Due to its rapid growth, it can outcompete most native species. While its seedbanks are viable for up to 18 months, the resupply of seed is often achieved through annual river flooding and riparian inundation with freshly deposited soil-laden alluvium.

Table 5.8 presents an assessment of potential treatment options available for the treatment of Himalayan balsam. The various methods are analysed and described in further detail as necessary. Control measures for Himalayan balsam should aim to prevent flowering and are therefore undertaken before June. However, eradication may take up to five years. It should be noted that successful localised management of Himalayan balsam is difficult along watercourses, as the spread of this non-native invasive species from upstream areas (e.g., outside of the Proposed Scheme) onto bare ground often occurs after winter flooding.

Table 5.8: Assessment of Management Methods for Himalayan balsam

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
Physical	Hand Pull	Small isolated and immature infestations, such as in gardens or roadsides can usually be readily pulled prior to flowering e.g., care must be taken not to leave lower plant sections as these can regrow rapidly. Additionally, any flower heads (if present) should be covered by a tied bag before pulling to ensure no seed drop.	Possible – ideal for smaller areas adjacent to the likely works boundary.
	Dig and dispose offsite, under license	This option requires that all plant material (above and below ground) is excavated along with soil and disposed of to a facility authorised to accept it. In addition to waste permits / authorisations, a wildlife license issued by NPWS is required for the transport of Third Schedule non-native invasive species offsite.	Possible – given the nature of the scheme, this may be an optimal control measure.
	Mechanical	Repeated cutting or mowing, is effective for larger stands, but plants can regrow if the lower parts (above lowest node) are left intact. Regeneration can be further halted by ensuring full ground vegetative layer through reseeding.	Possible but unlikely main option given the nature of works along existing road infrastructure.

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
	Grazing	Regular grazing is said to suppress the plant over time.	Not practical – given the nature of the metropolitan landscape and nature of the scheme.
Chemical	Spot/Weed Wiper	Can be used for smaller infestations in spring before flowering occurs, but as late as to allow germinating seedlings to have become established and thus be able to uptake the chemical treatment. adjacent to the likely works boundary – chemical treatments for infestations near water should be rated for use near aquatic locations.	Possible – within the works boundary – Where ground is to be excavated, may require physical control also.
	Foliar Spray	Can be applied to larger infestations via knapsack spray / lance spray etc. in spring before flowering occurs, but as late as to allow germinating seedlings to have become established and thus be able to uptake the chemical treatment. Chemical treatments for infestations near water should be rated for use near aquatic locations.	Possible – within the works boundary – Where ground is to be excavated, may require physical control also.

5.3.4.3.1 Temporary Storage of Collected Material

Given the nature and relative extent of Himalayan balsam infestations in some urban situations, collected biomass (pulled stems / roots and bagged flower heads), where not disposed of immediately to a facility authorised to accept such waste, could be double bagged and put in dedicated quarantine areas (locations to be approved as part of the ISMP). Here, the material could be left to decompose before disposal with similar non-native invasive species waste at an authorised facility.

5.3.4.3.2 Reseeding Following Eradication

Areas devoid of; or cleared of vegetative cover near watercourses should be resown with appropriate riparian ground cover species in summer months to ensure that bare banks do not provide favourable conditions for Himalayan balsam to become re-established and to protect banks from accelerated erosion.

For any area of ground that is cleared of this non-native invasive species, and which is not subsequently constructed upon, follow-on mechanical cutting regimes and / or chemical treatments may be required to ensure the seed bank is fully exhausted.

5.3.4.4 Three-cornered garlic (*Allium triquetrum*)

A medium impact, rhizomatous species, Three-cornered garlic is often planted and can become established in natural and semi natural habitats, where it is reported to spread by ant-dispersed seed and division of clumps (NNSS 2018).

It can readily establish in suitable ground resulting in it posing a threat to biodiversity where the plant forms early season dense monocultural masses, particularly at protected sites.

Management of this species is relatively straightforward, although there is a requirement that it be visible above ground so as to delineate its likely extent and ensure efficacy of management. Management of infestations can be managed through chemical or physical-based options or a combination of both. However, given the possibility of some underground bulbs / seedbank remaining within the ground post-treatment, eradication may require a number of repeat treatments over a number of years to ensure effective treatment of all bulbs.

Table 5.9 presents an assessment of potential treatment options available for the treatment of Three-cornered garlic. The various methods are analysed and described in further detail, as necessary.

Table 5.9: Assessment of Management Methods for Three-cornered garlic

Approach	Treatment Options	Comment	Potential for Implementation on the Proposed Scheme
Physical	Hand dig	Hand-dig when small population present, ensuring that all biomass including bulbs collected. May also require a number of years of mechanical cutting to exhaust seed/bulb bank in wider subsurface environment. In addition to waste permits / authorisations, a wildlife license issued by NPWS is required for the transport of Third Schedule non-native invasive species offsite.	Likely
	Mechanical Excavation	For larger areas of infestation only, soil can be screened, and bulbs removed. In addition to waste permits / authorisations, a wildlife license issued by NPWS is required for the transport of Third Schedule non-native invasive species offsite.	Unlikely given the nature and size of the identified populations.
Chemical	Spray	Chemical treatment can be made in the spring (when above ground vegetation visible) but before flowering. Multiple applications may be required due to persistence of bulbs and soil seed bank.	Possible - Where ground is to be excavated, may require physical control also

5.3.4.4.1 Temporary Storage of Collected Material

Given the nature and relative sizes of infestations of Three-cornered garlic, bulbs and vegetative material, where not disposed of immediately to authorised facilities, could be double bagged and placed in dedicated quarantine areas to decompose before disposal with similar non-native invasive species waste at authorised facilities.

5.3.4.4.2 Reseeding Following Eradication

For any area of ground that is cleared of Three-cornered garlic, and is not constructed upon, a follow-on mechanical hand-pulling / cutting regime and / or chemical treatment may be required post construction to ensure full exhaustion of the bulb / seed bank.

5.3.4.5 New Zealand pigmyweed (*Crassula helmsii*)

The trade and potential escape of New Zealand pigmyweed through the aquarium and garden industry is considered the principal vector for the introduction of this species into new locations, particularly discarded material. Once established, it can readily spread resulting in a threat to native biodiversity, where the plant can form monocultural masses. It does not reproduce from seed, but readily grows from small stem fragments (~5mm in length). It does not like shaded areas and where present can thrive in open, slow-moving waters and ponds. It responds well to nutrient enrichment, particularly nitrate enhancement.

Three forms of the plant are recognised, namely submerged, emergent, and terrestrial, with emergent and terrestrial forms easily identified. It is considered to be extremely difficult and costly to control, particularly where large monodominant stands occur, and its ability to form new plants vegetatively from small fragments facilitates its spread to new locations. Management of infestations may be managed through a range of measures, although it is recognised that it is very difficult to fully eradicate unless a catchment- based approach is taken. It is also noted that physical / chemical management is avoided in late summer and autumn.

Table 5.10 presents an assessment of potential treatment options available for the treatment of New Zealand pigmyweed.

Table 5.10: Assessment of Management Methods for New Zealand pigmyweed

Approach	Treatment Options Potential Actions	Comment	Potential for Implementation on the Proposed Scheme
Physical	Dredging	Dredging of material including soils (between October to March) followed by offsite composting or incineration.	Possible but unlikely. Onerous to undertake and efficacy is considered low unless strictly applied, as it could result in further spread.

Approach	**Treatment Options Potential Actions**	**Comment**	**Potential for Implementation on the Proposed Scheme**
		Up and downstream areas would need to be fully enclosed with fine net to captures released material. In addition to waste permits / authorisations, a wildlife license issued by NPWS is required for the transport of Third Schedule non-native invasive species and contaminated soil offsite.	
	Burying	Drying out the waterbody followed by burial (February to March) in excess of 20cm (centimetres) of collected dredged material.	Considered successful, when combined with chemical treatment but usually applied to ponds etc. Not possible if canal navigation to be retained and other species of note e.g., *Groenlandia densa* potentially present.
	Hand pulling	Up and downstream areas would need to be fully enclosed with fine net to capture released material. Collected material (All year – if plant is visible) could be composted offsite or sent for incineration. In addition to waste permits / authorisations, a wildlife license issued by NPWS is required for the transport of Third Schedule non-native invasive species and contaminated soil offsite.	Only suitable for areas that can be contained e.g., water flow unhindered despite area being netted. Submerged material may be overlooked.
	Covering site	Cover with black polythene or a similar material to shade the plant for at least three months, but preferably six.	Unlikely - given the nature of Crassula, treatment likely for small discrete infestation only.

Approach	**Treatment Options Potential Actions**	**Comment**	**Potential for Implementation on the Proposed Scheme**
		Has been demonstrated to work for other submerged species e.g., Lagarosiphon, but untested for Crassula.	Would be very onerous to cover submerged infested area with jute/polythene to shade outgrowth for 3 months plus. Could locally alter the area to detriment of native biodiversity. Does not confirm that dormant submerged material would not become established after removal of covering.
	Saltwater inundation	Flood affected areas with saltwater for a minimum of 31 days.	Only suitable for areas near the sea and where saline water can be prevented from flowing off. Not suitable in freshwater systems, where other native species would not tolerate saline conditions.
Chemical	Knapsack sprayer	Chemical treatment can be made in the April to November. Multiple applications within a season are not usually required if applied at the appropriate time and no further physical disturbance of the treated population occurs. Chemical treatments for infestations should be rated for use near aquatic locations.	Possible, but only captures emergent and terrestrial forms. Emergent form where present would remain untreated.
Environmental		Steepening banks, increasing the shading of the area and introducing fast growing, native species have all been shown to be effective in certain situations, particularly when used in conjunction with other methods above.	Unlikely given the nature of the project

Other options for which unconfirmed data is available or licensed to release biological controls are not yet approved and have been discounted from assessment as potential control methods. They include - grazing by introduced Grass carp (a non-native fish species), the release of Gall forming mites (currently at EU approval stage); hot foam and hot water and drying out the ground.

Although this species was not found present within the footprint of the Proposed Scheme during surveys, measures for addressing this species are covered within this ISMP on a precautionary approach, as it is known in the wider area and in the event that it becomes established within the Proposed Scheme area between the surveys taking place and construction commencing.

A pre-construction survey will be required in advance of works. Given that the presence of submerged vegetation is difficult to note and can be overlooked if dormant, the ISMP will detail the measures that are applicable for all works affecting water bodies. The key element for the Proposed Scheme will be the avoidance as far as practical of unnecessary disturbance of water body edge and sediments. Thereafter, standard environmental measures will be applied. This will include rigorous application of biosecurity measures for all plant / equipment brought onto or near waterbodies and again before moving to another area. No instream works will be permitted where this species is found present unless specific precautions and control measures have been clearly identified and implemented, to reduce for potential disturbance of riparian vegetation (where it occurs).

5.3.4.5.1 Temporary Storage of Collected Material

If this non-native invasive species is found present, all material, where not disposed of immediately to authorised facilities, will be double bagged and placed in dedicated quarantine areas (away from watercourses) to decompose before disposal with similar non-native invasive species waste at authorised facilities.

5.3.4.6 Canadian Pondweed (*Elodea canadensis*) & Nuttall’s pondweed (*Elodea nuttallii*)

Both species are regarded as perennials, overwintering in the deeper water, and reproducing asexually. Disturbance increases the dispersal of a considerable number of propagules and the vigorous re-growth is enhanced through changes in availability of nutrients. In Ireland although both are ranked as a medium risk plant, they are both ranked as highly invasive. Both species has a wide ecological tolerance and can grow relatively fast, resulting in displacement of native flora. The plant can form dense mats which outcompete native plant species and therefore decrease the biodiversity in an area, as well as interfering with navigation and recreational activities on watercourses.

Although, not considered as widespread as Canadian pondweed, Nuttall’s pondweed is nonetheless spreading, and in the UK and Ireland is regarded as now displacing the former, possibly due to increased eutrophication. Nuttall’s pondweed is also more tolerant of poorer water quality, disturbance, and poorly implemented management such as navigation clearance.

Both share many of the same attributes and are usually found in deeper water, rooted in sediment these pondweeds can be free floating in water column if disturbed.

Table 5.11 presents an assessment of potential treatment options available for the treatment of both pondweeds.

Table 5.11: Assessment of Management Methods for Canadian Pondweed (Elodea canadensis) & Nuttall's pondweed (Elodea nuttallii)

Approach	**Treatment Options**	**Comment**	**Potential for Implementation on the Proposed Scheme**
Physical	Draw down	Some studies indicate success where water levels can be dropped and sediments dried out, that this can be effective	Not likely, given the nature of the Proposed Scheme and the likely occurrence of this species further up the canal which could result in later reestablishment.
	Cutting	By hand or on specially adapted barges. Best undertaken before July, Repeat harvesting can result in nutrient depletion (if source of eutrophication into watercourse controlled). This is a longer-term solution that would require careful implementation to ensure no unnecessary spread of material.	This is long-term solution would require commitment from GCC and other stakeholders to undertake.
	Covering site	Cover with Jute or a similar material to shade the plant. Has been demonstrated to work for other submerged species e.g., Lagarosiphon, and a DCC sponsored project on the use of jute matting undertaken on parts of the River Liffey between Islandbridge and Chapelizod.	Possible but unlikely - given the nature of Elodea, and its potential distribution elsewhere could be onerous in terms of project timeframes and difficult to cover submerged infested area with jute to shade-out growth. Would not guarantee prevention of re-establishment and would require pollution sources to be addressed to reduce eutrophication.
Environmental	Water dyes	Both species can tolerate some shade of deeper water, but water dyes have been found to be effective in static waters. Additional landscape planting to increase shade are considered to be effective.	Not likely given the location of the canal in highly populated area, unless a well-developed PR campaign is put in place to explain. Potential for landscape planting is also limited by virtue of location and space requirements.
Chemical	There is currently no herbicide product approved for treatment of submerged macrophytes such as Elodea spp.		

Other options for which unconfirmed data is available or licensed to release biological controls are not yet approved and have been discounted from assessment as potential control methods. They include biological control through the introduction of grass carp (a non-native fish) and other bottom feeders.

Although these species were not found present within the footprint of the Proposed Scheme during surveys, measures for addressing these species are covered within this ISMP on a precautionary approach, as they are known in the wider area and in the event they become established within the Proposed Scheme area between the surveys taking place and construction commencing. A pre-construction survey shortly in advance of works will be required. Given that the presence of submerged vegetation is difficult to note and can be overlooked if dormant, the ISMP will detail the measures that are applicable for the duration of works at waterbody crossings. The key element for the Proposed Scheme will be the avoidance as far as practical of unnecessary disturbance of water body edge and sediments. Thereafter, standard environmental measures will be applied. This will include rigorous application of biosecurity measures for all plant/equipment brought onto or near the water-feature and again before moving to another area.

No instream works will be permitted where these species are found present unless specific precautions and control measures have been clearly identified and implemented, to reduce for potential disturbance of riparian vegetation (where it occurs).

5.3.4.6.1 Temporary Storage of Collected Material

If these non-native invasive species are encountered, all material, where not disposed of immediately to authorised facilities, will be double bagged and placed in dedicated quarantine areas (away from watercourses) to decompose before disposal with similar non-native invasive species waste at authorised facilities.

5.4 Surface Water Management Plan

5.4.1 Introduction

This Surface Water Management Plan (hereafter referred to as the SWMP) for the Proposed Scheme details the control and management measures for avoiding, preventing, or reducing any significant adverse impacts on the surface water environment during the Construction Phase.

The control and management measures are best practice approaches that can be used to protect surface water during the Construction Phase of the Proposed Scheme.

5.4.1.1 Objectives

The objectives of the SWMP are to:

- Ensure sediment and pollution control requirements can be built into the design stage and land requirements for the Proposed Scheme as far as practicable;
- Minimise and where possible, avoid potential for sediment, silty water, and other contaminants such as oil, fuel, concrete, cement, and other materials to discharge to a watercourse;
- Minimise the area and duration of exposed ground which has the potential to create runoff; and
- Minimise any potential impacts in the event of an accidental spillage or site runoff by providing appropriate control and containment measures on site and by maintaining sediment and pollution controls throughout the Construction Phase of the Proposed Scheme.

5.4.1.2 Legislation and Guidance

The SWMP and the control and management measures relating to surface water management have been prepared with regard to the following guidance documents, where relevant:

- Bathing Water Quality Regulations 2008 (S.I. 79 of 2008),
- EC Environmental Objectives (Groundwater) Regulations 2009 (S.I. 9 of 2010 and SI 366 2016),
- EC Environmental Objectives (Surface Waters) Regulations (S.I. 272 of 2009),
- EU Water Framework Directive (WFD) 2000/60/EC,
- European Communities (Marine Strategy Framework) Regulations 2011 (S.I. 249 of 2011),
- European Communities (Quality of Salmonid Waters) Regulations 1998 (S.I. 293 of 1998),
- European Communities (Water Policy) Regulations 2003-2005 (S.I. 722 of 2003),
- Groundwater Directive (2006/118/EC),
- Local Government (Water Pollution) Acts 1977 – 1990, and
- S.I. No. 9 of 2010 European Communities Environmental Objectives (Groundwater) Regulations 2010,
- Urban Wastewater Treatment (UWWT) Regulations (S.I. 254 of 2001) as amended.

Control and mitigation measures have been identified with reference to the following guidelines:

- CIRIA (Murnane et al.), 2006. C648 Control of Water Pollution from Linear Construction Projects: Technical Guide (CIRIA 2006a),
- CIRIA (Murnane et al.), 2006. C649 Control of Water Pollution from Linear Construction Projects: Site Guide (CIRIA 2006b),

- CIRIA, 2005. Environmental Good Practice on Site (C650); Construction Industry Research and Information Association (CIRIA 2005),
- Construction Industry Research and Information Association (CIRIA), 2001. C532 Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (CIRIA 2001),
- Enterprise Ireland, 2003. Best Practice Guidelines BPGCS005 – Oil Storage Guidelines (Enterprise Ireland 2003),
- Inland Fisheries Board (IFB), 2016. Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (IFB 2016),
- National Roads Authority (NRA), 2006. Guidelines for the Crossing of Watercourses during the Construction of National Road schemes (NRA 2006),
- S.I. No. 41 of 1999 Protection of Groundwater Regulations, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive),
- Safety, Health and Welfare at Work (Construction) Regulations 2013,
- The Planning System and Flood Risk Management - Guidelines for Planning Authorities (DEHLG and OPW, 2009),
- TII, 2015. Road Drainage and the Water Environment DN-DNG-03065) (TII 2015b), and
- Transport Infrastructure Ireland (TII), 2015. Design Manual for Roads and Bridges Part 3 DN-DNG-03022 (NRA HD 33/15) (Including Amendment No. 1) (TII 2015a).

5.4.2 Existing Environment

The project site is a highly urbanised part of Galway City. The main surface water receptors in the project area are:

- River Corrib,
- Distillery River,
- Friar’s River, and
- Lough Atalia.

Distillery River and Friar’s River are parts of the Corrib River system.

The site is in the Corrib River catchment within WFD Catchments 29 (Galway Bay South East) and 30 (Corrib). The River Water Quality Status of the River Corrib (CORRIB_020) for the 2013-2018 monitoring period was ‘Good’. The Transitional Waterbody WFD status (2013-2018) of Lough Atalia (and the River Corrib estuary waterbody) was also ‘Good’.

There are approximately 17 no. existing outfall locations: 11 no. outfalls to water bodies, 5no. outfalls to the wastewater treatment plans and 1 outfall to the wastewater treatment plans and to the water bodies as shown in Table 5.12. No new outfall locations are proposed, other than upgrading the existing ones and providing attenuation where road widening takes place.

Table 5.12: Surface Water Outfall Locations

No.	Catchment	Existing Network Type	Existing Outfalls
1	University Road/Canal Road Upper	Combined Sewer	Mutton Island Wastewater Treatment Plant.
2	Gaol Road/University Road	Combined Sewer	Mutton Island Wastewater Treatment Plant.
3	Gaol Road	Surface Water	Distillery River.
4	University Road/Salmon Weir Bridge	Surface water	Distillery River.
5	Saint Vincent Avenue/Walsh’s Terrace/Wood Quay/St Francis Street/ Eglinton Street	Combined Sewer	Mutton Island Wastewater Treatment Plant.
6	St Vincent’s Avenue	Surface Water	Friar’s River.
7	Dyke Road	Surface Water	River Corrib.
8	Williamsgate Street	Surface Water and Combined Sewer	Island Wastewater Treatment Plant.
9	Merchant’s Road and Forthill Street/ Victoria Place, Eyre Square and Forster Street	Surface Water and Combined Sewer	Mutton Island Wastewater Treatment Plant.
10	College Road (Fairgreen Road)	Surface Water	Lough Atalia
11	Loyola Park	Surface water	Lough Atalia
12	Lough Atalia Road/Petrol Station	Combined sewer	Mutton Island Wastewater Treatment Plan
13	College Road (Loyola Park)	Surface Water	Lough Atalia
14	College Road /Dublin Road	Surface Water	Lough Atalia
15	Dublin Road	Surface Water	Lough Atalia
16	Dublin Road	Surface Water	Lough Atalia
17	Dublin Road	Surface Water	Lough Atalia

5.4.3 Proposed Control Measures

The design of the surface water drainage system has considered the potential impacts to the receiving environment and has embedded mitigation measures in the design. The following sections outline additional preventive measures that ensure impacts are mitigated to acceptable level. The Appointed Contractor shall develop a more elaborate SWMP.

GCC will appoint an ECoW to monitor the implementation of mitigation measures outlined in the plan. The key surface water impacts because of the proposed project may include:

- Increased sediment discharge to receiving waters,
- Increased risk of flooding,
- Increased risk of accidental chemical and fuel spills, and

The proposals contained in this SWMP are required to mitigate against these impacts.

The Proposed Scheme generally maintains the existing road profile so that the existing drainage system remains mostly unchanged. In areas where widening takes place, flows from the extra impermeable surface area will be attenuated before discharging to existing drainage system.

The Proposed Scheme is largely in Flood Zone C, except for sections in Gaol Road, Victoria Place, and Lough Atalia Road at its junction to Dublin Road which is in either Flood Zone A or B. The Harbour Site Compound is located in Flood Zone C.

In areas where the risk of flooding is significant, i.e., Flood Zone A or B, the following actions shall be taken:

- Remove/dispose surplus material from site immediately,
- Avoid direct discharge (i.e., without attenuation) of surface water to the nearby watercourse,
- Avoid obstructing runoff pathways,
- Contact the OPW for surface water flooding related issues.

5.4.3.1 Groundwater Vulnerability

The bedrock aquifer beneath half the project site (southwest) is poor aquifer (which is unproductive except for local zones) and regionally important aquifer – (Karstified conduit) in the remaining half (northeast). According to the GSI website (accessed in March 2022), the project site's groundwater vulnerability is moderate to high, which indicates a general overburden depth of < 5m. There may be a significant requirement for groundwater dewatering due to the site's proximity to the Corrib River and Lough Atalia. All construction dewatering water shall be stored for removal off site for treatment and disposal if this applies.

5.4.3.2 River and Stream Crossings

The Proposed Scheme crosses the River Corrib system at three locations. The following best practice guidelines shall be adhered to at these crossing locations:

- Prior to construction commencing at these sites, the Appointed Contractor will ensure that all construction equipment is in good working order and that they do not need refuelling or maintenance,
- Fuels, chemicals, and other fluids will be handled with care to avoid accidental spills,
- Fuelling and maintenance shall not take place within 20m distance of these water courses,
- All spillages will be contained and removed from site immediately,
- Any accidental spills will be notified to the ECoW immediately.

5.4.3.3 Sediment Control Plan (SCP)

The Appointed Contractor shall develop a Sediment Control Plan (SCP) before construction commences. The Contractor will monitor the suspended solids and turbidity levels to ensure sediment concentrations are appropriate prior to discharge. The SCP shall, as a minimum, contain information on items discussed in the following sub-sections.

5.4.3.4 Construction Sequencing – Installation of Drainage Features

To protect water bodies from potential impacts, such as increased volumes of run-off, silty water and accidental spills, temporary drainage control measures will be installed at the outset, prior to any site clearance works. This will include measures such as construction of silt fences erected and set up of settlement tanks.

5.4.3.5 Silty Water Runoff

- Clearing and stripping of topsoil or existing roads and footpaths exposing underlying granular layers at each phase of works will be delayed as long as possible, being carried out shortly before construction begins,
- Silt fences will be installed / erected along the boundary of the Construction Compound and around surface water drains or watercourses to prevent any silt laden runoff from impermeable surfaces, and
- Weather conditions will be considered by the Appointed Contractor when planning construction activities to minimise the risk of silty water runoff from the site.

5.4.3.6 Retaining wall and Upgraded footpath parallel to Dublin Road

There is potential for significant sediment generation associated with the widening of the existing footpath running at the south side of Dublin Road very close to Lough Atalia. The following measures are recommended to minimise sediment runoff:

- Retaining Wall:
  - The concrete for the foundations will be poured in dry weather only,
  - Silt fences will be used along the top of the bank to reduce the likelihood of silty water runoff and cement washings reaching the canal, and
  - Any water collected behind the silt fences will be settled using a silt-buster tank (or similar) and then discharged to the foul sewer (with the permission from Galway City Council). It has the potential to have high pH from the concrete and so will not be discharged to the Lough Atalia.
- Footpath widening:
  - The concrete for the mass concrete gravity wall will be poured in dry weather only,
  - a sediment trap shall be located immediately downstream of the works to prevent silt discharging into Lough Atalia,
  - Soil stripping shall be undertaken under dry weather conditions,
  - Stockpiling soil and aggregate shall be at appropriate location with adequate setback,
  - Heavy vehicular movement shall be restricted and kept away as far as possible.

5.4.3.7 Upgraded of outfall at Lough Atalia

An existing 150mmØ pipe discharging to Lough Atalia, south of Lough Atalia Road is proposed to be upgraded to a 225mm outfall. The construction of the pipe will be carried out only from landside. The outfall will be hidden behind rock armour. There is potential for significant impacts associated with works related to trench excavation, bedding and haunching and surround filling. These will be avoided and minimised through best practice measures.

The Appointed Contractor is responsible for contacting the Environmental Protection Agency (EPA) and IFI to ensure these measures are in line with the requirements these agencies. Method Statements for the upgrade of the outfalls shall be agreed with IFI prior to construction.

5.4.3.8 Stockpiling Material

- The following measures will be implemented during stockpiling:
- Clearing and stripping of topsoil or existing roads and footpaths exposing underlying granular layers at each phase of works will be delayed as long as possible, being carried out shortly before construction begins rather than stripping the whole site many months before construction,
- Where an excavation contains a combination of acceptable and non-acceptable material for re-use the excavation will be conducted so that the acceptable material is excavated and stockpiled separately without contamination by the unacceptable material,
- Temporary stockpiles will be located away from surface water drains or watercourses at a minimum distance of 10m,
- The topsoil, and upper level of subsoil, will be stripped and stockpiled in identified locations,
- For watercourse crossings, stockpiles will not be located anywhere within the crossing working area,
- No stockpiles will be located within a European or National Site or within a floodplain area,
- Management of stockpiles to prevent siltation of watercourse systems through runoff during rainstorms will be required with the final measures to be determined by the appointed contractor. These will include the following measures or equivalent measures:
  - Allowing the establishment of vegetation on the exposed soil,
  - Providing silt fences or straw barriers at the toe of the stockpile to mitigate runoff during rain events,
  - Surrounding stockpiles with cut-off ditches to contain runoff,
  - Directing any runoff to the site drainage system to a suitable sediment control structure before discharging to a drainage system, and
  - Providing bunds or another form of diversion to keep runoff from entering the stockpile area.

5.4.3.9 Use of Concrete

Concrete will be used to construct kerbs, footpath, manholes, etc. The use of concrete will be minimised as much as possible. However, if the use of concrete is unavoidable, the following measures shall be employed:

- The use and management of concrete in or close to watercourses will be carefully controlled to avoid spillage. Alternate construction methods are encouraged for example, use of pre-cast concrete or permanent formwork will reduce the amount of in-situ concreting required,
- Weather conditions will be considered when planning construction activities which require the use of wet concrete to minimise the risk of the runoff of concrete 'washout' from site,
- Where on-site batching is proposed by the appointed contractor this activity will be carried out at least 10m from surface water drains or watercourses. Washout from such mixing plant will be carried out only in a designated contained impermeable area,
- Batching and mixing activities and material storage areas will be located at least 10m (as per CIRIA guidance listed in Section 5.4.1.2) away from surface water drains or watercourses,
- Chute washout will be carried out at designated locations only, at least 10m from surface water drains or watercourses. These locations will be signposted throughout the construction works areas. Chute washout locations will be provided with appropriate designated, contained impermeable area and treatment facilities including adequately sized settlement tanks,
- The clear water from the settlement tanks shall be pH corrected prior to discharge to any surface water drains or watercourses,
- There will be no hosing of concrete, cement, grout, or similar material spills into surface water drains or watercourses. Such spills shall be contained immediately, and runoff prevented from entering the watercourse, and
- Discharge of washout water to wastewater (foul) sewer will only be carried out with the express permission of the sewerage undertaker and will be treated to the standard required; for example, because of its high pH (alkalinity), washout water may need treatment before disposal to the foul sewer.

5.4.3.10 Accidental Spills

The site compounds shall be provided with spill/leak containment facility for fuel or chemicals in addition to the storm water and foul flows from the site. Refuelling shall be done on impermeable and bunded areas within the site compound away from any watercourses where oil interceptors are installed. Refuelling and maintenance in areas where there is a risk of surface water contamination shall be avoided where possible.

5.4.3.11 Environmental Incident Response Plan

An Incident Response Plan (IRP) will be prepared by the appointed Contractor as part of the CEMP. The IRP ensures that, in the unlikely event of an incident, response efforts are prompt, efficient, and suitable for the circumstances. This plan is a working document and will be maintained by the appointed contractor during the Construction Phase. The plan includes measures to address surface water related incidents such as accidental spillages of noxious substances e.g., oil and significant releases of sediment or concrete washings.

5.4.3.12 Vehicles and Plant

- Vehicles and plant provided for use on the Proposed Scheme will be in good working order to ensure optimum fuel efficiency, and will be regularly inspected to ensure they are free from leaks and are promptly repaired when not in good working order,
- Spill kits will be carried on all vehicles,
- Vehicles and plant will not park near or over surface water drains or watercourses,
- Refuelling of vehicles and plant will be carried out on hard standing surfaces, using drip trays to ensure no fuel can contaminate the ground outside of the bunded areas,
- For deliveries and dispensing activities, the appointed contractor will ensure that:
  - Site-specific procedures are in place for bulk deliveries,
  - Delivery points and vehicle routes are clearly marked, and
  - Emergency procedures are displayed, and a suitably sized spill kit is available at all delivery points, and staff are trained in these procedures and the use of spill kits.
- The appointed contractor will provide wheel washing facilities, and any other necessary measures to remove mud and organic material from vehicles, at the Construction Compound, where necessary. These will be located at least 10m away from any surface water drains or watercourses,
- The cleaning of delivery trucks shall be carried out at the Construction Compound and shall not be undertaken at the works areas,
- The surface run-off from vehicle washing areas will be directed to an on-site treatment system where possible; this also increases the potential for reusing the water. Such a treatment system would typically include:
  - A settlement tank to remove suspended solids such as mud and silt,
  - Catchpits or silt traps on drains and ensure that they are in place during cleaning. Empty them at regular intervals, and
  - Removal of oil, grease, petrol, and diesel from wash water by passing it slowly through an appropriately sized oil separator.
- The use of detergents in the cleaning process will be minimised; where required, biodegradable and phosphate-free detergents will be used,
- If detergents are used in the washing process, the wash water will not be directed through the oil separator as this will prevent it from working. It will be contained and disposed of off-site using a suitable licensed waste disposal operator, or if a foul or combined sewer is nearby, the surface runoff could be directed to it, with the permission of the sewerage undertaker, and
- To further minimise water used for washing vehicles, trigger-operated spray guns will be used, with an automatic water supply cut-off.

5.4.4 Construction Compounds

The main construction compounds will be located at Galway Harbour and a satellite construction compound at Galway Cathedral. The compounds will be used for material stockpiling, loading/unloading, fuel and machinery store, canteens, site office, toilet facilities, etc.

Further details on the Construction Compound are provided in Chapter 5 (Construction) of Volume 2 of this EIAR.

5.4.4.1 Site Compound Establishment

The proposed main site compound at Galway Harbour and the satellite site compound at the Galway Cathedral Car Park will include site offices, welfare facilities for GCC and Contractor’s personnel, and limited car parking for site and staff vehicles. The site compounds shall be established in accordance with the mitigation measures outlined in the EIAR. As a minimum:

- Surface water drains will be located and clearly signposted,
- All materials will be stored safely in line with best industry practice. Fuels and chemicals will be stored in bunded areas,
- The site compounds must be fenced off with setback of at least 5m from surface water receptors,
- Gaol Road, south of the satellite site Compound, is in Flood Zone B from fluvial source. This site compound is not impacted by this flood. However, access and egress to the site must not be from the southern side using Gaol Road,
- The main site Compound at Galway Harbour is not in Flood Zone A or B. However, the access route bridge over Lough Atalia will be submerged by excessive flood depth for a 0.5% AEP tidal event. In such scenario, the appointed contractor will be required to include a flood response plan within to ensure that incidents do not result in a pollution risk to the water body.
- Surface runoff from compounds shall be minimised by ensuring that the paved/impervious area is minimised. All surface water runoff from the site compounds shall be intercepted and directed to appropriate treatment systems (settlement facilities and oil trap) for the removal of pollutants prior to discharge.

5.4.4.2 Security

The Construction Compound will be fenced off, lit (during working hours) and secured with Closed-Circuit Television (CCTV), to ensure safe storage of all material, plant and equipment if required, to prevent acts of vandalism that could result in leaks or spills from materials.

5.4.4.3 Welfare and Sanitary Facilities

The Construction Compound will be engineered with appropriate services as discussed in Chapter 5 (Construction) of this EIAR. Water and wastewater disposal etc. will be organized by the Appointed Contractor. At work areas along the Proposed Scheme, where permanent provisions (for the duration of the construction programme) are not practicable, appropriate temporary provisions will be made. Temporary welfare facilities will need to be used, for example, portable toilets in the vicinity of works. Welfare facilities will discharge wastewater either to an existing sewer, with the permission of the sewerage undertaker, or will be collected and disposed of in an appropriate manner to a suitably licensed facility offsite to prevent water pollution and in accordance with the relevant statutory requirements.

5.4.4.4 Fuel Storage

- All hydrocarbons used during the Construction Phase will be appropriately handled, stored, and disposed of in accordance with recognised standards as laid out by the EPA,
- All chemical and fuel filling locations will be contained within signposted, designated bunded areas, a minimum of 10m from any surface water drain or watercourse,
- From compounds, where the site is pervious, an area of hard standing will be installed in a demarcated area for refuelling, and vehicle / plant cleaning and service areas. This area will be drained via a hydrocarbon interceptor trap to a soakaway,
- The retained contents of the separators will be collected for disposal by a licensed operator to a licensed waste disposal / recovery facility,
- Suitable precautions will be taken to prevent spillages from equipment containing small quantities of hazardous substances (for example, chainsaws and jerry cans) including:
  - Each container or piece of equipment will be stored in its own drip tray made of a material suitable for the substance being handled,
  - Spill kits and drip trays will be provided for all equipment and at locations where any liquids are stored and dispensed, and staff will be trained on the procedures to be followed, and
  - Containers and equipment will be stored on a firm, level surface.
- Procedures and contingency plans will be in place at each work areas to address cleaning up small spillages as well as dealing with an emergency incident (see Section 5.6.3.1). A stock of absorbent materials such as sand, spill granules, absorbent pads and booms will be kept at each work site, on plant working near water and particularly at refuelling areas and where fuel or oil is stored,
- When working in or in proximity to watercourses, an absorbent containment boom will be installed across the watercourse or around the works, securely and closely anchored to the banks or working platform,
- The storage of fuels, other hydrocarbons and other chemicals within the Construction Compound shall be in accordance with relevant legislation and with best practice. In particular:

  - Fuel tanks, drums, and mobile bowsers (and any other equipment that contains oil and other fuels) will be housed within a bund of at least 110% capacity of the fuel tank itself or at least 25% of the total volume of the containers, whichever is greatest. The fuel tank will be double skinned. There will be no passive drainage from the bund; any water collected within it will be pumped out and removed off site for disposal, and
  - Any designated area or areas for oils, fuel, chemicals, hydraulic fluids, etc. storage and refuelling will be set up at least 10m from any surface water drains or watercourses (as per CIRIA guidance) and the storage location within the Construction Compound shall be organised to be as far away from surface water drains or watercourses as is practicable to minimise risks from leaks and spills.
- Storage areas will be covered, wherever possible, to prevent rainwater filling the bunded areas,
- Fuel fill pipes will not extend beyond the bund wall and will have a lockable cap secured with a chain,
- Where fuel is delivered through a pipe permanently attached to a tank or bowser:
  - The pipe will be fitted with a manually operated pump or a valve at the delivery end which closes automatically when not in use,
  - The pump or valve will be fitted with a lock,
  - The pipe will be fitted with a lockable valve at the end where it leaves the tank or bowser,
  - The pipework will pass over and not through bund walls,
  - Tanks and bunds will be protected from vehicle impact damage,
  - Tanks will be labelled with contents, capacity information and hazard warnings, and
  - All valves, pumps and trigger guns will be turned off and locked when not in use. All caps on fill pipes will be locked when not in use.

5.4.4.5 Storage of Materials and Waste

The Construction Compound will be operated using a “Just-in-Time” approach, where practicable, for material deliveries to minimise the amount required to be stored. Where material is required to be stored:

- Storage areas for solid materials, including waste soils (where applicable), will be designed, and managed to prevent deterioration of the materials and their escape (via surface runoff or wind blow),
- Storage areas will be kept secure to prevent acts of vandalism that could result in leaks or spills, and
- All containers of any size will be correctly labelled indicating their contents and any hazard warning signs.

A register of all hazardous substances, which will either be used on site or expected to be present (in the form of soil and / or groundwater contamination) will be established and maintained. This register will be always available and shall include as a minimum:

- Valid Material Safety Data Sheets (MSDS),
- Health and safety, environmental controls to be implemented when storing, handling, using and in the event of spillage of materials,
- Emergency response procedures / precautions for each material, and,
- The Personal Protective Equipment (PPE) required when using the material.

Waste may be stored at the Construction Compound for a limited amount of time to help to limit the number of vehicle movements to and from site as far as possible to minimise effects on the local roads. Where waste is required to be stored:

- It will be stored in secure designated areas, in enclosures or containers to prevent material being dispersed by the wind,
- Designated areas will be sited at least 10m away from surface water drains or watercourses to limit risk of escape and contamination of watercourses,
- Waste storage containers will be labelled with their waste type and their List of Waste (LoW) code; any labelling will be consistent with Industry Best Practice at the time construction commences and reviewed annually,
- Liquid wastes will be stored in containers within bunded zones with secondary containment of at least 110% capacity of the largest container or at least 25% of the total tank capacity inside the bunded zone (whichever is the greatest), and
- Incompatible or hazardous wastes will be stored and handled in accordance with Hazardous Wastes Regulations.

5.4.5 Drainage Inspection and Surface Water Monitoring

5.4.5.1 Drainage Inspections

The effectiveness of the drainage system must be monitored periodically by the ECoW during construction to minimise the risk of discharging silt-laden water into the receiving waters. The monitoring frequency is best aligned with changing weather events and drainage conditions, as the project progresses.

Event based inspections by the ECoW are as follows:

- >10 mm/hr,
- >25 mm in a 24-hour period[1], or,
- Rainfall depth greater than monthly average in 7 days.

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[1] Met Eireann definition: A very wet day means rainfall accumulations ⩾10 mm in 24 hours. While falls of 10 mm or more in 24 hours would have a greater impact on outside activities.

5.4.5.2 Surface Water Quality Monitoring

The Appointed Contractor shall carry out visual monitoring of surface water control measures (settlement tanks, silt fences, fuel storage areas etc.) on a daily basis. In addition, weekly visual inspections of the water bodies in proximity to Proposed Scheme will be carried out by the Appointed Contractor.

Indicators that water pollution may have occurred include the following:

- Change in water colour,
- Change in water transparency,
- Increases in the level of silt in the water,
- Oily sheen to water surface, and
- Floating detritus, or scums and foams.

Suspended solids and turbidity will also be monitored.

If hydrocarbons are observed or other water quality parameters are suspected to have been exceeded, an investigation will be carried out to determine whether any element of the construction of the Proposed Scheme could be causing the contamination. If any potential sources of contamination are observed, appropriate actions will be taken (depending on the source and nature) to prevent further contamination and the incident shall be recorded and investigated in more detail to prevent a recurrence. If required, the relevant regulatory authorities will be informed.

5.5 Construction and Demolition Resource and Waste Management Plan

5.5.1 Introduction

This Construction and Demolition Resource and Waste Management Plan (CDRWMP) has been prepared to ensure that waste arising during the Construction Phase and Demolition Phase of the Proposed Scheme, will be managed and disposed of in a way that ensures compliance with the provisions of the Waste Management Act, and associated Regulations to ensure that optimum levels of reduction, re-use and recycling are achieved. The purpose of this CDRWMP is to facilitate reuse and recycling and divert waste from landfill.

The CDRWMP is consistent with best practice management practices and any relevant mitigation measures as contained within the EIAR. The content and headings used in this CDRWMP comply with the EPA Best Practice Guidelines for the Preparation of Resource Management Plans for Construction and Demolition (C&D) Projects (EPA 2021a).

This CDRWMP is based on the estimated quantities of waste generation and the proposed management measures from the Proposed Scheme at planning stage.

5.5.1.1 Legislation, Policy and Guidance

Resource and waste management takes place in a legislative and policy framework. Applicable legislation, policy and best practice guidance was reviewed during preparation of the CDRWMP. The key components of EU, national and local policy, legislation, and guidance relevant to proposed C&D are summarised as follows:

- Prevention and minimisation of waste is the preferred option;
- Where C&D waste is generated, it should be source separated to facilitate reuse and recycling and to maximise diversion of waste from landfill;
- Where waste may not be prevented or recycled it should be transported and disposed of in accordance with applicable legislation and without causing environmental pollution; and
- Waste may only be transferred by a waste collection permit holder and delivered to an authorised waste facility.

5.5.1.1.1 Legislative Context

The EPA Best Practice Guidelines for the Preparation of Resource Management Plans for Construction and Demolition (C&D) Projects (EPA 2021a) states that a plan is mandatory for all C&D projects, as best practice to inform the planning consent process. At planning stage, it is estimated that the Proposed Scheme will generate more than 100m^3 in volume of C&D waste, through demolition. Therefore, to comply with these guidelines, a Tier 2, bespoke C&D Plan has been prepared.

5.5.1.1.2 Guidance

An overview of relevant legislation, policy and best practice guidance related to waste management is presented in Appendix 18.1 Legislation and Policy in Volume 4 of this EIAR, however the main guidance documents used in the preparation of the CDRWMP were:

- Connacht-Ulster Waste Region (CUWR) (2016). Connacht Ulster Region Waste Management Plan;
- EU Construction & Demolition Waste Management Protocol (European Commission 2018)
- C&D Waste Soil and Stone Recovery / Disposal Capacity Update Report 2020 (Regional Waste Management Offices 2020);
- A Waste Action Plan for a Circular Economy, Ireland’s National Waste Policy 2020-2025 (Department of Communications, Climate Action and Environment (DCCAE 2020);
- Circular Economy Action Plan, For a Cleaner and More Competitive Europe (European Commission 2020);
- Best Practice Guidelines for the Preparation of Resource Management Plans for Construction and Demolition Projects – Draft for Public Consultation (EPA 2021a);
- Circular Economy Act 2021;

- Whole of Government Circular Economy Strategy 2021-2022, Pre-Consultation Draft (Department of Environment, Climate and Communications (DECC) 2021a); and
- Whole of Government Circular Economy Strategy 2022-2023: Living More, Using Less (DECC 2021b).

5.5.1.1.3 Sustainable Resource and Waste Management Principles

As stated in Section 17.2 in Chapter 17 (Waste & Resources) in this EIAR, the principal objective of sustainable resource and waste management is to use resources more efficiently, where the value of products, material and resources is maintained in the economy for as long as possible such that the generation of waste is minimised. To achieve resource efficiency there is a need to move from a traditional linear economy to a circular economy.

As stated in the Waste Action Plan for a Circular Economy, Ireland's National Waste Policy 2020-2025 'In a circular economy the value of products and materials is maintained for as long as possible; waste and resource use are minimised, and resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value' (DCCAE 2020).

The EU Circular Economy Action Plan notes that '*the EU needs to accelerate the transition towards a regenerative growth model that gives back to the planet more than it takes, advance towards keeping its resource consumption within planetary boundaries, and therefore strive to reduce its consumption footprint and double its circular material use rate in the coming decade'* (European Commission 2020).

However, where residual waste generation is unavoidable, it will be dealt with in a way that follows the waste hierarchy, (as shown in Section 17.1.1.2 in Chapter 17 (Waste & Resources) in this EIAR). The waste hierarchy supports the need to achieve efficient use of material resources, minimise the amount of waste produced (or otherwise increase its value as a resource) and reduce, as far as possible, the amount of waste that is disposed to landfill.

The Department for Environment, Climate & Communications released a Whole Government Circular Economy Strategy 2022-2023 (DECC 2021b), setting out a policy framework for transitioning to a circular economy, measures to reduce the circularity gap, raise awareness and support investment into circular initiatives and identify barriers.

5.5.1.1.4 Waste Management Target

Ireland achieved 82.4% material recovery of C&D waste in 2019, as stated in the EPA National Waste Statistics, Summary Report for 2018 (EPA 2021b). Under Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2009 on waste and repealing certain Directives and Directive 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste (hereafter referred to as the Waste Framework

Directive), EU Member States must achieve 70% of material recovery of non-hazardous and non-soil-and-stone C&D waste by 2020.

Every effort will be made to achieve the required level of material recovery of C&D waste as part of the Proposed Scheme. A baseline of available waste capacity for 2020 was calculated in Chapter 18 (Waste & Resources) of this EIAR and summarised in Table 5.13. This data has been used to establish a baseline of available waste capacity for 2020. The available C&D waste capacity in CUWR, and so the construction waste baseline, is approximately 795,800 million tonnes based on the following assumptions:

- using the minimum available capacity for permitted facilities within the CUWR (only including facilities that accept a single waste type in order to avoid double counting capacity and excluding Donegal and Monaghan);
- including only licensed facilities accepting soil and stones; and
- including all Article 27 notifications for 2020 in the CUWR.

Table 5.13: C&D waste management baseline for CUWR, 2020 (permitted, licensed and Article 27 notifications)

C&D Waste Management Baseline for 2020	**Capacity/ annual intake (Tonnes)**
Minimum Permitted capacity (Regional Waste Management Office (Offaly County Council, 2021)	685,316
Licenced annual intake (soil and stone facilities) (EPA 2022)	90,000
Article 27 (by-product) notifications (EPA 2021c)	20,500
Total	795,796

5.5.2 Proposed Scheme Description

Information on the Proposed Scheme will be included in this section of the CDRWMP. This information will assist those without detailed knowledge of the Proposed Scheme in quickly familiarising themselves with the key elements of the Proposed Scheme and will also assist those who have a need to examine, review or audit the CDRWMP.

Details will include a description of the key elements of the Proposed Scheme, an overview of the main works required at each section, the construction programme, construction methodology, plant and equipment requirements, details on the Construction Compounds, construction traffic management measures, and interfaces with other projects.

5.5.3 Roles and Responsibilities

The roles and responsibilities of key stakeholders are discussed in Section 5.1.8. The contractor will appoint a suitably qualified person to maintain the CDRWMP, who will be responsible for the following:

- Detailing and maintaining the CDRWMP, and updating it as appropriate;
- Following each update or revision of the CDRWMP, providing the CDRWMP to GCC, appointed contractor and all relevant personnel;

- Ensuring that all personnel are instructed about the objectives of the CDRWMP and informed of the responsibilities which fall upon them as a consequence of its provision. This will be carried out during the induction process for new personnel;
- Communicating the requirements of the CDRWMP using for example, toolbox talks, prominently displayed notices and audits as relevant;
- Implementing the CDRWMP throughout the Demolition, Excavation, and Construction Phases of the Proposed Scheme; and
- Ensuring where training is required regarding the handling and management of wastes on site that this is provided where required.

The appointed contractor and all personnel handling wastes must be in a position to:

- Distinguish reusable materials from material suitable for recycling;
- Ensure maximum segregation of waste and recyclables at source;
- Co-operate with the appointed contractor on best locations for stockpiling reusable material;
- Separate material for recovery; and
- Identify and liaise with operators of recovery outlets as appropriate.

Copies of the CDRWMP will be made available to all relevant personnel.

5.5.3.1 Auditing

Resource audits will be conducted during the Construction Phase. The quantity and types of waste and materials leaving site during the Construction Phase will be recorded. The name, address and authorisation details of all facilities and locations to which waste and materials are delivered will be recorded along with the quantity to each facility. Records will show material, which is recovered, which is recycled, and which is disposed of.

These audits will cover work practices, record keeping, and off-site tracking as follows:

- Periodic audits and inspections of work practices to assess compliance with the CDRWMP. The audit protocol will be risk based and focus on key issues of concern;
- A review of all records of wastes and resources generated on-site and transported off-site periodically throughout the Construction Phase. If waste movements are not accounted for, the reasons for this are to be established to understand why the record keeping system has not been maintained and implement corrective actions if needed;
- The resource records will be compared with established targets for the site (e.g., reuse of resource target or recycling of waste target);
- Examining material management on-site to determine where the largest percentage residual waste generation is occurring. The waste management methods for each material type will be reviewed in order to highlight how project contract targets can be achieved; and
- Issue corrective actions (training, penalties, etc.) as required to site operatives where deviations of the CDRWMP are observed.

5.5.3.2 Tracking and Tracing

The appointed contractor is required to maintain records for all resource material which is used on site and leaves the Proposed Scheme, either for reuse, recycling, energy recovery, backfilling or other recovery or disposal on third party sites. A recording system must be put in place to record residual waste and resources generated on the Proposed Scheme. The type of information to be recorded in the site tracking system is described below.

- For each movement of resource off-site, a signed docket / invoice will be obtained from the haulier / contractor detailing the following:
  - A description of the resource stream;
  - List of Waste (LoW) Code for each stream (where applicable);
  - Validated quantity of material moved off site by the haulier / contractor (typically reported in tonnes);
- The name and authorisation of the haulier to transport the material; in the case of a ‘waste’ this requires a valid Waste Collection Permit (WCP). In the case of by-product or other materials that are not a waste, no WCP is required. In both cases the vehicle registration number should also be recorded for each load of material removed from site;
- The name and authorisation of the destination site for the resource; again, for a ‘waste’ this requires a valid Cert of Registration, Waste Permit or Waste Licence and in the case of by-product the relevant by-product determination;
- The waste contractors must be required to provide details of end-use or waste treatment in waste reports;
- This recording will be carried out for each resource type and the system will also be linked with the delivery records. In this way, the percentage of residual resource generated for each material can be determined; and
- The system will allow the comparison of these figures with the targets established for the prevention, reuse and recovery of resources to highlight the successes or failures against these targets.

It is the obligation of the appointed contractor or their appointed person to ensure that all resources taken off site are in line with the relevant legislation and the key area relates to ensuring that hauliers and collection sites have the appropriate authorisations.

5.5.4 Key Materials, Quantities and Costs

5.5.4.1 Introduction

C&D waste is defined as waste which arises from construction, renovation and demolition activities. Typical C&D wastes which are likely to arise during the Construction Phase of the Proposed Scheme are set out in Appendix 17.2 List of Waste Codes for Construction and Demolition Wastes in Volume 4 of this EIAR, including EPA LoW codes.

The most environmentally sustainable means of managing excavated material is its prevention and minimisation. See Section 17.2.4.3 in Chapter 17 (Waste & Resources) of this EIAR for the principles of waste management. The appointed contactor will be responsible for implementation of these for the Proposed Scheme. In recent years there has been a shift in focus on best practice waste management and waste minimisation in construction and an increase in the reuse of construction by-products in projects.

It is expected that materials will be generated by the Proposed Scheme during the following activities:

- Demolition;
- Excavation; and
- Construction.

Likely materials that will be generated during each of these activities are discussed in further detail in Section 5.5.4.2 to Section 5.5.4.5.

5.5.4.2 Demolition Waste Generation

As described in Chapter 5 (Construction) of the EIAR, the main structures to be demolished along the Proposed Scheme are:

- No. 20 St. Brendan’s Avenue; and
- No. 5/6 Headford Road.

A large portion of demolition waste is expected to be inert waste such as concrete, brick and tiles etc. Metal waste will also be generated from demolition. Segregated wood, glass and plastic will also be generated.

The estimated quantity and type of waste that will be generated by demolition activities in connection with the Proposed Scheme is provided in Table 5.14. The estimated 700 tonnes of demolition waste which will be generated as a result of the Proposed Scheme is equivalent to 0.09% of the C&D waste management baseline in the CUWR set out in Table 5.13.

Table 5.14: Estimated Demolition Waste Types and Quantities

Waste Type	Approximate Waste and Material Quantity (Tonnes)
Concrete, bricks, tiles and similar	590
Metals	90
Segregated wood, glass and plastic	20
Total	**700**

5.5.4.3 Excavation Waste Generation

Excavation waste will arise from such activities as:

- Excavation of existing carriageways (e.g., road narrowing, removal of islands);
- Excavation of existing footpaths and cycle tracks and pedestrianised areas (e.g., widening, urban realm improvement; and

- Excavation for utility diversions and / or protections.

The waste types likely to be generated during the Construction Phase are set out in Table 5.15. The total forecast of surplus excavation material from the Proposed Scheme will be 68,100 tonnes and is equivalent to 8.56% of the C&D waste management baseline for the CUWR set out in Table 5.13.

Table 5.15: Summary of Excavation Material Type and Quantities

Materials from C&D Sources	Approximate Waste and Material Quantity (Tonnes)
Soil and stone	36,500
Concrete, bricks, tiles and similar	12,300
Bituminous mixtures	19,300
Total	**68,100**

5.5.4.4 Construction Waste Generation

Construction works, site offices and temporary works facilities are also likely to generate waste. General construction waste can vary significantly from site to site but typically will include the following non-hazardous fractions:

- Soil and stone;
- Concrete, brick, tiles and ceramics;
- Bituminous mixtures;
- Metals;
- Wood;
- Municipal type wastes generated by construction employees; and
- Other.

The hazardous waste streams which could arise from construction activities include the following:

- Waste electrical and electronic equipment (WEEE) components;
- Batteries;
- Asbestos;
- Wood preservatives;
- Liquid fuels; and
- Contaminated soil.

Also included within this definition are surplus and damaged products and materials arising in the course of construction work or used temporarily during the course of on-site activities.

The Construction Phase will require the importation of a number of key construction materials for the Proposed Scheme works. This material will include items such as concrete, granular fill / aggregate, bituminous mixtures and structural steel. Table 5.16 provides an estimate of the quantities of the major materials required to complete the Construction Phase of the Proposed Scheme.

Table 5.16: Estimated Quantities of Major Construction Materials Required by the Proposed Scheme

Materials	Estimated Quantity (Tonnes)
Asphalt	21,300
Granular Material	45,670
Concrete	34,000

In the case of the Proposed Scheme, the most likely type and quantity of general construction waste will be surplus concrete and unusable or damaged pipe segments which may arise on-site. Quantities of these materials are estimated to be small; assumed to be approximately between 5% to 15% of construction material delivered to site, as stated in the WRAP Builders: Estimating Waste (WRAP 2014). There is adequate capacity for the management of such wastes, see Table 5.13. Segregation facilities will be provided to ensure that recovery and recycling of such wastes are maximised.

5.5.4.5 Municipal Waste Generation

It is anticipated that there will be approximately 70-80, possibly up to 100 at peak, construction staff employed over the Construction Phase of the Proposed Scheme. Small volumes of general municipal wastes will be generated by construction staff during the Construction Phase (e.g., from offices and welfare facilities). Segregation facilities will be provided on the construction site to ensure that recovery and recycling of such wastes is maximised.

5.5.4.6 Costs of Waste Management

While landfill disposal has been the most commonly used method for waste management in Ireland in the past, waste to energy incinerators are also now in operation at Poolbeg, Dublin 4 and in Carranstown, County Meath.

Typically, the current cost of disposal of waste to landfill in Ireland exceeds €170 per tonne. From 1 July 2013 in accordance with the Waste Management (Landfill Levy) (Amendment) Regulations 2013 the ‘landfill levy’ increased to €75 per tonne for waste disposed to landfill. Disposal of hazardous waste can cost from €350.

In addition to landfill operator fees and landfill levies there are additional costs included in the ‘true cost of waste management’ including:

- The purchase cost of waste materials (including imported soil);
- Handling costs;
- Storage and transportation costs; and
- Revenue generated from sales.

Therefore, in order to reduce costs associated with waste management, surplus materials should be reused and recycled where possible and materials should be carefully stored and handled to minimise risk of damage.

5.5.5 Waste Management

5.5.5.1 Introduction

GCC is committed to implementing the principles of sustainable resource and waste management as set out in Section 5.5.1.1.3. Waste from the Proposed Scheme will be managed in accordance with the principles of circular economy and the waste hierarchy. Waste disposal will be minimised, in so far as is reasonably practicable, and opportunities for reuse of materials, by-products and wastes will be sought throughout the Construction Phase of the Proposed Scheme.

Following appointment, the contractor will be responsible for maintaining the CDRWMP. It will be at the discretion of the appointed contractor to determine how material from the Proposed Scheme will be managed. It is assumed, as a worst-case scenario, that all excavated soil will be managed or disposed of at an authorised facility, either in Ireland or abroad. However, all of the below options may also be used.

5.5.5.2 Demolition Waste Management

All material generated from the Proposed Scheme will be considered for reuse for construction within the Proposed Scheme or in other construction projects in accordance with Article 27 of the Waste Directive Regulations 2020 (S.I. 323 of 2020), (hereafter referred to as the Waste Directive Regulations). It will be the responsibility of the appointed contractor to review feasibility of reuse of materials and ensure that the necessary testing is undertaken to demonstrate compliance with Article 27, as appropriate.

Materials will require on-site segregation by waste classification and if not suitable for reuse, will be delivered to an authorised recycling, recovery or disposal facility.

Where practicable and appropriate, and if in reusable condition, street and roadside infrastructure such as bus stops, lighting poles, traffic signals, manhole access covers, and signs will be reused within the Proposed Scheme. If not reused, they will be delivered to appropriately authorised recycling or recovery facilities.

Where metal railings and gates are removed, they may have inherent value due to their metal content. These will be delivered for metal recycling to an authorised waste facility where not reused.

Some example facilities which are currently authorised to accept metal and electronic waste include:

- Irish Lamp Recycling Co. Ltd, Woodstock Industrial Estate, Kilkenny Road, Athy, Co. Kildare; and
- Hammond Lane Metal Company, Pigeon House Road, Dublin 4, Dublin.

The least preferable option is disposal to an authorised facility and will be considered by the appointed contractor when reasonable opportunities for reuse, recycling and recovery are unavailable.

5.5.5.3 Excavation Waste Management

In line with current practice in Ireland, surplus materials and wastes from the Proposed Scheme will be managed as follows:

- Where practicable, naturally occurring excavated material will be reused within construction in the Proposed Scheme in accordance with Article 2 of the Waste Directive Regulations, the Waste Framework Directive and Section 3 of the Waste Management Act, as amended;
- Excavation material will be used as engineering and landscaping material within the Proposed Scheme and on other projects requiring the types of materials generated, where practicable, through Article 27. Reuse of topsoil and excavated material within the Proposed Scheme is proposed, where practicable. The material will also be subject to testing to ensure it is suitable for its proposed end use;
- Should material meet the acceptance criteria set out in Article 28 of the Waste Directive Regulations, this material will be delivered to recovery or disposal facilities which are authorised to collect this material under the Waste Management Act (i.e., which hold a Certificate of Registration (CoR), Waste Facility Permit (WFP) or EPA Licence), should such recovery or disposal facilities become available by the time of commencement of construction of the Proposed Scheme;
- In accordance with the law all excavation wastes requiring removal from site for recycling or recovery will be delivered to facilities which are authorised under the Waste Management Act (i.e., which hold a CoR, WFP or EPA Licence). Examples of recycling / recovery activities for excavation material include:
  - Processing of stone to produce construction aggregate;
  - Backfilling of quarries; and
  - Raising land for site improvement or development.
- Any hazardous waste arising will be managed by the appointed contractor in accordance with the applicable legislation; and
- In accordance with the law all wastes removed from site will be transported by the holder of the appropriate waste collection permit, granted in accordance with – the Waste Management (Collection Permit) Regulations 2007 – S.I. No. 820 of 2007.

It will be the responsibility of the appointed contractor to secure agreements for acceptance of surplus excavation materials from the Proposed Scheme in authorised and regulated facilities, in accordance with the Waste Management Act and associated regulations.

Where carriageway is removed it will be reused where possible within the Proposed Scheme through implementation of the measures set out below.

Due to the nature of the works in an urban environment there are limited opportunities to achieve a cut / fill balance of materials that could be more readily accommodated on a greenfield project where earthworks embankments / bunds are more common. Material from the existing pavement layers will be temporarily stockpiled at the Construction Compounds and sent to a suitable recovery facility for recycling and reuse as recycled aggregate material in the industry as further described in Section 17.5 in Chapter 17 (Waste & Resources) of this EIAR (Volume 2).

Material for excavation will need to be tested by the appointed contractor for quality, contamination and could potentially be reused as general fill or general landscape fill material in construction under the provisions of Article 27. Material which meets the necessary acceptance criteria will be delivered to an authorised soil recovery facility. Material which requires recycling will be sent to an authorised waste facility and may be used in accordance with Article 28 of the Waste Directive Regulations as amended. Article 28 sets the criteria which must be complied with, and the EPA must use to determine a waste reaches “end of waste” status and becomes a material.

Excavated materials such as capping, subbase, bituminous and concrete materials could be reused or recycled in line with TII specifications:

- Capping, subbase, bituminous and concrete materials could be reused or recycled in fill and capping materials (e.g., 6A, 6B, 6C, 6F, 6G, 6H ,6I, 6M, 6N) providing they comply with the Specification for Road Works Series 600 – Earthworks (CC-SPW-00600) (TII 2013a);
- Subbase, bituminous and concrete materials could be reused or recycled in subbase or base materials (e.g., Granular Material Type A to Clause 803) providing they comply with the Specification for Road Works Series 800 – Unbound and Cement Bound Mixtures (CC-SPW-00800) (TII 2013b); and
- Subbase and bituminous materials could be recycled in base or binder materials (e.g., Asphalt Concrete base and binder products to Clause 3 or Low Energy Bound Mixtures to Clause 8.1) providing they comply with Road Pavements – Bituminous Materials (CC-SPW-00900) (TII 2015c).

Information on quantities of potential material reuse or recycle is provided in Table 5.17. These pavement materials will either be removed directly from the Proposed Scheme or temporarily stored and removed at a later date as part of a spoil / waste management strategy having consideration of the intermittent nature of the street works construction activities.

5.5.5.4 Construction Waste Management

The following measures will be implemented during construction, where practicable, to ensure the maximum quantity of material is reused on the Proposed Scheme and to contribute to achieving the objectives set out in the National Waste Action Plan (DCCAE 2020) as follows:

- Stockpiling of existing sub-base, capping layer and topsoil material generated on-site for direct reuse in the Proposed Scheme where practicable in the Construction Compounds (subject to material quality testing to ensure it is suitable for its proposed end use); and
- Recycled aggregates and reclaimed bituminous mixtures will be specified in the Proposed Scheme where practicable. For example, suitable recycled aggregates and appropriate site won material may be specified in the proposed road base / binder layers, sub-base layers under footpaths / cycle tracks, and capping layer material within the road, footpath and cycle track pavement, subject to testing to ensure material is suitable for its proposed use.

Information on the quantities of potential material reuse is provided in Table 5.17. It is estimated that potentially up to approximately 19,800 tonnes of recycled or reused materials could be incorporated into the Proposed Scheme. The waste management measures which will be implemented by the appointed contractor in so far as reasonably practicable are also set out in Table 5.17.

Table 5.17: Quantities of Proposed Material for Reuse and Recycling

Reuse or Recycle	Material for Reuse or Recycle	Approximate Quantity (Tonnes)	Reuse or Recycle Specification for Example TII Series or Other Reuse or Recycle Specification	Reuse or Recycle Class (note: Class to be Provided in all Cases where TII Specification is used)
Recycle on Proposed Scheme	Bituminous Materials	2,300	TII Series 800 and 900 (TII 2013b and TII 2015c)	Bituminous plannings for recycle in subbase material, base and binder layers
Reuse on Proposed Scheme	Subbase material	2,600	TII Series 800 (TII 2013b)	Sub-base material
Reuse on Proposed Scheme	Capping material	12,500	TII Series 600 (TII 2013a)	Capping material
Reuse on Proposed Scheme	Concrete	2,400	TII Series 800 (TII 2013b)	CBGM Base to paved footway

5.5.5.5 Article 27

Surplus excavation material may be declared a by-product (under Article 27 of the Waste Directive Regulations) for reuse in one or more known construction projects.

By-product notifications to the EPA provide an opportunity for reuse of surplus clean soil and stone material arising from construction activity. This can apply to locations other than authorised recovery facilities e.g., quarries operating under planning permission, parks or other developments requiring earthworks and importation of clean soil and stone.

This option can bring significant economic benefits while facilitating beneficial re-use of by-products. This plays a role in Ireland's implementation of Circular Economy principles.

An Article 27 notification to the EPA under Article 27 of the Waste Directive Regulations, is required to achieve by-product status for soil and stones. It is noted that the use of Article 27 is limited to clean soil and stone, and it must be demonstrated to the EPA that the following four conditions are met:

- Further use of the soil and stone is certain;
- The soil and stone can be used directly without any further processing other than normal industrial practice;
- The soil and stone is produced as an integral part of a production process; and
- Further use is lawful in that the soil and stone fulfil all relevant requirements for the specific use and will not lead to overall adverse environmental or human health impacts.

Where it is proposed to use an Article 27 EPA notification in relation to excavation material from the Proposed Scheme, the appointed contractor is responsible for submission of the Article 27 notification to the EPA.

Where it is proposed to use soil from off-site with an Article 27 notification, the appointed contractor is responsible for carrying out any necessary due diligence regarding the material and ensuring that all EPA guidelines relating to that Article 27 notification have been complied with before the soil is imported into the site. Where feasible, appropriate and available Article 27 materials arising from other sites will be used in the development of this site.

The appointed contractor is responsible for ensuring all applicable regulatory requirements under waste, planning and other laws are complied with prior to movement of excavation material. Any hazardous waste arising will be managed in accordance with the applicable legislation.

5.5.5.6 Soil Recovery at Sites Holding CoR, WFP or EPA Waste Licence

Where removal of wastes from the Proposed Scheme is unavoidable it will be delivered by the appointed contractor only to facilities which are authorised under the Waste Management Act, 1996 as amended and which hold the appropriate CoR, WFP or EPA Waste Licence.

The Waste Management (Facility Permit and Registration) Regulations 2007, as amended sets out the classes of waste activity requiring CoR or WFP. The most relevant class of activity in relation to soil recovery facilities is:

Class 5 (Third Schedule, Part 1 of the Regulations) for the 'Recovery of excavation or dredge spoil, comprising natural materials of clay, silt, sand, gravel or stone and which comes within the meaning of inert waste, through deposition for the purposes of the improvement or development of land, where the total quantity of waste recovered at the facility is less than 100,000 tonnes.'

For CoR and WFP the capacity is typically a lifetime capacity, and when reached, the facility typically closes. CoR and WFP are granted to private operators by local authorities.

EPA licensed waste activities authorised to accept soil and stones for recovery and disposal include soil recovery sites, landfills, transfer stations and materials recovery facilities. These typically handle a larger tonnage of wastes than facilities holding CoR or WFP. EPA Waste Licences typically include an annual maximum intake capacity and a maximum lifetime capacity for the licensed facility.

Where the appointed contractor proposes to deliver excavated materials from the Proposed Scheme to facilities holding a CoR, WFP or EPA Waste Licence the appointed contractor is responsible for ensuring the authorisation is valid and allows acceptance of the relevant List of Waste Code.

A copy of the authorisation will be included in the Plan and evidence will be provided that the proposed facility will have capacity to accept the required quantity of waste from the Proposed Scheme.

5.5.6 Proposed Scheme Infrastructure

5.5.6.1 Construction Compounds

Construction Compound requirements to facilitate the Construction Phase of the Proposed Scheme are illustrated in Section 5.6 in Chapter 5 (Construction) of this EIAR. The main Construction Compounds will be located in the Galway Harbour Enterprise Park, within Galway Docks and a satellite compound at Galway Cathedral Car-Park.

The Construction Compounds will contain a site office, and welfare facilities for GCC personnel and contractor personnel. Limited car parking will be allowed at the Construction Compounds. Materials such as topsoil, subsoil, concrete, rock etc., will be stored at the Construction Compounds for reuse as necessary. Items of plant and equipment will also be stored within the Construction Compounds. All necessary authorisations, under the Waste Management Act, as amended, will be obtained prior to undertaking temporary storage.

5.5.6.2 Waste Collection and Transportation

Waste from the Proposed Scheme will be transported by authorised waste collectors in accordance with the Waste Management (Collection Permit) Regulations, 2007 as amended.

A list of currently authorised waste collectors used to transport waste during the Proposed Scheme will be maintained at the Construction Compounds and updated by the appointed contractor. Copies of valid appropriate waste collection permits will also be held at the Construction Compounds by the appointed contractor. A list of the currently authorised waste collectors is available on the following website: https://www.nwcpo.ie/permitsearch.aspx.

5.5.6.2.1 Hazardous Wastes

The following steps must be taken where hazardous waste is being transported from the Proposed Scheme to a hazardous waste recovery or disposal facility within Ireland:

- Waste transfer forms shall be obtained by the waste producer from the local authority website, and completed on-line before the waste is collected;
- A copy shall be downloaded, printed and signed, accompanying the consignment of hazardous waste when it is in transit; and
- On the load's arrival, the operator of the recipient disposal or recovery facility shall log-in and complete the relevant details documenting the receipt of the waste.

Export of hazardous waste from the Proposed Scheme outside of Ireland is subject to a Europe-wide control system founded on Regulation (EC) 1013 of 2006 on the European Parliament and of the Council of 14 June 2006 on shipments of waste (known as the Transfrontier Shipment Regulations), as amended. This legislation is supplemented by the Waste Management (Shipments of Waste) Regulations 2007 – S.I. 419 of 2007, as amended, which makes DCC responsible for the enforcement of this regulatory system throughout Ireland.

Export of hazardous waste from the Proposed Scheme outside Ireland should comply with the procedures set out in this legislation.

5.5.6.3 Waste Recovery and Disposal

Wastes will be delivered to authorised waste facilities in accordance with the Waste Management Act as amended. The following authorisations are applicable:

- CoR from the local authority (issued to private sector);
- CoR from the EPA (issued to local authority);
- WFP from the local authority; and
- Waste Licence from the EPA.

A list of currently authorised (CoR or WFP) waste sites in each local authority is available on the following website: http://facilityregister.nwcpo.ie/. A list of sites currently licensed by the EPA (Waste Licence) is available on the following website: http://www.epa.ie/terminalfour/waste/.

An up-to-date list of all waste facilities to which waste from the site will be delivered will be maintained on site and updated by the appointed contractor. Copies of valid facility CoR, WFP, and EPA Waste Licences will be held on site by the appointed contractor.

5.6 Environmental Incident Response Plan

5.6.1 Introduction

This Environmental Incident Response Plan (EIRP) has been prepared to ensure that in the unlikely event of an incident, response efforts are prompt, efficient, and suitable for the particular circumstances. The EIRP details the procedures to be undertaken in the event of a significant release of sediment into a watercourse, or a significant spillage of chemical, fuel or other hazardous substances (e.g., concrete), non-compliance incident with any permit or license, or other such risks that could lead to a pollution incident, including flood risks. The EIRP will identify the onsite risks and appropriate responses. The focus of including the measures in this EIRP is on prevention of the incident arising in the first place.

5.6.1.1 Objectives

The objectives of this EIRP are to:

- Ensure the health and safety of personnel and visitors along the Proposed Scheme;
- Minimise any impacts to the environment and ensure protection of the water quality and the aquatic species dependent on it;
- Minimise any impacts on properties, services etc.; and
- Establish procedures that could enable personnel to respond to incidents with an integrated multi-departmental effort and in a manner that minimises the possibility of loss and reduces the potential for affecting health, property, and the environment.

5.6.1.2 Guidance

This EIRP has been prepared with regard to the following guidance documents, where relevant:

- Control of Water Pollution from Linear Construction Projects. Technical Guidance (C648) (CIRIA 2006a);
- Control of Water Pollution from Linear Construction Projects. Site Guide (C649) (CIRIA 2006b); and
- Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (C532) (CIRIA 2001);
- A Framework for Emergency Management (Department of Housing, Local Government and Heritage (DHLGH) 2021); and

5.6.2 Roles and Responsibility

The EIRP will be reviewed and updated regularly so that it continues to apply to construction activities and is amended when applicable regulations are revised or when amendments are required by a regulatory authority.

It will be the responsibility of the EM or equivalent as stipulated by the appointed contractor to maintain and change the EIRP as required. The EIRP may also require amendments from the various stakeholders or suppliers as the Proposed Scheme progresses.

The appointed contractor shall provide a full list, including the exact locations, of all pollution control plant and equipment. All such plant and equipment shall be maintained in place and in working order for the duration of the works.

As part of the development and management of the EIRP, the appointed contractor will:

- Assess the pollution risks and develop emergency and spill response procedures for specific construction activities;
- Obtain details of key people that may need to be contacted for help in the event of an incident;
- Provide equipment for dealing with pollution incidents;
- Identify emergency access routes along the Proposed Scheme;
- Train personnel to follow procedures and use equipment correctly;
- Audit the EIRP; and
- Take action following an incident to ensure it does not occur again.

5.6.2.1 Contacts

The EIRP will detail the initial contact that should be made in case of an emergency incident as well as those responsible for following up once an emergency event is declared. To cover the full length of the Proposed Scheme, more than one contact may be needed. The EIRP will indicate which contacts apply to which sections of the Proposed Scheme.

Contact details will include the organisation, position title, name, mobile phone number and email address of relevant personnel. Numbers will be obtained for contacts, including the following:

- Radio / mobile contacts for management staff and trained personnel;
- Out-of-hours contacts;
- Environmental regulators (hotline or local contact);
- Local authorities;
- Fire Services;
- Irish Water (IW);
- National Parks and Wildlife Service (NPWS);
- Environmental Protection Agency (EPA);
- Department of the Environment, Climate and Communications (DECC);
- Department of Housing, Local Government and Heritage (DHLGH); and
- Spill response and clean-up contractors.

5.6.2.1.1 Training and Testing

Personnel will be trained on the implementation of the EIRP and how to use the necessary equipment such as spill kits. Emergency arrangements will need to be reviewed and tested periodically (and always after an incident) to ensure that measures are effective, and that the workforce is aware of what to do in the event of an incident. Emergency drills will be recorded, and improvements noted and actioned accordingly.

5.6.3 Environmental Emergency Response Procedures

5.6.3.1 Fuel and Chemical Spillages

For pollution prevention measures refer to the SWMP in Section 5.4. Emergency procedures will be further developed; either Proposed Scheme specific, works area specific or activity specific and all personnel will be required to know these procedures.

An effective pollution EIRP relies on the following elements, with regards to fuel, and chemical spillages:

- Identification of receptors / pathways (e.g., surface water drains and / or watercourses);
- Identification and clear marking of surface water drain locations within the Construction Compounds;
- Identification of all possible emergency scenarios;
- Effective planning, e.g., availability of booms, spills kits at appropriate locations along the Proposed Scheme;
- Identification and dissemination of contact numbers;
- Definition of personnel responsibilities;
- Assurance that all appropriate personnel are aware of the emergency procedure(s) (e.g., spillage, leakage, fire, explosion, and flooding), that drain covers and spill kits are available, and personnel know how to use them;
- Knowledge of incident scenarios, such as spill drills; and
- Implementation of lessons learnt from previous incidents.

In terms of pollution spill response procedures, these will vary depending on the sensitive receptor and nature of construction activities, however the following information will be included as a minimum and displayed at appropriate locations along the Proposed Scheme, at river crossings, near outfalls, refueling locations, fuel storage areas etc.:

- Instructions on how to stop work and switch off sources of ignition;
- Instructions on how to contain the spill;
- Location of spill clean-up material;
- Name and contact details of responsible personnel (these personnel should assess the scale of the incident to determine whether the environmental regulator needs to be called); and
- Measures particular to that location or activity (for example, close to a settlement pond).

More detailed plans may be location-specific, or specific to a particular activity depending on the nature of the work. They will identify the potential sources of pollution and pathways to receptors so that containment measures can be put in place at these locations. Suitable equipment, such as spill kits, oil booms and absorbent material, will be held at appropriate locations along the Proposed Scheme and personnel will be trained in the use of the equipment.

Emergency equipment will be obtained from a reputable supplier, and personnel will be trained in its correct use. Material Safety Data Sheets (MSDS) and best practice assessments will be used for advice on appropriate spill measures. The type of equipment required will depend on the activity taking place. The Construction Industry Research and Information Association, Control of Water Pollution from Linear Construction Projects(C648), Technical Guidance document (CIRIA 2006a), hereafter referred to as the CIRIA Technical Guidance Document, provides details on the types and applications of emergency equipment. Refer to Table 15.2 of the CIRIA Technical Guidance Document for further information.

Every effort will be made to prevent an environmental incident during the Construction Phase of the Proposed Scheme. The objective of the measures in the EIRP and the SWMP is to prevent an incident arising in the first place. Oil / fuel spillages are one of the main environmental risks that will exist during the Construction Phase of the Proposed Scheme which will require an emergency response procedure. An example of the steps that could be followed in the event of a spillage to ensure that the environmental risk is reduced to as low as reasonably practical is provided in this section. This procedure can be tailored to be location / activity specific as required:

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers;
- Notify the EM immediately giving information on the location, type, and extent of the spill so that they can take appropriate action;
- If necessary, the EM will inform the appropriate regulatory authority, including the Fire Services, depending on the size and nature of the spill. The appropriate regulatory authority will vary depending on the nature of the incident;
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident;
- Contain the spill using the spill control materials, track mats or other material as required. Do not use detergent or hoses to disperse spilled fuel;
- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats;
- Clean up as much as possible using the spill control materials;
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited;

- The details of the incident will be recorded on an Environmental Incident Form (such as that provided in Section 5.6.3.3 or equivalent identified by the appointed contractor), which will provide information such as the cause, extent, actions, and remedial measures used following the incident. The form will also include any recommendations made to avoid reoccurrence of the incident. This form will be appended to the EIRP;
- A record of all environmental incidents will be kept on file by the EM and the appointed contractor. These records will be made available to the relevant authorities if required; and
- The EM will be responsible for any corrective actions required as a result of the incident e.g., an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the appointed contractor as appropriate.

By carrying out the above steps, a proper system will be in place to investigate, record and report any potential fuel or chemical spillages.

5.6.3.2 Other Environmental Incidents

Environmental incidents are not limited to just fuel spillages. For example, other environmental incidents could include:

- Accidental stripping of a protected habitat;
- Accidental excavation of protected archaeological structure (without archaeologist present);
- Accidental release from settlement pond / tank etc.; and
- Unplanned utility strikes, resulting in foul water releases, temporary loss of services etc.

Therefore, any environmental incident will be investigated in accordance with the following steps.

- Immediately notify the EM, giving information on the location, type, and extent of the incident so that they can take appropriate action;
- In the very unlikely event of an incident occurring which may impact on a sensitive receptor, the EM will inform the appropriate persons / regulatory authority. The appropriate persons / regulatory authority will vary depending on the nature of the incident;
- The details of the incident will be recorded on an Environmental Incident Form (such as that provided in Section 5.6.3.3 or equivalent identified by the appointed contractor) which will provide information such as the cause, extent, actions, and remedial measures used following the incident.
- The form will also include any recommendations made to avoid reoccurrence of the incident. This form will be appended to the EIRP;
- A record of all environmental incidents will be kept on file by the EM and the appointed contractor. These records will be made available to the relevant authorities if required; and

- The EM will be responsible for any corrective actions required as a result of the incident e.g., an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the appointed contractor as appropriate.

By carrying out the above steps, a proper system will be in place to investigate, record and report any potential accidents or incidents.

5.6.3.3 Environmental Incident Form

An example of an Environmental Incident Form (EIF) is provided in Table 5.18. An EIF will record details of any environmental incidents. This form will be appended to the EIRP.

Table 5.18: Environmental Incident Form Example

Incident Details				
Date:				
Time:				
Location:				
Extent:				
Direct Activity being Undertaken:				
Cause:				
Dangerous Substances(s) Involved (identity and quantity):				
Remedial Measures Undertaken:				
Parties Involved in the Incident				
Name	**Role**	**Phone Number**	**Email**	**Address**
Description of the Incident				
Recommendations following the Incident				

5.6.3.4 Fire Control

Every effort will be made to prevent the outbreak of a fire during the Construction Phase of the Proposed Scheme. Fire extinguishers and first aid supplies will be available in the work area. In the event of such an incident, the health and safety of all personnel will be a priority. All relevant legislation and guidance on health and safety of people and in particular fire safety will be complied with.

5.6.3.5 Flood Risk Control

Where temporary stockpiles of invasive species infected material cannot for practical limitations, be situated away from a potential flood risk area, the appointed contractor will be required to include a flood response plan within the EIRP, to ensure that any inundation of the Construction Compounds does not result in a pollution event to nearby water bodies.

5.6.4 Corrective Action

When an incident happens, it is important to learn from it and ensure that such an incident does not occur again. This may involve changing the method of work for a particular activity, providing containment or treatment materials, or simply training personnel so they are aware of the correct method of work. Similarly, if an audit of planned arrangements indicates that measures are not in place, or those in place need to be improved, action will be taken immediately.

A record of corrective actions and lessons learned will be kept and communicated to all relevant persons, teams, sub-contractors etc. across the Proposed Scheme.

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Chapter 06
(Traffic & Transport)
Appendices

Galway Cross-City Link

Transport Modelling Report

March 2022

TRANSPORT MODELLING REPORT

GALWAY CROSS-CITY LINK

IDENTIFICATION TABLE	
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		Mateo Gudic	Consultant		
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	Approved by	Sean Kearns	Regional Market Director	30/03/2022	

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LIST OF ABBREVIATIONS

RMS: Regional Modelling System
WRM: West Regional Model
GCCL: Galway Cross-City Link
GTS: Galway Transport Strategy
LAM: Local Area Model
PT: Public Transport
EIAR: Environmental Impact Assessment Report

1. INTRODUCTION

This Transport Modelling Report is an appendix to Chapter 6 of the Environmental Impact Assessment Report (EIAR) which has considered the potential traffic & transport impacts associated with the Construction and Operational Phases of the BusConnects Galway Cross-City Link (University Road to Dublin Road) Scheme (hereafter referred to as the Proposed Scheme).

The Proposed Scheme has an overall length of approximately 6.7km, and routes along University Road, St. Vincent’s Avenue, St. Francis Street, Eglinton Street, Eyre Square, Forster Street, College Road and Dublin Road and also encompasses numerous roads within the city centre.

The Proposed Scheme includes an upgrade of the existing bus priority alongside changes to pedestrian and cycle facilities. The Proposed Scheme includes constitutes a substantial increase in the level of bus priority in Galway, including the provision of additional lengths of bus lane.

ARUP, on behalf of the National Transport Authority, commissioned SYSTRA to perform the modelling to assess the transport impact of the proposed scheme. This report summarises the methodology and results of the modelling study.

1.1 Report Structure

The following outlines each Chapter of this Modelling Report:

- Chapter 2 summarises the modelling methodology
- Chapter 3 provides an overview of the NTA’s Regional Modelling System (RMS)
- Chapter 4 describes the forecast land use assumptions used in the modelling
- Chapter 5 describes the individual modelled scenarios
- Chapter 6 outlines the main WRM results
- Chapter 7 focuses on the Local Area Model and its results

2. MODELLING METHODOLOGY AND ASSUMPTIONS

This section gives a high-level overview of the modelling methodology and modelling assumptions and references the relevant Chapters that discuss each aspect in more detail.

2.1 Modelling Methodology

The modelling methodology can be summarised as follows:

- Modelling is based on use of the NTA's Regional Modelling System (RMS). Please see Chapter 3 for description of RMS and its components.
- Modelling was undertaken for three forecast years (2019, 2023 and 2038). Please see Chapter 4 for description of the land use assumptions that were used to generate individual forecasts.
- Modelling was done for three scenarios (Base Year, Do-Minimum and Do-Something). Please see Chapter 5 for a description of the modelled scenarios and Chapter 0 for the overview of the modelling results.
- A Highway Local Area Model (LAM) has been developed, calibrated and validated for the base and two forecast years. Please see Chapter 7 for a description of the calibration and validation process.

Figure 2-1 illustrates the overall modelling process undertaken.

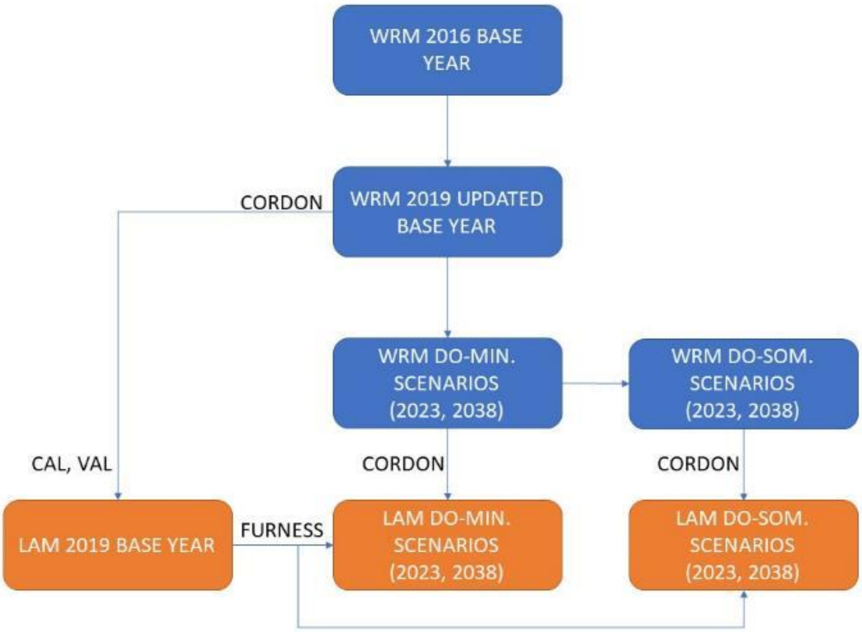

Figure 2-1: Overall modelling process undertaken for the study

3. NTA REGIONAL MODELLING SYSTEM

3.1 Introduction

This section provides an overview of the NTA Regional Modelling System (RMS).

The NTA Regional Modelling System comprises five regional transport models covering the Republic of Ireland and centred on the five main cities of Dublin, Cork, Galway, Limerick, and Waterford (as summarised in Table 3-1 below).

Regional Modelling System	Abbreviation	Counties Covered
Eastern Regional Model	ERM	Louth, Monaghan, Cavan, Longford, Westmeath, Meath, Offaly, Laois, Kildare, Dublin, Wicklow, Carlow & Northern Wexford
South East Regional Model	SERM	Wexford, Kilkenny, Waterford & Tipperary South
South West Regional Model	SWRM	Cork & Kerry
Mid-West Regional Model	MWRM	Limerick, Clare & North Tipperary
Western Regional Model	WRM	Galway, Mayo, Roscommon, Sligo, Donegal & Leitrim

Table 3-1: Regional Modelling System

Each regional model has the following key attributes:

- Full geographic coverage of the relevant region;
- A detailed representation of the road network;
- A detailed representation of the public transport network & services;
- A representation of all major transport modes including active modes (walking and cycling);
- A detailed representation of travel demand, e.g. by journey purpose, car ownership/availability, mode of travel, person types, user classes & socio-economic classes, and representation of five time periods (AM, Lunch Time, School Ride, PM and Off-Peak);
- A prediction of changes in trip destination in response to changing traffic conditions, transport provision and/or policy; and
- A prediction of mode-choice in response to changing traffic conditions.

Figure 3-1 illustrates the geographical extent of each of the Regional Models.

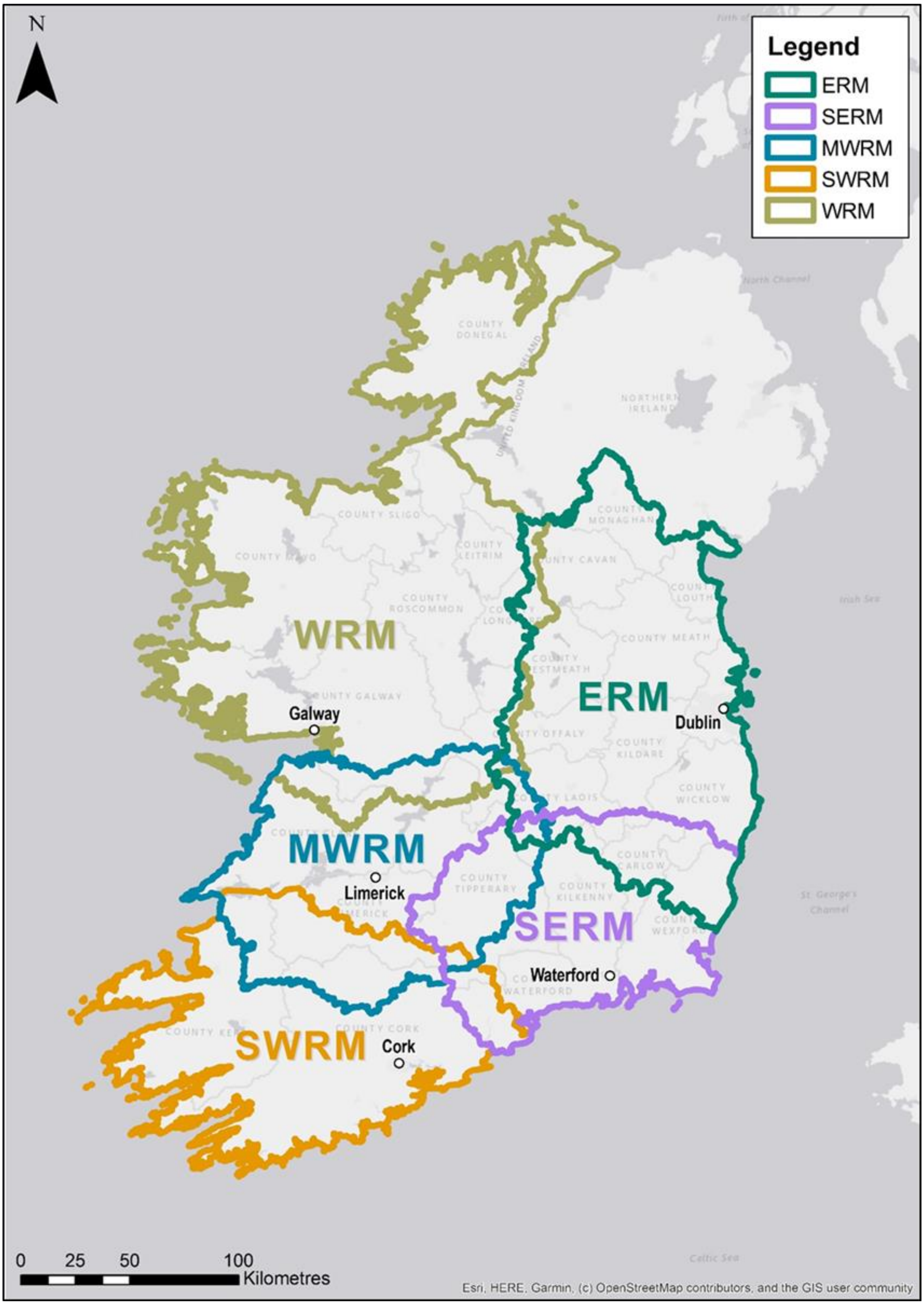

Figure 3-1: Regional Modelling Systems – Areas of Coverage

The West Regional Model (WRM), which is centred around Galway City and covers Donegal, Leitrim, Sligo, Roscommon and Mayo, has been used to support the demand analysis for the Galway-Athenry Capacity Study.

3.2 RMS Overarching Structure

All the regional models, including the WRM, include 3 core modelling processes (i.e. Demand Model, Road Assignment Model, Public Transport Assignment Model) which receive inputs from the National Demand Forecast Model (NDFM) and provide outputs for transport appraisal and secondary analysis. This process is shown in Figure 3-2.

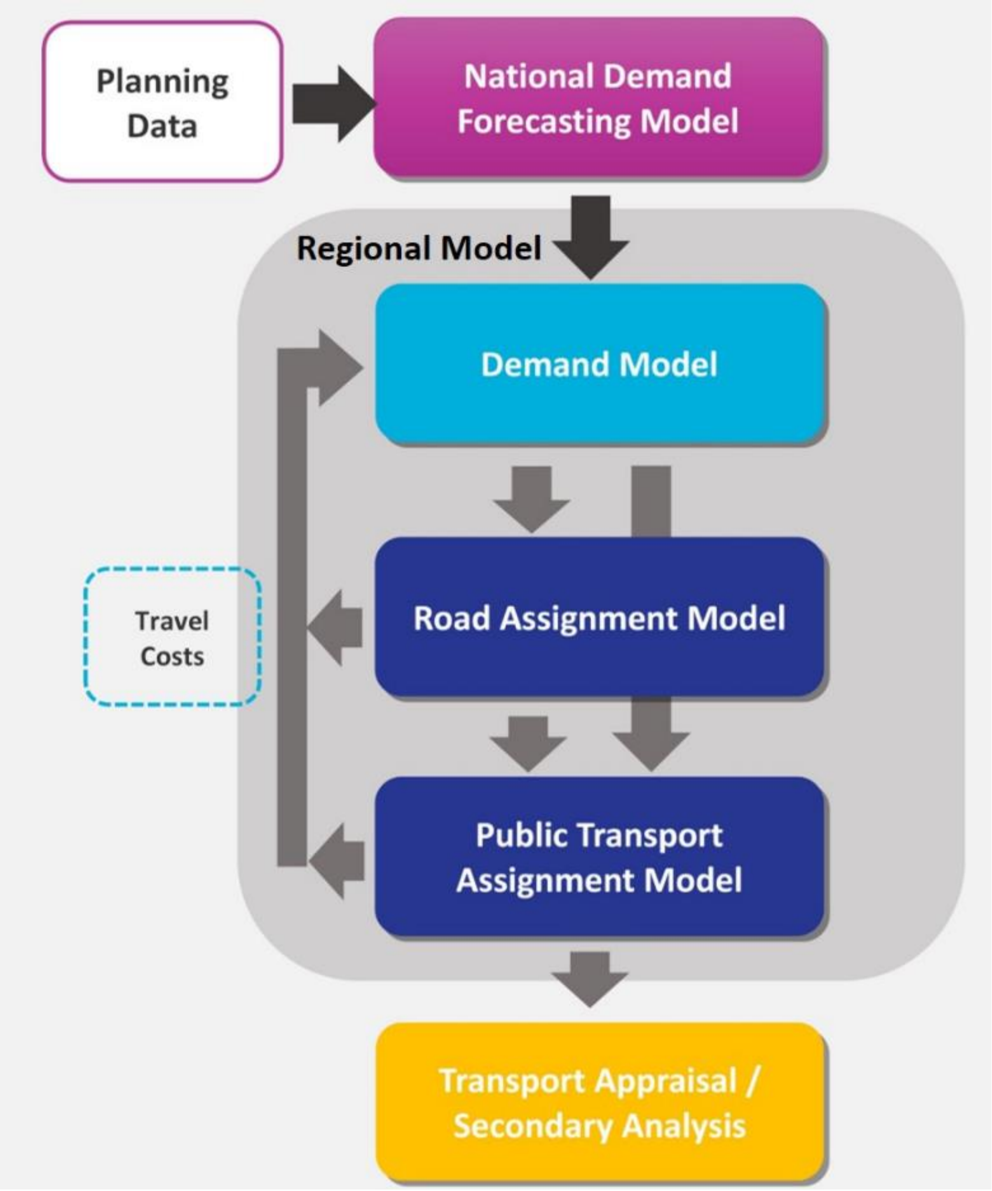

Figure 3-2: Regional Modelling System Structure

The two main RMS components (NDFM and Regional Model) are discussed in more detail in Sections 3.3 and 3.4.

3.3 National Demand and Forecasting Model (NDFM)

The NDFM is a separate modelling system that estimates the total quantity of travel demand generated by and attracted to every Census Small Area (CSA) daily. The level of demand from, and to, each CSA (referred to as trip ends) is related to characteristics such as population, number of employees and land-use data. Trip ends are then used by Regional Models to create travel demand matrices for the internal area of each of the Regional Models.

Additionally, the NDFM also estimates the inter-regional demand (demand crossing the boundary of each of the Regional Models), which then forms the external demand for each of the Regional Models.

The NDFM consists of five interoperating components, as follows:

- Planning Data Adjustment Tool (PDAT) – prepares the planning data forecasts, which are then used by other applications within the NDFM suite.
- Car Ownership / Car Competition Models (COCMP) – forecasts car competition for each Census Small Area (proportion of households with no cars, with fewer cars than adults and with the same number or more cars than adults).
- National Trip End Model (NTEM) – provides a forecast on the numbers of trips to and from each CSA in Ireland for a typical weekday. NTEM derives trip ends by journey purpose based on various attributes of each CSA, such as levels of employment and population.
- Long Distance Model (LDM) – provides a forecast on the number of long-distance trips (trips longer than 20km) which are made on a typical weekday across Ireland and Northern Ireland.
- Regional Model System Integration Tool (RMSIT) – converts the long-distance trips generated by the LDM into external demand entering/exiting each Regional Model, with entry and exit points represented by route zones.

A high-level overview of the NDFM is shown in Figure 3-3.

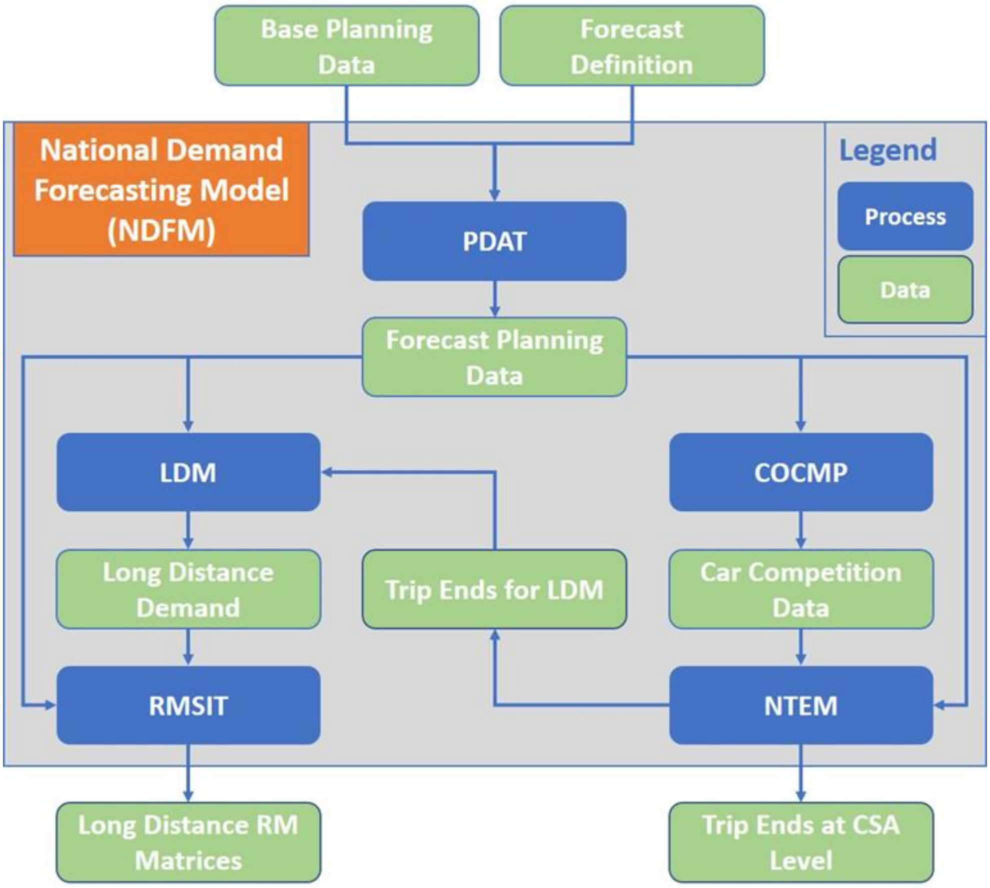

Figure 3-3: NDFM Structure

The Planning Data shown in Figure 3-3, represents a key input into the NDFM. It is a national database of 114 demographic and spatial variables for each of the 18,641 CSAs in the state. The main categories of planning data are:

- Spatial definitions (CSA/DED/NUTS names, area types etc.);
- Production related variables – demographic data about residents living in each CSA (e.g. total population living in each CSA, age bands, gender, employment status etc.);
- Attraction related variables – data related to employment and education in each CSA (e.g. number of jobs within each CSA, number of education places etc.).

Further details about the NDFM structure, its components and calibration can be requested from the NTA via the NTA's website[1]

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[1] https://www.nationaltransport.ie/planning-and-investment/transport-modelling/regional-modelling-system/ndfm-overview-rtm/

3.4 West Regional Model (WRM)

3.4.1 Model Dimensions

The WRM dimensions are defined in terms of:

- Zone system;
- Modes of travel represented;
- Base year;
- Time-periods; and
- Demand segmentation.

3.4.1.1 Zone System

The zone system definitions for each of the regional models were based on Census Small Area (CSA) boundaries and Electoral Districts (EDs). The 2016 CSAs are the core base layer for each zoning system. The criteria used for developing zone boundaries for the WRM and other regional models included:

- Population, Employment and Education – maximum values were specified for zone population, number of jobs and persons in education;
- Activity Levels – limits were applied to zone activity levels ensuring that zones with either very low, or very high, levels of trips were not created;
- Intra-zonal Trips – threshold values were applied to the proportion of intra-zonal trips, within each zone, to avoid an underestimation of flow, congestion and delay on the network;
- Land Use – zones were created with homogeneous land use and socio-economic characteristics where possible;
- Zone Size/Shape – thresholds were applied to zone size, and irregularity of shape, to avoid issues with inaccurate representation of route choice;
- Political Geography – zone boundaries do not intersect ED boundaries;
- Special Generators/Attractors – large generators/attractors of traffic such as Airports, Hospitals, shopping centres etc. were allocated to separate zones.

The West Regional model includes 693 internal zones as follows:

- Galway City: 138
- Galway County: 201
- Donegal County: 108
- Leitrim County: 27
- Sligo County: 46
- Roscommon County: 48
- Mayo County: 123
- Special Zones: 2 (Knock Airport and Donegal Airport)

Figure 3-4 shows the WRM Zone System.

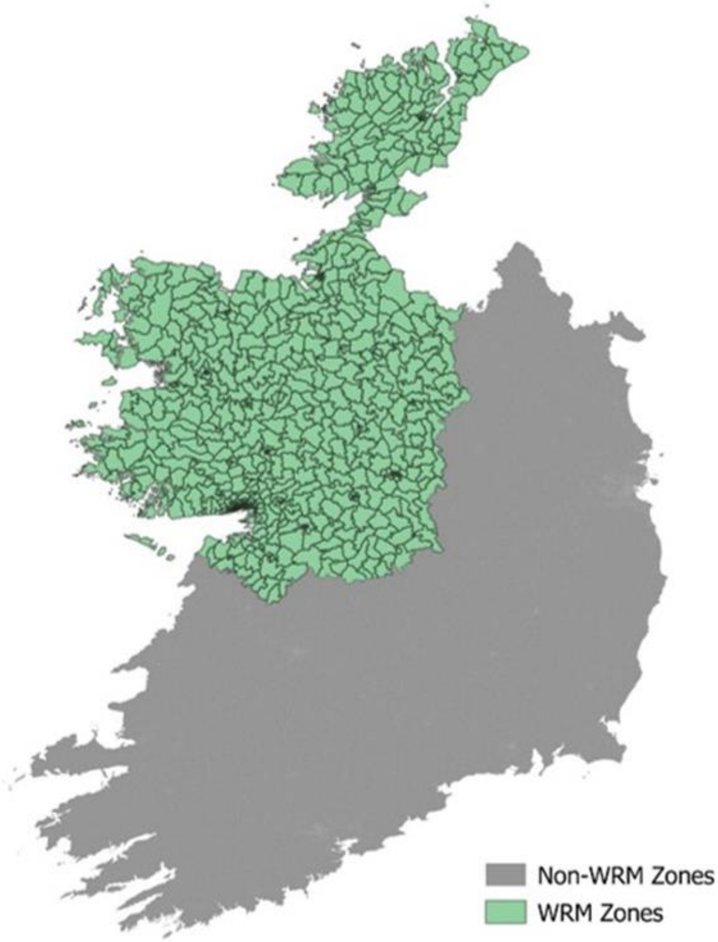

Figure 3-4: WRM Zone System

External zones represent demand from areas across the country to / from the West Regional Model study area. This demand is provided by the Long Distance Model, part of the NDFM. The LDM is a national model designed to provide external trips for each of the Regional Models, this includes both Road and PT demand. This demand is assigned to the WRM through route zones representing entry/exit points into the WRM study area by major roads and rail. There are 35 route zones in the WRM. Further information on the WRM Zone System can be found in the WRM zone system development report[2].

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[2] https://www.nationaltransport.ie/wp-content/uploads/2018/06/WRM_Zone_System_Development_Report-1.pdf

3.4.1.2 Modes of Travel

The regional model covers all surface access modes for personal travel and goods vehicles:

- Private vehicles – taxis and cars;
- Public transport – bus, rail, Luas, BRT, Metro;
- Active modes – walking and cycling; and
- Goods vehicles – light goods vehicles and heavy goods vehicles.

3.4.1.3 Base Year

The base year of each regional model is 2016 with a nominal month of April. This is largely driven by the date of the Census (POWSCAR) and the National Household Travel Survey (NHTS).

3.4.1.4 Time Periods

The regional model represents an average weekday. The day is split into five time periods as detailed in Table 3-2 below. The periods allow the relative difference in travel cost between time periods to be represented.

Period Name	Demand Model Period	Assignment Period
AM Peak	07:00-10:00	08:00-09:00
Morning Inter Peak – Lunch Time (LT)	10:00-13:00	12:00-13:00
Afternoon Inter Peak – School Run (SR)	13:00-16:00	15:00-16:00
PM Peak	16:00-19:00	17:00-18:00
Off Peak	19:00-07:00	20:00-21:00

Table 3-2: Time Periods

3.4.2 Core Modelling Processes

The WRM includes the following core modelling processes:

- Demand Model;
- Road Assignment Model;
- Public Transport Assignment Model; and
- Active Modes Model

3.4.2.1 Demand Model

The Demand Model processes all-day travel demand from the NDFM through a series of choice models to represent combined mode, time of day, destination and parking decision making. The outputs of the demand model are a set of trip matrices which are assigned using the Road Assignment Model and Public Transport Assignment Model to determine the route-choice and generalised costs.

The demand model consists of several components:

- Macro Time of Day;
- Mode Choice;
- Destination Choice;
- Parking; and
- Tours and One-Way.

A simple representation of the model structure is shown in Figure 3-5.

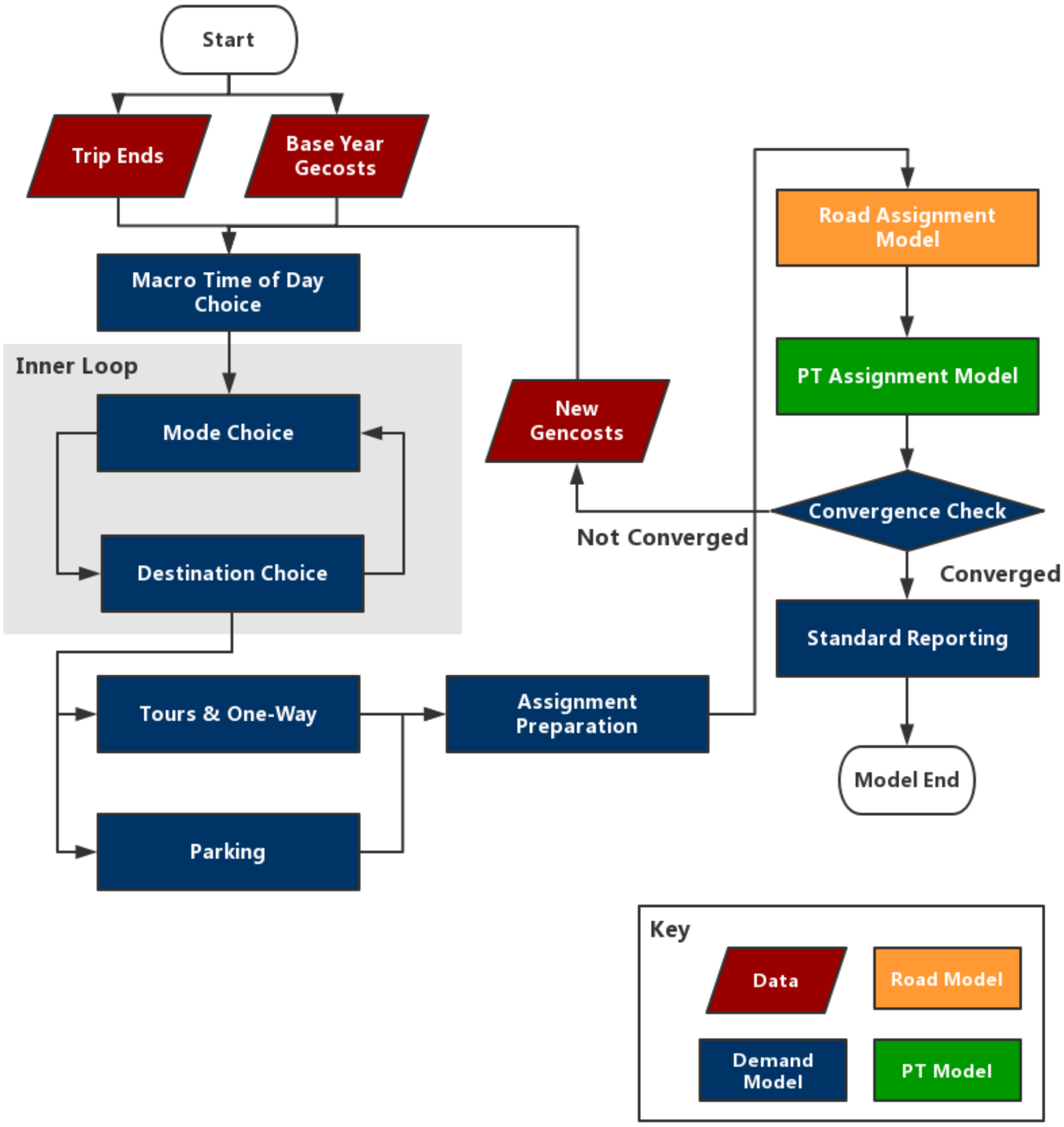

Figure 3-5: Demand Model Structure

3.4.2.2 Road Assignment Model

The main purpose of the Road Assignment Model (RDAM) is to assign road users to routes between their origin and destination zones. The RDAM is implemented in SATURN road assignment software and includes capacity restraint whereby travel times are recalculated in response to changes in assigned flows.

The inputs to the Road Assignment Model from the Demand Model are the road assignment matrices. The outputs from the Road Assignment Model back to the Demand Model consist of generalised cost of travel by time period.

3.4.2.3 Public Transport Assignment Model

To generate costs to update the Demand Model processes, a PT assignment must be undertaken to establish new generalised costs. The Public Transport Assignment Model (PTAM) is used to allocate PT users to services between their origin and destination zones. The model includes a representation of the public transport network and services for existing and planned modes within the modelled area. In addition, the PTAM network includes walk links to provide for improved permeability and access.

The model includes:

- Heavy Rail;
- Light Rail;
- Urban Bus;
- Inter-Urban Bus; and
- Bus Rapid Transit (BRT).

The outputs from the Public Transport Assignment Model for the Demand Model processes consist of the assigned networks which are passed on to the Active Modes Model and generalised cost skim matrices by user class for each of the assigned time periods that feed back into the main Mode and Destination choice demand model loop. An overview of the PTAM process is shown in Figure 3-6.

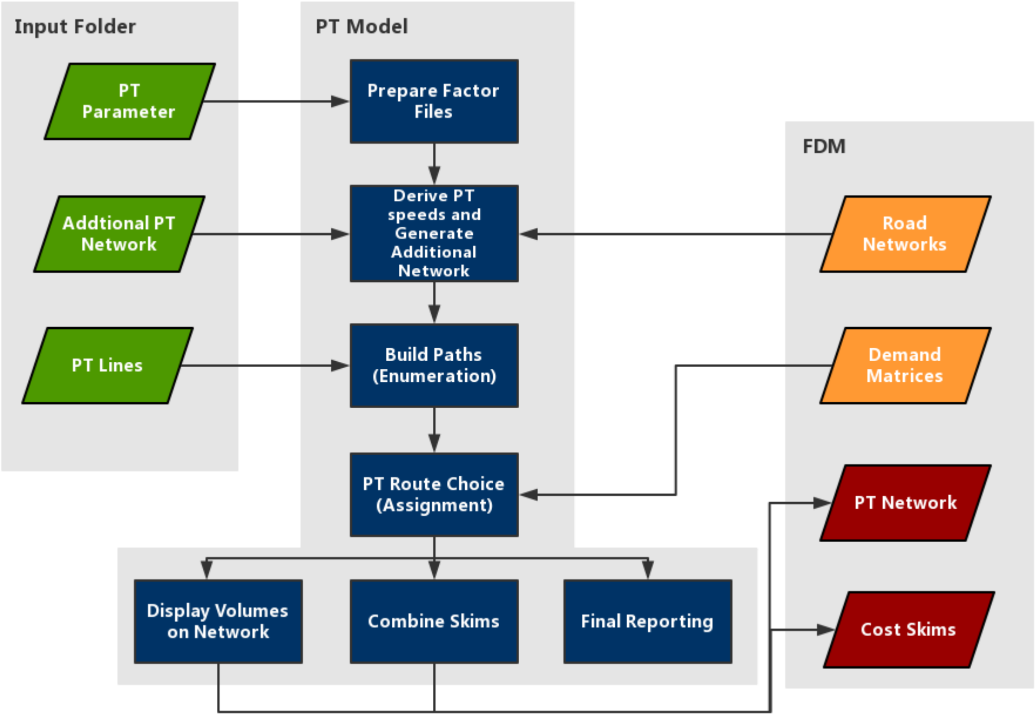

Figure 3-6: PT Model Process

3.4.2.4 Active Modes Model

The active modes assignment is run after the PTAM using the PT network with rail and motorway links removed. The active mode assignment is a shortest path assignment and does not include delays or crowding.

The inputs for the active assignment model are the output CUBE format PT networks, the demand model produced assignment matrices and separate input pedestrian only links and cycle lanes. The outputs of this process include an assigned network with walk and cycle flows by user class, and a set of generalised cost skims. The active assignment is a CUBE-based lowest cost path assignment model with no junction modelling based purely on distance and a constant speed by mode.

3.5 Suitability of West Regional Model

3.5.1 Model Calibration and Validation

The WRM has been subject to a comprehensive calibration and validation process in line with best practice guidelines whereby a substantial amount of observed data has been incorporated into both the demand model and the assignment models as presented in Table 3-3.

Demand Model	Assignment Models
Tour proportions	Road traffic volumes
Generalised cost distributions	Road journey times
Travel distance distributions	Road trip length distribution
Modal share	Public transport in-vehicle time factors
Journey time distribution	Public transport fares and ticket types
	Public transport passenger flows
	Public transport boardings and alightings
	Public transport journey times
	Public transport interchange/transfers

Table 3-3: Observed data used for Model Calibration and Validation

The calibration and validation process ensures that the WRM accurately reflects existing conditions and 'costs' associated with travel. This allows changes in the transport demand and impacts of strategic transport infrastructure schemes and transport policies to be modelled and tested using the WRM. Further details on the WRM calibration can be found in the Model Development and Calibration Reports available on the NTA's website[3].

3.5.2 Use of WRM for Strategic Transport Planning

The model has many strengths and features that make it the ideal tool to aid the strategic planning process. The WRM has been developed from first principles making best use of the most recently available data (POWSCAR and NHTS) to replicate travel choices and transport network conditions as accurately as possible.

Several distinct journey purposes and characteristics including car availability, employment status, and education level are considered within the model to evaluate travel choices more accurately. This carries through to forecasting whereby specific person type demand can be forecast to derive appropriate trip distributions and future year travel conditions.

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[3] https://www.nationaltransport.ie/planning-and-investment/transport-modelling/regional-modelling-system/regional-multi-modal-models/west-regional-model/

The model utilises a tour-based approach which allows for more accurate mode choice modelling and consideration of travel costs.

Four main modes of travel are included in the model: private car, public transport, walking, and cycling. Each mode has been calibrated individually, for each journey purpose, to replicate observed trip cost distributions.

The use of SATURN software in the road model allows for junction modelling to be included in the model which improves network representation in congested areas. Link speeds and delays are transferred to the public transport model which allows journey times of on-street modes (Bus, BRT) to reflect real traffic conditions rather than being based strictly on timetables.

3.5.3 Summary

The West Regional Model provides a comprehensive representation of travel patterns across the Galway Cross City Link Study area and it is a suitable tool for assessing the effects of the proposed scheme.

4. FORECAST LAND-USE ASSUMPTIONS

4.1 Introduction

This Chapter describes the land use assumptions used in development of forecasts for the individual forecast years and present population and employment growth within the study area.

The land use forecasts have been prepared by the NTA for the required forecast years (2019, 2023 and 2038). Reference to the individual NTA's NDFM forecast scenarios is shown in Table 4-1.

Forecast Year	NDFM Forecast Scenario	NDFM Version
2019	D19	NDFM_V045
2023	D22	
2038	D37	

Table 4-1: NDFM Forecast Scenarios

Forecasts of population, employment and education data are defined by the National Transport Authority at the Census Small Area (CSA) level for standard reference years of 2024 and 2040. The National Demand Forecasting Model converts planning data forecasts to trip forecasts (in total productions and attractions per zone) for input to the WRM. The assessment years for this project (i.e. 2023 and 2038) are derived by linear interpolation from the NTA's 2040 NPF reference case planning sheet and the 2016 Census based planning sheet.

4.2 Population Growth

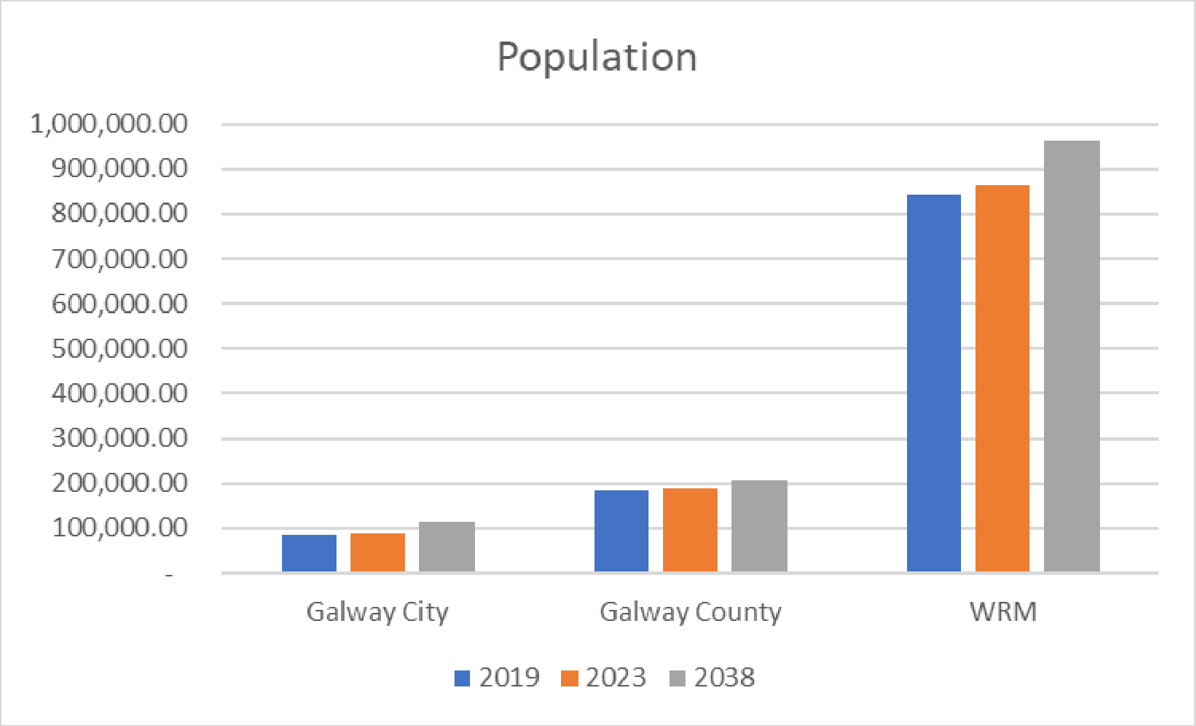


Figure 4-1: Population Growth

As can be seen from Figure 4-1, the population is expected to grow substantially in the future both in Galway City/County and across the WRM region.

Galway City will see in increase from approximately 83,700 in the Base Year to 88,700 in 2023 and 113,700 in 2038. This represents a 36% increase between 2019 and 2038.

The population in Galway County is expected to grow by 13% between 2019 and 2038 and by 14% across the WRM region.

4.3 Employment Growth

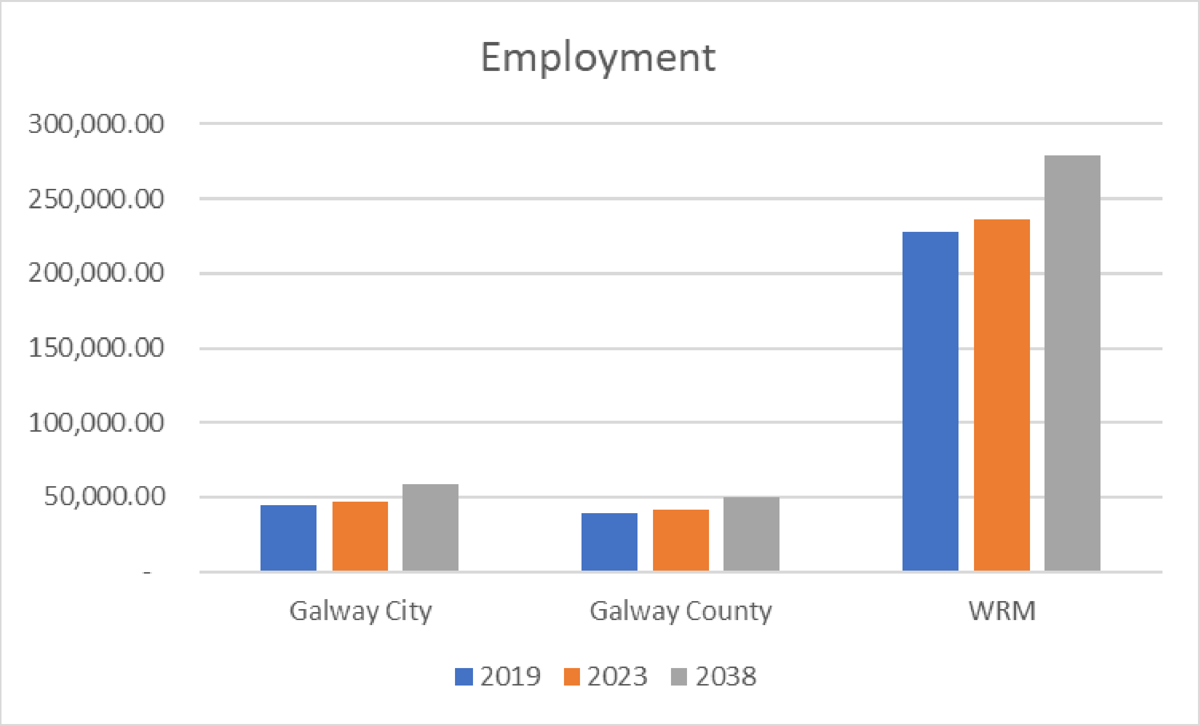


Figure 4-2: Employment Growth

As can be seen from Figure 4-2, the number of jobs is expected to grow substantially in line with the population in both Galway and across the WRM region.

Galway City will see in increase in jobs from approximately 44,300 in the 2019 Base Year to 46,600 in 2023 and 58,000 in 2038. This represents a 31% increase between 2019 and 2038.

The employment figures in Galway County are expected to grow by 28% between 2019 and 2038 and by 22% across the WRM region.

5. MODELLED SCENARIOS

5.1 Overview

Three scenarios types have been tested in the WRM to assess the impact of the scheme. These were:

- Do Minimum – committed schemes only; and
- Do Something – committed schemes and Proposed Scheme.

Each scenario has been tested in two forecast years: 2023 and 2038.

Along with these, a 2019 Base Year has been prepared to provide a comparison accounting for recent infrastructure development and growth since the 2016 Base Year. The 2019 Base Year has also been the starting scenario for calibrating and validating the Base Year Local Area Model (LAM), which is described in Chapter 7.

5.2 Base Year

The 2019 Base Year has been developed to take into consideration recent infrastructure developments that were not included in the 2016 calibrated WRM model. The new base year has also been the starting point for the calibration and validation of the Local Area Model Base Year, which will be discusses later in this report.

The 2019 WRM Base Year has been built starting from the calibrated 2016 WRM with the addition of the pieces of infrastructure listed in Table 5-1.

SCHEME	DESCRIPTION
Parkmore Widening	Widening of Ballybrit Cres in the direction of Parkmore Road
Kirwan Roundabout	Upgrade from a roundabout to two signalised junctions
M17-M18	M17 and M18 motorways between Gort and Tuam with connection to the M6
Right Turn Bans	Right Turn bans at Moneenageisha Cross and Threadneedle/Taylors Hill

Table 5-1: Additional infrastructure included in the 2019 Base Year

5.3 Do Minimum

The Do Minimum networks have been coded on top of the 2019 Base Year scenario and included the committed schemes to be implemented post-2019. Do Minimum networks have been coded for the future years 2023 and 2038.

The 2023 Do-Minimum scenario includesd the set of road and public transport schemes listed in Table 5-2.

SCHEME	DESCRIPTION	COMMITTED SCHEME	GTS SCHEME
Martin Junction	Upgrade from a roundabout to a signalised junction	X	
GTS Bus Services	Brown, red, blue, green and yellow bus routes to replace existing local bus services 401-412 and 414.		X

Table 5-2: schemes included in the 2023 Do-Minimum Scenario

The 2038 Do-Minimum networks have been coded on top of the 2023 Do Minimum Model and included the set of road and public transport schemes listed in Table 5-3.

SCHEME	DESCRIPTION	COMMITTED SCHEME	GTS SCHEME
Galway Outer Bypass	N6 to R336 Barna Road	X	
Skerlett Rbt Signalisation	Upgrade from a roundabout to a signalised junction.		X
N59 Dangan Upgrade	Speed limit increase		X
W4 BC2 - Tuam Road Bus Corridor	It is proposed to install an outbound shared bus/cycle lane from the junction with Wellpark Rd/Connolly Av, north to the		X

SCHEME	DESCRIPTION	COMMITTED SCHEME	GTS SCHEME
	junction with the Tuam Rd and east to the junction with Bothar na dTreabh		
W6 BC4 - Father Griffin Road Corridor	It is proposed to reduce vehicle speeds to advertise the presence of pedestrians and cyclists.		X
W7 BC5 - Monivea Road Scheme	Add an on-road bus priority to allow buses to travel to the Briarhill Junction.		X
W9 BC7 - Western Distributor Road Corridor	It is proposed to transform Blake and Athy roundabouts into signalised junctions and add bus lanes in both direction along the road.		X
W11 BC9 - Rahoon Road Bus Lane	Adding an inbound bus lane from Rahoon Cemetery to the junction with Seamus Quirke Road.		X
W13 BC11 - Galway Bus Connects	It is proposed to install bus corridors all along Dublin Rd from Martin Roundabout to Moneenageisha Junction (about 4km long) in both directions.		X
GTS Bus Services	Brown, red, blue, green and yellow bus routes to replace existing local bus services 401-412 and 414.		X

Table 5-3: schemes included in the 2038 Do-Minimum Scenario

5.4 Do Something

The Do Something network has been coded on top of the Do Minimum scenarios and includes the Proposed Scheme in both 2023 and 2038.

This includes traffic restrictions for general traffic on Salmon Weir Bridge, St. Vincent's Avenue, Eglinton Street, Eyre Square and Forster Street. A Bus Gate is also introduced on College Road, at the western end of the scheme.

Approaching the junction at Moneenageisha, outbound bus lanes are introduced between Lough Atalia Road and the signalised junction, while outbound bus lanes are introduced on Dublin Road.

To aid traffic management, Bóthar Bhreandain Uí Eithir, Prospect Hill and Gaol Road are converted to two-way traffic routes.

Figure 5-1 shows an overview of the GCCL scheme. Scheme drawings are included in the Appendix.

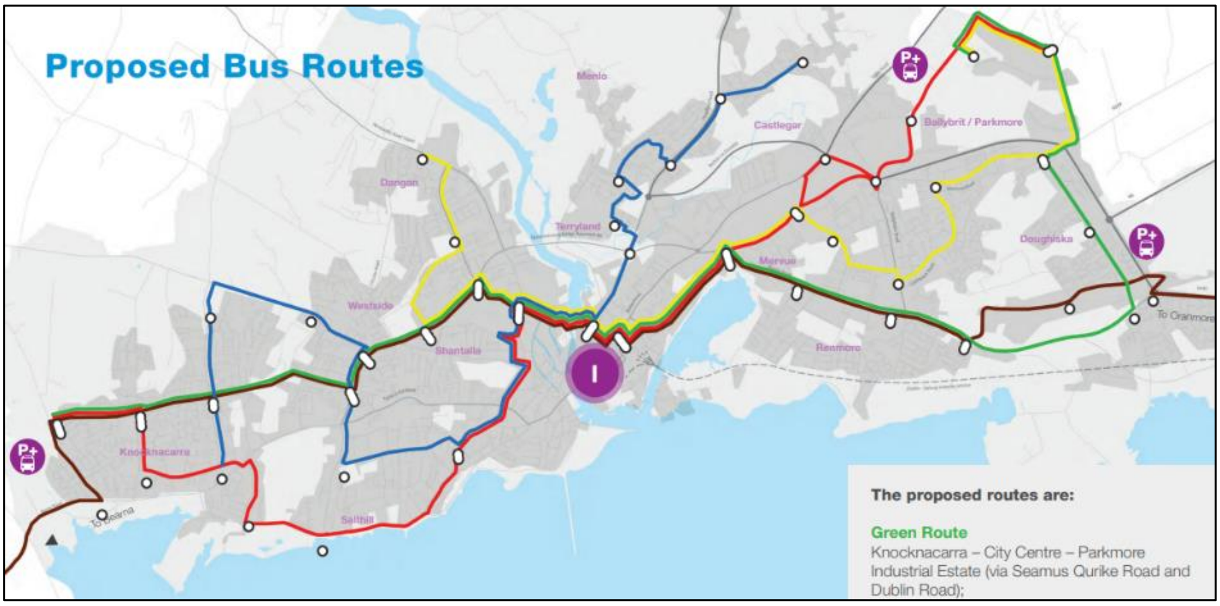
Figure 5-1: Overview of the GCCL scheme

5.5 Public Transport

The new bus routes proposed as part of the Proposed Scheme are included in both the Do Minimum and Do Something scenarios (in 2023 and 2038) as the aim is to evaluate the impact of the Proposed Scheme only.

Figure 5-2 shows the routing of the new bus routes. These lines are coded as indicated in Table 5-4.

As outlined in section 6.3.4.2 of the EIAR, bus journey time data for the Proposed Scheme was provided by the NTA from the Automatic Vehicle Location (AVL) dataset used to monitor bus performance. The data provides information on bus travel time and dwell times at existing bus stops and has been used to inform the development of the transport models used to assess the impacts of the Proposed Scheme. Time factors have been applied to the new bus routes in the Do Minimum scenarios to reflect the AVL data.



The proposed routes are:

Green Route
Knocknacarra – City Centre – Parkmore Industrial Estate (via Seamus Qurike Road and Dublin Road);

Figure 5-2: Galway Bus Connects bus routes

SERVICE	NAME	ROUTE	HEADWAYS [MIN]	TIME FACTORS (DM ONLY)
8001	Brown	Bearna-Oranmore: Eastbound	AM: 20 LT: 20 SR: 20 PM: 15 OP: 20	AM:1.11 LT:1.11 SR:1.00 PM:1.15 OP:1.00
8002	Brown	Bearna-Oranmore: Westbound	AM: 20 LT: 20 SR: 20 PM: 15 OP: 20	AM:1.09 LT:1.09 SR:1.00 PM:1.15 OP:1.00
8003	Red	Salthill - Parkmore: Eastbound	AM: 10 LT: 10 SR: 10 PM: 10 OP: 10	AM:1.12 LT:1.12 SR:1.00 PM:1.20 OP:1.00
8004	Red	Salthill - Parkmore: Westbound	AM: 10 LT: 10 SR: 10 PM: 10	AM:1.11 LT:1.11 SR:1.00 PM:1.19

SERVICE	NAME	ROUTE	HEADWAYS [MIN]	TIME FACTORS (DM ONLY)
			OP: 10	OP:1.00
8005	Blue	Knocknacarra - Tirellan: Eastbound	AM: 15 LT: 15 SR: 15 PM: 15 OP: 15	AM:1.05 LT:1.05 SR:1.00 PM:1.08 OP:1.00
8006	Blue	Knocknacarra - Tirellan: Westbound	AM: 15 LT: 15 SR: 15 PM: 15 OP: 15	AM:1.02 LT:1.02 SR:1.00 PM:1.05 OP:1.00
8007	Green	Knocknacarra - Parkmore: Eastbound	AM: 10 LT: 10 SR: 10 PM: 10 OP: 10	AM:1.15 LT:1.15 SR:1.00 PM:1.23 OP:1.00
8008	Green	Knocknacarra - Parkmore: Westbound	AM: 10 LT: 10 SR: 10 PM: 10 OP: 10	AM:1.12 LT:1.12 SR:1.00 PM:1.21 OP:1.00
8009	Yellow	Dangan - Parkmore: Eastbound	AM: 15 LT: 15 SR: 15 PM: 15 OP: 15	AM:1.12 LT:1.12 SR:1.00 PM:1.19 OP:1.00
8010	Yellow	Dangan - Parkmore: Westbound	AM: 15 LT: 15 SR: 15 PM: 15 OP: 15	AM:1.09 LT:1.09 SR:1.00 PM:1.16 OP:1.00

Table 5-4: new bus lines coded in the modelling scenarios

6. RESULTS

This section outlines the results of the modelling, listing the following key statistics for each modelled scenario:

- Number of trips and mode shares for Cycling, Walking, PT and Car;
- Public Transport Flows, Boardings and Journey Times
- Car Flows

6.1 Trips and Mode Shares

This section outlines the number of trips over 24 hours and mode shares. Results are shown for the 2019 Base Year, the 2023 and 2038 Do-Minimum and Do-Something scenarios. Light and heavy goods vehicles are not included. As the impact of the Proposed Scheme varies according to the geographical extent of the area modelled, results are reported for both the entire WRM region and the area limited to Galway City. In the WRM, Galway City includes zones belonging to sectors 1 to 5, as shown in Figure 6-1.

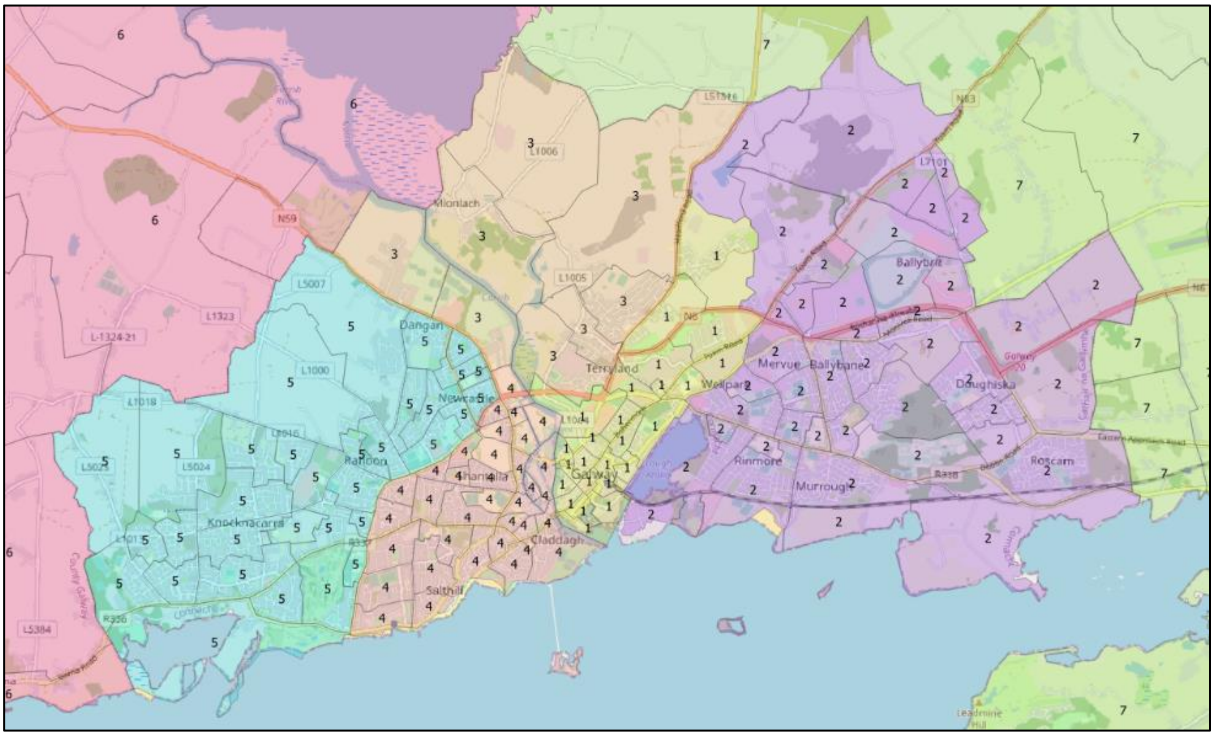


Figure 6-1: Sectoring System for Galway City

The number of trips, mode shares and variations within the WRM region are shown in Figure 6-2, Figure 6-3 and **Error! Reference source not found.** respectively. The same indicators limited to Galway City are reported in Figure 6-4, Figure 6-5 and 6. The first observation is that the number of trips made by car reduces consistently in all scenarios, while walking, cycling and PT increases. Mode shares for sustainable modes also increase across all scenarios (with the exception of walking between the 2019 Base Year and 2023 Do Minimum, share of trips likely taken over by the newly introduced bus lines). This is even more evident by looking at the values limited to Galway City, and due to the limited geographic extent of the scheme it is worth focusing attention on these.

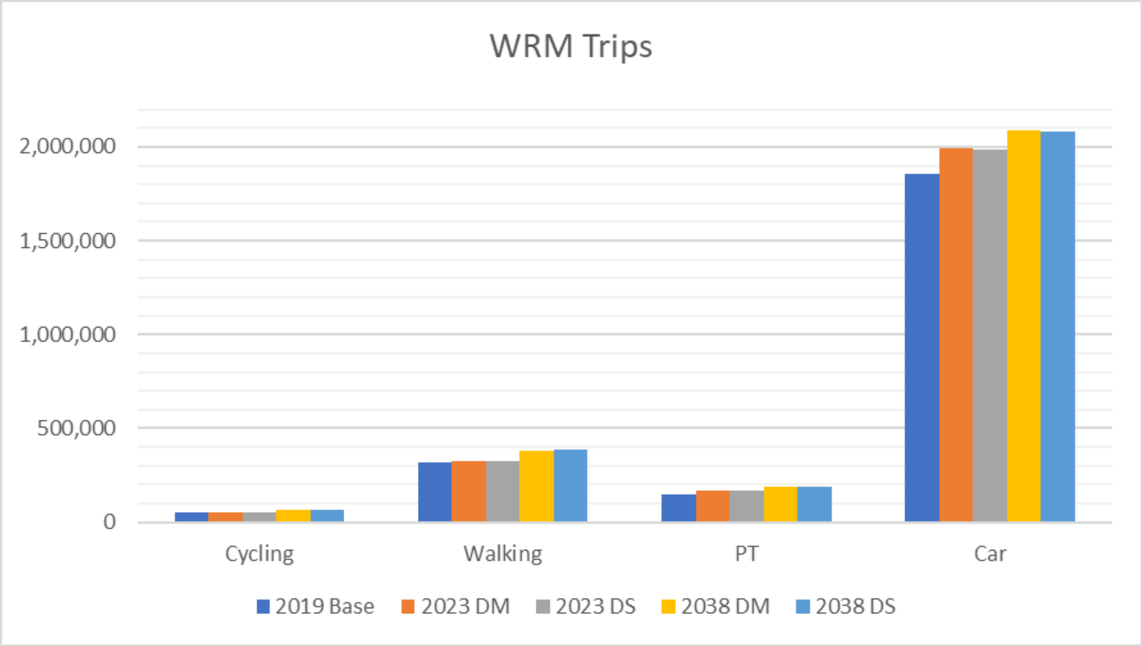


Figure 6-2: Number of trips by mode within the WRM region

As can be seen from Figure 6-2, car trips are growing between the forecast years due to the projected population growth. However, the number of car trips see a slight decrease between the Do Minimum and the Do Something scenarios in both 2023 and 2038 as a result of the Proposed Scheme. At the same time the number of walking and cycling trips across the WRM is increasing slightly.

The number of public transport trips is increasing slightly between the Do Minimum and the Do Something scenarios as a result of the Proposed Scheme.

Overall, the car remains the most dominant mode of transport, followed by walking, public transport and cycling.

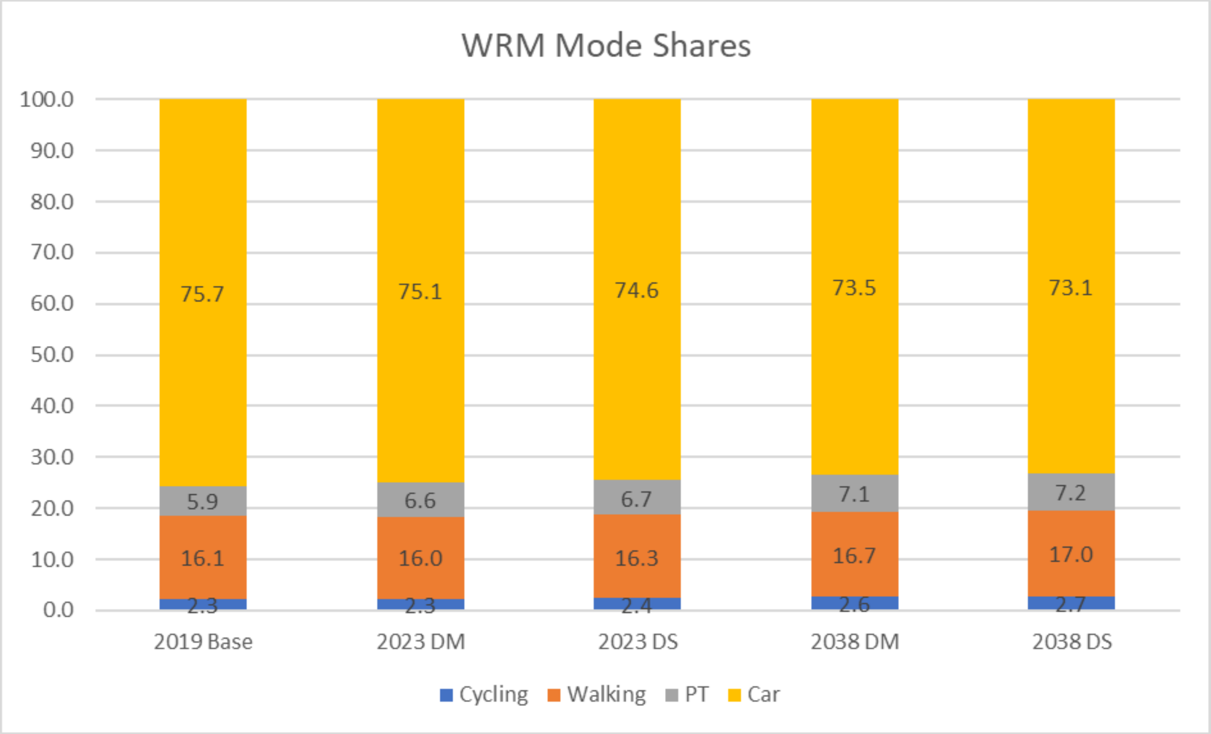


Figure 6-3: mode shares within the WRM region

Figure 6-3 above shows the mode share percentages in the different scenarios within the WRM region. As can be seen from the figure, the car mode share decreases from 75.7% in the Base year to 75.1% in the 2023 Do Minimum scenario. However, as a result of the Proposed Scheme, the percentage drops to 74.6% in the Do Something scenario in 2023 and from 73.5% to 73.1% in 2038 despite the expected significant population growth.

The mode share for public transport increases from 5.9% in the Base Year to 6.6% in the Do Minimum and 6.7% in the Do Something scenario. The figures for 2038 are slightly higher with a similar percentage increase.

Walking and cycling are also projected to increase slightly as a result of the Proposed Scheme.

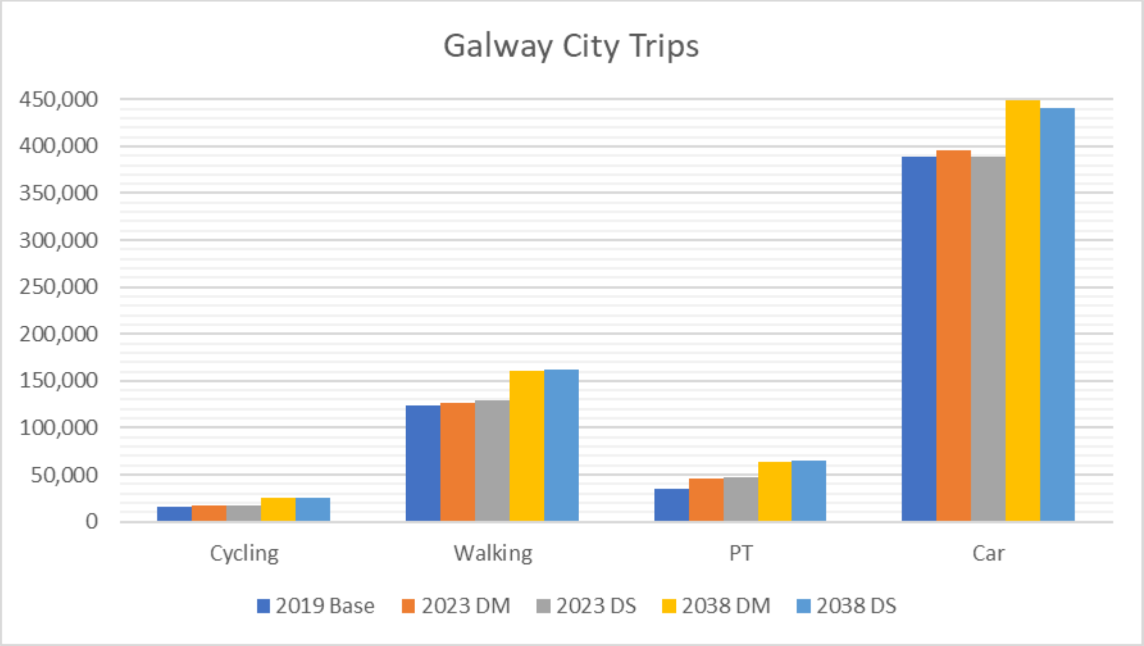


Figure 6-4: Number of trips by mode within Galway City

Figure 6-4 shows the number of trips by model within Galway City. This shows similar trends to Figure 6-2 which covered the entire WRM region. This is mainly the increase in cycling, walking and public transport trips as well as a decrease in car trips as a result of the Proposed Scheme.

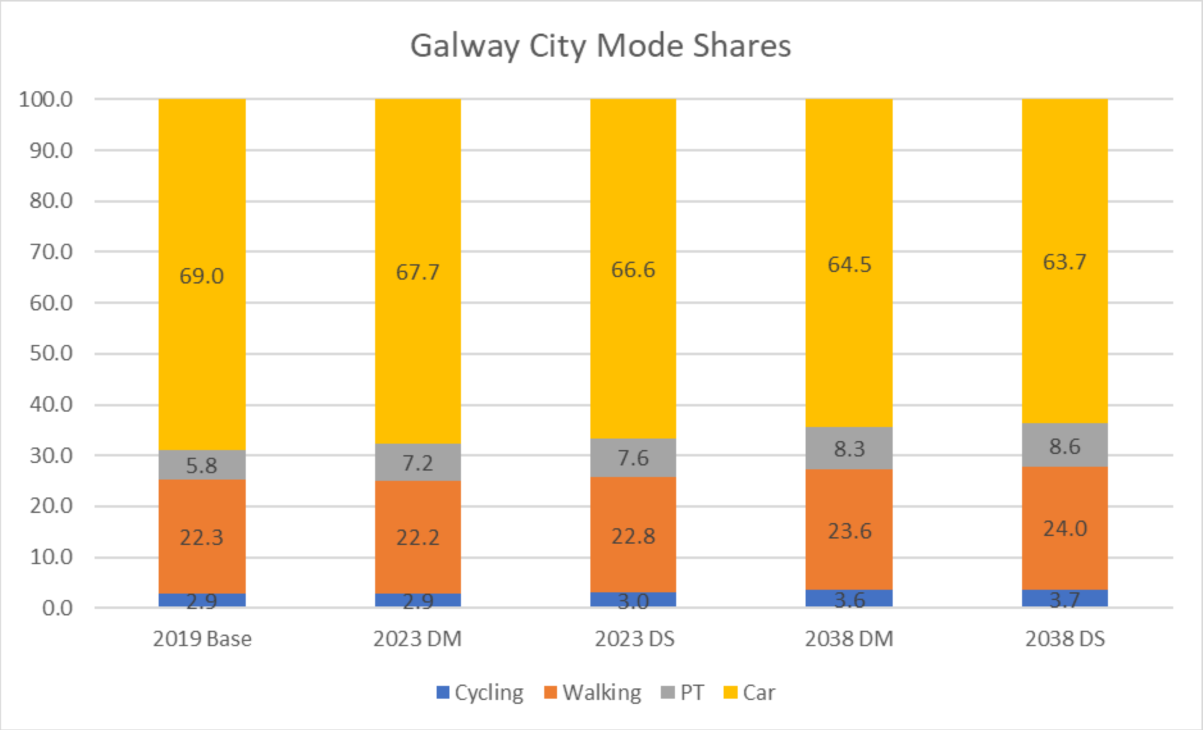


Figure 6-5: Mode shares within Galway City

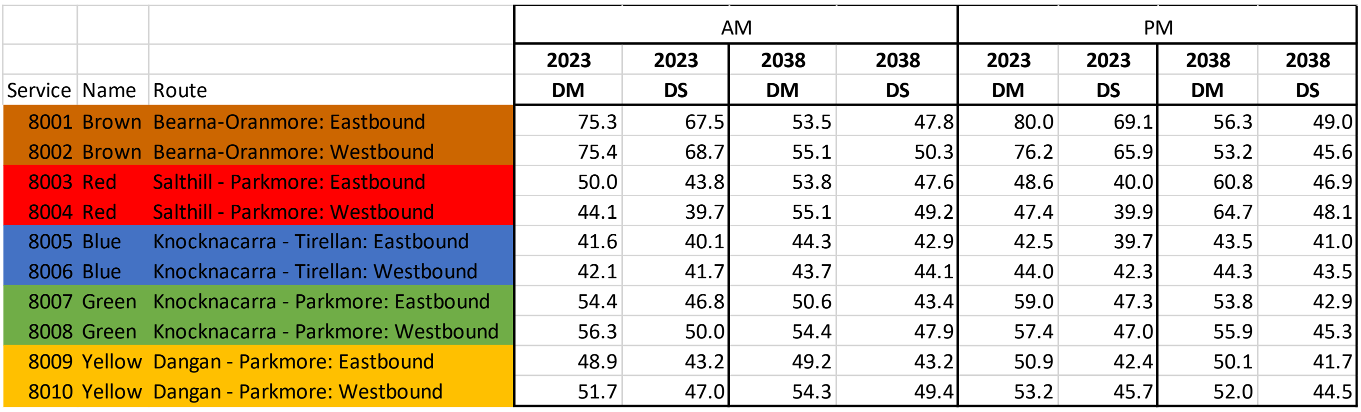
Figure 6-5 above shows the percentages of mode shares in different scenarios within Galway City. Car usage decreases from 69.0% in the Base Year to 67.7% in the 2023 Do Minimum scenario. As a result of the Proposed Scheme, this drops to 66.6% in the Do Something scenario in 2023 and from 64.5% to 63.7% in 2038.

Public transport mode shares are projected to grow from 7.2% to 7.6% in 2023 and from 8.3% to 8.6% in 2038. However, it should be noted that the GTS bus routes are included in both the Do Minimum and the Do Something scenarios. Looking at the public transport mode share in the Base (5.8%), it should be noted that this increases substantially between the Base and the Do Minimum scenario despite the exclusion of the Proposed Scheme.

Walking is also projected to increase from 22.2% in the Do Minimum to 22.8% in the Do Something scenario in 2023 with a similar increase projected for 2038. Cycling mode shares are also projected to increase slightly as a result of the Proposed Scheme.

6

6.2 Public Transport Journey Times



			AM				PM			
			2023	**2023**	**2038**	**2038**	**2023**	**2023**	**2038**	**2038**
Service	Name	Route	**DM**	**DS**	**DM**	**DS**	**DM**	**DS**	**DM**	**DS**
8001	Brown	Bearna-Oranmore: Eastbound	75.3	67.5	53.5	47.8	80.0	69.1	56.3	49.0
8002	Brown	Bearna-Oranmore: Westbound	75.4	68.7	55.1	50.3	76.2	65.9	53.2	45.6
8003	Red	Salthill - Parkmore: Eastbound	50.0	43.8	53.8	47.6	48.6	40.0	60.8	46.9
8004	Red	Salthill - Parkmore: Westbound	44.1	39.7	55.1	49.2	47.4	39.9	64.7	48.1
8005	Blue	Knocknacarra - Tirellan: Eastbound	41.6	40.1	44.3	42.9	42.5	39.7	43.5	41.0
8006	Blue	Knocknacarra - Tirellan: Westbound	42.1	41.7	43.7	44.1	44.0	42.3	44.3	43.5
8007	Green	Knocknacarra - Parkmore: Eastbound	54.4	46.8	50.6	43.4	59.0	47.3	53.8	42.9
8008	Green	Knocknacarra - Parkmore: Westbound	56.3	50.0	54.4	47.9	57.4	47.0	55.9	45.3
8009	Yellow	Dangan - Parkmore: Eastbound	48.9	43.2	49.2	43.2	50.9	42.4	50.1	41.7
8010	Yellow	Dangan - Parkmore: Westbound	51.7	47.0	54.3	49.4	53.2	45.7	52.0	44.5

Figure 6-7: Bus Journey Times (Minutes)

Figure 6-7 above shows the bus journey times per GTS bus service during the AM and PM peak periods in 2023 and 2038 for both the Do Minimum and Do Something scenarios. Bus journey times vary significantly due to different route lengths.

Figure 6-8 below highlights the differences in bus journey times as a result of the Proposed Scheme. As can be seen from this table, all GTS bus services see a maximum reduction in journey times in 2023 of 7 minutes along the entire route in the AM and 11 minutes during the PM period. The green and red services see the greatest reduction in bus journey times in 2023. The smallest increase can be seen on the blue route in both directions.

Note that journey times in the DM are representative of an average journey time per the AVL data; however, these data also show significant variability in journey time, with buses often taking far longer than the average due to congestion. It is expected, and has been shown using the micro-simulation modelling, the variability of journey time in the DS would be far lower, as a result of the protection offered by the scheme to buses traversing the relevant corridor.

As previously shown in Figure 5-2, the brown, red, green and yellow bus routes are routed via Eyre Square whilst the blue route is using the Headford Road corridor.

The bus journey time reductions are similar in 2038 with some greater reductions in the PM peak period. The only notable difference is a slight increase of 0.4min westbound for the blue route during the AM peak period. The slight increase has been caused by a junction delay at Headford Road/Bothar Na Dige/St. Brandan's Avenue Junction.

			AM				PM			
			2023	**2023**	**2038**	**2038**	**2023**	**2023**	**2038**	**2038**
Service	Name	Route	DS-DM	DS-DM	DS-DM	DS-DM	DS-DM	DS-DM	DS-DM	DS-DM
8001	Brown	Bearna-Oranmore: Eastbound	-7.8	-10.4%	-5.8	-10.8%	-10.8	-13.5%	-7.3	-13.0%
8002	Brown	Bearna-Oranmore: Westbound	-6.7	-8.9%	-4.8	-8.7%	-10.3	-13.5%	-7.6	-14.2%
8003	Red	Salthill - Parkmore: Eastbound	-6.2	-12.5%	-6.3	-11.6%	-8.6	-17.6%	-13.9	-22.8%
8004	Red	Salthill - Parkmore: Westbound	-4.4	-10.0%	-5.9	-10.8%	-7.4	-15.7%	-16.6	-25.7%
8005	Blue	Knocknacarra - Tirellan: Eastbound	-1.4	-3.5%	-1.3	-3.0%	-2.8	-6.5%	-2.5	-5.7%
8006	Blue	Knocknacarra - Tirellan: Westbound	-0.3	-0.8%	0.4	1.0%	-1.7	-3.8%	-0.8	-1.8%
8007	Green	Knocknacarra - Parkmore: Eastbound	-7.6	-14.0%	-7.2	-14.2%	-11.7	-19.9%	-10.9	-20.2%
8008	Green	Knocknacarra - Parkmore: Westbound	-6.3	-11.2%	-6.6	-12.1%	-10.4	-18.1%	-10.6	-19.0%
8009	Yellow	Dangan - Parkmore: Eastbound	-5.7	-11.6%	-5.9	-12.1%	-8.5	-16.7%	-8.4	-16.8%
8010	Yellow	Dangan - Parkmore: Westbound	-4.7	-9.0%	-4.9	-9.0%	-7.4	-14.0%	-7.5	-14.4%

Figure 6-8: Bus Journey Time Differences (Minutes)

6.3 Public Transport Flows

In this section the number of Bus Passengers on the two main corridors linked to the GCCL schemes is reported. Figure 6-9 shows the route of the two corridors considered.

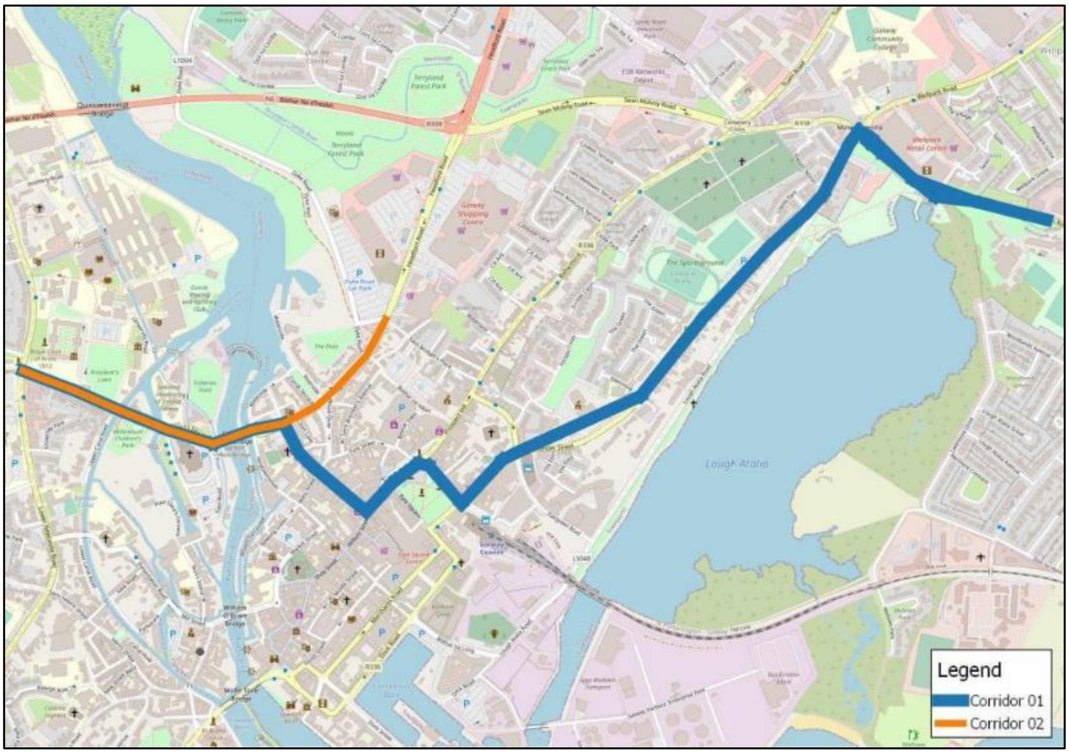


Figure 6-9: routes of the two Bus Corridors

Table 6-1 and Table 6-2 report the hourly numbers of Bus Passengers on the two corridors in the forecast years 2023 and 2038 (in the AM and PM peak hours).

Overall, bus passengers increase steadily between the Do-Something and Do-Minimum scenarios in both corridors, in both directions and in both forecast years. The highest flows are observed on Corridor 1, where in 2038 a peak of 1240 passengers per hour is forecasted, with an increase +23% in the AM peak hour.

	AM			PM		
	DM	DS	Diff	DM	DS	Diff
Corridor 1 WB	810	910	12%	460	530	15%
Corridor 2 WB	460	510	11%	300	350	17%
Corridor 1 EB	650	710	9%	640	750	17%
Corridor 2 EB	440	470	7%	380	430	13%

Table 6-1: 2023 AM and PM hourly Bus Passengers in the two corridors in both directions

	AM			PM		
	DM	DS	Diff	DM	DS	Diff
Corridor 1 WB	1240	1520	23%	600	710	18%
Corridor 2 WB	600	650	8%	450	500	11%
Corridor 1 EB	790	860	9%	910	1050	15%
Corridor 2 EB	630	670	6%	470	510	9%

Table 6-2: 2038 AM and PM hourly Bus Passengers in the two corridors in both directions

6.4 Highway Flows

The following sections shows highway flow difference plots for both 2023 and 2038. Blue indicates a decrease in flows whilst green shows an increase.

6.4.1 AM Peak

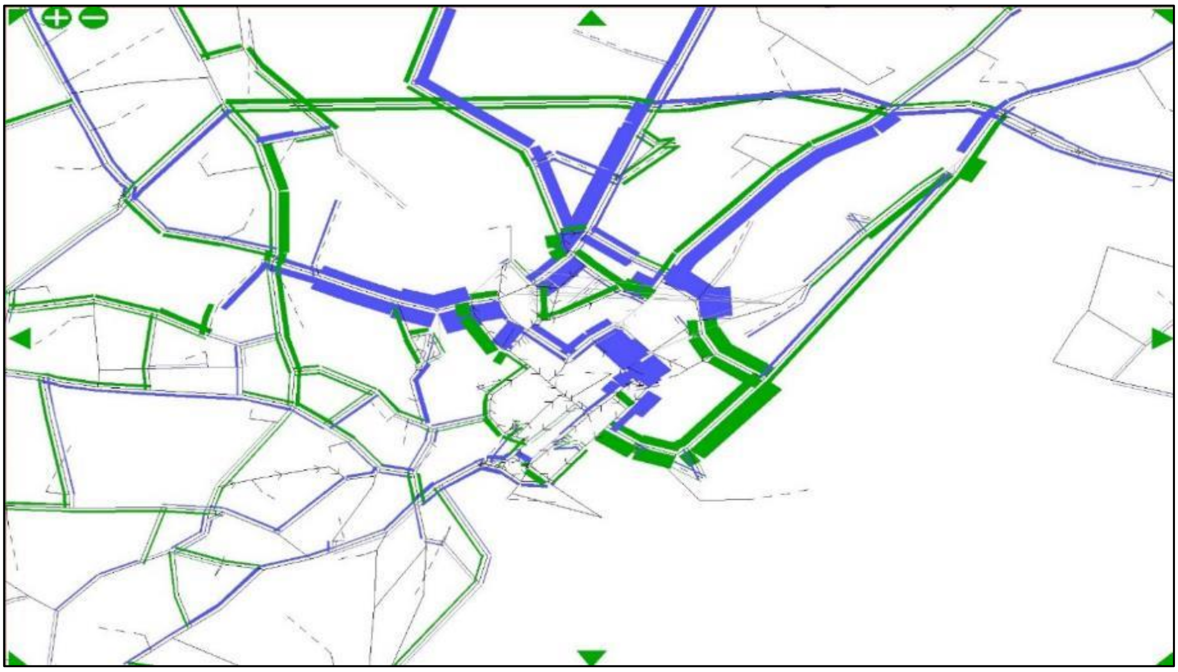


Figure 6-10: 2023 flow difference between DS and DM in Galway City during the AM Peak

Figure 6-10 shows the highway flow difference in 2023 during the AM peak period. As a result of the traffic restrictions implemented as part of the Proposed Scheme, significant rerouting has been identified. This includes a significant reduction in both eastbound and westbound flows on Salmon-Weir-Bridge due to the bus gate, on Eyre Square, Headford Road, Bohermore (inbound) College Road and Bothar Na Dige (inbound).

At the same time, traffic is routing onto the City Centre Access Network with flow increases on the N6 including Quincentenary Bridge, Lower Newcastle, Lough Atalia Road and Fairgreen Road.

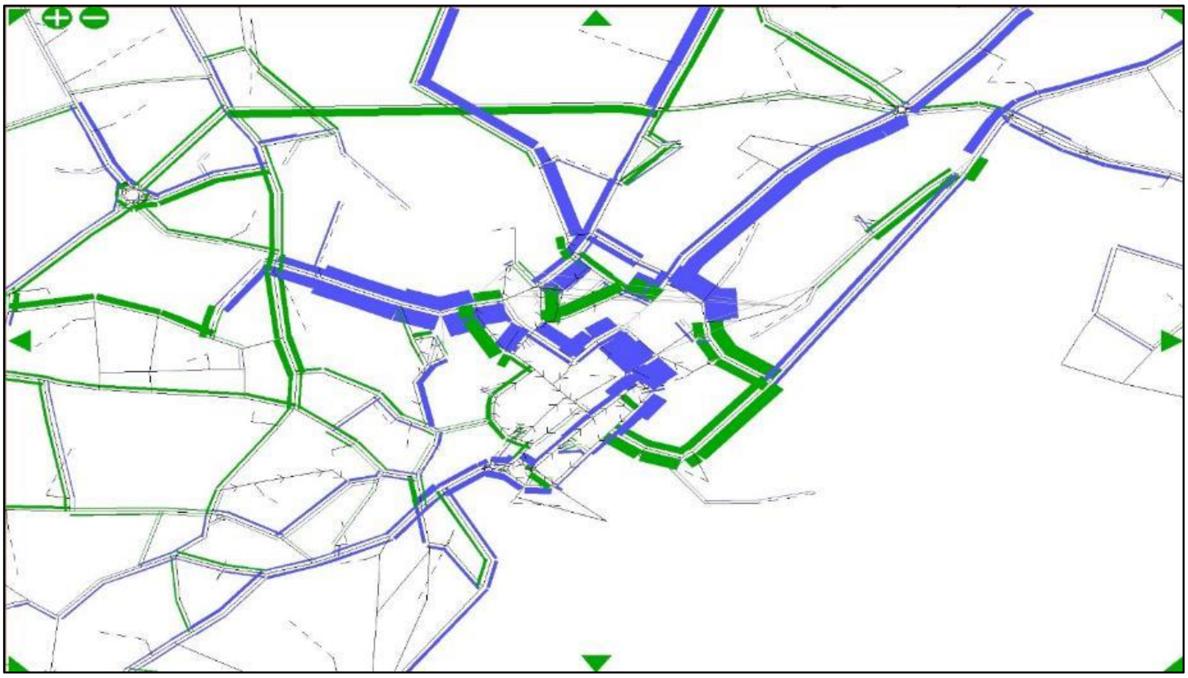


Figure 6-11: 2038 flow difference between DS and DM in Galway City during the AM Peak

The flow differences for 2038 shown in Figure 6-11 are similar to 2023 with the exception of more strategic rerouting due to the inclusion of Galway Outer Bypass. This can be seen from Figure 6-13.

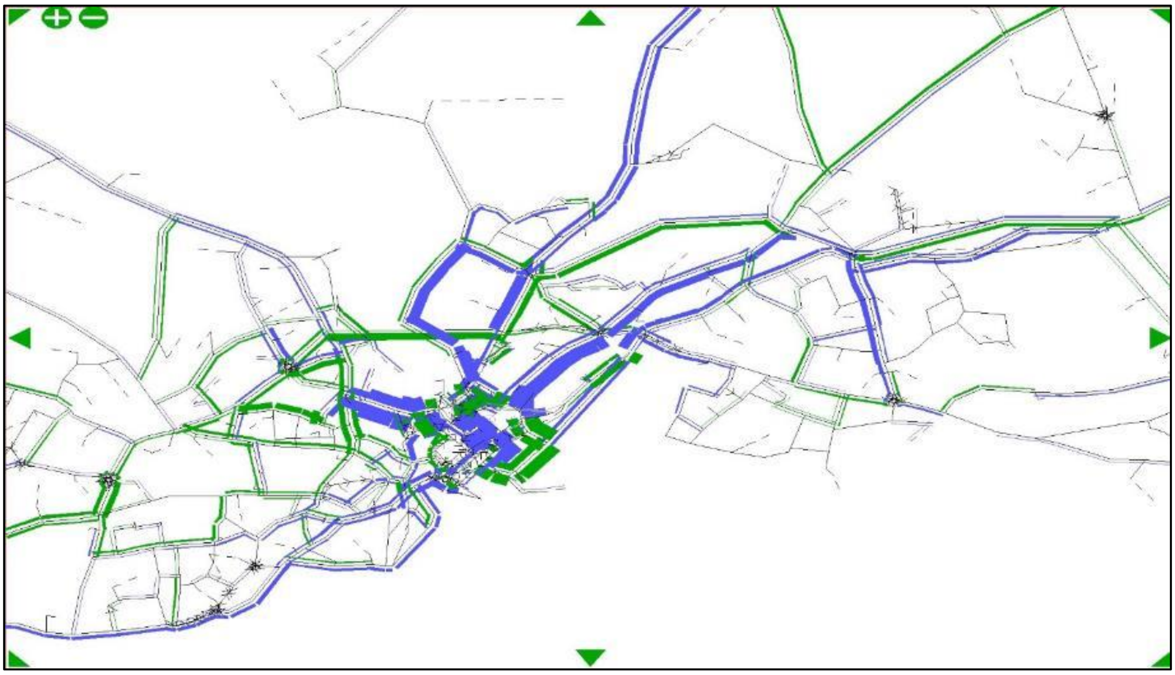


Figure 6-12: 2023 flow difference between DS and DM in Galway City and surroundings during the AM Peak

Figure 6-12 shows the wider strategic rerouting within Galway City due to the Proposed Scheme. As can be seen from the plot, The N84 road, Ballybane Road (R865), Tuam Road (R336) and Wellpark Road (R339) as well as Grattan Road/Seapoint Promenade/Upper Salthill Road in the Salthill Area are expected to see flow decreases.

Further flow increases are expected on the N83 road and the Western Distributor Road.

Figure 6-13: 2038 flow difference between DS and DM in Galway City and surroundings during the AM Peak

Figure 6-13 shows the wider strategic rerouting in the Galway City Area in 2038. In addition to the flow changes described in the city centre, it can be seen that more traffic is rerouted onto the Galway Outer Bypass.

6.4.2 PM Peak

Figure 6-14 to Figure 6-17 show the flow differences during the PM peak period in both 2023 and 2038. The impacts of the Proposed Scheme on highway flows are in line with those seen during the AM peak period outlined in section 6.4.1.

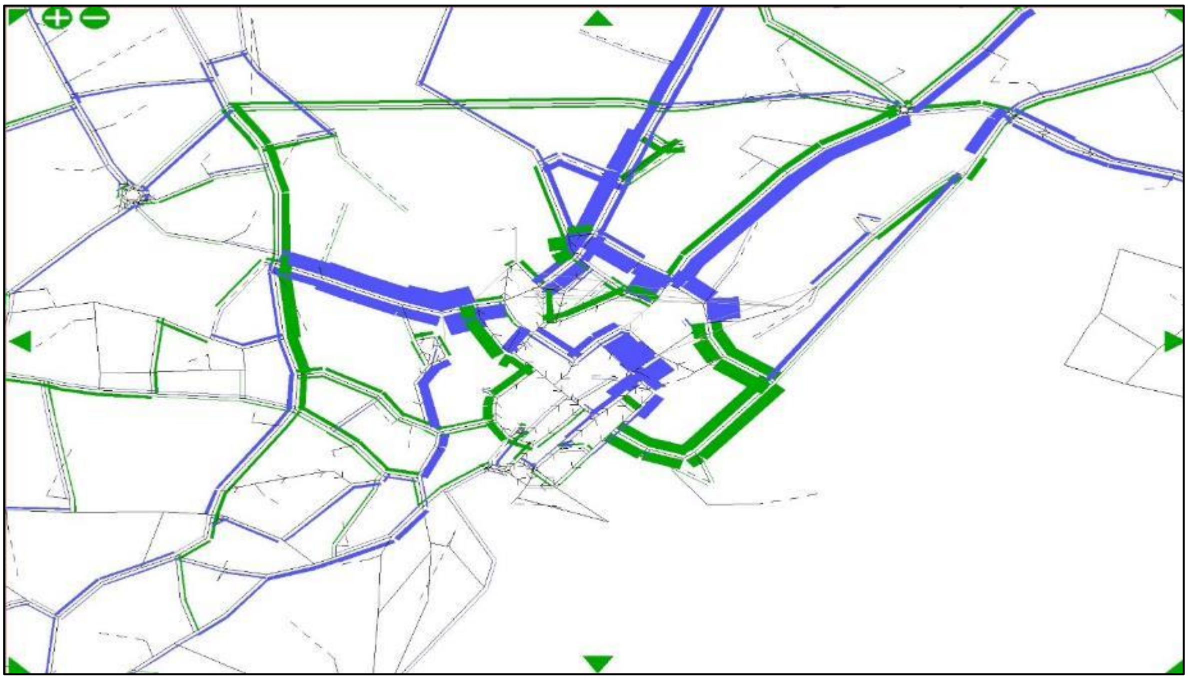


Figure 6-14: 2023 flow difference between DS and DM in Galway City during the PM Peak

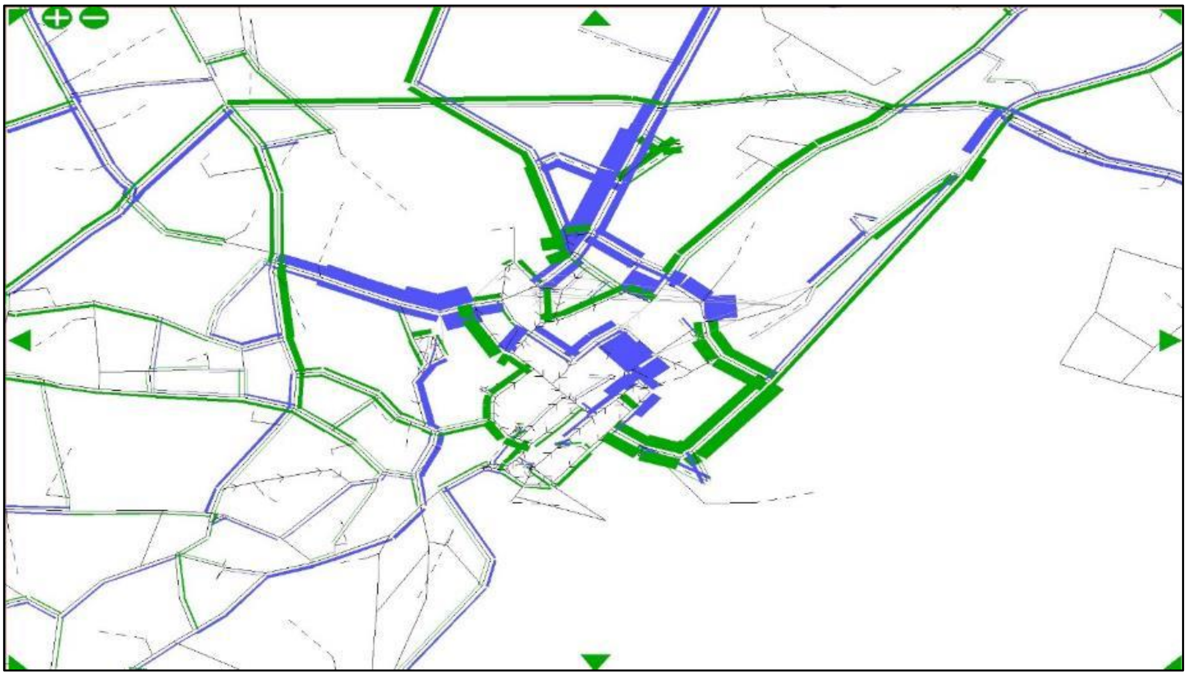


Figure 6-15: 2038 flow difference between DS and DM in Galway City during the PM Peak

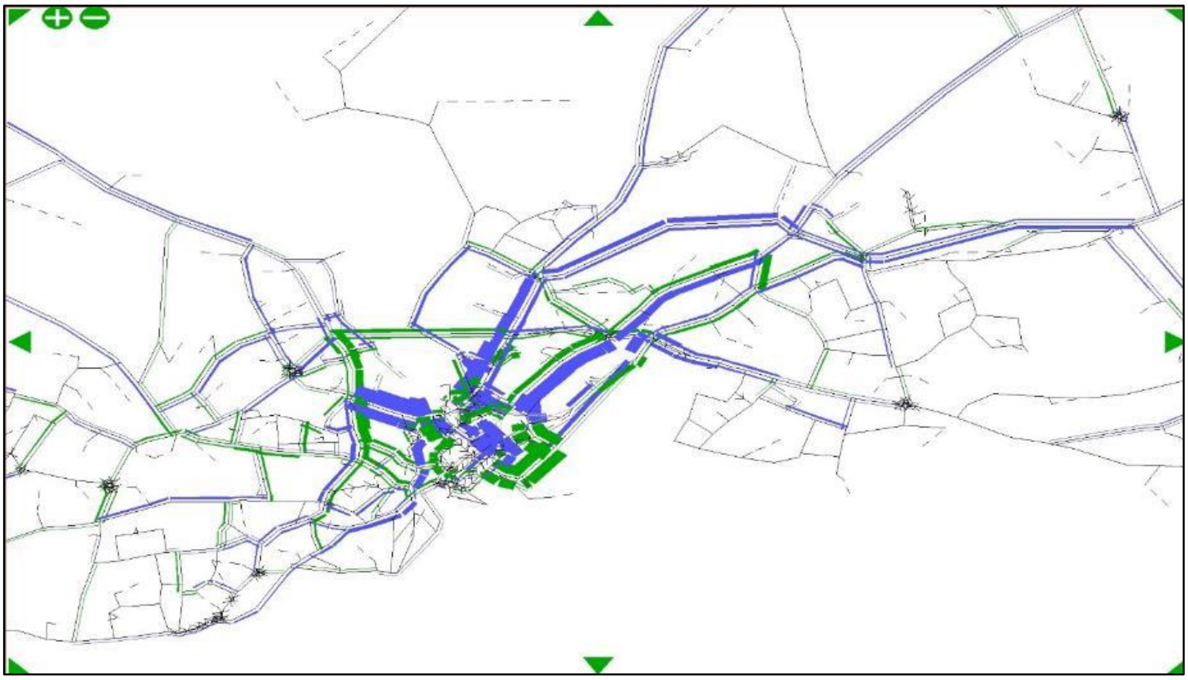


Figure 6-16: 2023 flow difference between DS and DM in Galway City and surroundings during the PM Peak

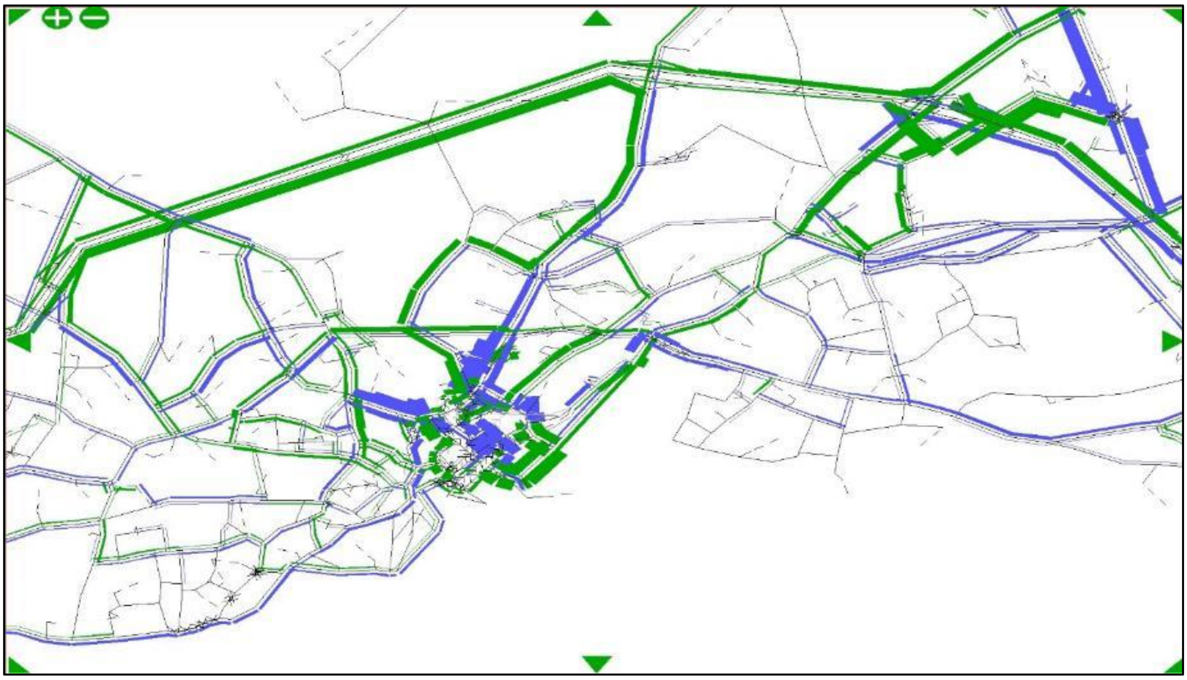


Figure 6-17: 2038 flow difference between DS and DM in Galway City and surroundings during the PM Peak

7. GALWAY LOCAL AREA MODEL

7.1 Introduction

The analysis undertaken within the WRM regional model provided a valuable measure of the impact that the Proposed Scheme has on transport within Galway City and environs, in particular to evaluate the effects on public transport and active modes. However, for more detailed analysis, a Local Area Model (LAM) is more suitable to assess traffic impacts caused by the new scheme on the highway network. LAMs provide an additional level of confidence in the assessments due to the greater detail and updated calibration of the road network. The LAM for example has been developed from the larger regional model with additional focus on the accuracy of e.g. signal times, turning flows and delays.

This Chapter describes the steps undertaken to develop, calibrate and validate a Base Year LAM. It then explains how the future year LAM scenarios have been produced by combining the cordoned WRM networks with future demand, the latest obtained by pivoting the Base Year matrix using the Furness Method. Finally, the main results of the local area modelling are reported. This Chapter is structured as follows:

- **Methodology**: Chapter 7.2 provides an overview of the methodology used to develop, calibrate and validate the Base Year LAM.
- **Model Specification:** Chapter 7.3 presents information on the Galway LAM specification including the defined model area, demand segmentation, time periods modelled, model software and key assignment parameters.
- **Traffic Data:** Chapter 7.4 outlines the traffic data used to facilitate the calibration and validation of the Galway LAM.
- **Road Network and Zone System Development:** Chapter 7.5 describes the development of the LAM road network and zone system to ensure that it provides an accurate representation of existing conditions.
- **Model Calibration Process and Results:** Chapter 7.6 outlines the calibration process adopted and the results achieved to ensure that the LAM is meeting relevant Transport Infrastructure Ireland (TII) and NTA guidelines.
- **Model Validation:** Chapter 7.7 presents the validation process and results, which demonstrate that the model is a suitable and robust tool to be used to assess the impact of the Galway Cross-City Link within the boundary area.
- **Future Year Scenarios:** Chapter 7.8 outlines the steps undertaken for developing the future year scenarios.
- **Results:** Chapter 7.9 presents the main results obtained from the future year LAM scenarios.

7.2 Methodology

The methodology for developing the Galway LAM from the RMS is illustrated in Figure 7-1.

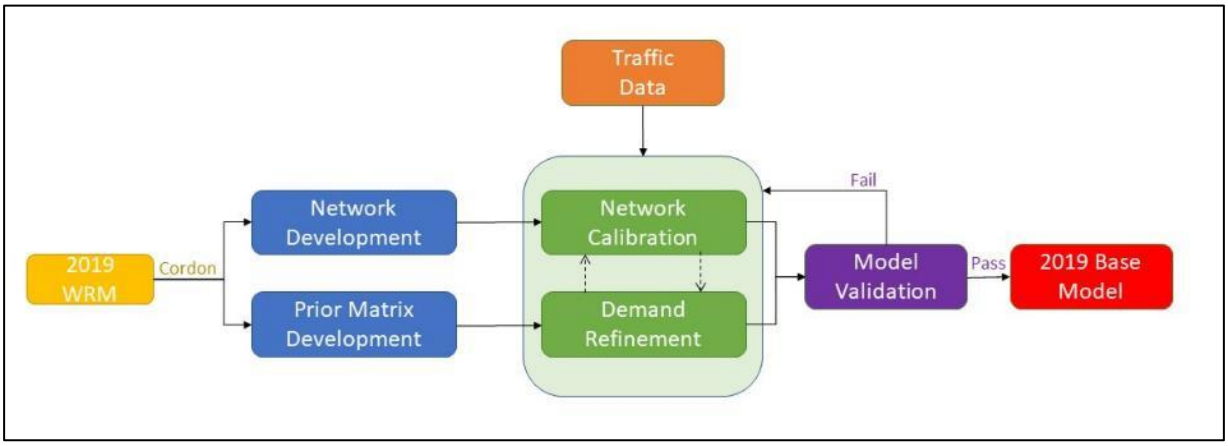


Figure 7-1: Galway LAM Development Methodology

In Summary:

- **2019 WRM Run:** the WRM has been raun with 2019 NTA planning data using inputs from the 2016 model and the addition of recent infrastructure developments as reported in section 5.2.
- **WRM Cordon:** the 2019 WRM road assignment was cordoned to extract the initial network and traffic matrix covering the Galway LAM extent.
- **Network and Prior Matrix Development:** the initial WRM cordoned road network was reviewed in greater detail for the study area for items including junction layouts, network speeds, missing links etc. The zone system from the WRM was maintained. Further details on the network and zone system development are provided in section 7.5.
- **Traffic Data:** due to the Covid-19 pandemic, it has not been possible to collect traffic data specifically for this project. However, 2019 traffic counts data was available from a data collection campaign conducted by Galway County Council and it was used to calibrate and validate the LAM (refer to section 7.4 for further information).
- **Calibration:** calibration is the process of adjusting the model to better represent observed data. This is normally undertaken in two steps:
    - **Network Calibration:** adjustments to the road network based on observations extracted from traffic survey data e.g. altering turning capacities at junctions, updating link speeds etc.; and
    - **Demand Refinement:** adjustments to the prior matrix to better represent observed travel movements from count data.

  The Galway LAM was calibrated in-line with Transport Infrastructure Ireland's (TII) Project Appraisal Guidelines (PAG) and the UK Department for Transport (DfT) TAG guidance, and further information is provided in Chapter 7.6.

- **Validation:** validation is the assessment of the validity of the calibrated model and its robustness in representing observed traffic conditions. Calibration and validation is an iterative process. If the results of the validation checks are unsatisfactory, then adjustments will be made as required in order to achieve a better representation of reality. The Galway LAM was validated in-line with TII and TAG guidance, and further information is provided in section 7.7 of this report.

7.3 Model Specification

This section provides an overview of the key parameters that define the Galway LAM, with specific reference to the following aspects:

- Model Area;
- Model Time Periods;
- Demand Segmentation;
- Model Software; and
- Assignment Parameters.

7.3.1 Model Area

The area to be analysed in detail in the Galway LAM is illustrated in Figure 7-2, and was identified through the following:

- Review of all major roads and alternative routing options in event of the level crossings being closed to vehicular traffic;
- Internal discussions with ARUP; and
- An Area of Impact Assessment to analyse the impact of the Proposed Scheme on flows in the surrounding network using the WRM.

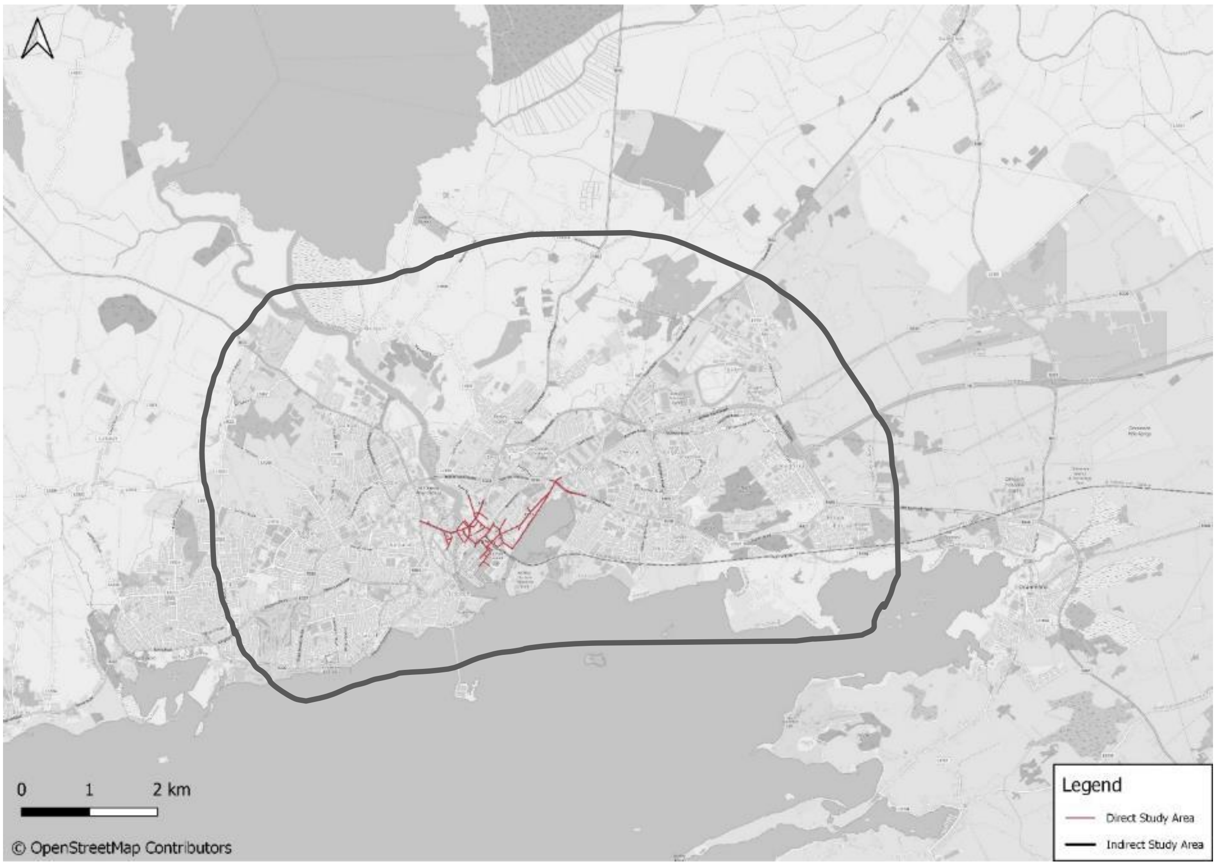


Figure 7-2: LAM Extension

7.3.2 Model Time Periods

The analysis of existing traffic data allowed to identify the typical profile of traffic demand within the study area throughout an average weekday. The results follow a typical trend with peaks in traffic volumes in the morning and evening. The ATC data suggests that the hours experiencing the highest levels of traffic are from 08:00-09:00 in the AM, and 17:00-18:00 in the PM.

Therefore, the Galway LAM was developed, calibrated and validated to represent the following time periods:

- AM Morning peak : 08:00 to 09:00
- Average IP (Interpeak) Period: 10:00 to 16:00
- PM Evening peak: 17:00 to 18:00

7.3.3 Demand Segmentation

The prior travel demand for the Galway LAM was derived from the NTA’s WRM. The WRM assignment matrices contain the following ten user classes:

- Car Employer’s Business (in work time)

- Car Commute (travel to/from work);
- Car Other (other non-work purposes such as shopping, visiting friends, etc);
- Car Education (travel to/from school);
- Car Retired;
- Taxi;
- Light Goods Vehicles (LGV);
- Other Goods Vehicles (OGV) 1;
- OGV2 Permit Holder (5 or more axles and allowed drive in Dublin city centre – not used in WRM); and
- OGV2 (5 or more axles and not allowed drive in Dublin city centre).

Each user class has its own defined set of generalised cost parameters based on a price per kilometre and a price per minute. To ensure consistency with the larger strategic WRM, the ten user classes and their associated generalised cost parameters were retained for the Galway LAM.
The ten assigned user classes were then grouped in to three broader vehicle classes, based on the availability of disaggregated survey data. The three vehicle classes represented are:

- All Car;
- LGV; and
- All other Goods Vehicles.

7.3.4 Model Software

The model software used to develop the Galway LAM is the SATURN (Simulation Assignment of Traffic to Urban Road Networks) suite of transportation modelling programs.

SATURN has 6 basic functions:

1. As a combined traffic simulation and assignment model for the analysis of road-investment schemes ranging from traffic management schemes over relatively localised networks (typically of the order of 100 to 200 nodes) through to major infrastructure improvements where models with over 1,000 junctions are not infrequent;
2. As a “conventional” traffic assignment model for the analysis of much larger networks (e.g., up to 6,000 links in the standard PC version, 37,500 in the largest);
3. As a simulation model of individual junctions;
4. As a network editor, database and analysis system;
5. As a matrix manipulation package for the production of, for example, trip matrices; and
6. As a trip matrix demand model covering the basic elements of trip distribution, modal split, etc.

7.3.5 Assignment Parameters

The Galway LAM was developed in SATURN and the model was calibrated and validated using release version 11.4.07H MC of the software. The SATURN application SATNET was used to build the various data files in to an assignable road network (UFN) file.

Matrices were then assigned to the network using the SATALL application, where it iterates through assignment and simulation loops until the user defined levels of convergence are reached (RSTOP and STPGAP), or the model reaches the user defined maximum number of assignment and simulation loops (MASL). SATALL uses a converged equilibrium assignment method to assign the traffic to the road network over successive iterations, until user defined convergence criteria are achieved.

The key convergence criteria are presented in Table 7-1.

VARIABLE	DESCRIPTION	VALUE
MASL	Maximum number of assignment / simulation loops.	150
PCNEAR	Percentage change in flows judged to be “near” in successive assignments	1%
RSTOP	The assignment / simulation loops stop if RSTOP % of link flows change by less than PCNEAR % in successive assignments	98%
NISTOP	Number of successive loops which must satisfy the RSTOP criteria for convergence	4
STPGAP	Critical gap value (%) used to terminate assignment / simulation loops	0.05

Table 7-1: SATURN Convergence Criteria

7.4 Traffic Data

This Chapter provides an overview of the traffic count data used to facilitate calibration and validation of the Galway LAM. Due to the Covid-19 pandemic, it has not been possible to collect traffic data specifically for this project, therefore the latest existing count data available from November 2019 was used instead.

7.4.1 Junction Turning Counts (JTCs)

The JTCs are 24-hour counts broken down into 15-minute segments over a full day. All main junctions within the study area have been included and provide information on the volume, and types of vehicles, making turning movements at each location. This data is utilised within the models to ensure that the flow of vehicles through the main junctions on the network is being represented accurately.

The locations of the 74 JTCs collected in 2019 and used for this study are displayed in Figure 7-3 .

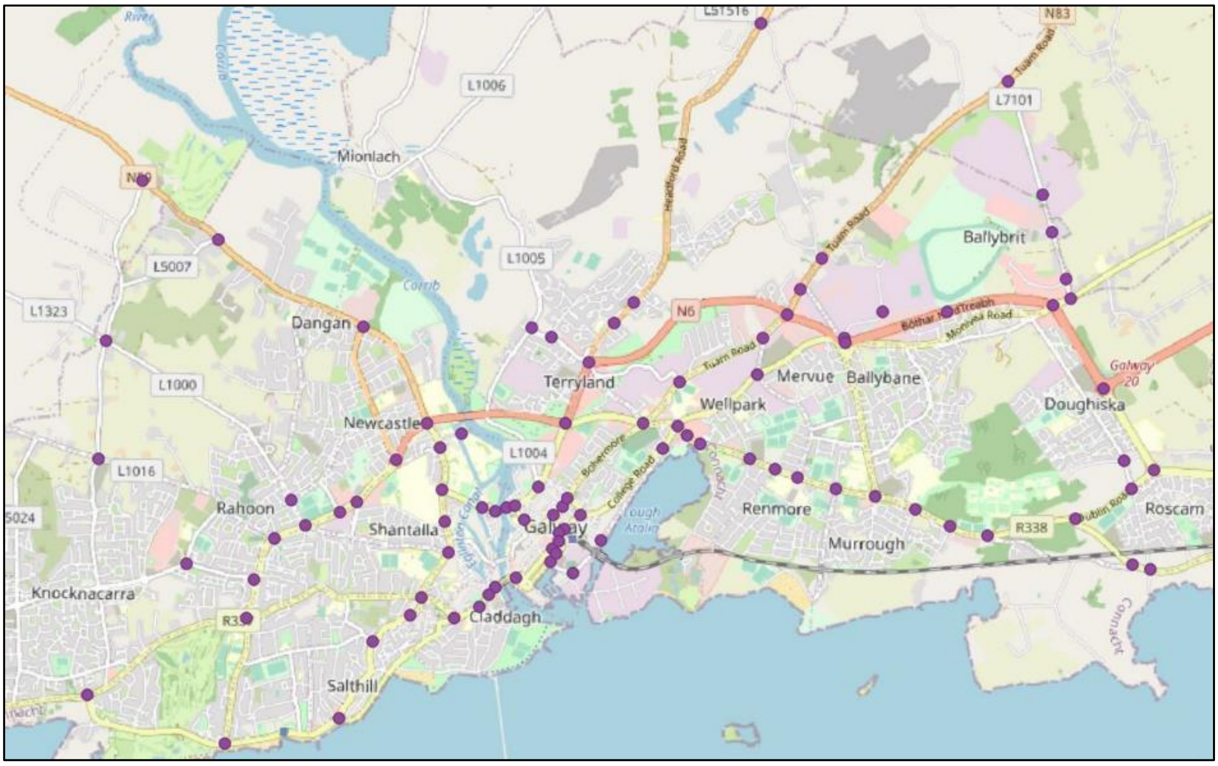


Figure 7-3: Location of the JTC counts

7.4.2 Automatic Traffic Counts (ATCs)

The ATC data provides information on:

- The daily and weekly profile of traffic along the Proposed Scheme; and
- Busiest time periods and locations of highest traffic demand on the network.

The ATCs were taken for an entire week.

In Figure 7-4 the location of the 19 ATCs collected in 2019 and used for this study isare displayed.

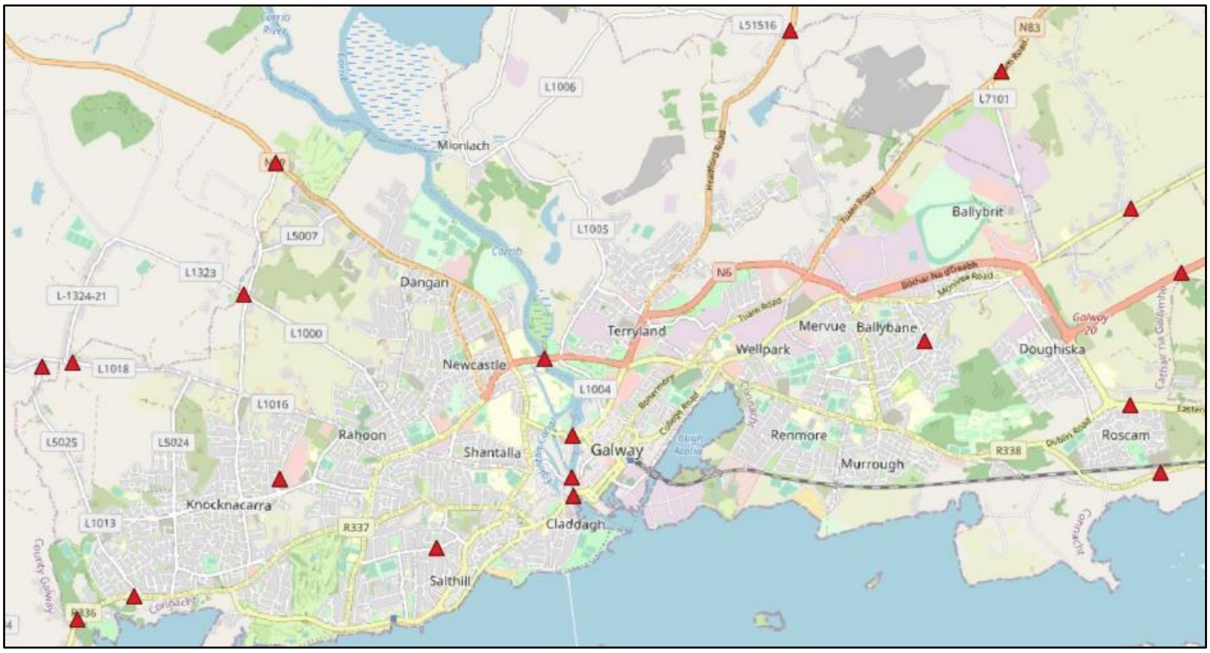


Figure 7-4: Location of the ATC counts

7.4.3 TomTom Road Journey Time Data

Road Journey time data for the Proposed Scheme models has been sourced from TomTom, who calculate journey times using vehicle position data from GPS-enabled devices and provide this on a commercial basis to a number of different users. The NTA purchased a license to access the anonymised Custom Area Analysis dataset through the TomTom TrafficStats portal. The NTA has an agreement with TomTom to provide travel time information covering six areas of Ireland and for certain categories of road.

The data is provided in the form of a GIS shapefile and accompanying travel time database file. The shapefile contains topographical details for each road segment, which is linked to the travel time database via a unique link ID. The database file then contains average and median travel time, average and median speed, the standard deviation for speed, the number of observations and percentile speeds ranging from 5 to 95 for each link.

7.5 Road Network and Zone System Development

7.5.1 Network Development

The NTA's WRM was utilised as a base for generating the highway network for the Galway LAM. The base WRM network was developed from the HERE mapping layer which provides a detailed representation of all National Primary, Secondary, Regional and local roads in Ireland.

The Galway LAM road network, extracted from a cordon of the WRM, is illustrated in Figure 7-5 overleaf. A detailed review was undertaken of all model coding in the study area using digital mapping systems such as Google Earth to ensure it represented, as accurately as possible, the existing road network. This included aspects such as network speed limits, availability of bus lanes, junction layouts, pedestrian crossing points etc.

Junction capacities and saturation flows were adopted from the Network Coding Guidelines developed for the NTA as part of the RMS development, and were further reviewed during the calibration process. Where required, additional detail was added to ensure that traffic was loading onto the road network at the correct locations.

As illustrated in Figure 7-5, the WRM provides a detailed representation of all significant roads within the study area. To ensure full network coverage and route choice, all roads have been considered, from the national primary routes to minor residential streets. The short dead-end links in Figure 7-5 are "spigots" used to load traffic from the zones accurately onto the network, and reflect the further developed zone system that is outlined in section 7.5.2 below.

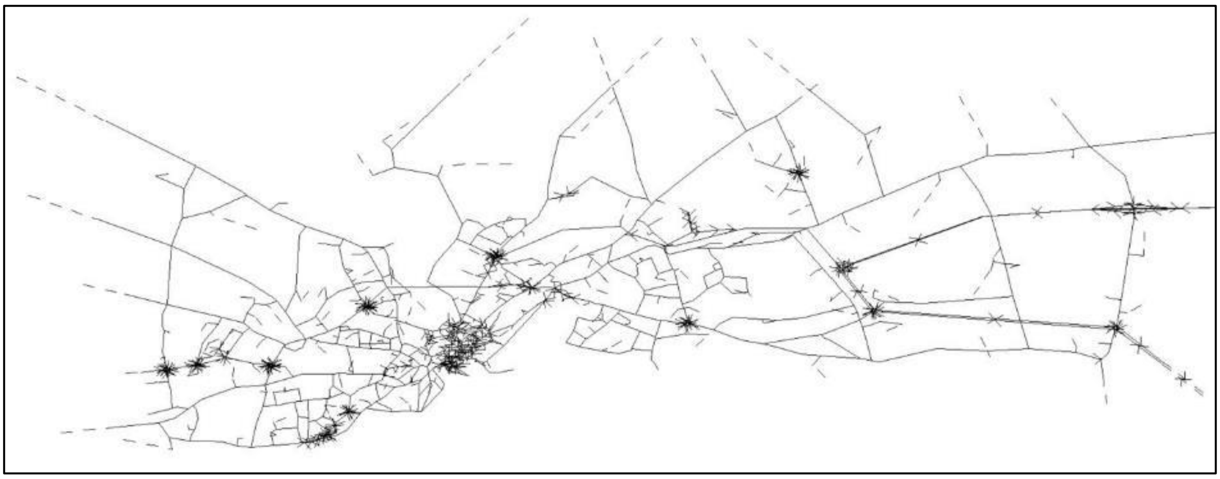


Figure 7-5: Galway LAM highway network

7.5.2 Zone System Development

Similarly to the road network described previously, the base Galway LAM zone system was adopted from the WRM. The WRM zone system was developed using the Census Small Area Population Statistics (SAPS) and Place of Work, School or College Census of Anonymised Records (POWSCAR) to get detailed information on population, employment and education centres across the model area. Other data sources such as MyPlan and Geo Directory were also used to obtain information on specified land-use zoning and location of commercial development. The following rules were then applied to generate the zone system:

- **Population, Employment and Education** – the number of zones with values of population, number of jobs and persons in education above a certain threshold should be minimised;
- **Activity Levels** – the number of zones with activity levels that have very low or very high levels of trips should be minimised;
- **Intra-zonal Trips** – threshold values should be applied to the proportion of intra-zonal trips within each zone, to avoid an underestimation of flow, congestion and delay on the network;
- **Land Use** – zones should be created with homogeneous land use and socio-economic characteristics where possible;
- **Zone Size/Shape** – zone size and the regularity of zone shape should be considered in order to avoid issues with inaccurate representation of route choice;
- **Political Geography** – it should be possible to aggregate all zones to ED level i.e. zone boundaries do not intersect ED boundaries; and
- **Special Generators/Attractors** – large generators/attractors of traffic such as Airports, Hospitals, shopping centres etc. should be allocated to separate zones.

Figure 7-6 illustrates the base WRM zone system within the study area. As the area of interest is relatively close to Galway City Centre, the zones are represented in quite a high level of detail. The WRM zones become larger and more aggregate in nature around the city centre primarily due to the low levels of activity (population and employment) in these areas.

It has been agreed that the WRM zoning system provided sufficient level of detail for the purpose of this study and therefore, no zone disaggregation was performed for the LAM.

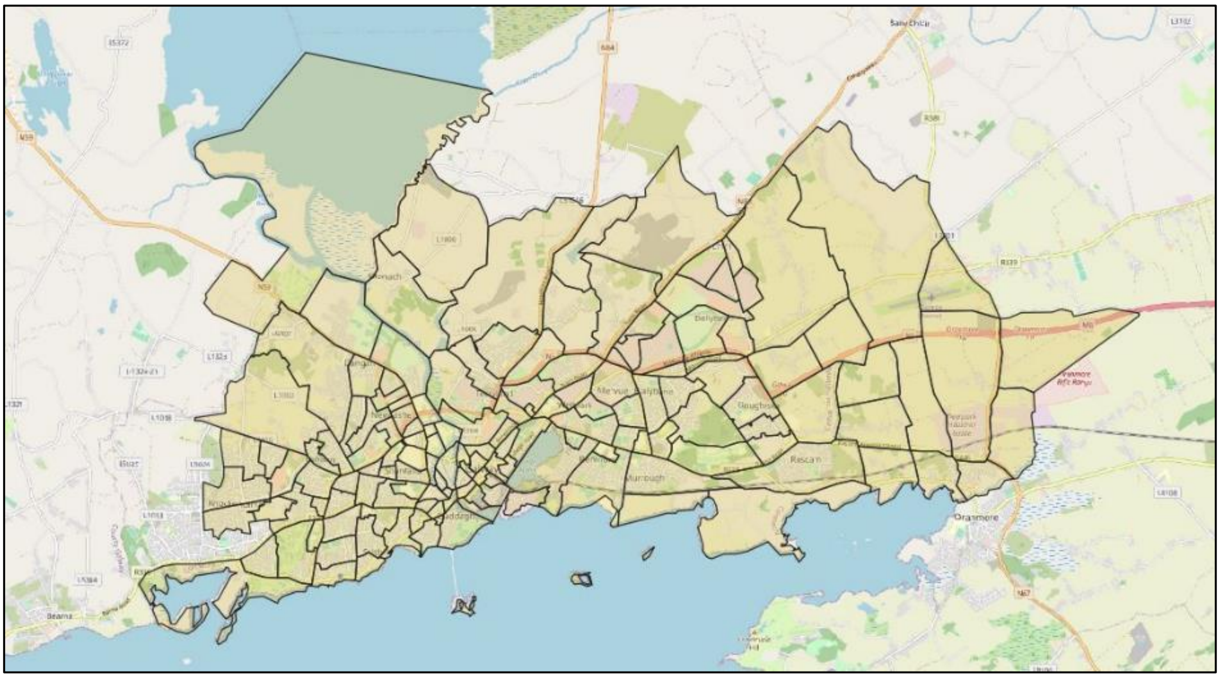


Figure 7-6: LAM zones derived from the WRM

7.6 Model Calibration Process and Results

7.6.1 Introduction

Calibration is the process of adjusting the LAM network and demand to ensure that it provides a robust estimate of assignment when compared to 2019 observed traffic characteristics. Generally, the components of the model that may be adjusted on the demand side are trip distribution and trip production/generation levels, and this usually involves trip ‘Matrix Estimation’.

On the supply side (network), modelled junction and link characteristics may be altered if sufficient new information is available to justify changes to the existing network.

The Galway LAM was calibrated and validated in accordance with Transport Infrastructure Ireland’s (TII) *Project Appraisal Guidelines (PAG) for National Roads Unit 5.1 – Construction of Transport Models (October 2016)*. This is a widely accepted standard in Ireland that provides robust calibration and validation criteria to which certain types of highway models should adhere. Additionally, the LAM development has followed guidance from the UK’s Department for Transport’s Transport Analysis Guidance (TAG) unit M3-1, particularly in terms of matrix estimation controls.

The method for the calibration of the Galway LAM is illustrated in Figure 7-7 overleaf, and comprises of the following key elements:

- **Network and Zone System Development:** As outlined in section 7.5, the initial LAM network and zone system is derived from the ERM with further detail added where necessary to provide an accurate representation of existing conditions;
- **Network Adjustments:** A detailed review is undertaken of the road network coding taking cognisance of surveyed traffic volumes and network speeds with adjustments made where necessary;
- **Prior Matrix:** The initial prior matrix is extracted from a cordon of the WRM;
- **Calibration Criteria Check:** The LAM is then assessed against guideline calibration criteria in terms of modelled versus observed traffic volumes;
- **Matrix Estimation:** If the model is not passing the initial calibration check, a process known as 'Matrix Estimation' is undertaken to adjust the trip demand in order to provide an improved correlation between counts and modelled flows;
- **Post-Estimation Calibration Check:** The model is then re-tested against the calibration criteria with a focus on correlation between modelled and observed flows, along with an analysis of the demand changes introduced by 'Matrix Estimation'; and
- **Validation:** Once all the calibration criteria have been achieved, the model is passed forward to validation.

The following sections of this Chapter provide an overview of the steps outlined above along with the calibration guidelines for LAM development.

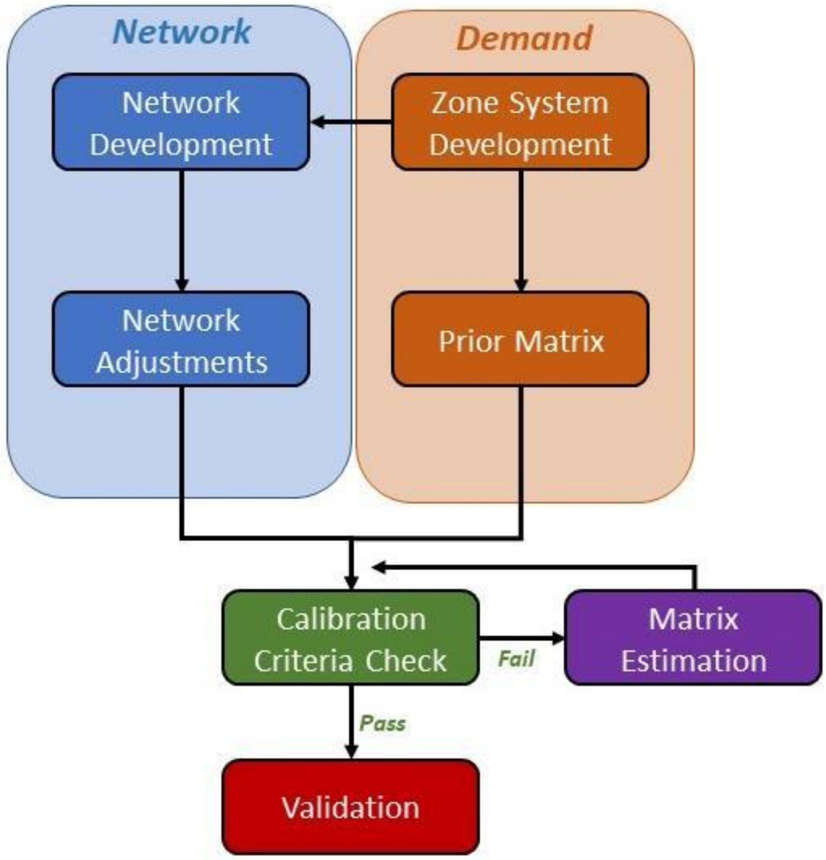


Figure 7-7: LAM calibration process

7.6.2 Calibration Criteria

The guidelines for calibration of the Galway LAM have been taken from the following:

- Transport Infrastructure Ireland's (TII) Project Appraisal Guidelines (PAG) for National Roads Unit 5.1 - Construction of Transport Models;
- UK Department for Transport (DfT) TAG Unit M3.1 Highway Assignment Modelling; and
- NTA guidance on LAM development from Regional Models.

The TII guidelines are a widely accepted standard in Ireland and have been developed in cognisance with the UK DfT TAG guidance. They focus on correlations between modelled and observed traffic flows at an individual count level, and at a Screenline level, along with monitoring of demand changes introduced by 'Matrix Estimation'.

7.6.2.1 *Traffic Flow Calibration*

Table 7-2 outlines the TII PAG criteria for permissible differences between observed and modelled traffic flows. The guidelines are measured as absolute and percentage differences at various link flows, and also make use of the Geoffrey E. Havers (GEH) statistic.

The GEH statistic is a measure that considers both absolute and proportional differences in flows. Thus, for high levels of traffic volumes a low GEH may only be achieved if the percentage difference in flow is small. For lower flows, a low GEH may be achieved even if the percentage difference is relatively large. GEH is formulated as:

$$GEH = \sqrt{\frac{(Observed - Modelled)^2}{0.5\ X\ (Observed + Modelled)}}$$

The reason for introducing such a statistic is the inability of either the absolute difference or the relative difference to cope over a wide range of flows. For example, an absolute difference of 100 passenger car units per hour (pcu/h) may be considered a big difference if the flows are of the order of 100 pcu/h, but would be unimportant for flows in the order of several thousand pcu /h. Equally a 10% error in 100 pcu/h would not be important, whereas a 10% error in, say, 3000 pcu/h might mean the difference between adding capacity to a road or not.

In general, the GEH parameter is less sensitive to the above statistical biases since a modeller would probably feel that an error of 20 in 100 would be roughly as bad as an error of 90 in 2,000, and both would have a GEH statistic of roughly 2.

As a rule of thumb in comparing assigned volumes with observed flows, a GEH parameter of 5 or less would be an acceptable fit, while GEH parameters greater than 10 would require closer attention.

CRITERIA	ACCEPTABILITY GUIDELINE
Individual flows within 100 v/h for flows less than 700 v/h	>85% of cases
Individual flows within 15% for flows between 700 & 2,700 v/h	
Individual flows within 400 v/h for flows greater than 2,700 v/h	
Individual flows – GEH < 5	>85% of cases

Table 7-2: Model Flow Calibration Criteria

Screenline Analysis

Screenlines represent an amalgamation of count sites that capture key movements across the model network. TII guidelines suggest that an additional check on the quality of trip matrices should be undertaken by comparing modelled and observed flows across screenlines by vehicle type and modelled time period using the following criteria:

CRITERIA	ACCEPTABILITY GUIDELINE
Total screen line flows (> 5 links) to be within 5%	> 85% of cases
GEH statistic: screenline totals < 4	> 85% of cases
Notes: Screenlines containing high flow routes (such as motorways) should be presented both with and without such routes	

Table 7-3: Screenline Calibration Criteria

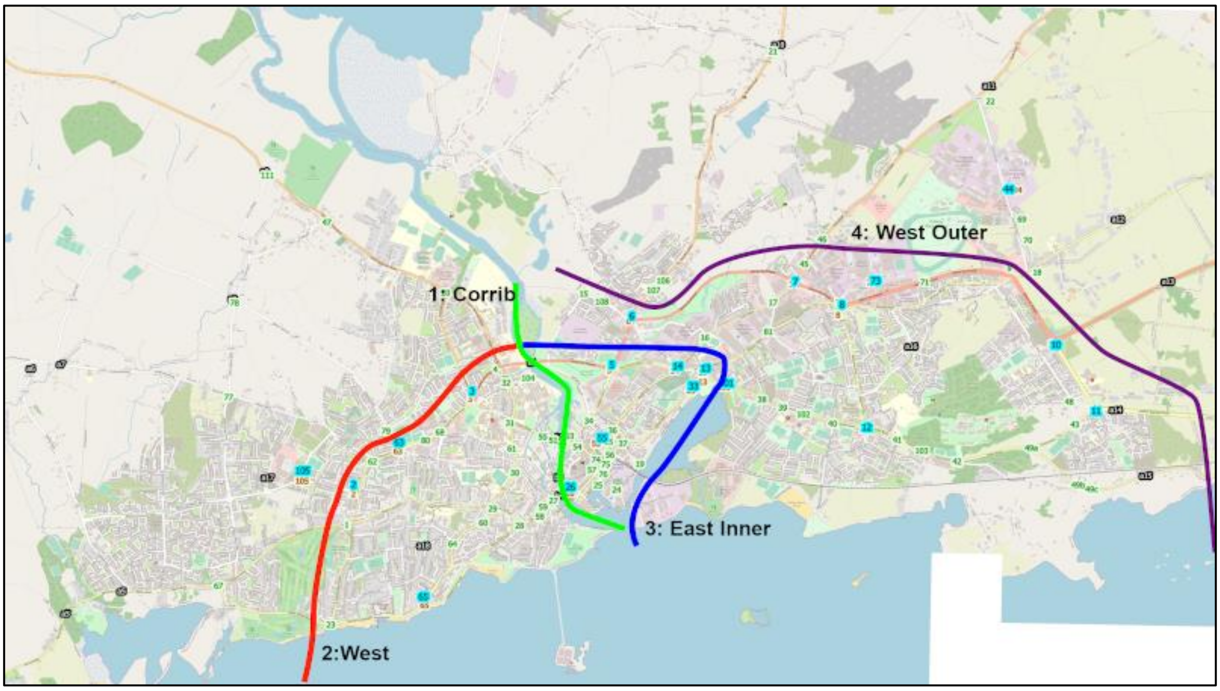


Figure 7-8: Screenlines

7.6.2.2 Analysis of Trip Matrix Changes

Regression Analysis

As noted previously, ‘Matrix Estimation’ was used to adjust the prior trip matrix in order to provide a better correlation between modelled and observed flows. However, both TII and TAG guidance suggest that caution should be taken when using estimation, and that the changes introduced should be monitored to ensure that the original matrices are not overly distorted, thus providing irregular movement patterns.

Table 7-4 outlines the matrix estimation change criteria, as specified in WebTAG Unit M3-1, Section 8.3, Table 5. The guidelines use regression analysis to identify the correlation/relationship between the demand pre and post ‘Matrix Estimation’, and suggest careful monitoring by the following means:

- Scatter plots of matrix zonal cell values, prior to and post matrix estimation, with regression statistics (slopes, intercepts and R^2 values); and
- Scatter plots of zonal trip ends, prior to and post matrix estimation, with regression statistics (slopes, intercepts and R^2 values).

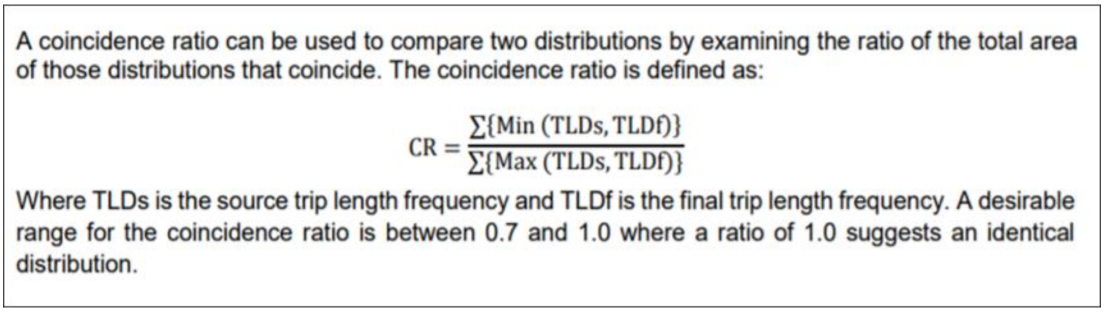
MEASURE	SIGNIFICANCE CRITERIA
Matrix zonal cell value	Slope within 0.98 and 1.02; Intercept near zero; R2 in excess of 0.95
Matrix zonal trip ends	Slope within 0.99 and 1.01; Intercept near zero; R2 in excess of 0.98.

Table 7-4: Significance of Matrix Estimation Changes

Trip Length Distribution Analysis

A further calibration step recommended by TII guidance is to compare trip length distributions for the prior and post calibrated matrices to ensure they have not been overly distorted by the 'Matrix Estimation' process.

'Matrix Estimation' can sometimes generate increased short distance trips to match count information, thus distorting the profile of trip making on the network. PAG suggests that the coincidence ratio[4] should be used to compare trip length distributions before and after estimation, with a desirable range between 0.7 and 1.0



A coincidence ratio can be used to compare two distributions by examining the ratio of the total area of those distributions that coincide. The coincidence ratio is defined as:

$$\mathrm{CR} = \frac{\sum\{\mathrm{Min}\ (\mathrm{TLDs}, \mathrm{TLDf})\}}{\sum\{\mathrm{Max}\ (\mathrm{TLDs}, \mathrm{TLDf})\}}$$

Where TLDs is the source trip length frequency and TLDf is the final trip length frequency. A desirable range for the coincidence ratio is between 0.7 and 1.0 where a ratio of 1.0 suggests an identical distribution.

Figure 7-9: Coincidence Ratio Calculation – TII PAG Page 20

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[4] The coincidence ratio is a calculation used to examine the how the total area under different distributions coincide, with a value of 1 representing an identical distribution.

7.6.3 Network Adjustments

The Galway LAM was coded based on best practice approaches developed during the NTA Regional Model Scoping Process, and as such, the model provided an accurate and up-to date representation of the existing road network.

When the traffic survey data was processed and analysed, the network coding was re-checked with the following edits undertaken where there was a clear justification for doing so:

- **Junction Capacity:** The SATURN software flags an error where a junction has insufficient modelled capacity to achieve the observed traffic flow. All these instances were reviewed in detail and remedial action was taken where required. This included:
  - Adjusting Signal Timings (mostly synthesised within the model area);
  - Adding/removing flared lanes;
  - Adding/removing approach lanes; and
  - Adjusting saturation flows through junctions.
- **Network Speeds:** The capacity and speeds of modelled links were checked to ensure they were broadly in line with survey information;
- **Zone Connectors:** A review was undertaken on the location of zone connectors in close proximity to count sites to ensure they were providing an accurate representation of traffic loading onto the road network.

7.6.4 Prior Matrix Development

As noted previously in Chapter 3, the Full Demand Model carries out mode and trip destination choice for all zones within the WRM. The FDM has been calibrated using Census data, and hence, provides a robust and accurate representation of trip distributions across the model network. In order to generate prior matrices for the Galway LAM, a cordon was extracted from a run of the WRM, which has been updated to include 2019 planning data. The cordon function within SATURN, facilitates the extraction of trip matrices for a subset area of the WRM whilst still maintaining route and destination choice from the full model.

Since the LAM used the same zoning system of the WRM, there was no need to disaggregate the demand.

7.6.5 Pre-Estimation Calibration Check

The prior matrix was assigned to the updated road network to determine how well the Galway LAM replicated observed traffic volumes, and the total results are outlined in Table 7-5. Detailed results divided by Vehicle Class can be found in Appendix 8.1.1.

CRITERIA	AM	IP	PM
Individual flows within 100 v/h for flows less than 700 v/h	61%	72%	65%
Individual flows within 15% for flows between 700 & 2,700 v/h			
Individual flows within 400 v/h for flows greater than 2,700 v/h			
Individual flows – GEH < 5	54%	64%	56%

Table 7-5: Total Traffic Count Calibration Statistics (pre Matrix Estimation)

The results indicate quite a good performance in terms of flow criteria and GEH for both LGV and HGVs. However, the car demand is falling outside guideline recommendations. In particular, the percentage of total traffic at all count locations with a GEH less than 5 is modest in the AM, IP and PM peaks at 54%, 64% and 56% respectively.

Therefore, further calibration adjustments including ‘Matrix Estimation’ were carried out on the AM, IP and PM prior matrices to improve the fit between model flows and observed traffic volumes.

7.6.6 Matrix Estimation

‘Matrix Estimation’ is a process used to adjust trip demand so that there is an improved correlation between counts and modelled flows. The base prior matrix is fed into a SATURN programme called SATME2. SATME2 then adjusts origin-destination patterns to produce a trip demand matrix that better replicates traffic counts when assigned to the network.

The prior matrix is adjusted only after all options for improving the network are exhausted. Any matrix adjustment must significantly improve the match between observed and modelled flows, and not introduce more trips into a zone than could realistically be expected. Controls are placed on zones to ensure that the trip demand generated is sensible and in line with census population and employment statistics.

The algorithm driving the SATME2 estimation process tends to reduce long trips in place of chains of short trips, especially when counts are spread over the entire area, which may not fully reflect reality. Constraints are therefore placed on the adjustment process to protect the number of movements and distribution of the through trips contained within the original car trip matrix. By restricting such long through trips, the matrix adjustment algorithm is forced to create or re-distribute short trips.

7.6.7 Post-Estimation Calibration

The post 'Matrix Estimation' model was then re-tested against the TII and TAG calibration criteria to assess performance. This was undertaken in an iterative process, with adjustments made to the road network where necessary to facilitate a better correspondence between model and observed flows e.g. altering junction capacity to facilitate count demand, fixing routing issues and rat-running etc.

A calibration and validation dashboard was created to identify areas of the network requiring adjustment/improvement and not meeting the calibration guidelines. Once all options for network improvement were exhausted, 'Matrix Estimation' was re-run to try and achieve a better match between modelled and observed flows. The iteration between network alterations and 'Matrix Estimation' was carried out until the calibration criteria had been achieved.

7.6.7.1 Traffic Flow and GEH Calibration Results

Table 7-6 summarises the traffic flow and GEH calibration results for the Galway LAM after the matrix estimation process, for each of the modelled time periods.

CRITERIA		AM	IP	PM
Individual flows within 100 v/h for flows less than 700 v/h	>85% of cases	86%	92%	93%
Individual flows within 15% for flows between 700 & 2,700 v/h				
Individual flows within 400 v/h for flows greater than 2,700 v/h				
Individual flows – GEH < 5	>85% of cases	84%	88%	89%

Table 7-6: Total Traffic Count Calibration Statistics (Post Matrix Estimation)

The results in Table 7-6 demonstrate that a satisfactory calibration has been achieved in the model for the IP and PM peak periods, with GEH values falling well within TII standards. The morning peak shows a lower level of performance with the GEH criteria just below the admissible threshold. This indicates that the Galway LAM represents an acceptable match between modelled flows and observed traffic count data.

The full list of flow calibration results for each traffic count location are presented in Appendix 8.1.2.

7.6.7.2 Screenline Flows

As noted in Section 4.4 previously, counts have been grouped into screenlines covering movements across four screenlines. The comparison between modelled and observed traffic flows at each of the screenlines is presented in Table 7-7 and

Table 7-8 for the AM and PM peak hours.

Table 7-7 AM Screenline Calibration Statistics (Post-Estimation) – Total Flows

Screenline	Observed Flow	Modelled Flow	% Difference	GEH
1 River Eastbound	3,867	3,758	3%	1.8
1 River Westbound	3,088	3,127	-1%	0.7
2 West Inbound	4,876	4,959	-2%	1.2
2 West Outbound	2,661	2,554	4%	2.1
3 East Inbound	3,068	2,687	14%	7.1
3 East Outbound	2,521	2,518	0%	0.1
4 West Outer Inbound	6,275	6,071	3%	2.6
4 West Outer Outbound	4,003	3,733	7%	4.3

Table 7-8 PM Screenline Calibration Statistics (Post-Estimation) – Total Flows

Screenline	Observed Flow	Modelled Flow	% Difference	GEH
1 River Eastbound	2,821	2,625	7%	3.8
1 River Westbound	3,175	3,156	1%	0.4
2 West Inbound	3,121	2,638	18%	9.0
2 West Outbound	4,241	4,121	3%	1.9
3 East Inbound	2,423	2,254	7%	3.5
3 East Outbound	2,491	1,989	25%	10.6
4 West Outer Inbound	4,317	3,929	10%	6.1
4 West Outer Outbound	6,591	5,983	10%	7.7

Table 7-9 Screenline Calibration Criteria Check

TIME PERIOD	SCREENLINES WITHIN 5%	SCREENLINES WITHIN 10%	GEH <4
AM	75%	88%	75%
PM	25%	75%	50%

The results in Table 7-7-**Error! Reference source not found.** indicate that no time period achieves TAG's recommended criterion of all or nearly all screenlines within 5% of observed levels, although relaxing the criteria to 10% shows the AM periods with more than 85% achieves this looser measure.

Considering the performance of individual screenlines, screenline 1 along the River Corrib performs well in both time periods although the percentage difference is slightly too high in the eastbound direction during the PM peak.

Away from Galway city centre, the West screenline performs well in the AM time period and the outbound direction in the PM time period. However, observed flows are 18% higher than the modelled flows in the inbound direction during the PM peak.

The East screenline performs well in the outbound direction during the AM and the inbound direction during the PM time period. However, modelled flows are too low in the opposing directions.

Modelled flows on the West Outer Screenline are too low apart from the inbound direction during the AM peak period. However, this screenline is at the edge of the Local Area Model and does not cover flows within the model.

Overall, when applying the relaxed criteria of 10%, most screenlines provide an accurate representation of key traffic movements within the model area in the AM and PM peak hours. In particular, the model represents cross river movements very well which is especially important given the nature of changes to be tested as part of the Proposed Scheme i.e. closing Salmon-Weir-Bridge for general traffic.

7.6.7.3 Analysis of Trip Matrix Changes - Regression

As noted in Chapter 7.6.7 previously, both TII and TAG model development guidance recommend that care is taken when applying 'Matrix Estimation', and stringent checks should be carried out to ensure that the model demand is not overly distorted.

Pre and Post 'Matrix Estimation' matrices were plotted and the slope, and R^2 measure of goodness of fit were calculated for car trips. The results of this analysis are outlined in Table 7-10 and Table 7-11 below, and Figure 7-10, Figure 7-11 and Figure 7-12.

Within the WRM, the Goods Vehicle matrices are not calculated as accurately as for car traffic as they are not generated by the Full Demand Model. As such, SATME2 was allowed to make more changes to the prior Goods Vehicle matrices to match traffic count data. Constraints were applied to restrict unrealistic Goods Vehicle movement patterns. However, the changes made to the prior Goods Vehicle matrix were not restricted to adhere with DfT TAG guidance.

MEASURE	SIGNIFICANCE CRITERIA	AM	IP	PM
R^2	R^2 in excess of 0.95	0.794	0.837	0.813
Slope	Within 0.98 and 1.02	0.983	0.958	0.932
Intercept	Intercept near zero	0.007	0.837	0.071

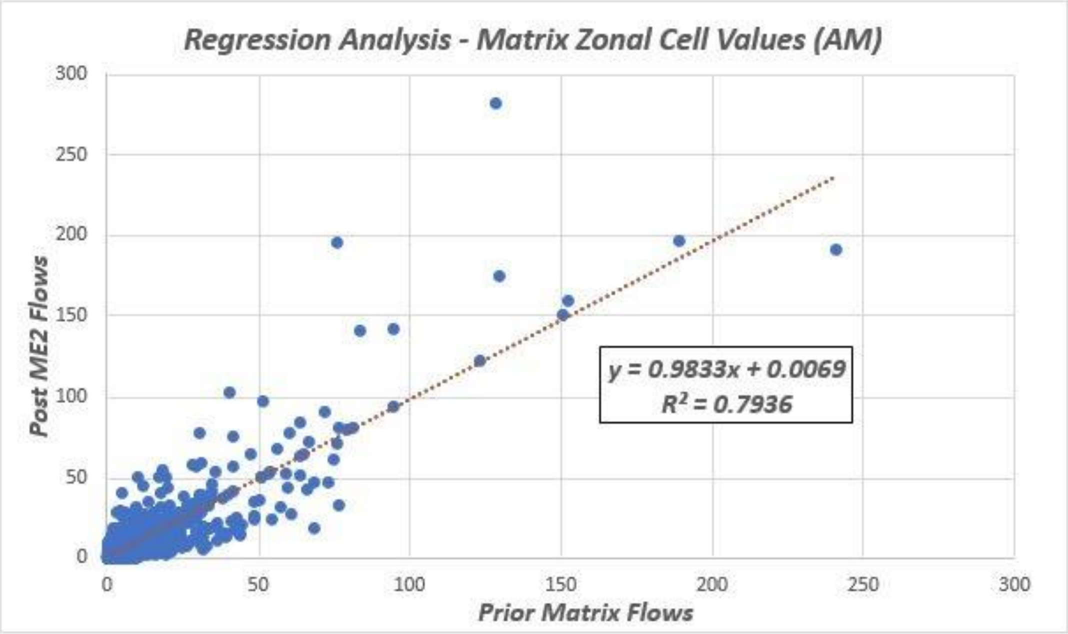
Table 7-10: AM, IP and PM Matrix Zonal Cell Regression Analysis

MEASURE	SIGNIFICANCE CRITERIA	AM	IP	PM
R^2	R^2 in excess of 0.98	0.972	0.959	0.98
Slope	Within 0.99 and 1.01	0.893	0.991	0.962
Intercept	Intercept near zero	14.33	7.49	7.883

Table 7-11: AM, IP and PM Matrix Trip End Regression Analysis (Origin and Destination)

The regression statistics indicate that the calibration struggles to achieve a satisfactory level of correlation between the post calibrated and prior matrices for car trips. Various reasons can be associated to this.

Firstly, the 2019 Base Model has been developed based on the WRM Base Model which has been calibrated to 2016. A number of network changes have been included in the 2019 WRM, creating substantial discrepancies compared to the original 2016 WRM Base Year. Moreover, the WRM uses synthetic matrices which do not necessarily describe real behaviour, but they are the result of mathematical modelling instead. Count data for a total of 58 count sites have been processes as part of the calibration for this Base Year LAM. However, compared to the WRM donor model, many count sites are more localised and differ from those in the WRM.



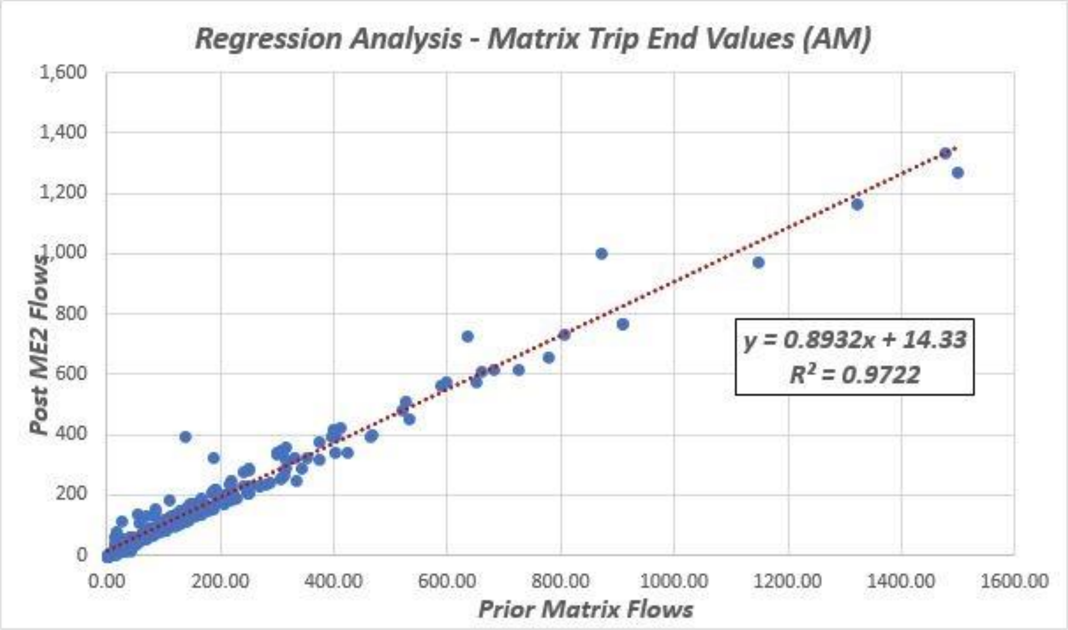


Figure 7-10: AM regression analysis – Matrix Zonal cell values (above) and Origin/Destination Trips ends (below)

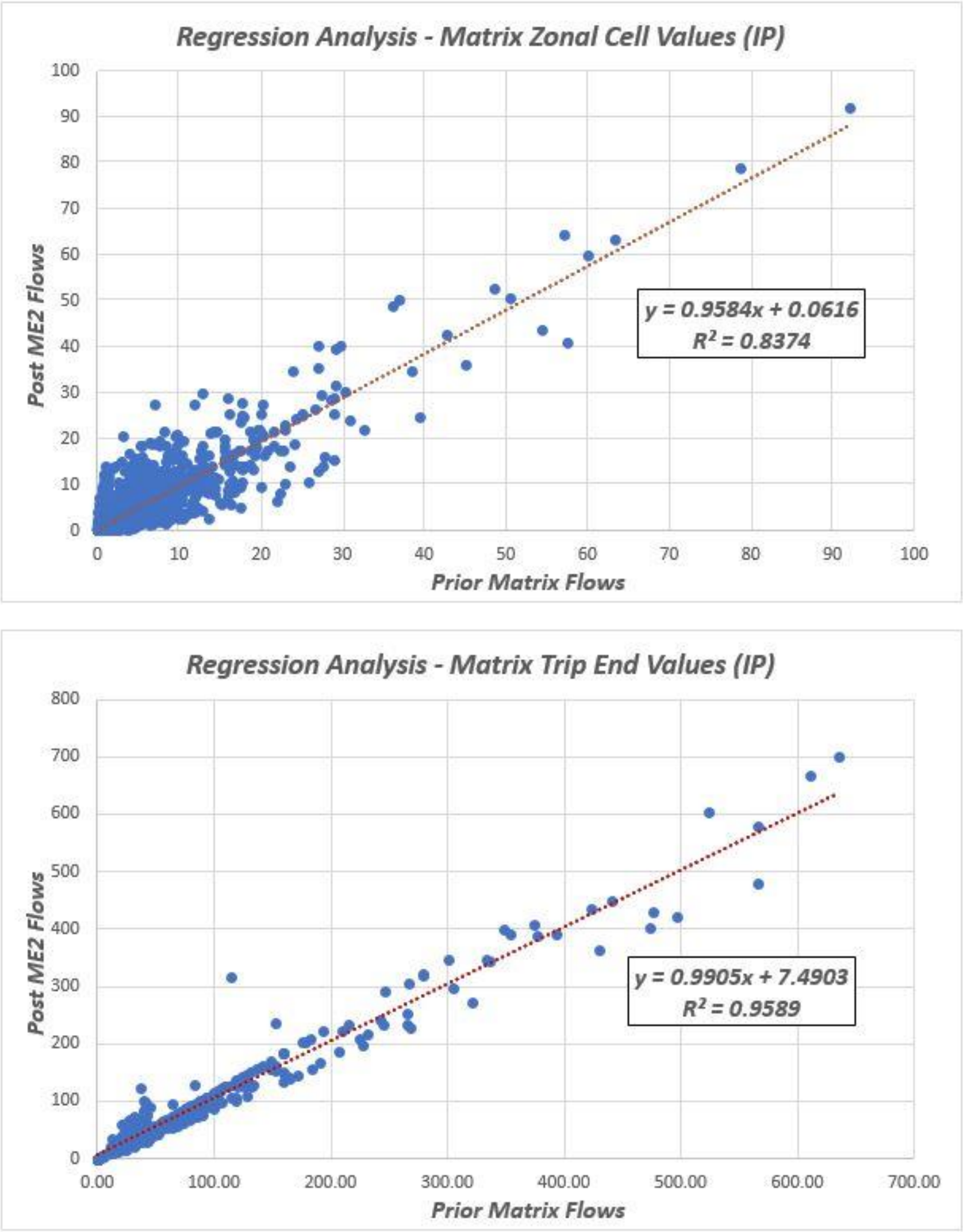
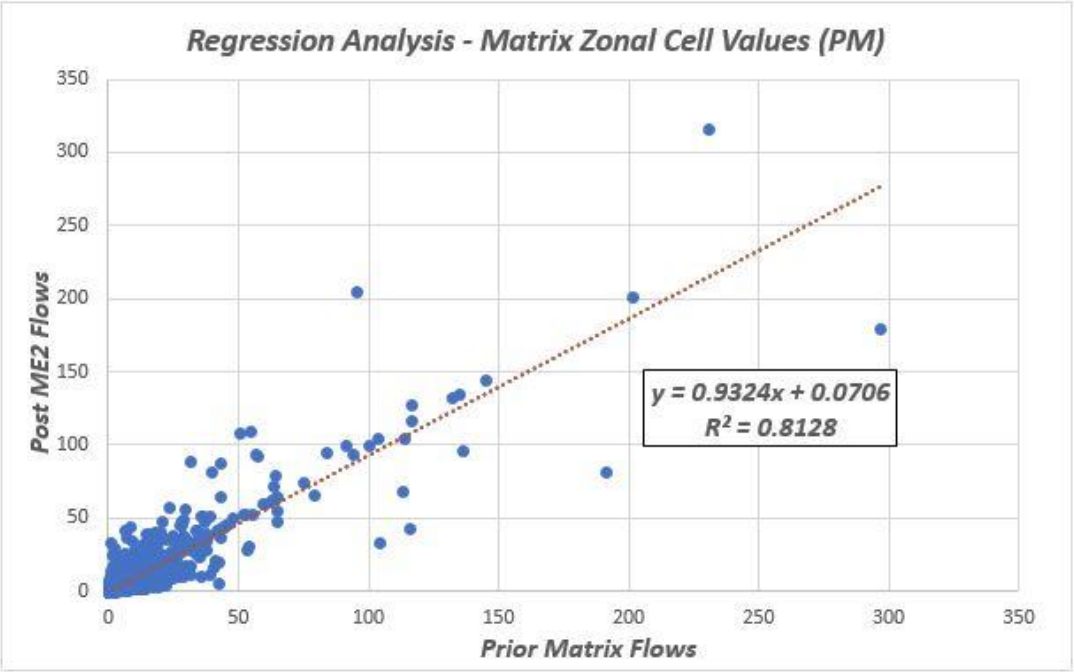


Figure 7-11: IP regression analysis – Matrix Zonal cell values (above) and Origin/Destination Trips ends (below)



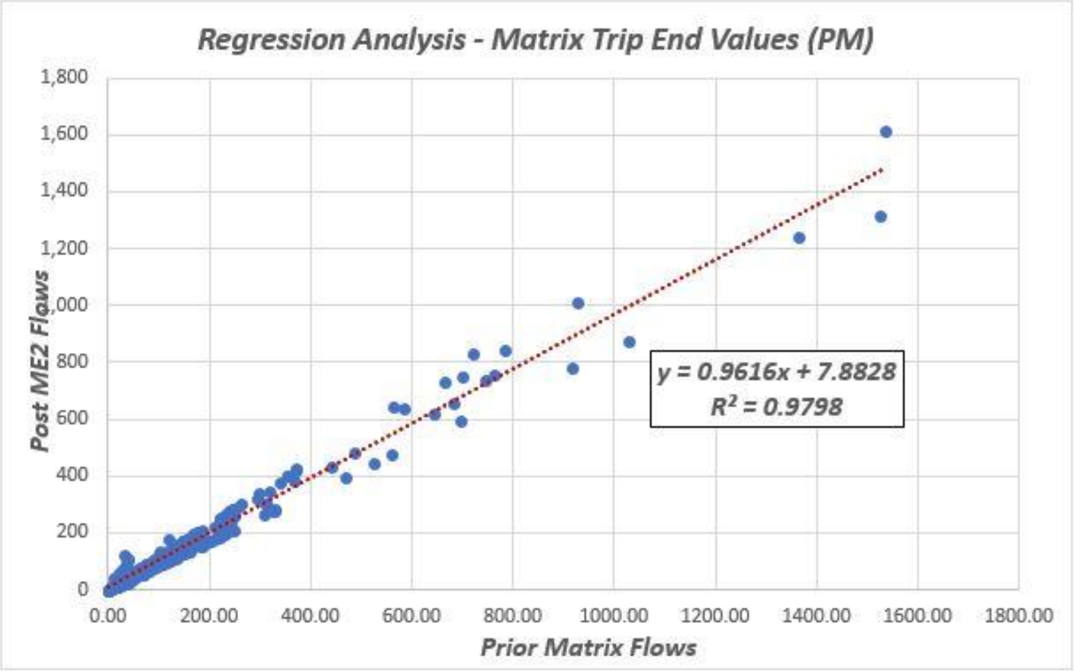


Figure 7-12: PM regression analysis – Matrix Zonal cell values (above) and Origin/Destination Trips ends (below)

7.6.7.4 Analysis of Trip Matrix Changes – Trip Length Distribution

TII guidance recommends comparing trip length distributions for the prior and post calibrated matrices to ensure they have not been overly distorted by the 'Matrix Estimation' process.

The 'Matrix Estimation' programme SATME2 can sometimes generate increased short distance trips to match count information, thus distorting the profile of trip making on the network. PAG suggests that the coincidence ratio should be used to compare trip length distributions before and after estimation, with a desirable range between 0.7 and 1.0.

Table 7-12 below outlines the coincidence ratios for each of the calibrated LAM time periods. The coincidence ratios suggest that there has been some minor distortion of trip lengths but that it is within acceptable bounds.

MEASURE	SIGNIFICANCE CRITERIA	AM	LT	PM
Coincidence Ratio	Between 0.7 and 1.0	0.9	0.95	0.92

Table 7-12: Trip Length Analysis - Coincidence Ratios

The trip length distributions illustrated in Figure 7-13, Figure 7-14 and Figure 7-15 below display the proportion of trips travelling various distances for both the pre and post estimation matrices. The results indicate that there have been some changes, however, the general shape of the distributions are similar. The changes overall are not large, and therefore, it is considered that 'Matrix Estimation' has not overly distorted the overall trip length distribution inherited from the WRM.

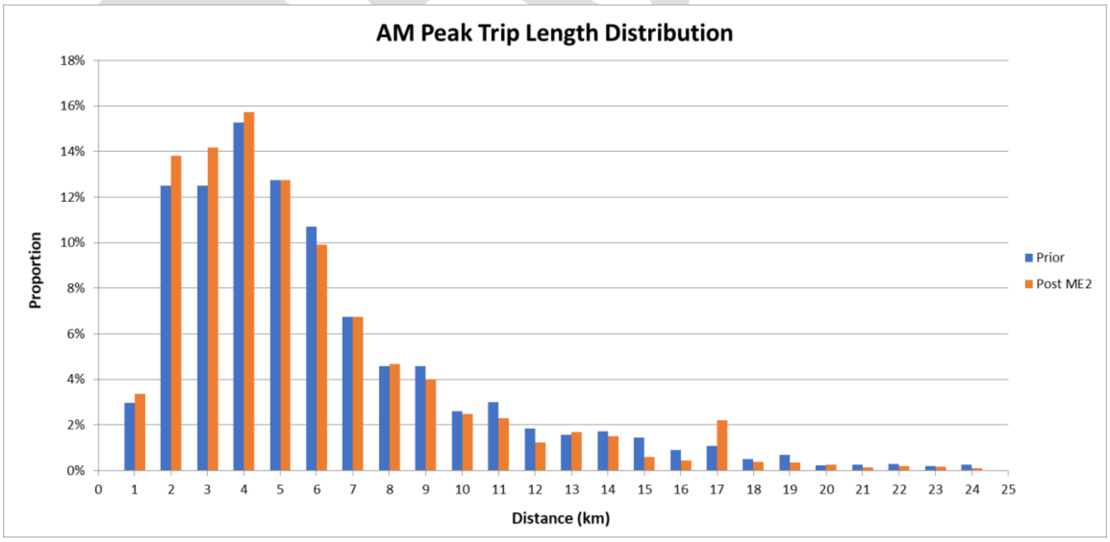


Figure 7-13: AM Peak Trip Length Distribution

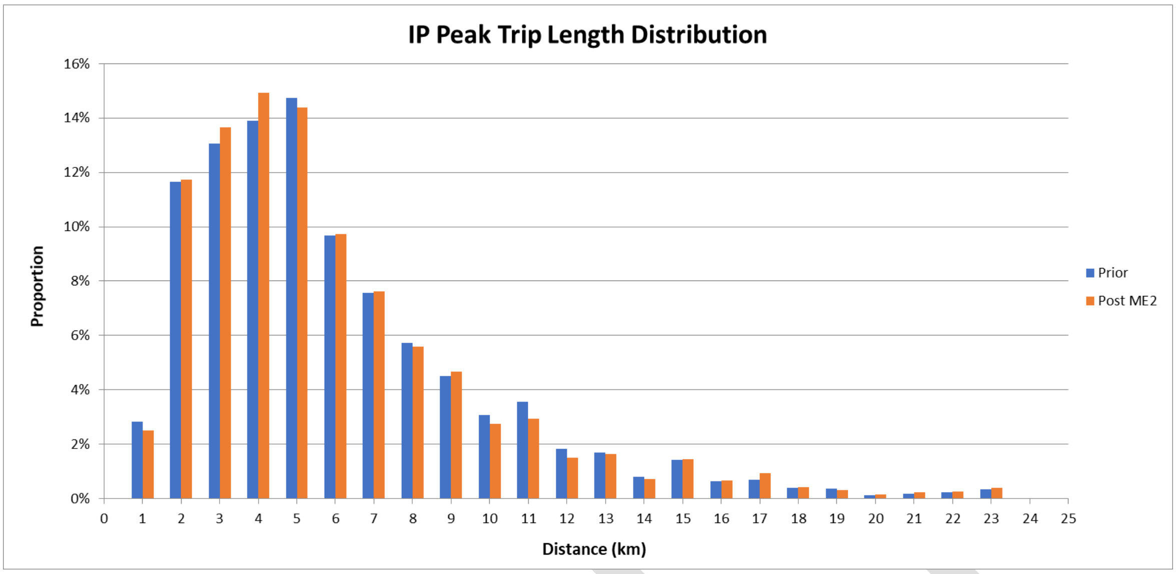


Figure 7-14: IP Peak Trip Length Distribution

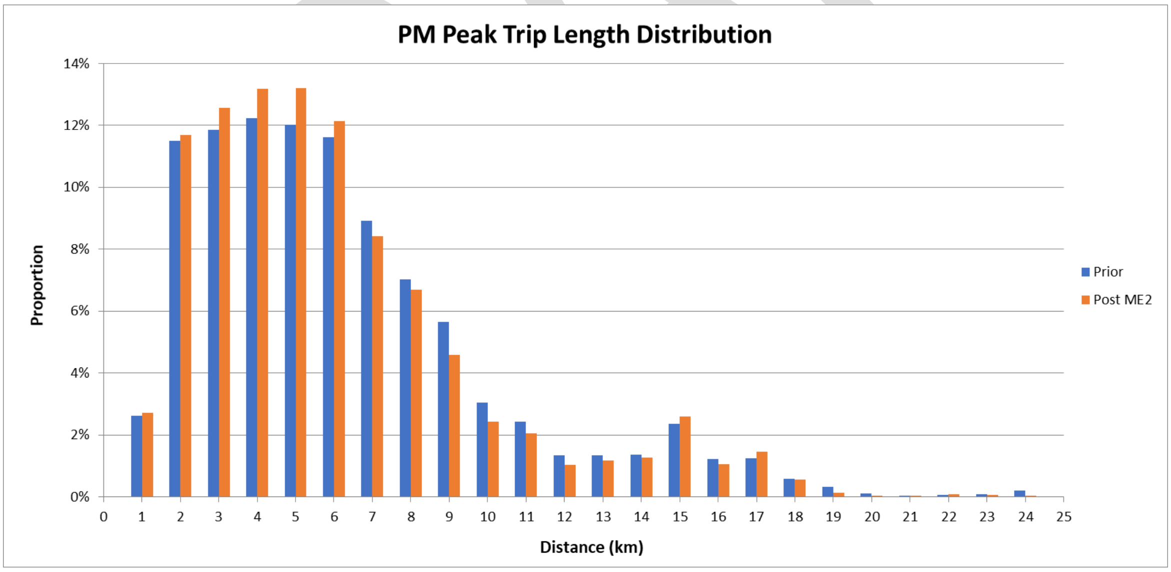


Figure 7-15: PM Peak Trip Length Distribution

7.6.8 Calibration Summary

The previous sections of this Chapter have outlined the methodology used to calibrate the Galway LAM to better reflect observed traffic survey data. In summary:

- A combination of network edits and 'Matrix Estimation' have been used to provide a better correlation between modelled and observed traffic flows;
- The model meets a satisfactory level of calibration following TII and DfT TAG criteria regarding GEH and individual link flows;
- The Screenline Analysis shows that when applying the 'relaxed' 10% criteria, key traffic movements are accurately represented within the study area, in particular the cross-river movements;
- Analysis of 'Matrix Estimation' changes to the prior matrices (derived from the WRM), show some differences, but this it to be expected given the different year of observed count data (2016 in WRM vs 2019 in the LAM), furthermore these changes are a function of short-duration traffic counts used in one model versus the other which would be expected to fluctuate from one day to the next and over time; and
- The coincidence ratio is well within TII guidelines and, as such, it is considered that 'Matrix Estimation' has not overly distorted the overall trip length distribution inherited from the WRM.

7.7 Model Validation

7.7.1 Introduction

The validation of the model uses additional comparative measures against which the robustness of the calibrated model may be judged. Calibration and validation are separate concepts, however, in reality these two elements are part of an iterative process. If the results of the validation checks are not satisfactory, then the modeller will review the inputs and coding within the model and adjust as required in order to achieve a better representation of reality.

It is important that the information used in calibrating the model, including count data for matrix estimation, is kept separate from that used for validation if it is to be a true independent test of the model. As such two main data sources were used in the validation of the Galway LAM:

- Junction turning counts not utilised during model calibration; and
- Observed journey times on key routes.

The guidelines for model validation are very similar to those described previously for calibration in Chapter 7.6.2, and are outlined in Table 7-13.

CRITERIA	ACCEPTABILITY GUIDELINE
Assigned hourly flows compared with observed flows	
Individual flows within 100 v/h for flows less than 700 v/h	>85% of cases
Individual flows within 15% for flows between 700 & 2,700 v/h	
Individual flows within 400 v/h for flows greater than 2,700 v/h	
Individual flows – GEH < 5	>85% of cases
Modelled journey times compared with observed times	
Times within 15% or 1 minute if higher	>85% of cases

Table 7-13: Validation Criteria

The following sections of this Chapter present the results of the validation checks carried out on the Galway LAM to ensure that it is providing a robust representation of existing traffic conditions within the model area.

7.7.2 Traffic Flow Validation

Traffic flow validation was carried out for link and turning counts not initially included within calibration (89 link and 74 turning counts). Table 7-14 summarises the traffic flow and GEH validation results for the Galway LAM for each of the modelled time periods. The list of full Validation results can be found in Appendix 8.2.

The validation results show a reasonable level of agreement between model and observed, albeit with lower results than obtained for calibration, but within acceptable levels. The GEH results for individual flow less than five exhibits around a 60% match. It is noted that around 74% of flows agree with the other criteria, indicating that broadly speaking the model validates well especially for links with higher levels of traffic. Finally, the description of the flow calibration results reported in Chapter 7.6.7.1 provides reasons for the low level of validation achieved.

CRITERIA		AM	IP	PM
Individual flows within 100 v/h for flows less than 700 v/h	>85% of cases	72%	75%	74%
Individual flows within 15% for flows between 700 & 2,700 v/h				
Individual flows within 400 v/h for flows greater than 2,700 v/h				
Individual flows – GEH < 5	>85% of cases	62%	61%	59%

Table 7-14: Traffic Count Validation Statistics

7.7.3 Journey Time Validation

As outlined in Table 7-13, TII guidelines recommend that modelled journey times should be within +/-15% of the observed time, or 1 minute if higher, in more than 85% of cases. Journey Times have been validated comparing Joy Ride Journey Times extracted from Saturn with TomTom data on nine different routes (in both directions).

The 9 routes can be seen in Figure 7-16 while Table 7-15 and Table 7-16 report the validation results for the 18 routes (nine for each direction). Overall, the LAM achieves good journey time validation results with 13 out of 18 routes falling within the +/-15% TII criteria in the AM and 15 in the PM.

Figure 7-16: the nine routes used for Journey Time Validation

Route	Direction	Modelled	Observed	Diff	% Diff	Pass/Fail
1	Eastbound	485	431	54	13%	Pass
1	Westbound	465	562	-97	-17%	Fail
2	Northbound	898	945	-47	-5%	Pass
2	Southbound	1035	947	88	9%	Pass
3	Eastbound	812	714	98	14%	Pass
3	Westbound	769	854	-85	-10%	Pass
4	Westbound	432	473	-42	-9%	Pass
4	Eastbound	450	393	57	15%	Pass
5	Westbound	771	678	93	14%	Pass
5	Eastbound	875	779	96	12%	Pass
6	Southbound	732	604	128	21%	Fail
6	Northbound	624	471	153	32%	Fail
7	Southbound	587	525	62	12%	Pass
7	Northbound	725	587	138	24%	Fail
8	Southbound	648	572	76	13%	Pass
8	Northbound	713	684	29	4%	Pass
9	Westbound	521	462	59	13%	Pass
9	Eastbound	507	418	89	21%	Fail

Table 7-15: validation results for the 9 routes in the AM peak

Route	Direction	Modelled	Observed	Diff	% Diff	Pass/Fail
1	Eastbound	441	404	37	9%	Pass
1	Westbound	480	431	49	11%	Pass
2	Northbound	941	1009	-68	-7%	Pass
2	Southbound	1017	1026	-9	-1%	Pass
3	Eastbound	737	703	34	5%	Pass
3	Westbound	884	852	32	4%	Pass
4	Westbound	442	420	22	5%	Pass
4	Eastbound	453	440	13	3%	Pass
5	Westbound	849	754	95	13%	Pass
5	Eastbound	902	882	20	2%	Pass
6	Southbound	588	574	14	2%	Pass
6	Northbound	619	528	91	17%	Fail
7	Southbound	642	669	-27	-4%	Pass
7	Northbound	645	679	-34	-5%	Pass
8	Southbound	639	819	-180	-22%	Fail
8	Northbound	600	687	-87	-13%	Pass
9	Westbound	506	597	-91	-15%	Fail
9	Eastbound	523	544	-21	-4%	Pass

Table 7-16: validation results for the 9 routes in the PM peak

Route 9 is the one covering the path of the proposed scheme and it can be seen in Figure 7-17 and Figure 7-18. The full set of charts for all routes is available in Appendix 8.2.

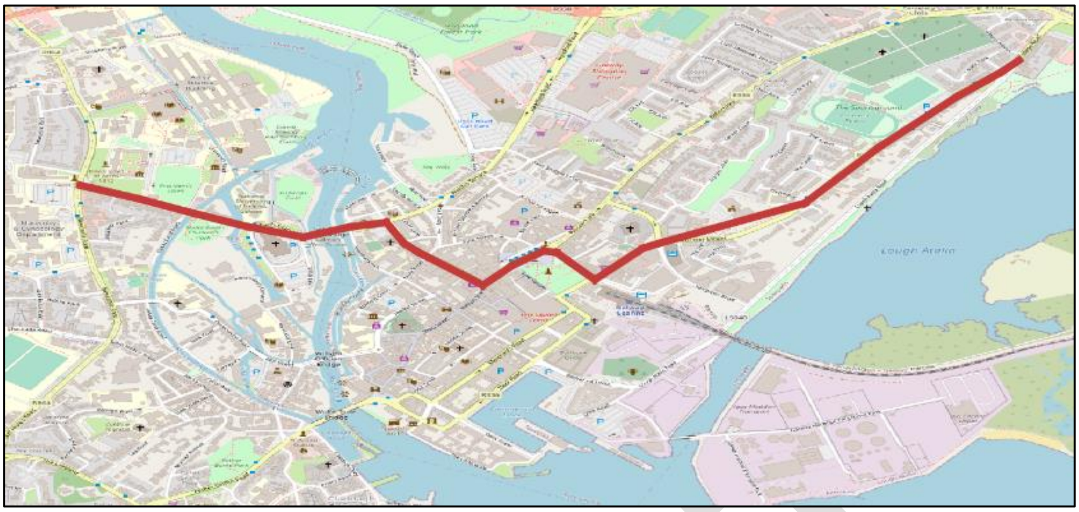


Figure 7-17: route 9 westbound for Journey Time Validation

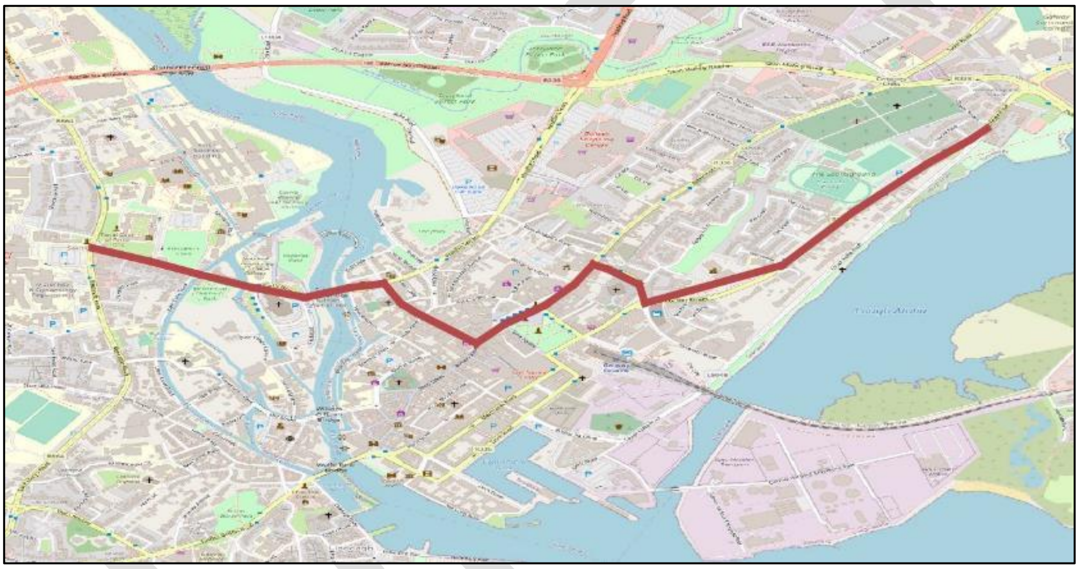


Figure 7-18: route 9 eastbound for Journey Time Validation

AM Results

Figure 7-19 and Figure 7-20 illustrate the comparison between modelled and observed journey times for route 9 inbound and outbound in the AM peak.

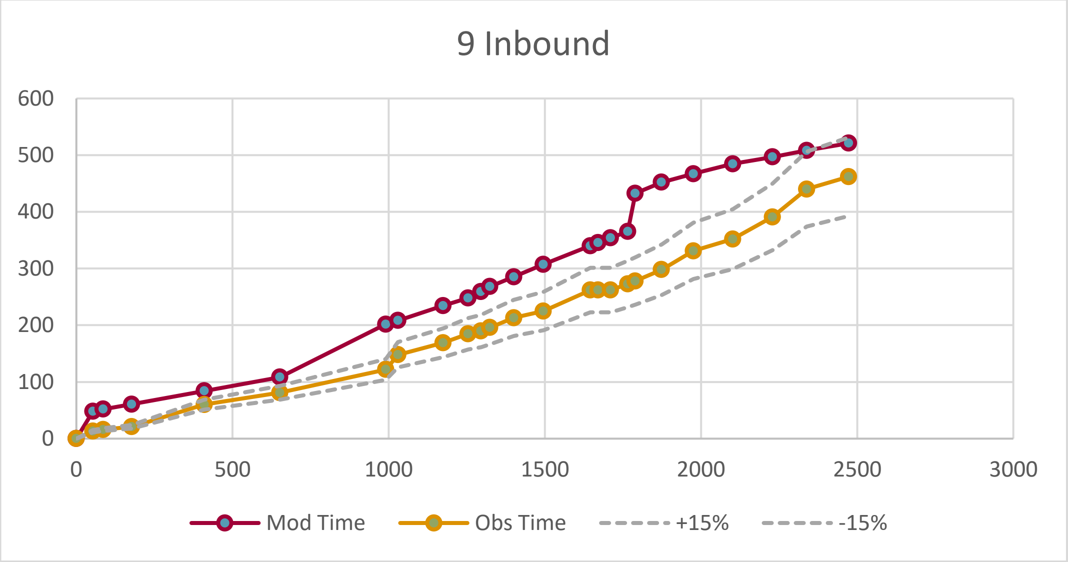


Figure 7-19: Journey Time Validation Plot - Route 9 Westbound AM

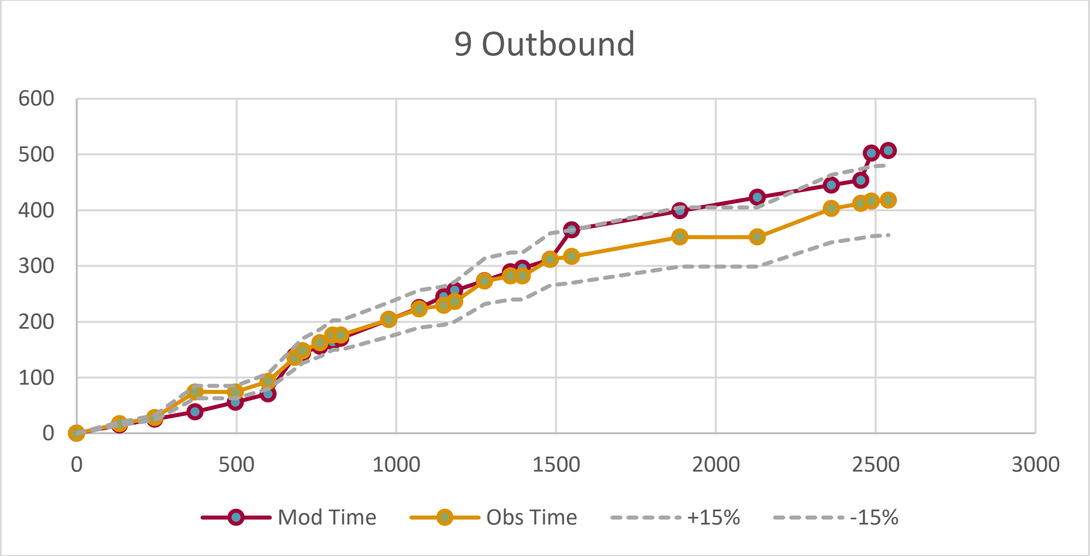


Figure 7-20: Journey Time Validation Plot - Route 9 Eastbound AM

The results indicate that the model is slightly overestimating delay along this route in the AM peak hour. However, in this instance the journey time validation is deemed acceptable as the difference between modelled and observed flows of 13% falls within the TII guidelines. The outbound route, on the other hand, fails the validation as the difference is at 21%.

PM Results

Figure 7-21 and Figure 7-22 illustrate the comparison between modelled and observed journey times for route 9 inbound and outbound in the PM peak.

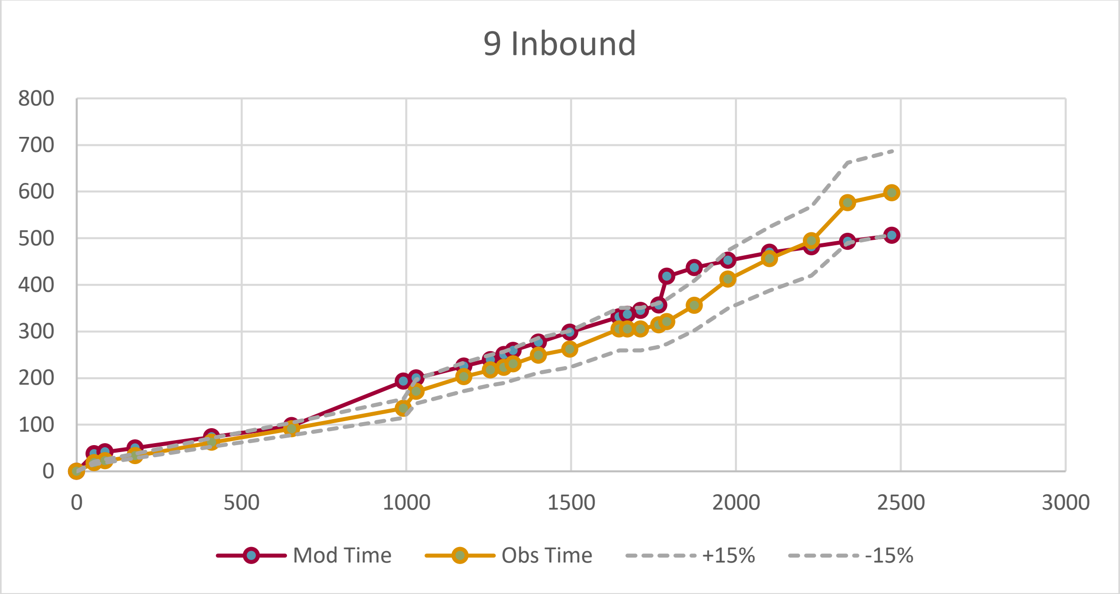


Figure 7-21: Journey Time Validation Plot - Route 9 Westbound PM

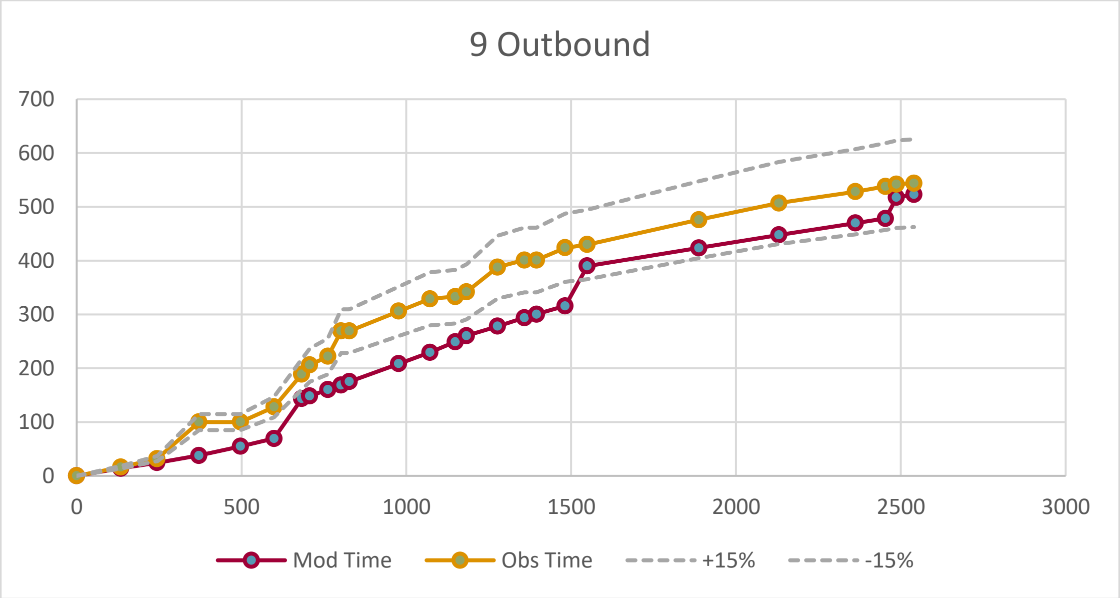


Figure 7-22: Journey Time Validation Plot - Route 9 Eastbound PM

The results indicate that the model is underestimating journey time along the outbound route in the PM peak hour. However, in this instance the journey time validation is deemed acceptable as the difference between modelled and observed flows of 15% is on the edge of the TII guidelines. The inbound route, on the other hand, performs positively with a difference of only 4% with the observed journey time data.

7.7.4 Validation Summary

The previous sections of this Chapter have outlined the validation checks undertaken to assess the robustness of the calibrated LAM. Overall, the Galway LAM does not meets all TII and DfT TAG validation criteria regarding GEH and individual link flows, however a good correlation has been achieved between modelled and observed journey times in both the AM and PM peaks.

7.8 Future Year Scenarios

The first section of this report has described the process to model future years scenarios within the WRM. The analysis provided valuable insights on the effects of the proposed scheme on Public Transport and Active Modes. Impacts on the highway network offered an indication of the extent to which the scheme caused major changes in terms of traffic flows and mode share at regional level. However, for a more detailed analysis of the effect that the GCCL scheme will have within the study area, a Base Year Local Area Model was produced, and the previous sections provided details for its calibration and validation process.

The main reason for producing a Base Year LAM was to have a solid reference to build the scenarios on. In terms of future year LAM networks, these were cordoned from the WRM scenarios and improved where needed to increase realism. In terms of Demand, on the other hand, this is more tricky. One could possibly use the cordoned Demand coming from the future year WRM scenarios, however, a more recent calibrated Base Year LAM would provide a stronger starting point to derive future year demand. For this reason, the Furness Method was used to “Pivot” the Base Year demand to the required future years by applying growth factors derived from the WRM scenarios. The pivoted demand is then assigned to the LAM networks.

In this section the process followed to obtain the future year LAM scenarios is presented.

7.8.1 Future Year Demand – Furness Method

The Furness Method (also known as *Doubly Constrained Growth Factor Method* – or as *Fratar* in the US) is an iterative process typically used when the future number of trips originating and terminating in each zone is known. The method calculates “*a set of intermediate correction factors which are then applied to cell entries in each row or column as appropriate. After applying these corrections to say, each row, the totals for each column are calculated and compared with the target values. If the differences are significant, new correction coefficients are calculated and applied as necessary” (Modelling Transport, Ortuzar, Willumsen, 2011)*.

Figure 7-23 provides an overview of the Furness method applied to produce the Galway Future Year LAM demand. The steps on the left side of the diagram represent the process of calibrating the Base Year LAM as reported in Chapter 7.6. The first two rectangles on the right side of the diagram refer to the cordoning of the WRM forecast scenarios which results in a cordoned forecast demand matrix (Forecast Year LAM Prior).

The procedure involves the calculation of growth factors at origin and destination level between the 2019 Prior and the Forecast Year Prior. These factors are then applied to the 2019 Calibrated Base Year

LAM (2019 LAM Post) in an iterative process that "pivots" the 2019 demand to match the growth trends observed between the two prior matrices. This results in a final pivoted Forecast Year matrix.

This process has been performed using the Software Cube Voyager and its "FRATAR" program, which performs the Furnessing procedure with an internal algorithm. Before running through this process, the matrices produced by SATURN (which are in .UFM format) have been converted into .MAT first. The final matrices resulting from the Furnessing procedure are then converted back into .UFM to allow the new Demand to be assigned to the LAM network.

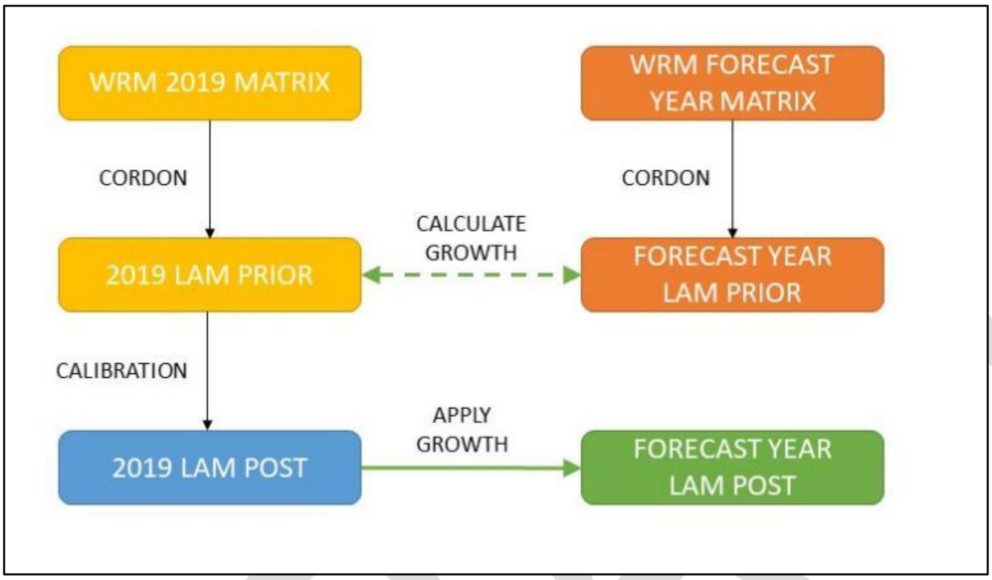


Figure 7-23: Overview of the Furnessing method for the Galway LAM

Before assigning the forecast demand to the LAM network, a detailed analysis of the total Trip Ends was performed to ensure the growth trends of the demand remained consistent across all zones.

The entire process has been repeated for all forecast scenarios in both 2023 and 2038.

7.8.2 Future Year LAM Networks

The WRM provides a detailed representation of all significant roads within the study area and with the cordoning of the forecast scenarios the highway schemes coded in the regional model have been brought into the LAM.

The cordoned network was then revised by adding additional details to refine the model quality and realism. In an iterative process, adjustments were made to improve assignment convergence by reducing congestion, delays and blocking back. Main interventions involved the optimization of signal times, variation of the saturation flows (in particular for spigots connecting to centroids with high demand) and the introduction of new zone connectors.

7.8.3 Construction Scenario

7.9 Results

7.9.1 Network Performance Indicators

Network performance indicators for the LAM network were extracted for all modelled scenarios in the AM, Inter-peak and PM peak hours and are presented in Table 7-17. It is important to note that the results presented cover the full LAM network, therefore the impact of transport scenarios along the Cross-City corridor may be viewed as relatively marginal in consideration of the entire network. For each scenario the following network statistics are presented:

- Transient Queues: this is expressed in total pcu.hours which is essentially the volume of vehicles on the network multiplied by the time spent in transient queues and it represents time spent in queues at junctions which are not over capacity (e.g. at a signalised junction where the queue is able to clear during a single cycle).
- Over-capacity queues: expressed in total pcu.hours, this occurs where the volume of turning movements exceeds junction capacity, such that a permanent queue builds (e.g. at a signalised junction where a queue is unable to clear in a single cycle).
- Average Speed: represents the average speed of all vehicles travelling on the network within the modelled time period measured in km/h.
- Total Travel Distance: represents the total distance travelled by vehicles on the road network in the modelled period measured in pcu.km.
- Total Travel Time: represents the total time travelled by vehicles on the road network in the modelled period measured in pcu.kmhr.

Overall, transient and over capacity queues increase across all scenarios in all time periods. The rise of population and consequent higher number of car trips, joined with the network changes provided by the GCCL and GTS, are likely the cause of the traffic deterioration within the study area. The average speed sees a decrease between the base and the 2023 scenarios, while it increase again in 2038, likely due to the introduction of the outer bypass. The increase in total travel distance and travel time are also a consequence of the measure introduced within the city of Galway which causes significant traffic re-routing around the city centre.

	Time Period	Transient Queues [pcu-hrs]	Over Capacity Queues [pcu-hrs]	Average Speed [km/h]	Total Travel Distance [pcu-km]	Total Travel Time [pcu-hrs]
2019 BASE YEAR	**AM**	1,256	195	29	146,422	5,045
	IP	805	8	32	111,412	3,466
	PM	1,105	422	29	142,731	4,930
2023 DO-MIN	**AM**	1,620	360	27	163,751	5,998
	IP	919	20	31	117,204	3,749
	PM	1,412	567	28	159,617	5,799
2023 DO-SOM	**AM**	1,968	866	24	162,364	6,800
	IP	1,050	24	30	118,461	3,906
	PM	1,594	788	26	158,625	6,187
2038 DO-MIN	**AM**	2,169	417	30	229,532	7,547
	IP	1,353	57	35	172,583	5,008
	PM	2,046	1,190	27	216,062	7,891
2038 DO SOM	**AM**	2,471	964	28	233,640	8,406
	IP	1,508	110	33	175,565	5,275
	PM	2,320	1,554	26	218,068	8,553

Table 7-17: LAM network performance indicators

7.9.2 Highway Flows

Figure 7-24 shows the combined two-way highway flow differences in 2023 during the AM peak period. The figure shows only flow increases on links if they are greater than 100 Passenger Car Units (PCUs) or decreases of greater than 100 PCUs.

As a result of the traffic restrictions implemented as part of the Proposed Scheme, significant rerouting has been identified. This includes a significant reduction in flows on Salmon-Weir-Bridge due to the bus gate, on Eyre Square, Headford Road, Tuam Road, College Road, Thomas Hynes Road and Bothar Na Dige.

At the same time, traffic is routing onto the City Centre Access Network with flow increases on the N6 including Quincentenary Bridge, Lower Newcastle, Lough Atalia Road and Fairgreen Road.

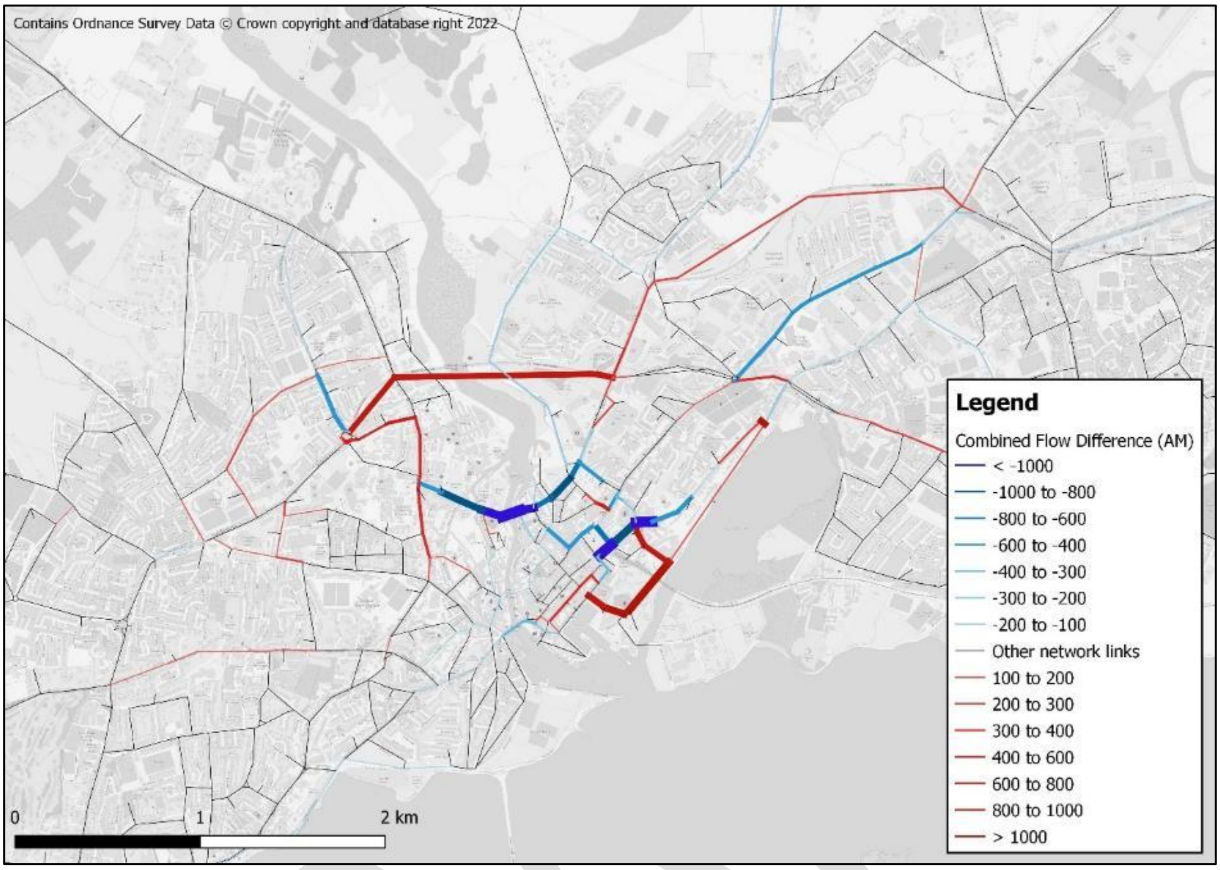


Figure 7-24: 2023 Combined Flow Differences AM

Figure 7-25 shows the flow differences as a result of the Proposed Scheme in 2038 during the AM peak period. The impacts are similar to those identified for 2023 with generally stronger increases and decreases due to higher traffic volumes in 2038. However, Galway Other Bypass, which can be seen in the northern section of the map, will remove some traffic from the city centre as a result of the Proposed Scheme.

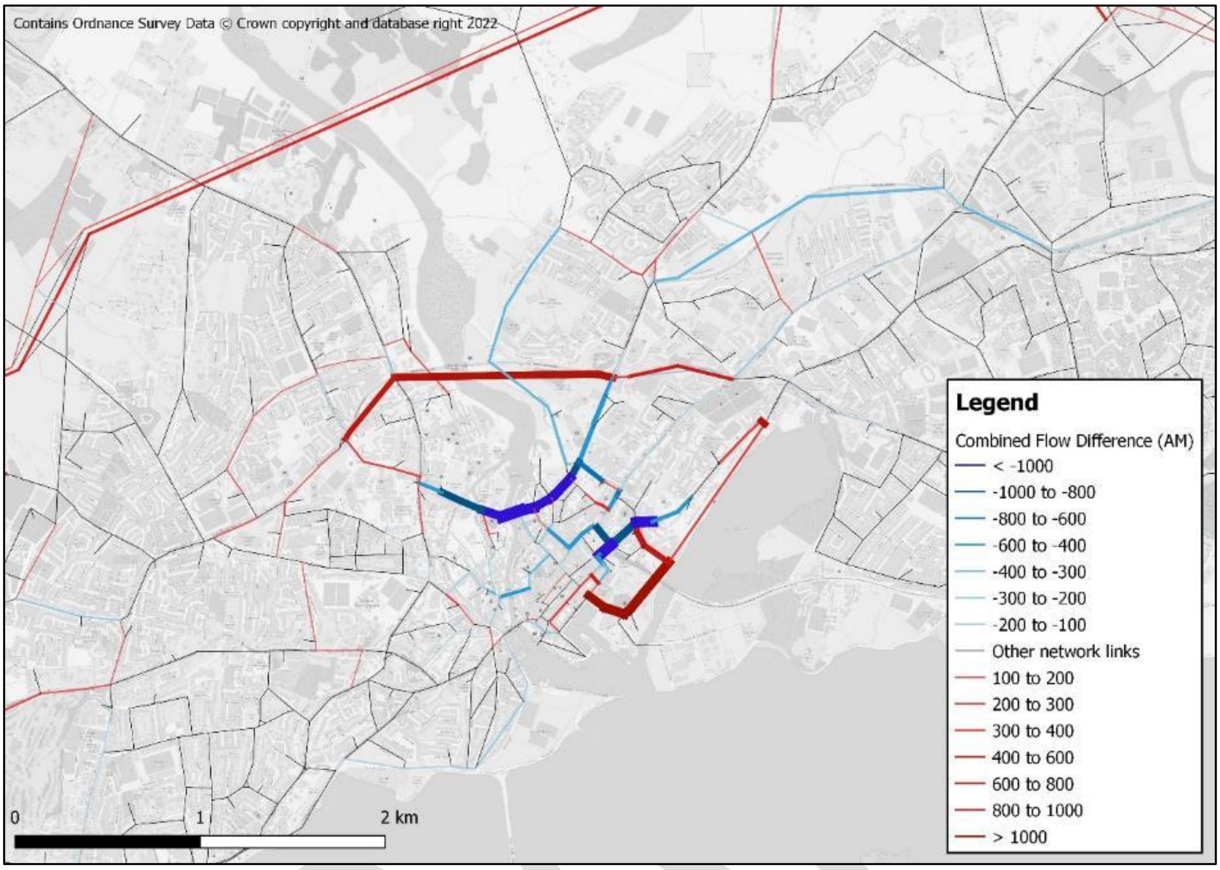


Figure 7-25: 2038 Combined Flow Differences AM

Figure 7-26 shows the combined two-way highway flow differences in 2023 during the PM peak period.

Similar to the AM peak period, a significant reduction in flows has been identified on Salmon-Weir-Bridge due to the bus gate, on Eyre Square, Headford Road, College Road and Bothar Na Dige.

As a result of the Proposed Scheme, traffic is routing onto the City Centre Access Network with flow increases on the Quincentenary Bridge, Lower Newcastle, Lough Atalia Road and Fairgreen Road. Unlike the AM peak period, there are no significant flow increases on the N6 apart from Quincentenary Bridge.

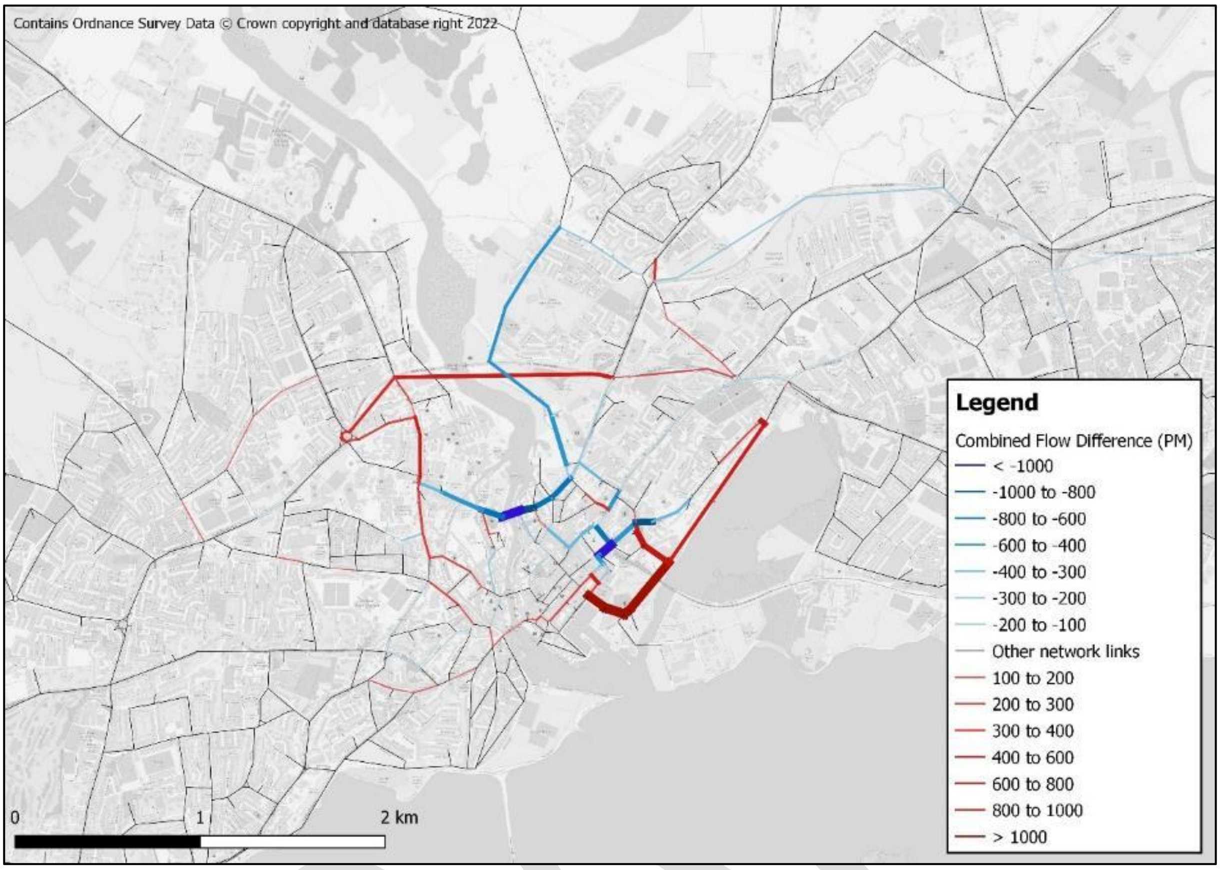


Figure 7-26: 2023 Combined Flow Differences PM

Figure 7-27 below shows the flow differences as a result of the Proposed Scheme in 2038 during the PM peak period. The impacts are similar to those identified for 2023 with generally stronger increases and decreases due to higher traffic volumes in 2038. However, Galway Other Bypass, which can be seen in the northern section of the map, will remove some traffic from the city centre as a result of the Proposed Scheme.

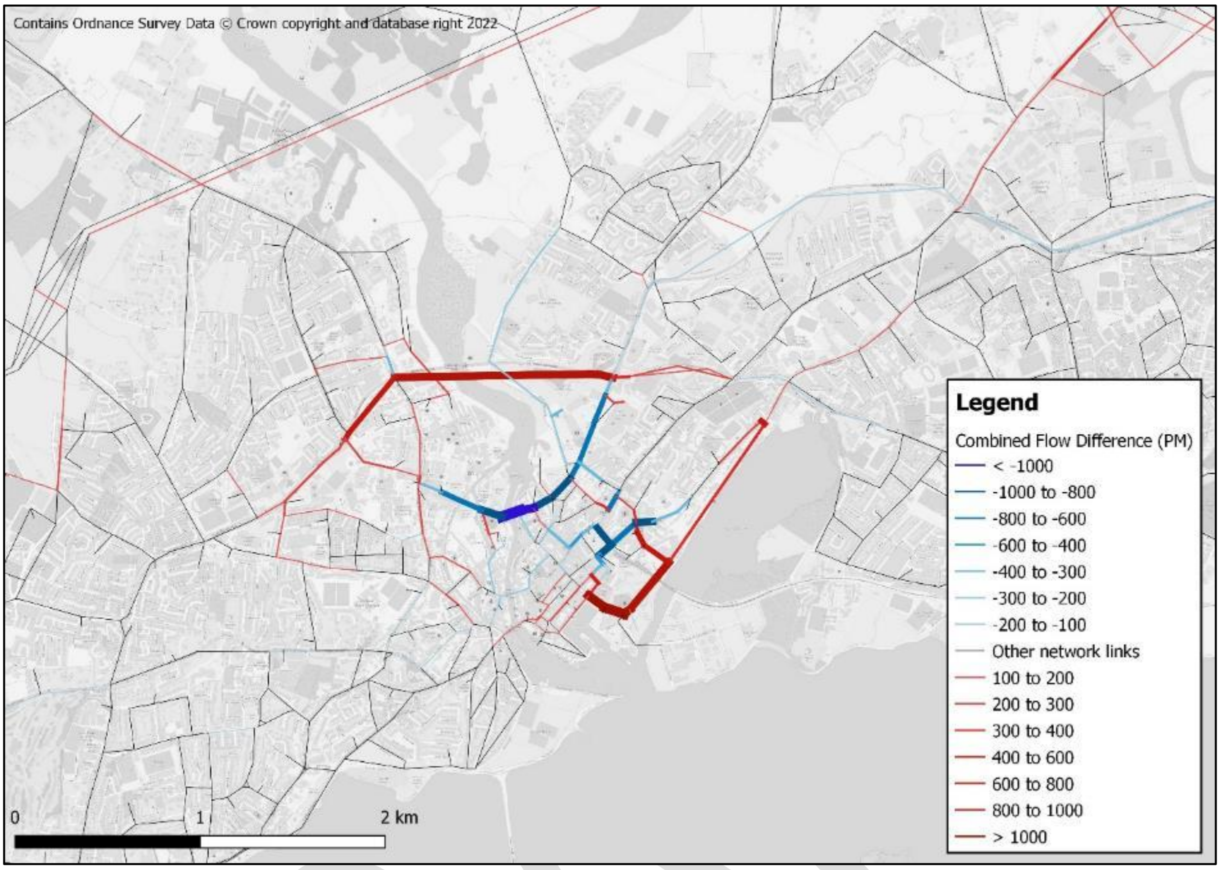


Figure 7-27: 2038 Combined Flow Differences PM

7.10 Construction Scenario

7.10.1 Assumptions

As highlighted in section 6.5.5 of the EIAR, a Construction Scenario has been developed to assess the traffic impacts of temporary traffic management measures that construction of the Proposed Scheme will have during the construction phase.

The Proposed Scheme has been divided into the following three principal sections, and multiple sub-sections, in relation to construction:

- Section A - University Road to Eyre Square, Woodquay and Headford Road:
- Section A1 – University Road
- Section A2 – Goal Road & Galway Cathedral
- Section A3 – Salmon Weir Bridge
- Section A4 – Newtownsmith / Waterside
- Section A5 – St Vincent’s Avenue / Walsh’s Terrace
- Section A6 – Dyke Road / Headford Road
- Section A7 - St. Francis Street/Eglinton Street/Williamsgate Street
- Section A8 - Woodquay/Daly’s Place/Mary Street
- Section B - Eyre Square to Dock Road, Bothar na Mban to College Road
- Section B1 - Bóthar nam Ban/St. Brendan’s Avenue
- Section B2 - Prospect Hill
- Section B3 - Eyre Square North/Eyre Square East/Eyre Square South
- Section B4 - Victoria Place/Merchant’s Road/Queen Street
- Section B5 - Forster Street
- Section B6 - College Road/Forster Street/Fairgreen Road/Bóthar Uí hEithir junction
- Section B7 - Bóthar Uí hÉithir
- Section B8 - Fairgreen Road
- Section C - College Road to Dublin Road
- Section C1 - College Road (Forster Street to Lough Atalia Road)
- Section C2 - College Road/Lough Atalia Road junction
- Section C3 - College Road (to junction at Moneenageisha)
- Section C4 - Moneenageisha junction
- Section C5 - R338 Dublin Road

The location of each principal section and the various sub-sections can be seen in Figure 7-28 to Figure 7-30.

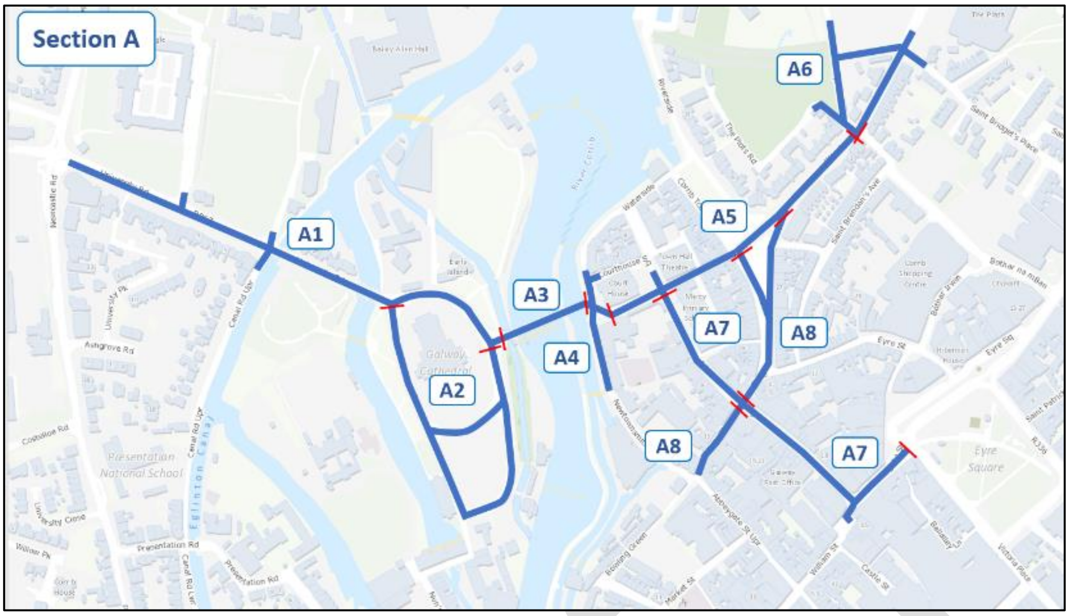


Figure 7-28: Proposed Sub Sections of Construction Phase – Section A

Figure 7-29: Proposed Sub Sections of Construction Phase – Section B

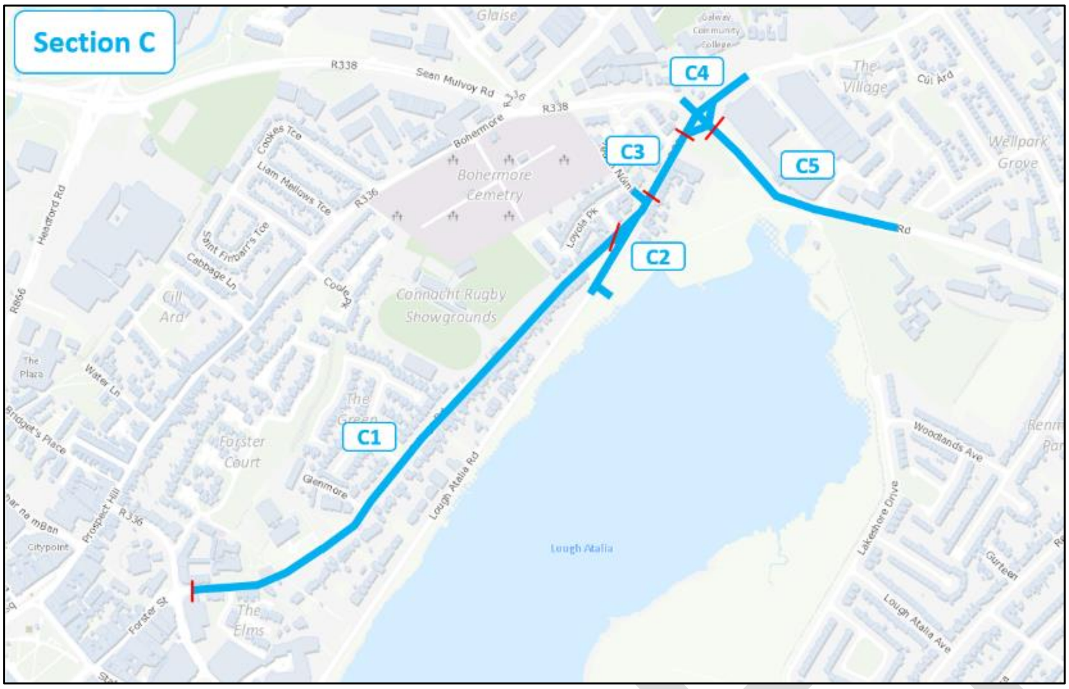


Figure 7-30: Proposed Sub Sections of Construction Phase – Section C

Following discussions with ARUP, it has been decided to model traffic restrictions during months 4 and 5 before the traffic restrictions as part of the Proposed Scheme are being implemented. This includes the following measures:

Section A6 - Dyke Road/Headford Road

- Phase 1 – Closure of the road connecting Dyke Road to Headford Road adjacent to the Dyke Road car-park and completion of the widening on the northern side of this road and the footpath widening on the southern side of the road.

Section B1 - Bóthar na mBan/St. Brendan’s Avenue

- Phase 2 – On Bóthar na mBan, works on Eastern lane, traffic reduced to single lane in each direction and realigned in narrow lanes to the West.
- Phase 3 – On Bóthar na mBan, works on Western lane, traffic reduced to single lane in each direction and realigned in narrow lanes to the East.

Section C3 - College Road (to junction at Moneenageisha)

- Phase 1 – Works on western side, traffic reduced to single lane in each direction and realigned in narrow lanes to the east.
- Phase 2 – Works on eastern side, traffic reduced to single lane in each direction and realigned in narrow lanes to the East.
- Phase 3 – Road surfacing works in the carriageway, traffic reduced to single lane in each direction and realigned as required to complete the works.

Phases 2 and 3 in section B1 can be seen as identical from a modelling perspective. The same applied to Phases 1, 2 and 3 in section C1. The 2022 Do Minimum Local Area Model has been used as a starting point for the Construction Scenario.

7.10.2 Results

Figure 7-28 below shows the flow differences during the AM peak period as a result of the temporary traffic management measures. Due to the closure of Dyke Road, traffic has been rerouted onto Bothar Na Dige. However, due to delays at Bothar Na Dige/Headford Road Junction, southbound traffic in also rerouting to Headford Road.

The reduction to a single lane between College Road and junction at Moneenageisha, traffic is rerouting from College Road and Lough Atalia Road to Bohermore.

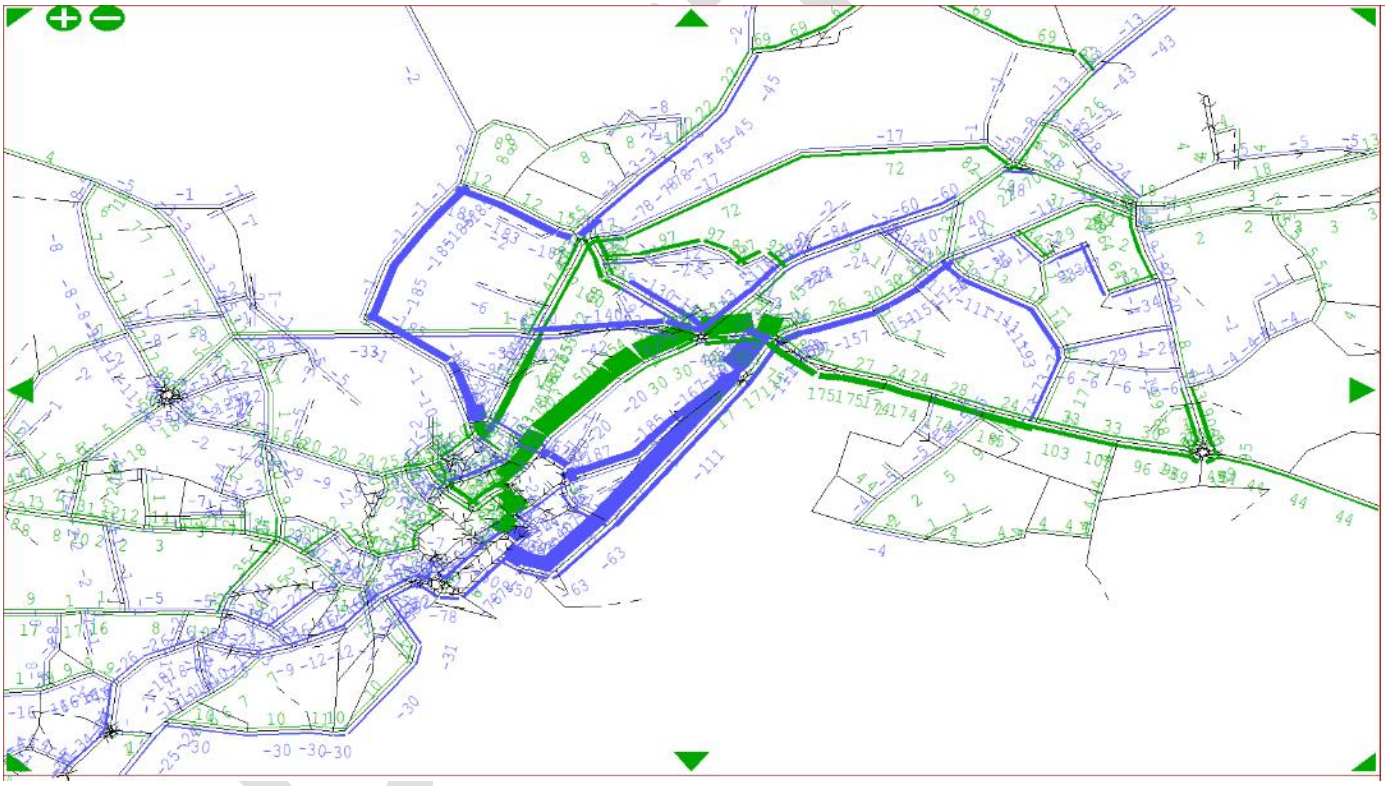


Figure 7-31: 2022 Flow Differences Construction Scenario minus Do Minimum (AM)

Figure 7-29 below shows the impacts of the Construction Scenario compared to the Do Minimum scenario during the PM peak period. This scenario shows similar trend to the AM peak period but significantly fewer levels of rerouting due to lower traffic levels and delays during the PM peak period.

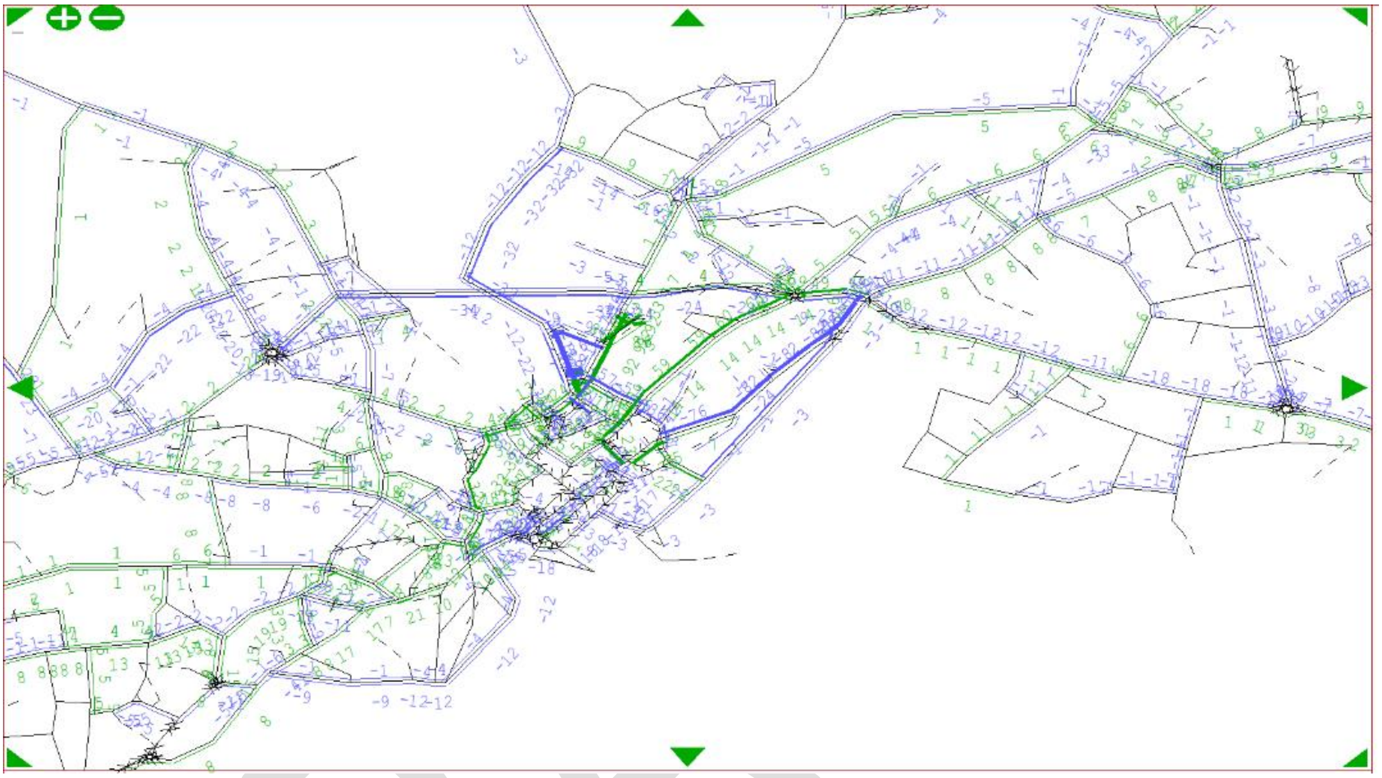


Figure 7-32: 2022 Flow Differences Construction Scenario minus Do Minimum (PM)

Overall, the temporary traffic management measures as part of the Construction Scenario have mainly local impacts and do not cause strategic rerouting.

8. APPENDIX

8.1 Flow Calibration

8.1.1 Prior

			AMCar	AMLGV	AMHGV	AMTOT	LTCar	LTLGV	LTHGV	LTTOT	PMCar	PMLGV	PMHGV	PMTOT
Links	WebTAG	Count Pass	96	162	162	95	116	162	162	110	104	162	162	101
		Count Fail	66	0	0	69	46	0	0	53	58	0	0	62
		Total	162	162	162	164	162	162	162	163	162	162	162	163
		% Pass	59.3%	100.0%	100.0%	58%	72%	100%	100%	67%	64%	100%	100%	62%
		% Fail	40.7%	0.0%	0.0%	42%	28%	0%	0%	33%	36%	0%	0%	38%
	> 85% of cases?		NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO
	GEH Criteria	Count GEH<5	88	146	141	88	109	147	144	106	94	144	155	96
		Count GEH>=5	76	18	23	76	55	17	20	58	70	20	9	68
		Total	164	164	164	164	164	164	164	164	164	164	164	164
		% GEH<5	53.7%	89.0%	86.0%	54%	66%	90%	88%	65%	57%	88%	95%	59%
		% GEH>=5	46.3%	11.0%	14.0%	46%	34%	10%	12%	35%	43%	12%	5%	41%
	> 85% of cases?		NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO
Turns			AMCar	AMLGV	AMHGV	AMTOT	LTCar	LTLGV	LTHGV	LTTOT	PMCar	PMLGV	PMHGV	PMTOT
	WebTAG	Count Pass	31	41	41	30	38	41	41	36	30	41	41	31
		Count Fail	10	0	0	11	3	0	0	5	11	0	0	10
		Total	41	41	41	41	41	41	41	41	41	41	41	41
		% Pass	75.6%	100.0%	100.0%	73%	93%	100%	100%	88%	73%	100%	100%	76%
		% Fail	24.4%	0.0%	0.0%	27%	7%	0%	0%	12%	27%	0%	0%	24%
	> 85% of cases?		NO	YES	YES	NO	YES	YES	YES	YES	NO	YES	YES	NO
	GEH Criteria	Count GEH<5	23	38	40	22	25	38	41	25	19	40	40	18
		Count GEH>=5	18	3	1	19	16	3	0	16	22	1	1	23
		Total	41	41	41	41	41	41	41	41	41	41	41	41
		% GEH<5	56.1%	92.7%	97.6%	54%	61%	93%	100%	61%	46%	98%	98%	44%
		% GEH>=5	43.9%	7.3%	2.4%	46%	39%	7%	0%	39%	54%	2%	2%	56%
	> 85% of cases?		NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO

8.1.2 Post

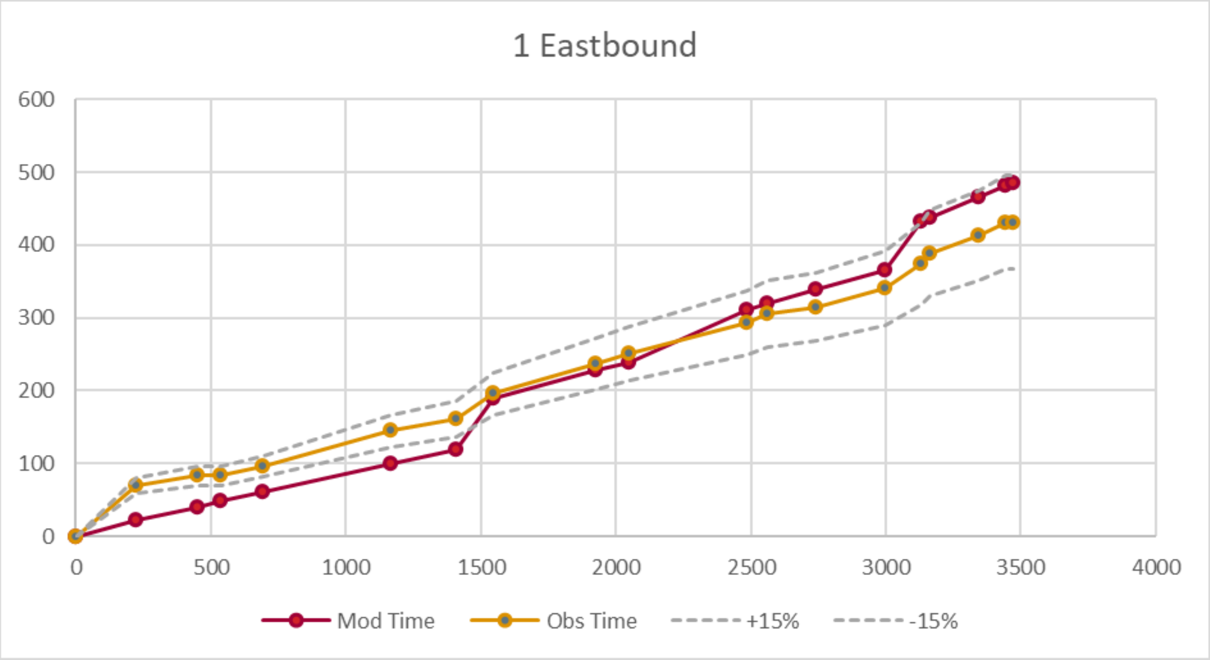
			AMCar	AMLGV	AMHGV	AMTOT	LTCar	LTLGV	LTHGV	LTTOT	PMCar	PMLGV	PMHGV	PMTOT
Links	WebTAG	Count Pass	149	162	162	146	150	162	162	148	154	162	162	154
		Count Fail	13	0	0	18	12	0	0	15	8	0	0	9
		Total	162	162	162	164	162	162	162	163	162	162	162	163
		% Pass	92%	100%	100%	89%	93%	100%	100%	91%	95%	100%	100%	94%
		% Fail	8%	0%	0%	11%	7%	0%	0%	9%	5%	0%	0%	6%
	> 85% of cases?		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
	GEH Criteria	Count GEH<5	145	160	155	143	149	161	159	146	150	161	159	150
		Count GEH>=5	19	4	9	21	15	3	5	18	14	3	5	14
		Total	164	164	164	164	164	164	164	164	164	164	164	164
		% GEH<5	88%	98%	95%	87%	91%	98%	97%	89%	91%	98%	97%	91%
		% GEH>=5	12%	2%	5%	13%	9%	2%	3%	11%	9%	2%	3%	9%
	> 85% of cases?		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Turns			AMCar	AMLGV	AMHGV	AMTOT	LTCar	LTLGV	LTHGV	LTTOT	PMCar	PMLGV	PMHGV	PMTOT
	WebTAG	Count Pass	31	41	41	31	40	41	41	40	36	41	41	36
		Count Fail	10	0	0	10	1	0	0	1	5	0	0	5
		Total	41	41	41	41	41	41	41	41	41	41	41	41
		% Pass	76%	100%	100%	76%	98%	100%	100%	98%	88%	100%	100%	88%
		% Fail	24%	0%	0%	24%	2%	0%	0%	2%	12%	0%	0%	12%
	> 85% of cases?		NO	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES
	GEH Criteria	Count GEH<5	29	38	41	29	34	41	41	35	32	41	41	32
		Count GEH>=5	12	3	0	12	7	0	0	6	9	0	0	9
		Total	41	41	41	41	41	41	41	41	41	41	41	41
		% GEH<5	71%	93%	100%	71%	83%	100%	100%	85%	78%	100%	100%	78%
		% GEH>=5	29%	7%	0%	29%	17%	0%	0%	15%	22%	0%	0%	22%
	> 85% of cases?		NO	YES	YES	NO	NO	YES	YES	YES	NO	YES	YES	NO

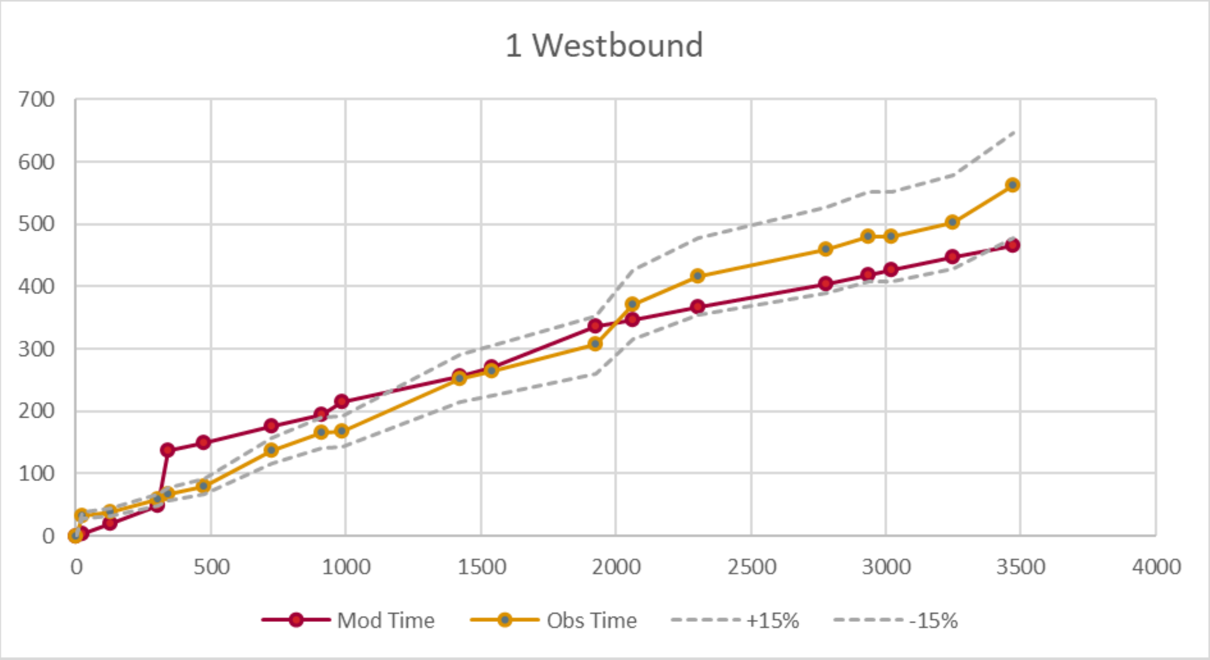
8.2 Flow validation

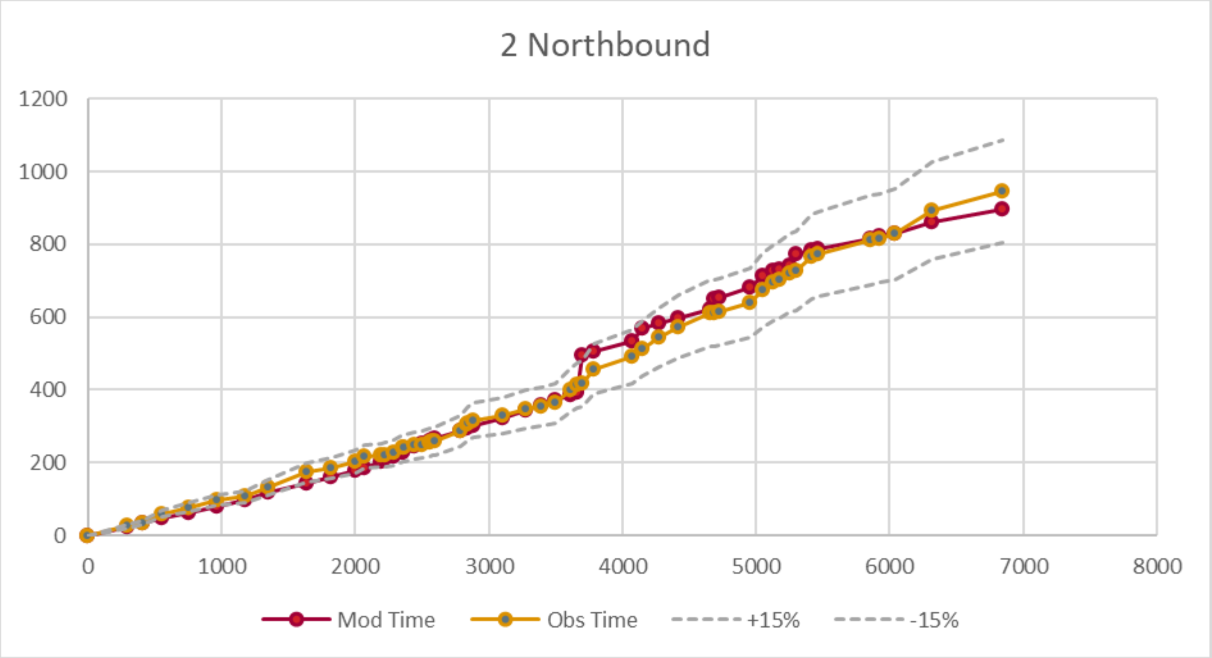
Links			AMCar	AMLGV	AMHGV	AMTOT	LTCar	LTLGV	LTHGV	LTTOT	PMCar	PMLGV	PMHGV	PMTOT
	WebTAG	Count Pass	60	89	89	60	63	89	89	63	60	89	89	61
		Count Fail	29	0	0	29	26	0	0	26	29	0	0	28
		Total	89	89	89	89	89	89	89	89	89	89	89	89
		% Pass	67%	100%	100%	67%	71%	100%	100%	71%	67%	100%	100%	69%
		% Fail	33%	0%	0%	33%	29%	0%	0%	29%	33%	0%	0%	31%
	> 85% of cases?		NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO
	GEH Criteria	Count GEH<5	58	83	74	60	62	83	82	60	56	83	87	55
		Count GEH>=5	31	6	15	29	27	6	7	29	33	6	2	34
		Total	89	89	89	89	89	89	89	89	89	89	89	89
		% GEH<5	65%	93%	83%	67%	70%	93%	92%	67%	63%	93%	98%	62%
		% GEH>=5	35%	7%	17%	33%	30%	7%	8%	33%	37%	7%	2%	38%
	> 85% of cases?		NO	YES	NO	NO	NO	YES	YES	NO	NO	YES	YES	NO
Turns			AMCar	AMLGV	AMHGV	AMTOT	LTCar	LTLGV	LTHGV	LTTOT	PMCar	PMLGV	PMHGV	PMTOT
	WebTAG	Count Pass	61	74	74	58	65	74	74	59	62	74	74	60
		Count Fail	13	0	0	16	9	0	0	15	12	0	0	14
		Total	74	74	74	74	74	74	74	74	74	74	74	74
		% Pass	82%	100%	100%	78%	88%	100%	100%	80%	84%	100%	100%	81%
		% Fail	18%	0%	0%	22%	12%	0%	0%	20%	16%	0%	0%	19%
	> 85% of cases?		NO	YES	YES	NO	YES	YES	YES	NO	NO	YES	YES	NO
	GEH Criteria	Count GEH<5	39	64	68	41	42	69	73	39	40	70	73	41
		Count GEH>=5	35	10	6	33	32	5	1	35	34	4	1	33
		Total	74	74	74	74	74	74	74	74	74	74	74	74
		% GEH<5	52.7%	86.5%	91.9%	55.4%	56.8%	93.2%	98.6%	52.7%	54.1%	94.6%	98.6%	55.4%
		% GEH>=5	47.3%	13.5%	8.1%	44.6%	43.2%	6.8%	1.4%	47.3%	45.9%	5.4%	1.4%	44.6%
	> 85% of cases?		NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO

8.3 Journey Time Validation Charts

8.3.1 AM Peak



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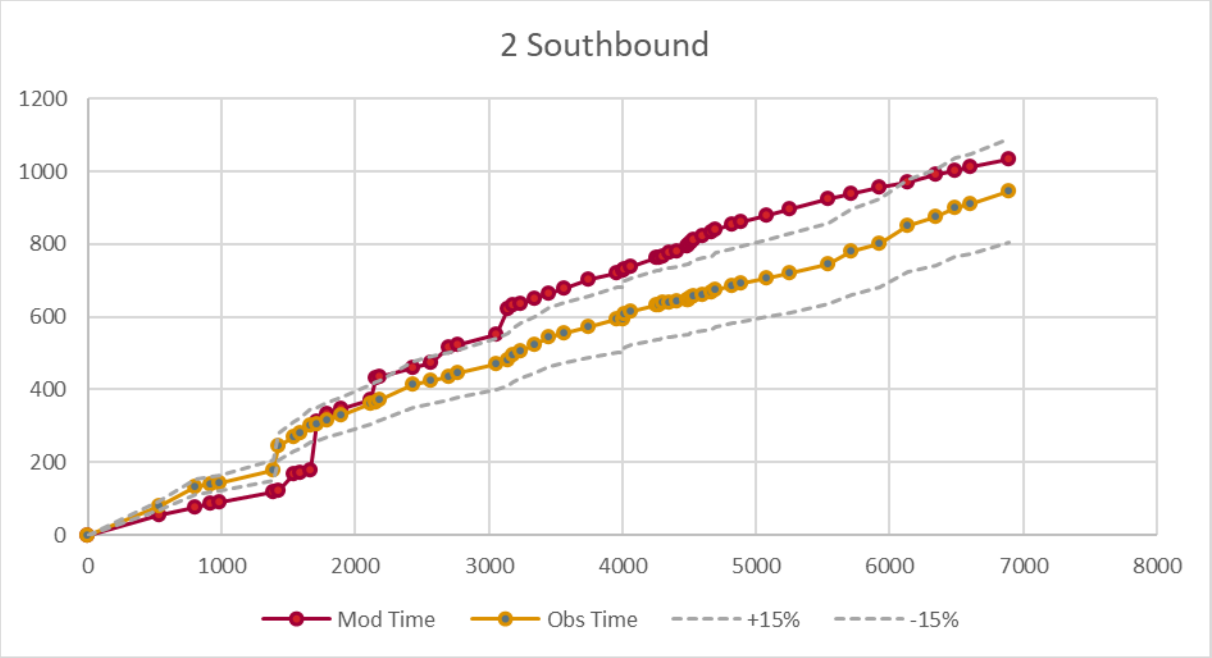
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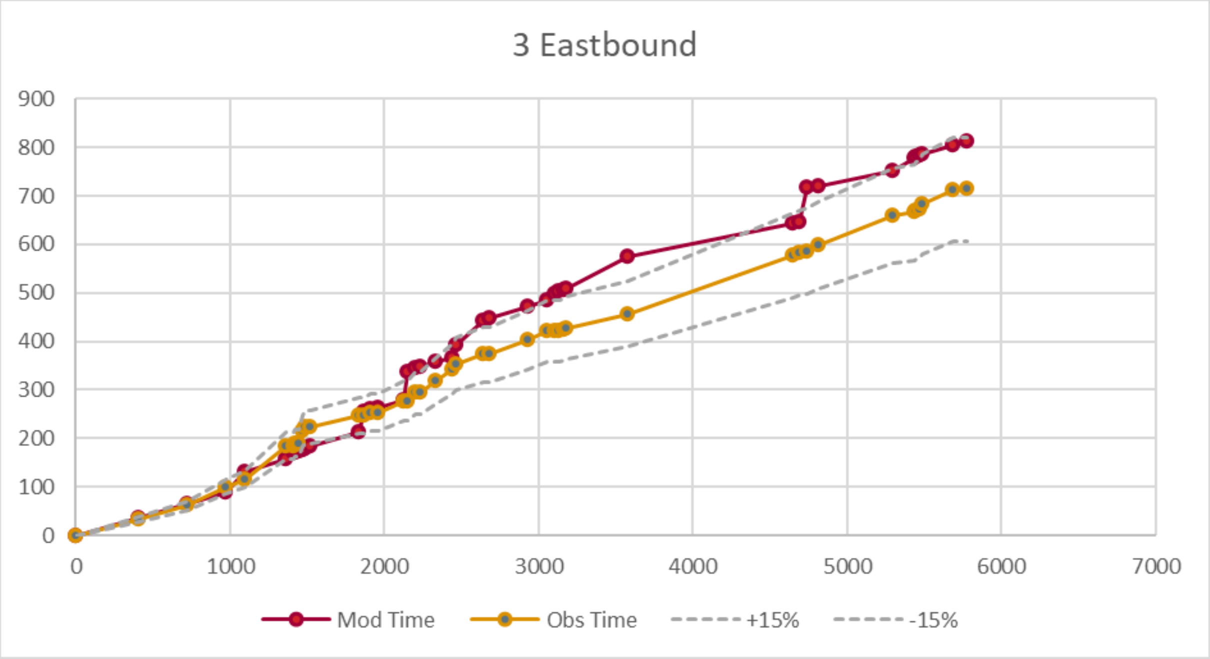
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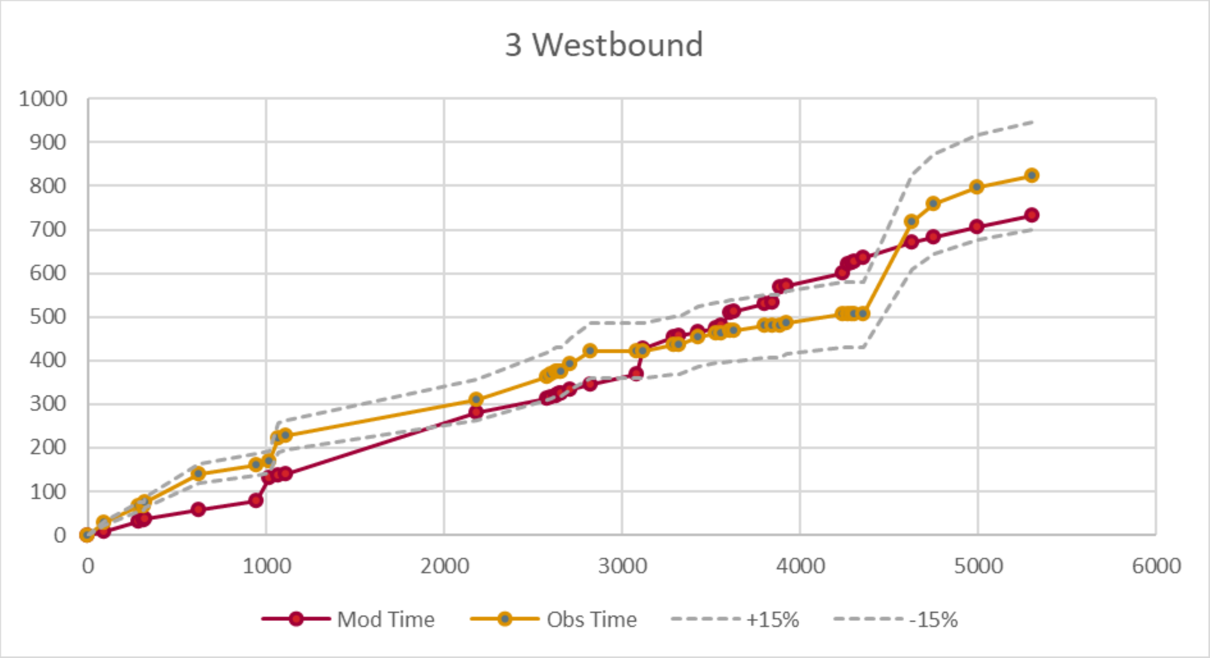
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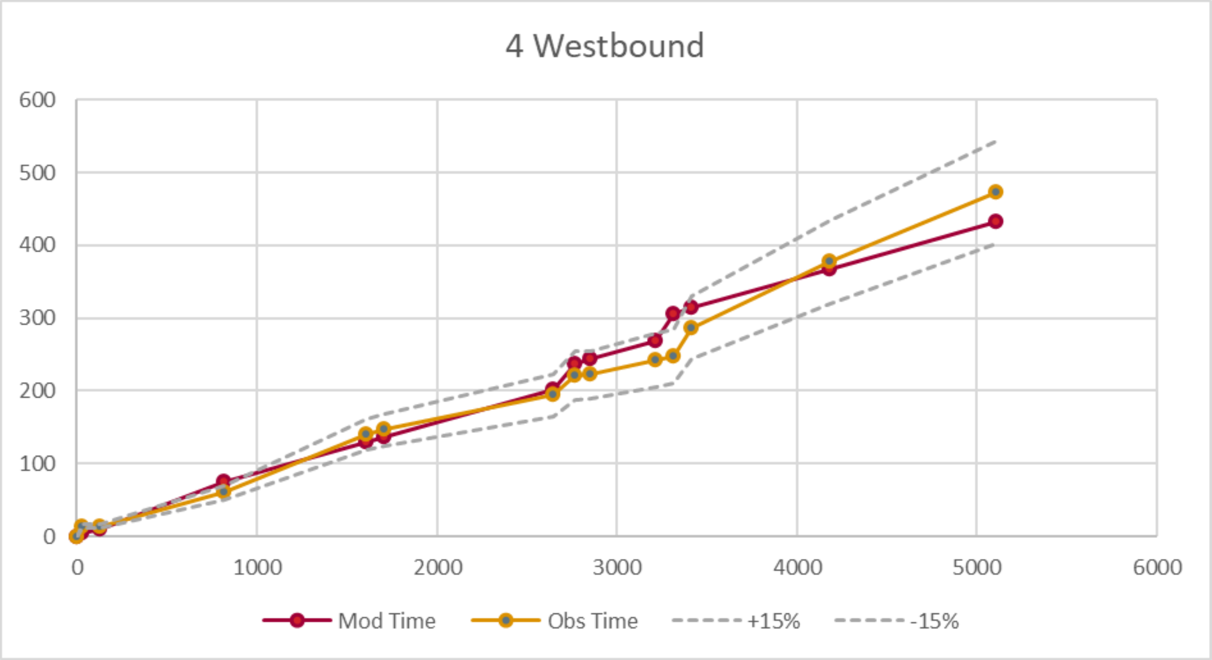
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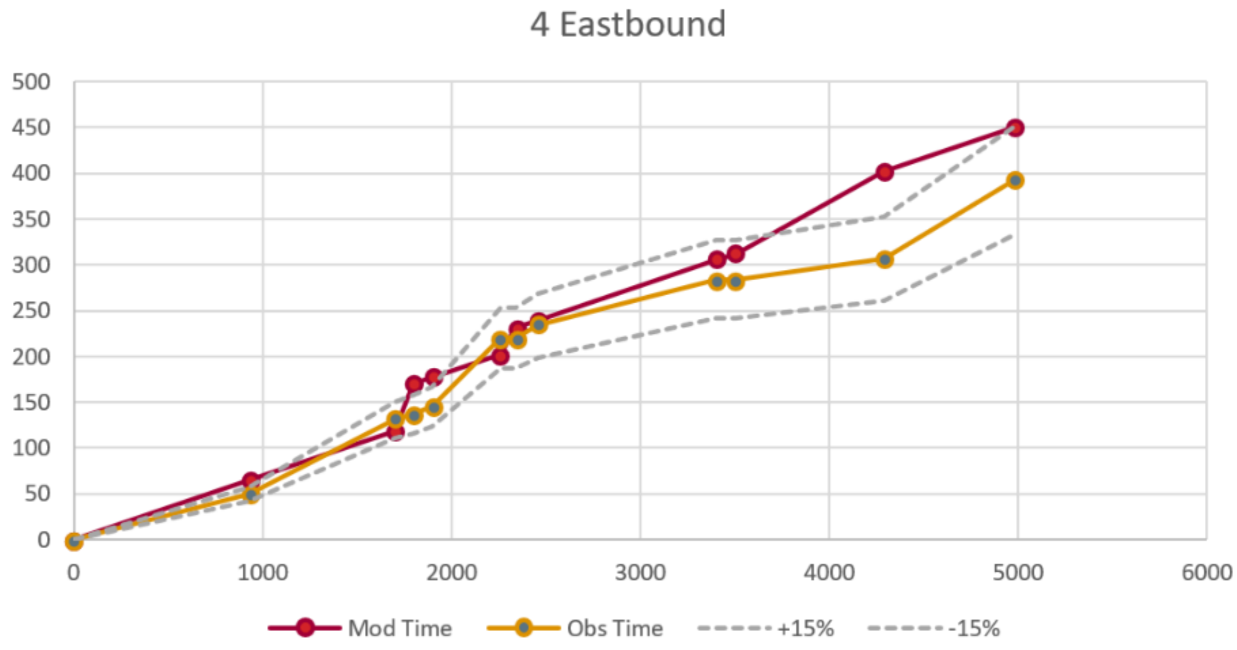
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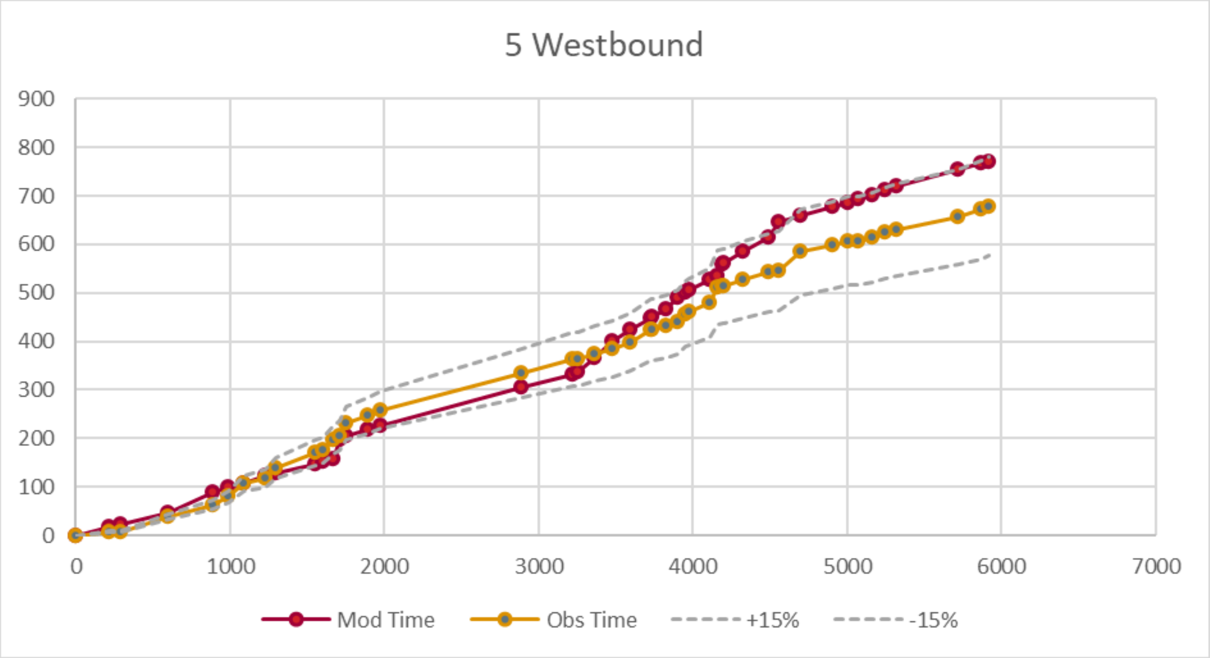
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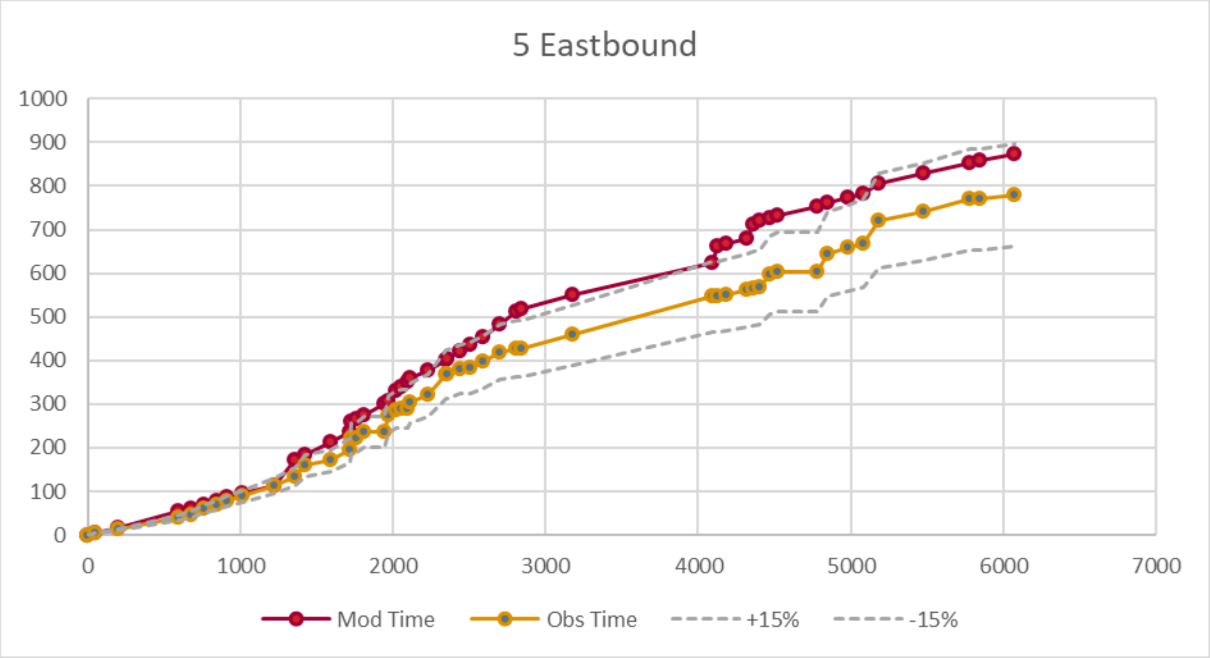
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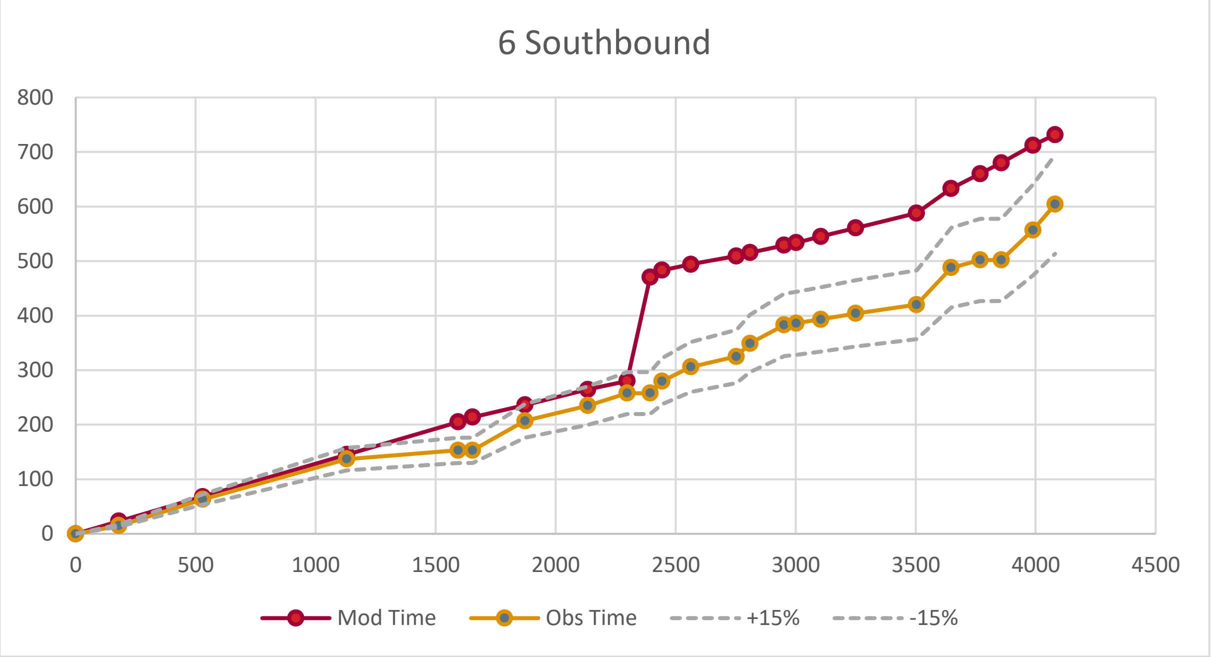
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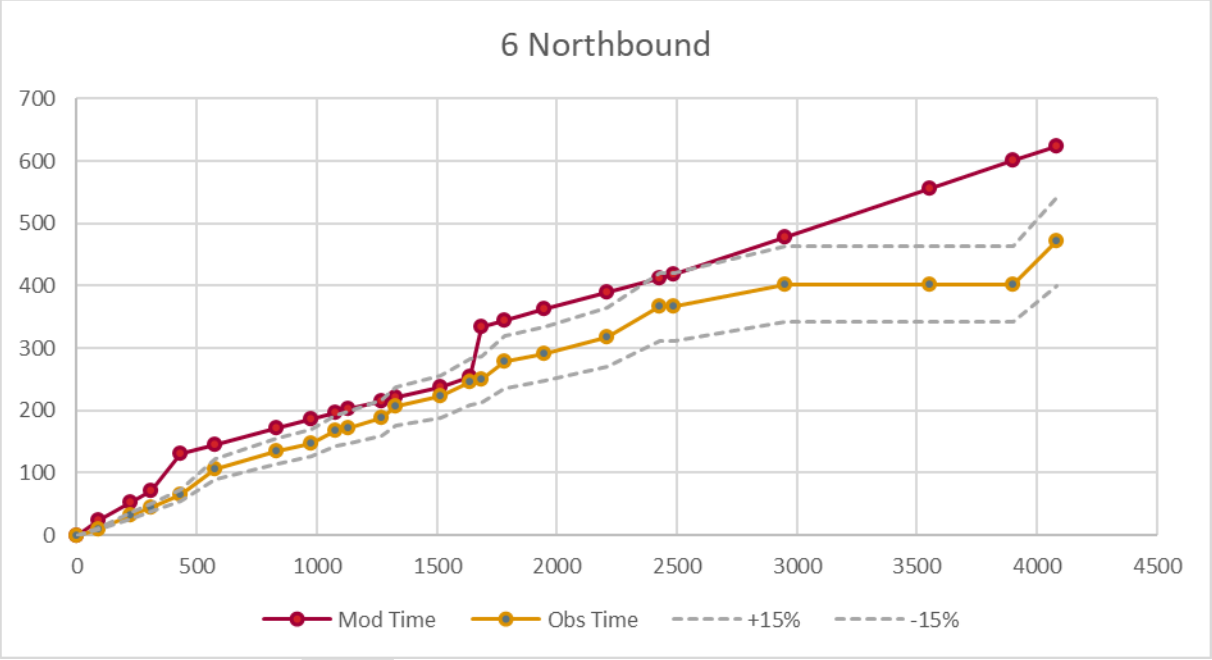
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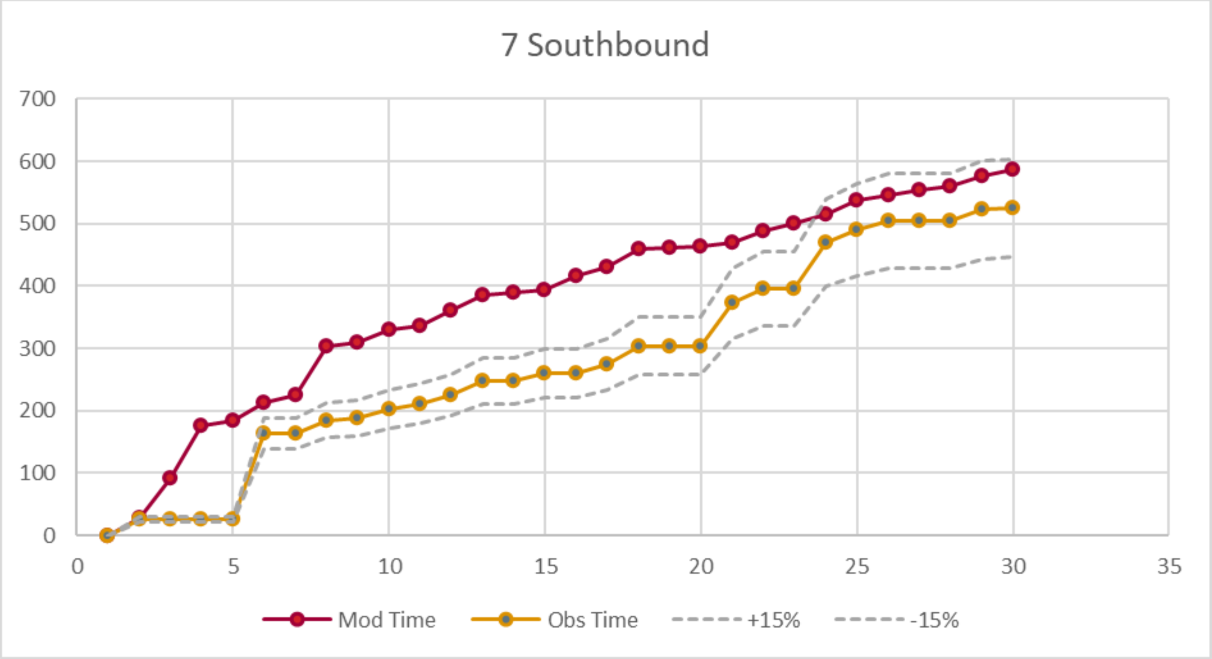
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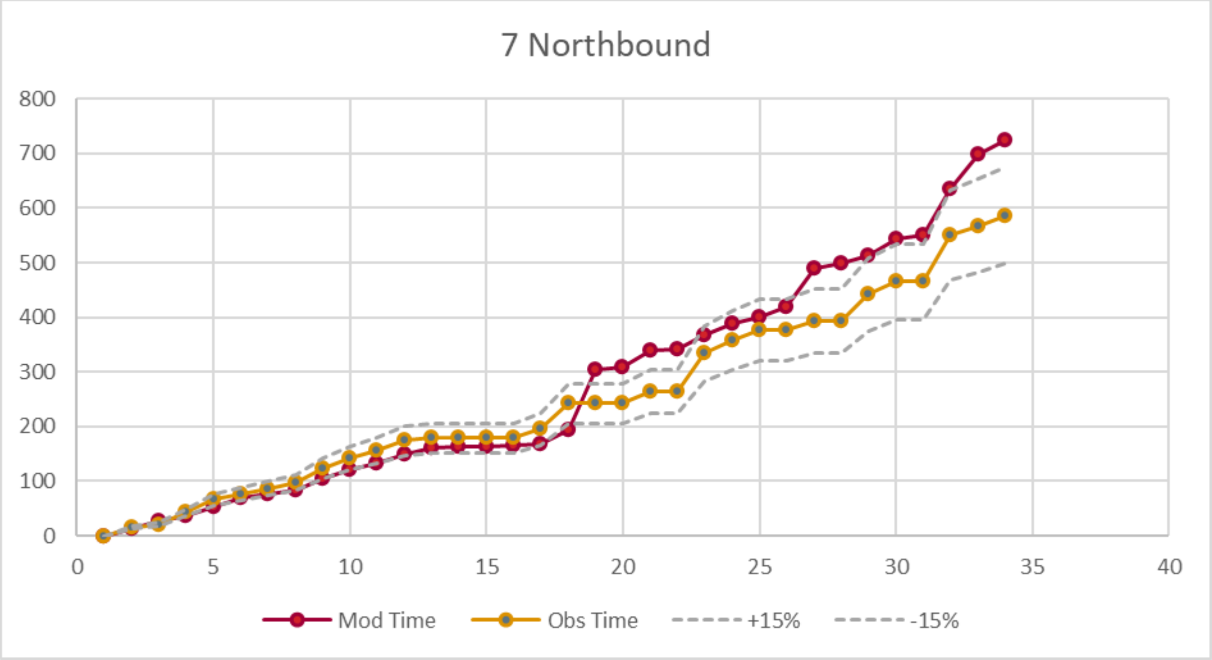
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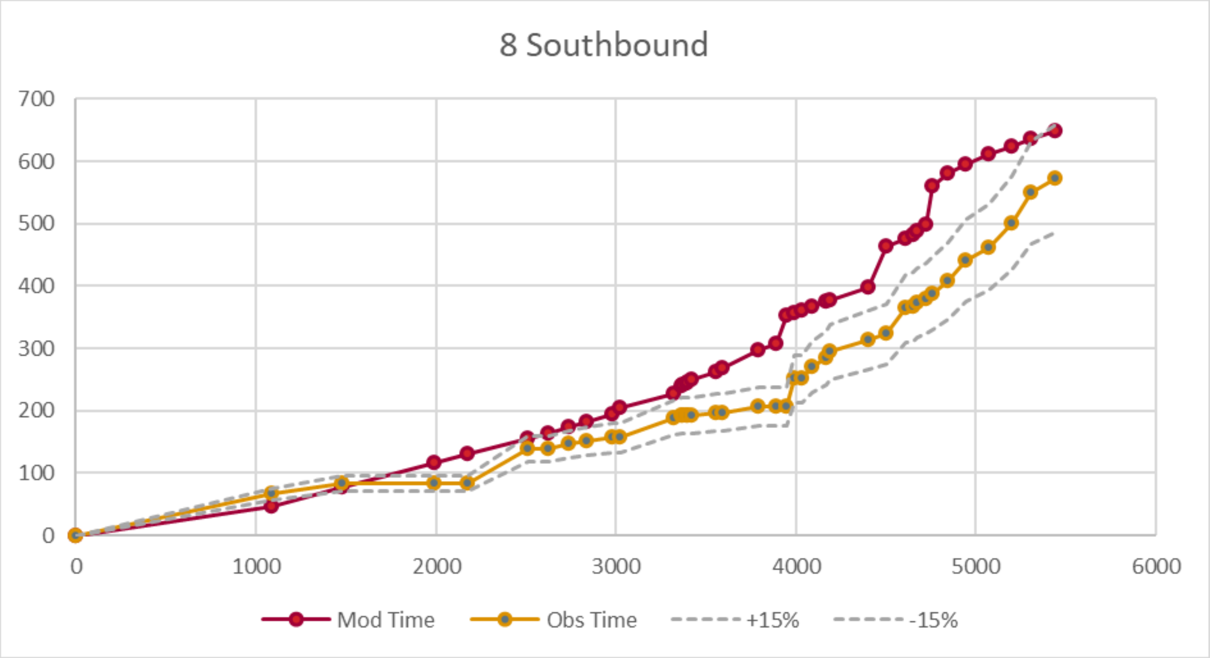
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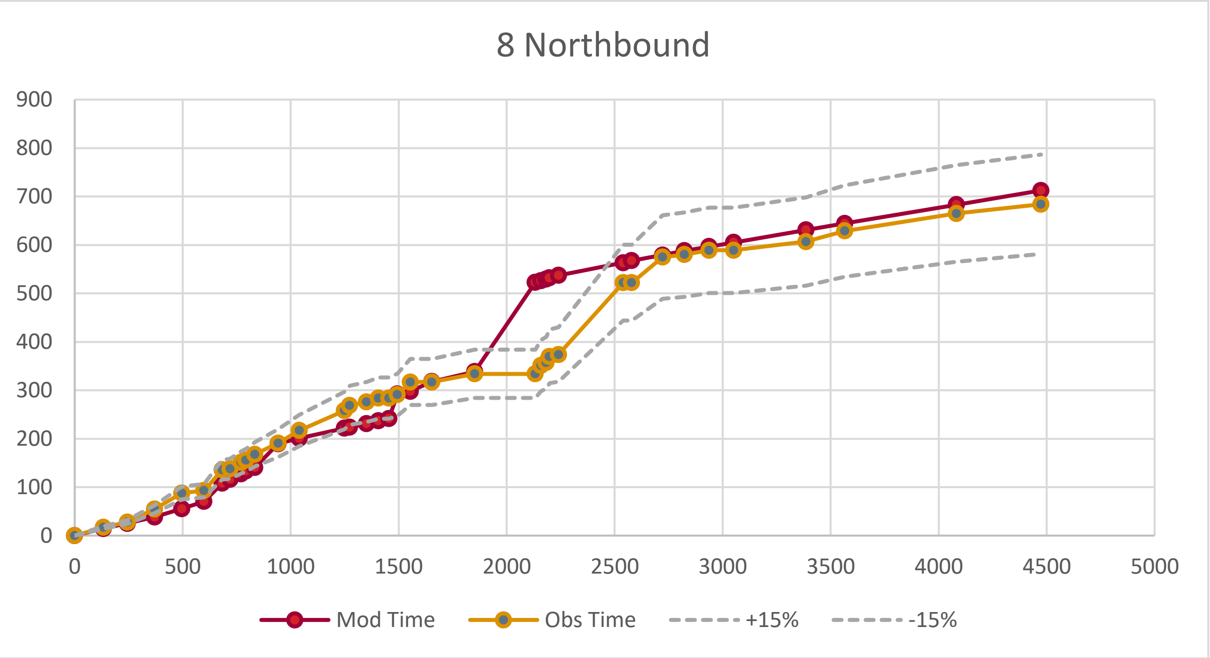
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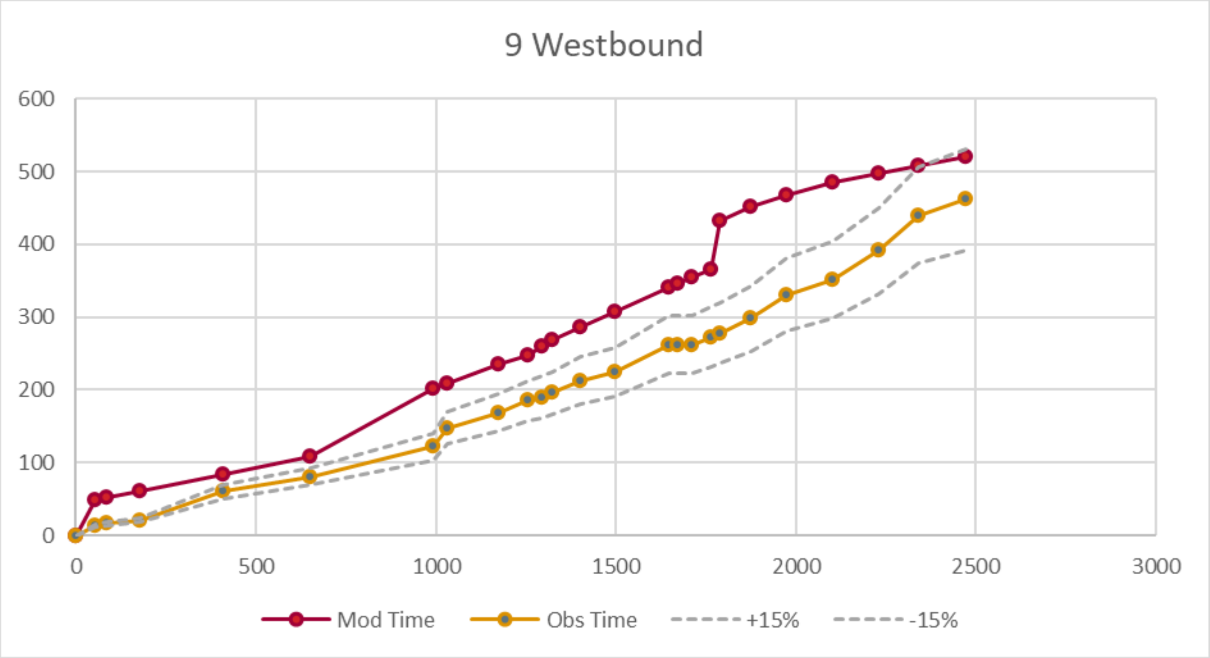
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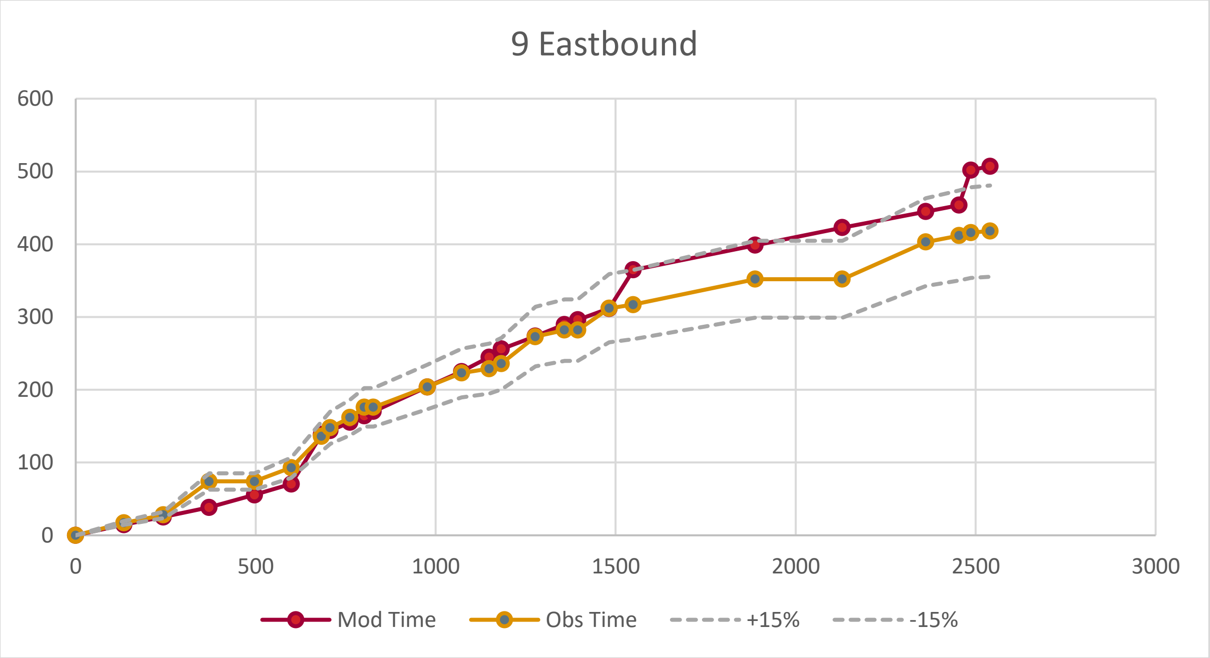
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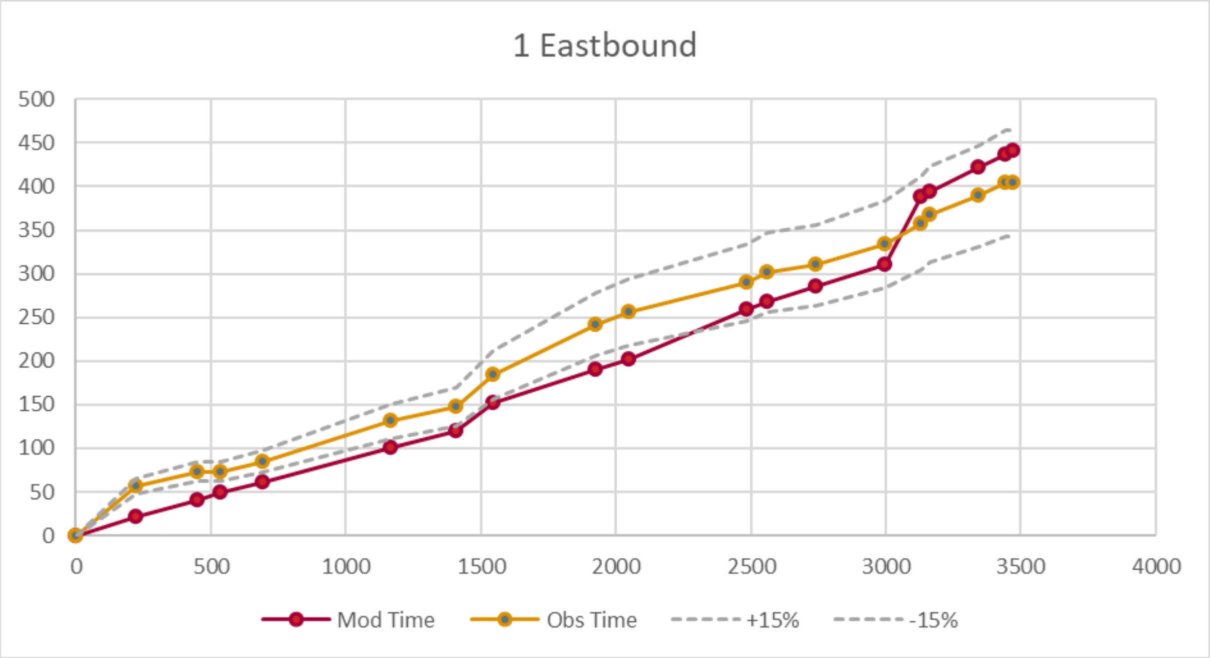
8.3.2 PM Peak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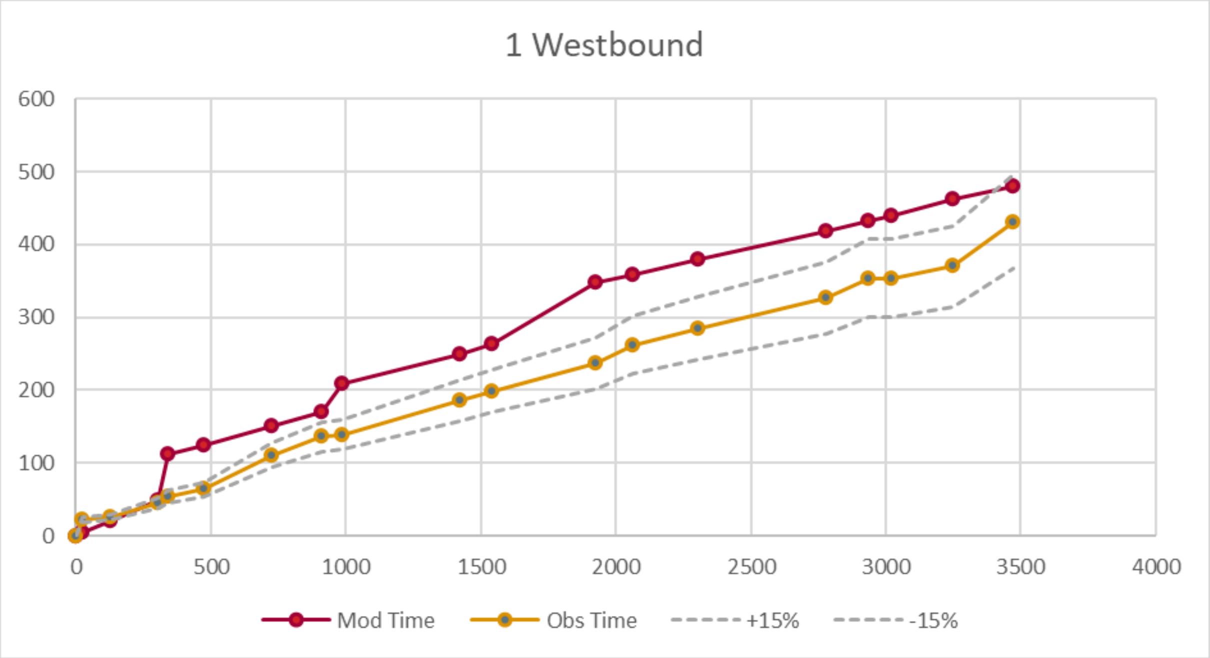
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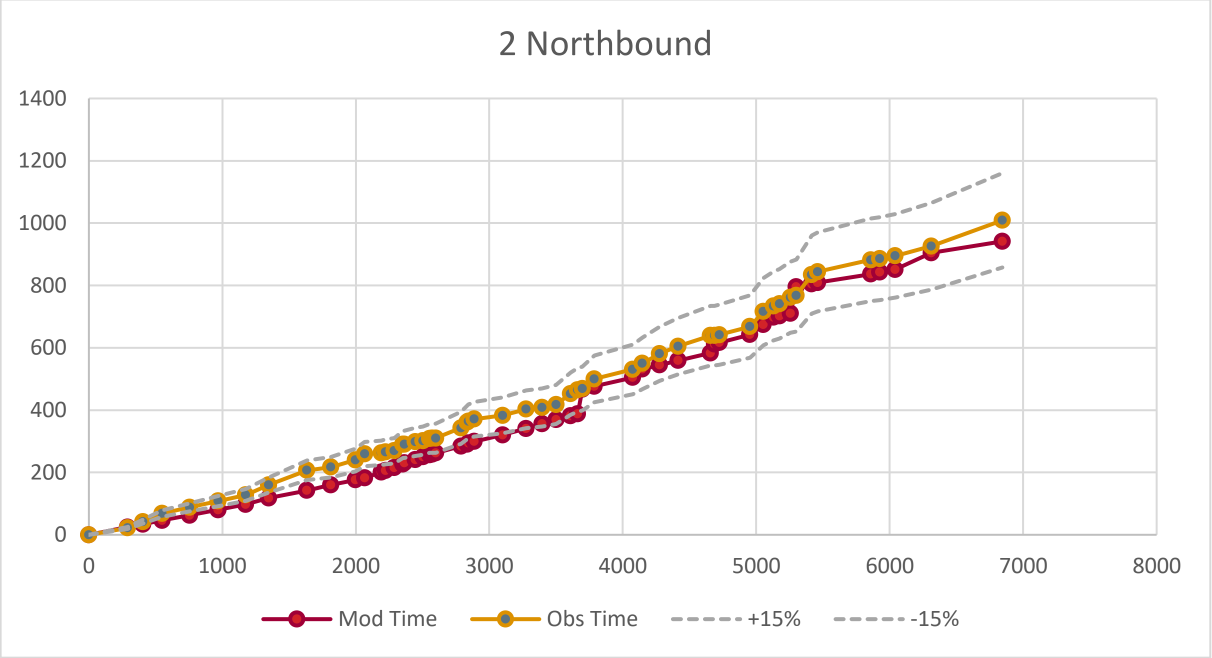
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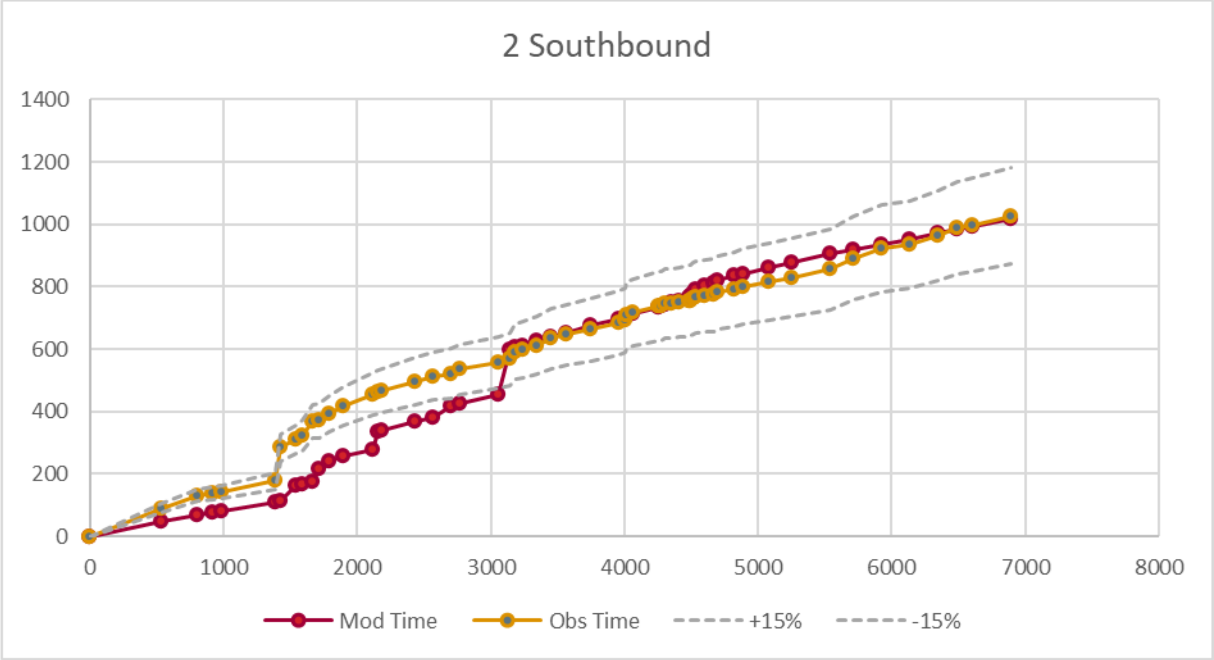
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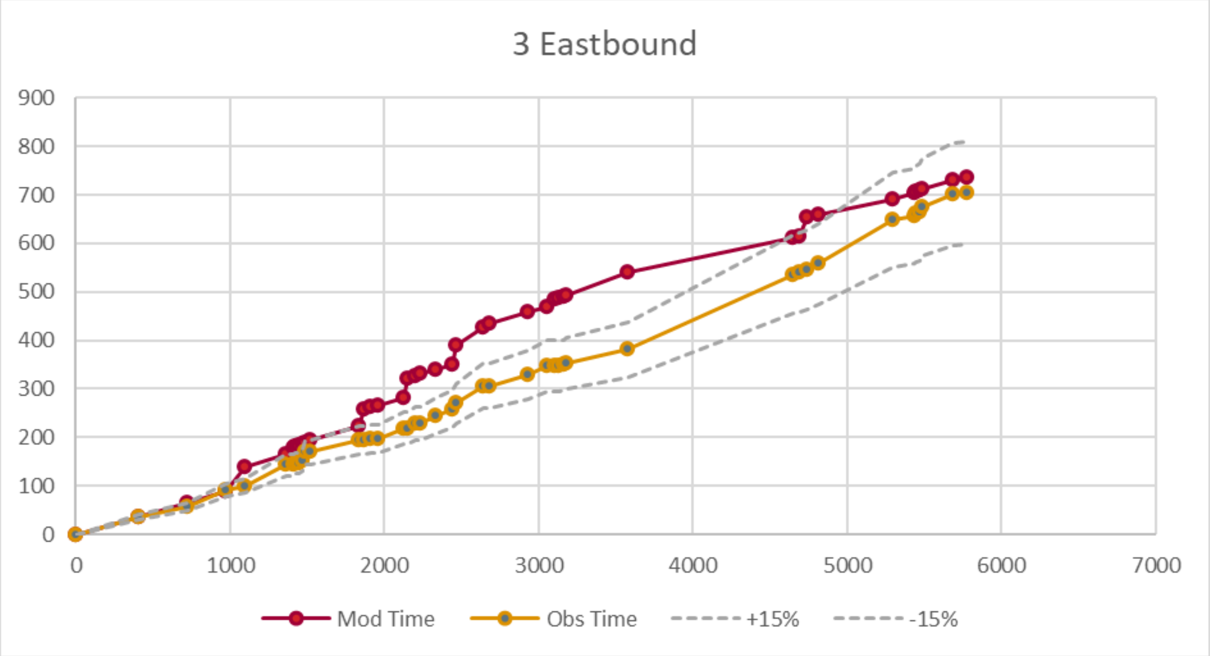
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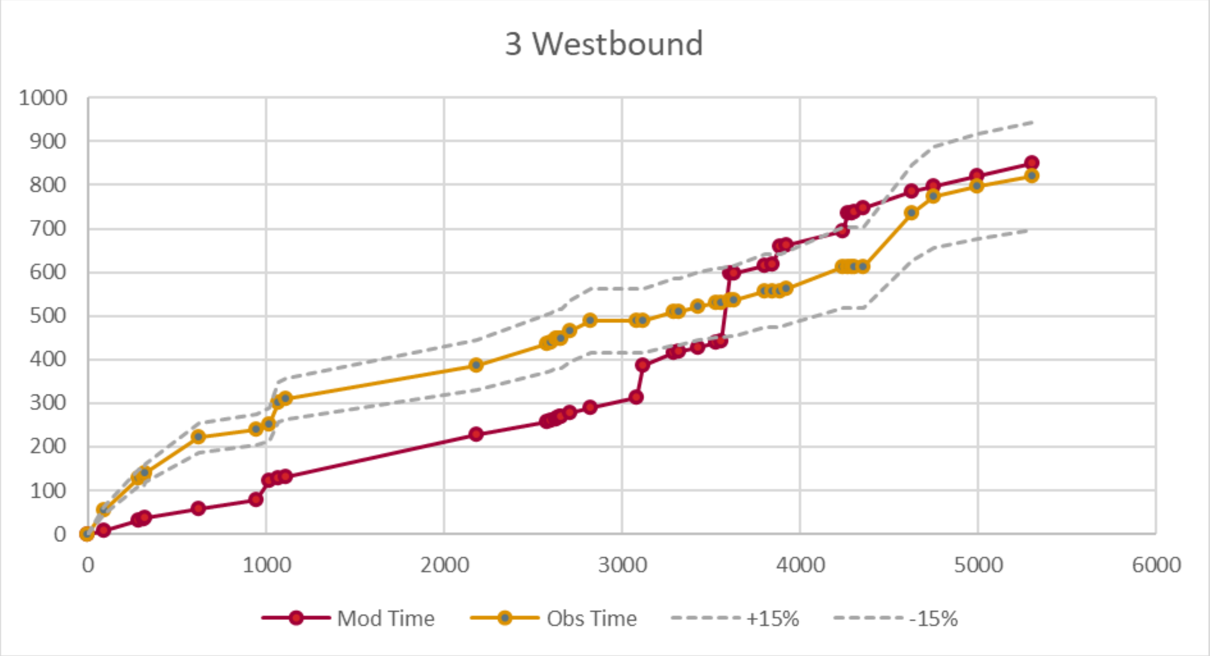
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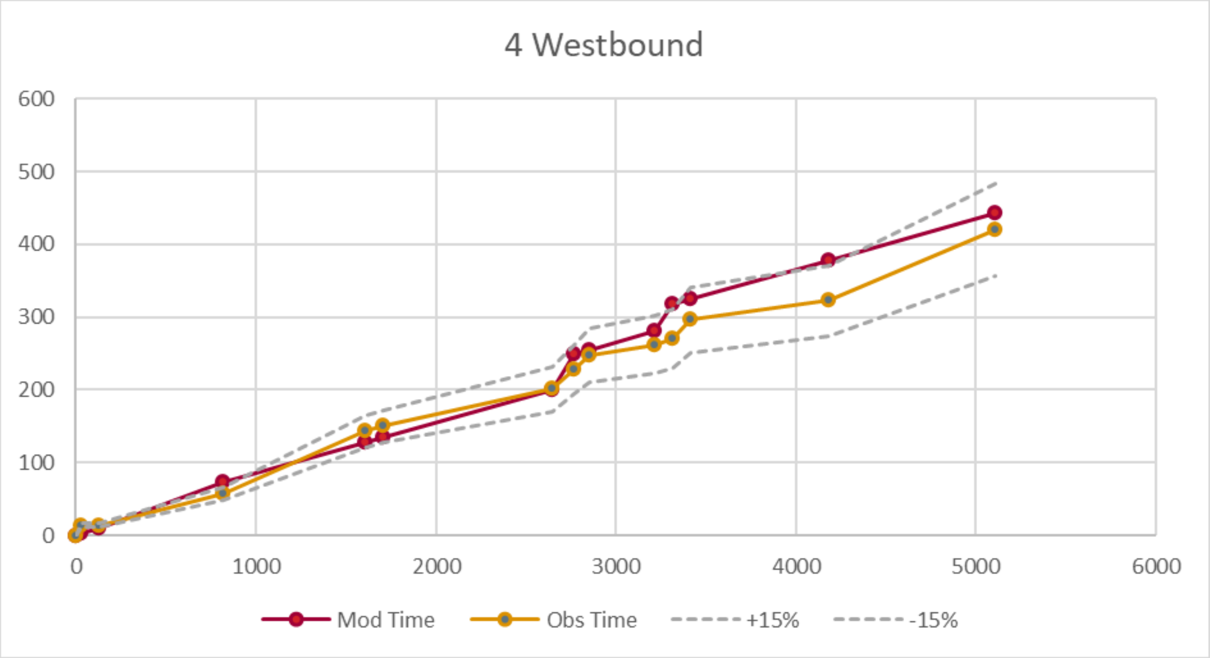
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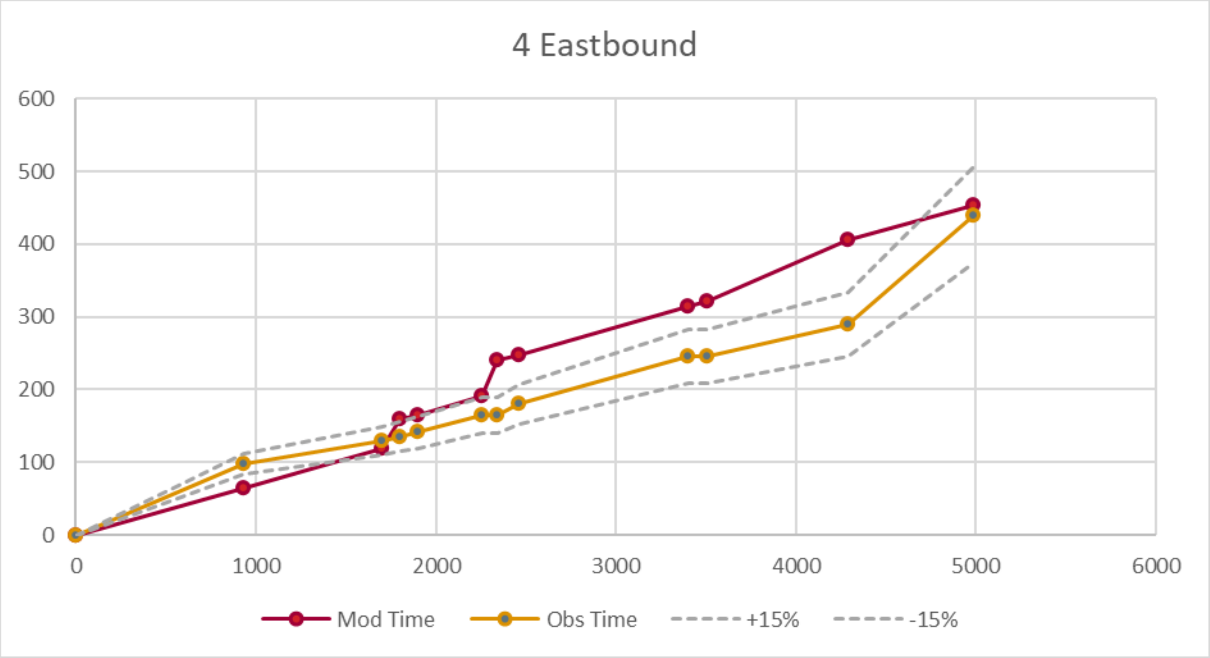
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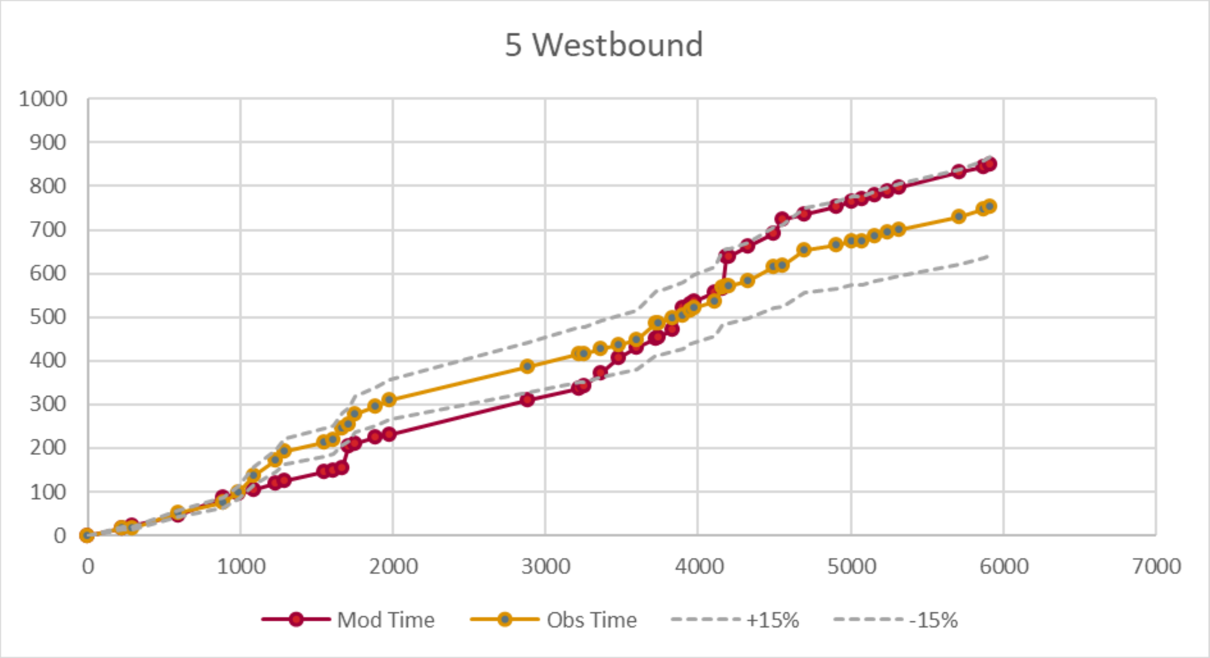
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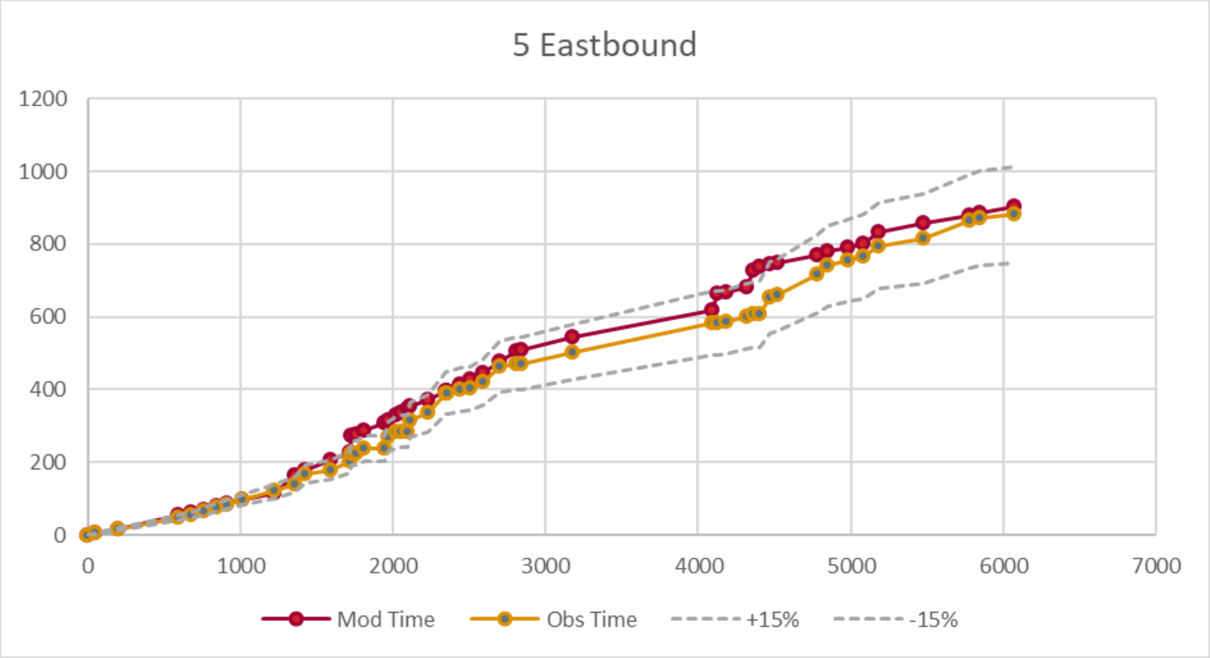
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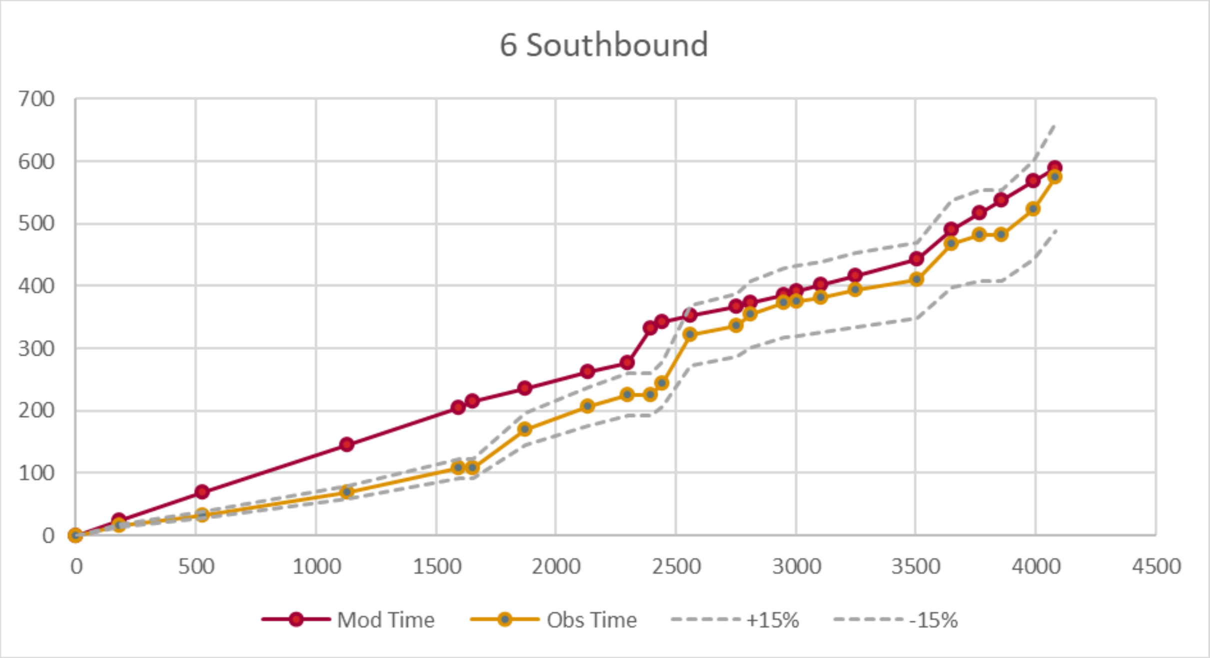
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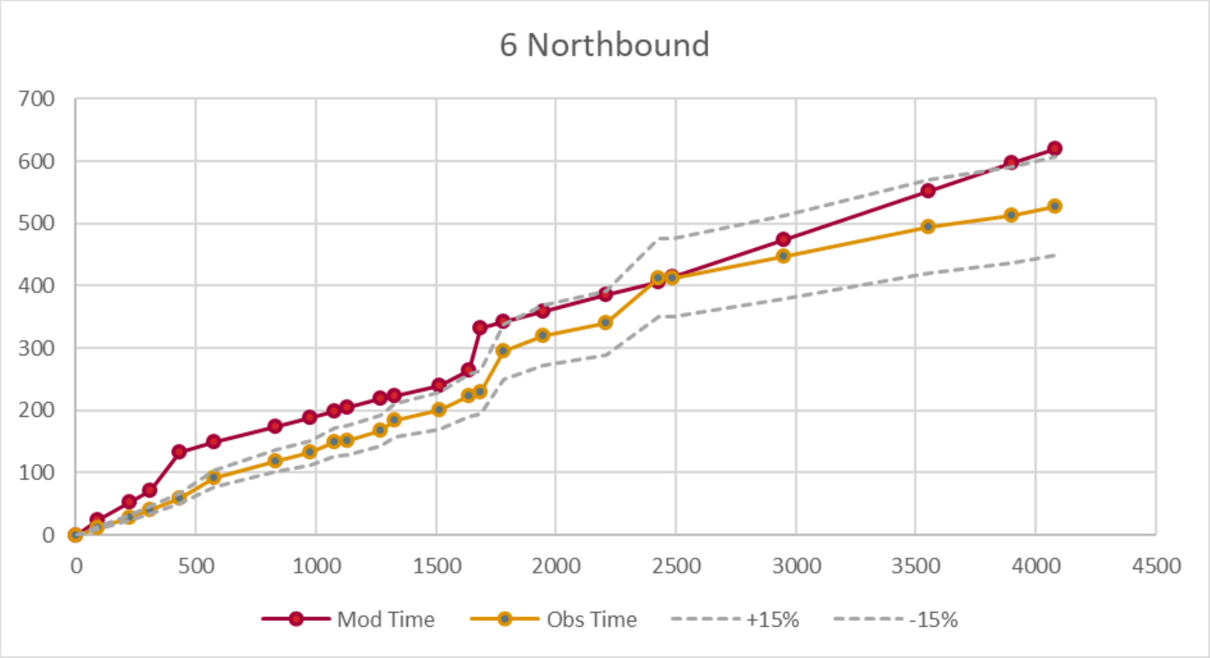
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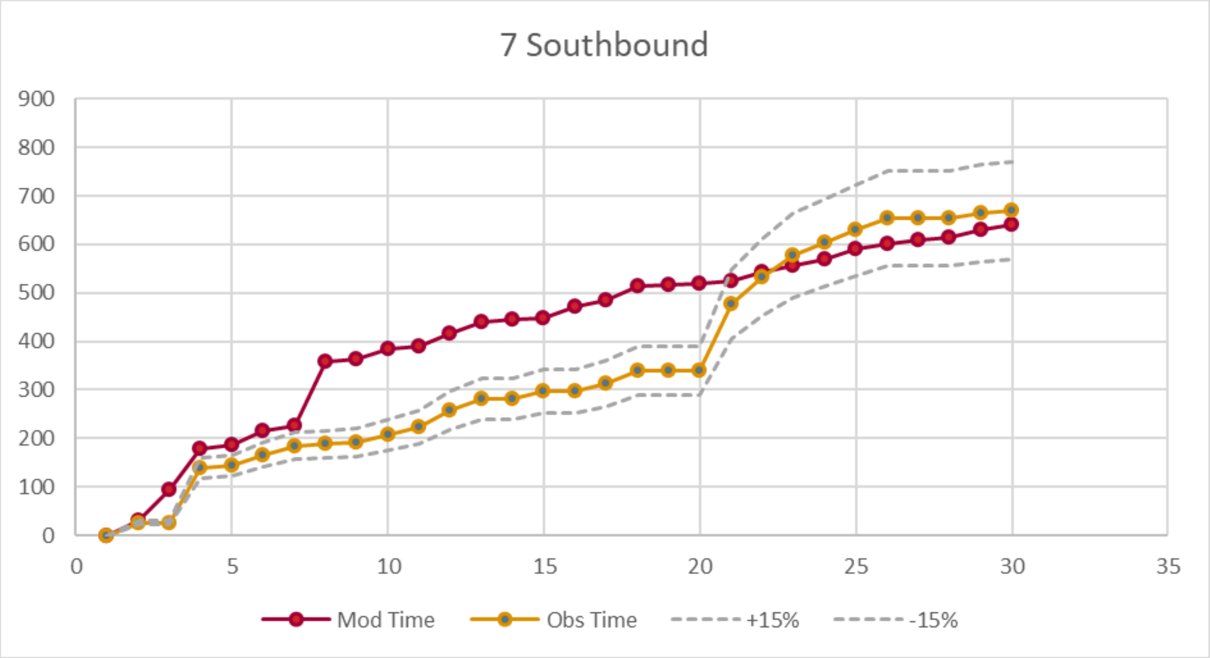
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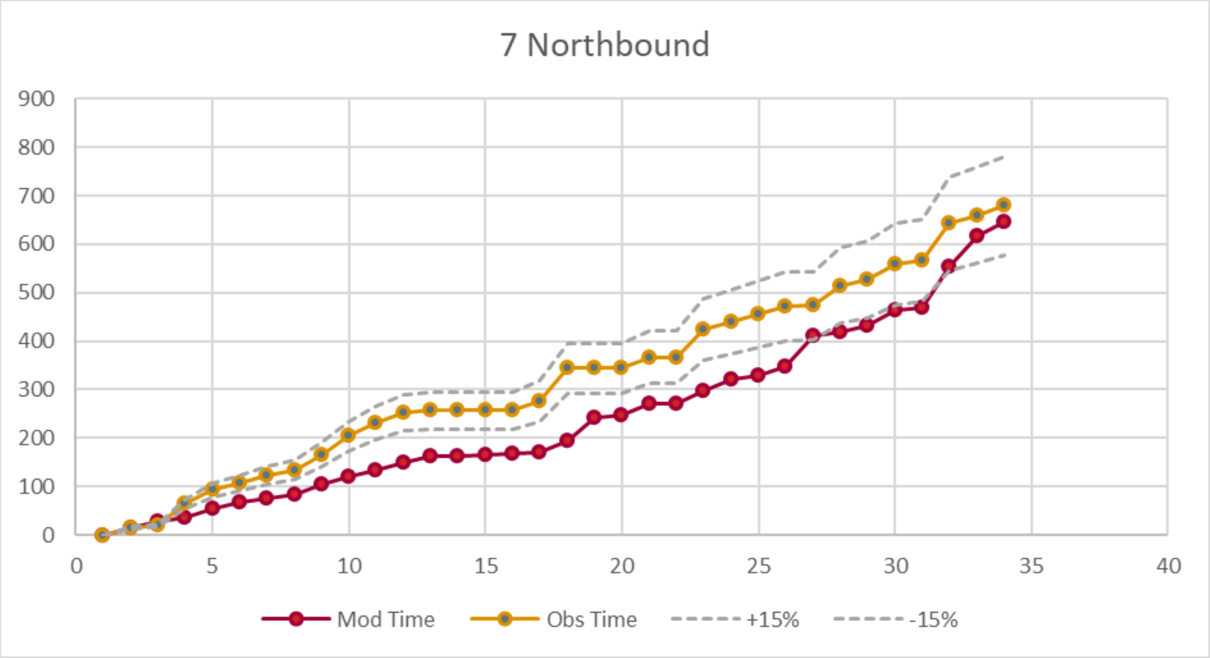
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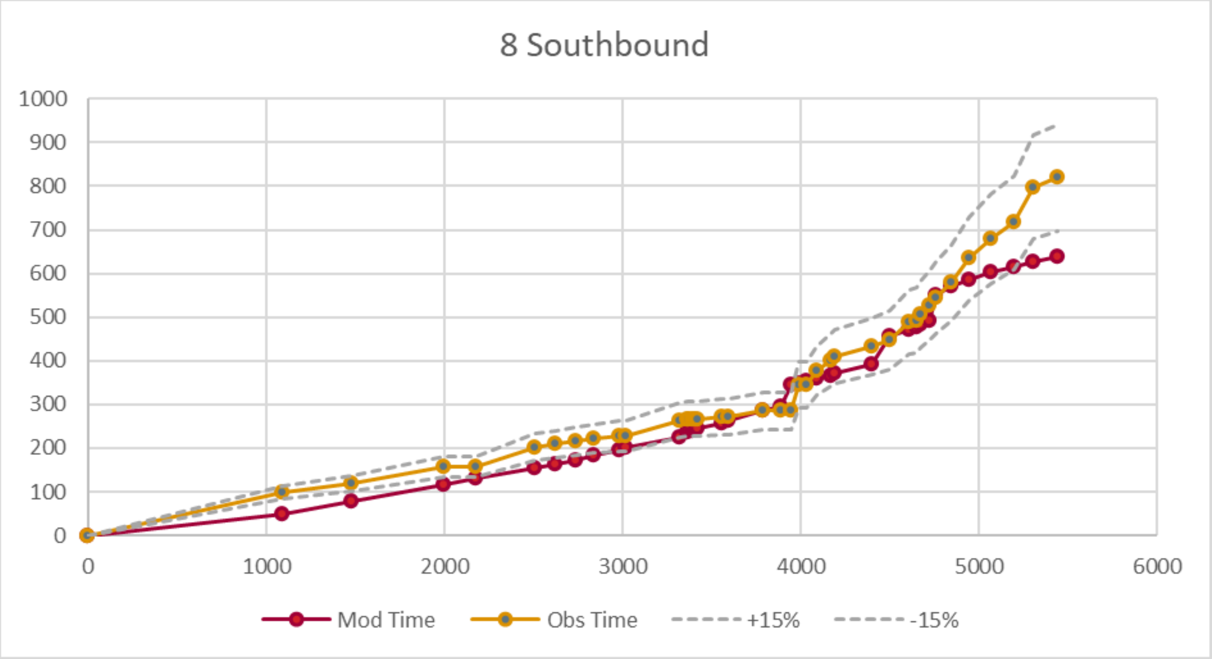
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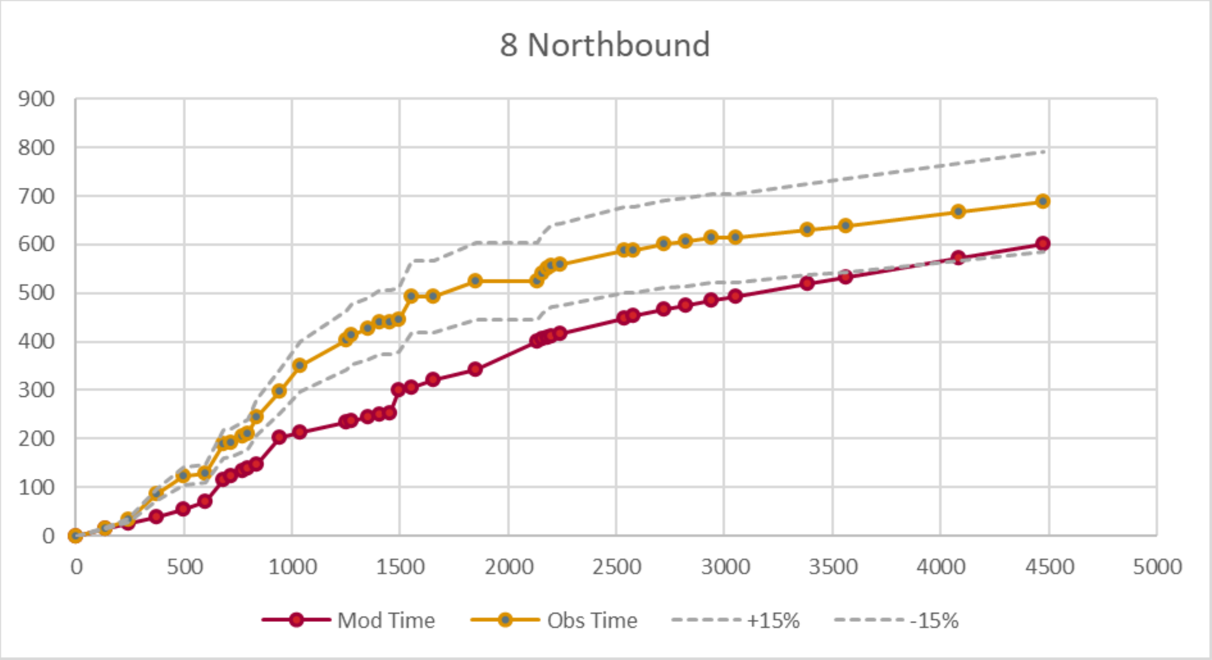
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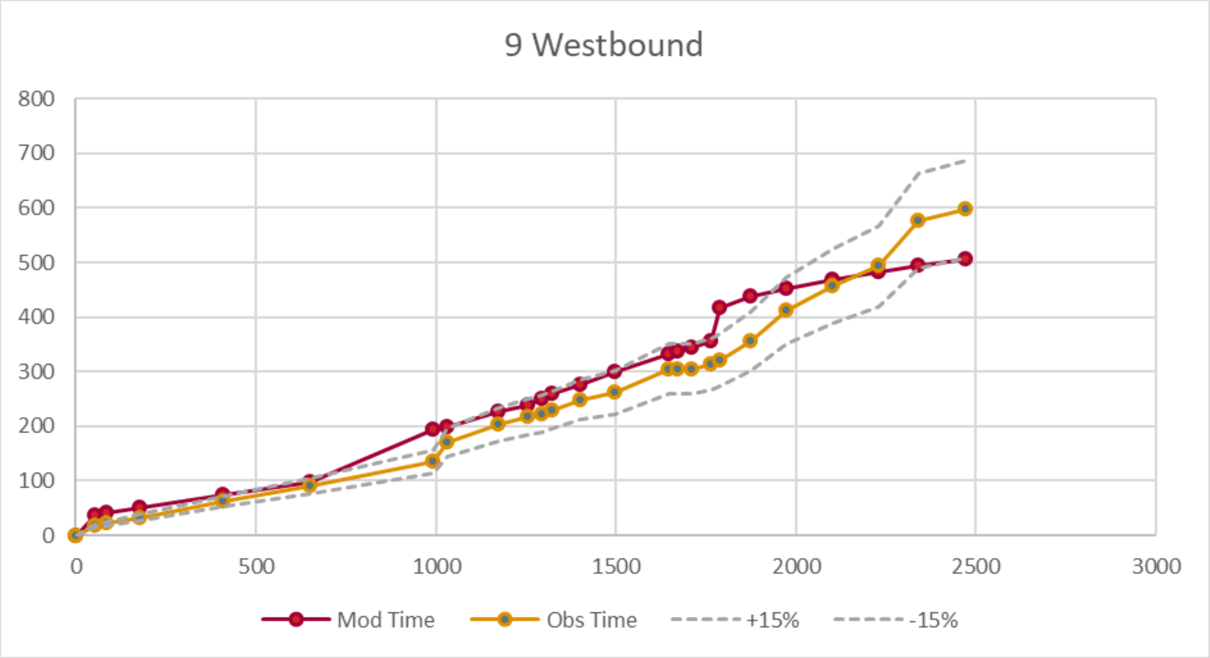
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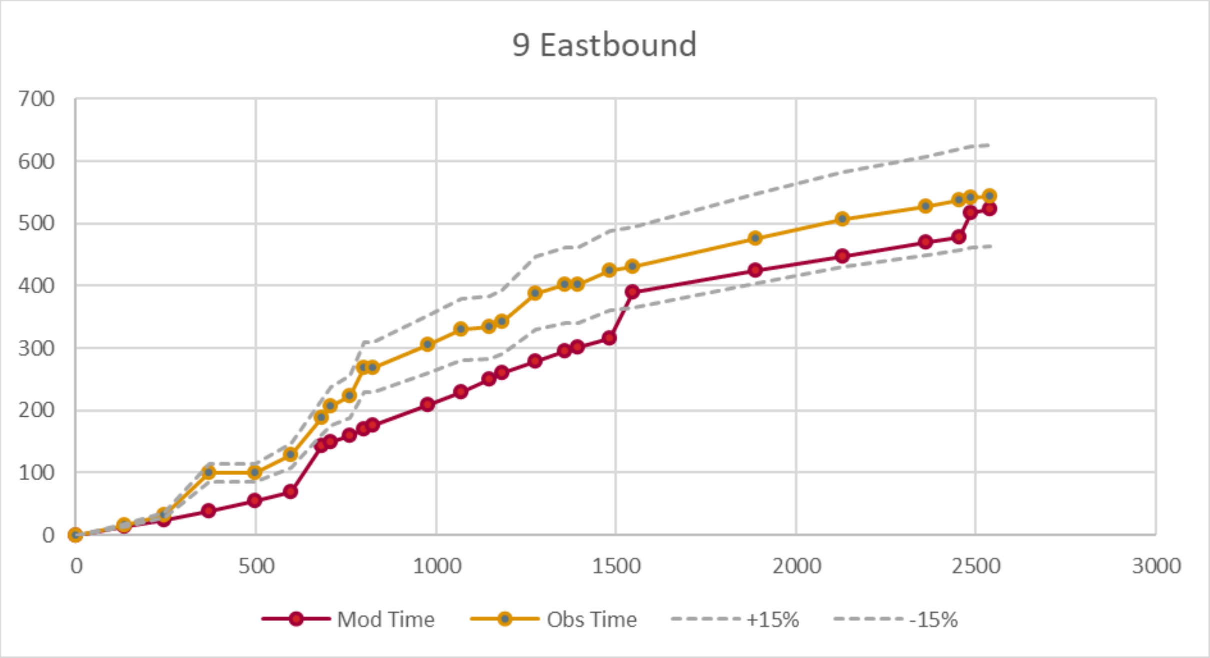
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Galway City Council

BusConnects Galway - Cross City Link

Chapter 6 Traffic and Transport - Appendix 6.2 Impact Assessments

235532-04-03-02

Issue | 12 August 2022

Job number 235532

Ove Arup & Partners Ireland Ltd

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50 Ringsend Road
Dublin 4
D04 T6X0
Ireland
www.arup.com

Contents

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6 Appendix A6.2 Impact Assessments

6.1 Pedestrian Infrastructure

Junctions	**Criteria**	**Do Minimum**		**Do Something**		**Impact**	**Sensitivity**	**Significance of Effect**
		Comment	**Criteria Met**	**Comment**	**Criteria Met**			
Section 1								
University Road / NUIG (southwest to President's Lawn) Uncontrolled JCT	Pedestrian Routing:	Uncontrolled crossing on NUIG arm, no crossings available on University Road	✗	Signalised crossing will be provided on University Road (east) arm alongside raised entry treatment at NUIG arm.	✓	Low	High	Positive Moderate and Long-Term
	Pedestrian Directness:	Crossing is in one stage.	✓	Crossing will be in one stage.	✓			
	Accessibility:	Adequate tactile paving, dropped kerbs and road markings at existing crossing points.	✓	Junction will be raised at NUIG entry and signalised with dropped kerbs at University Road arm. Tactile paving on both arms	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 3m wide. Crossings width is 2m wide.	✓	Existing footpath width to be retained. Crossing width to be provided up to standard.	✓			
	Overall LoS	**3 indicators met**	**B**	**4 indicators met**	**A**			
University Road / Canal Road Upper Uncontrolled JCT	Pedestrian Routing:	No crossings present.	✗	Raised table and crossing will be provided at all arms	✓	High	High	Positive Profound and Long-Term
	Pedestrian Directness:	No crossings present.	✗	Crossing will be in one stage.	✓			
	Accessibility:	No tactile paving or road markings available. Dropped kerbs present.	✗	Junction will be raised with tactile paving	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 2.4m wide. Crossings width is 1.2 wide.	✗	Crossing width to be provided up to standard.	✓			
	Overall LoS	**0 indicators met**	**E**	**4 indicators met**	**A**			
University Road / NUIG (north of Galway	Pedestrian Routing:	No crossings available	✗	Similar to do minimum	✗	Low	High	Positive Moderate

Junctions	Criteria	Do Minimum		Do Something		Impact	Sensitivity	Significance of Effect
		Comment	Criteria Met	Comment	Criteria Met			
Cathedral) Uncontrolled JCT	Pedestrian Directness:	No crossings available	×	Crossing will be in 1 stage.	✓			and Long-Term
	Accessibility:	No tactile paving, dropped kerbs and road markings at existing crossing points. However, the footpath is continuous where pedestrians take the priority.	✓	Junction will be raised with tactile paving	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 2.4m wide.	✓	Similar to do minimum	✓			
	Overall LoS	**2 indicators met**	**C**	**3 indicators met**	**B**			
University Road / Gaol Road Signalised JCT	Pedestrian Routing:	Signalised crossings available on southern arm (Gaol Road) only.	×	Signalised crossing will be retained at University Road and existing southern arm (Gaol Road) will be transformed into pedestrian plaza.	✓	Medium	High	Positive Very Significant and Long-Term
	Pedestrian Directness:	Crossings are in one stage.	✓	Crossings will be in one stage at University Road. Crossings at Gaol Road will be abandoned.	✓			
	Accessibility:	Adequate tactile paving, dropped kerbs and road markings at existing crossing points.	✓	Existing southern arm (Gaol Road) will be transformed into pedestrian plaza, junction north from the Cathedral will be raised and with tactile paving and signalized junction before the bridge will be raised and have tactile paving.	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 2.4m wide on the narrower side. Crossings are 1.6m wide.	×	Fully compliant footpath and crossing widths will be provided.	✓			
	Overall LoS	**2 indicators met**	**C**	**4 indicators met**	**A**			
Gaol Road (Southeast of Galway Cathedral) Uncontrolled JCT	Pedestrian Routing:	No crossings available	×	Non signalised raised entry treatment will be provided at crossing.	×	Medium	Low	Positive Moderate and Long-Term
	Pedestrian Directness:	No crossings available.	×	Crossings will be in one stage	✓			
	Accessibility:	No tactile paving, dropped kerbs and road markings for crossing at the junction.	×	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			

Junctions	Criteria	Do Minimum		Do Something		Impact	Sensitivity	Significance of Effect
		Comment	**Criteria Met**	**Comment**	**Criteria Met**			
	Footpath and Crossing Widths:	Existing footpaths are approximately 3m wide. Crossings width not specified.	×	Kerb will be realigned to provide wider footpaths and improved pedestrian facilities.	✓			
	Overall LoS	**0 indicators met**	**E**	**3 indicators met**	**B**			
Gaol Road (Southwest of Galway Cathedral) Uncontrolled JCT	Pedestrian Routing:	No crossings available	×	Non signalised raised entry treatment will be provided at crossing.	×	Low	Low	Positive Slight and Long-Term
	Pedestrian Directness:	No crossings available	×	Crossings will be staggered in two stages	×			
	Accessibility:	No tactile paving, dropped kerbs and road markings for crossing at the junction.	×	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 3m wide. Crossings width not specified.	×	Splitter island will be provided in the middle of the carriageway. Existing footpath to be set back with fully compliant crossings width.	✓			
	Overall LoS	**0 indicators met**	**E**	**2 indicators met**	**C**			
Section 2								
St Vincent's Avenue / St Francis Street / Courthouse Square Signalised JCT	Pedestrian Routing:	Signalised crossings available on all arms.	✓	Similar to do minimum	✓	Low	High	Positive Moderate and Long-Term
	Pedestrian Directness:	Crossings are in one stage.	✓	Similar to do minimum	✓			
	Accessibility:	Adequate tactile paving, dropped kerbs and road markings at existing crossing points.	✓	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 1.6m wide. Crossings are 2m wide.	×	Junction will be realigned with improved pedestrian facilities	✓			
	Overall LoS	**3 indicators met**	**B**	**4 indicators met**	**A**			
St Francis Street / Dalys Place / Eglinton Street / Mary Street Uncontrolled JCT	Pedestrian Routing:	Crossing points available on all four arms.	✓	Signalised crossing will be available on one arm (St. Vincent's Road), while the junction will be raised with tactile paving.	✓	Medium	High	Positive Very Significant and Long-Term
	Pedestrian Directness:	Crossings are in one stage.	✓	Similar to do minimum	✓			

Junctions	**Criteria**	**Do Minimum**		**Do Something**		**Impact**	**Sensitivity**	**Significance of Effect**
		Comment	**Criteria Met**	**Comment**	**Criteria Met**			
	Accessibility:	Adequate tactile paving, dropped kerbs and road markings at existing crossing points.	✓	Similar to do minimum	✓			
	Footpath and Crossing Widths:	Existing footpaths and crossings are approximately 1.6m wide.	×	Fully compliant footpath and crossing widths will be provided.	✓			
	Overall LoS	**3 indicators met**	**B**	**4 indicators met**	**A**			
Section 3								
Williamsgate Street / Rosemary Avenue/ Eyre Square Uncontrolled JCT & Signalised Crossing (QGIS ID: 21)	Pedestrian Routing:	Signalised crossing available on Williamsgate Street and uncontrolled crossing of Rosemary Avenue.	✓	Existing signalised crossing at Williamsgate Street will be moved to NW exit of Eyre Square and improved.	✓	Negligible	High	Not Significant and Long-Term
	Pedestrian Directness:	Crossings are in one stage	✓	Crossings will be in one stage	✓			
	Accessibility:	Adequate tactile paving, dropped kerbs and road markings at existing crossing points.	✓	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths and crossings are approximately 3m wide.	✓	Similar geometry to DoMinimum.	✓			
	Overall LoS	**4 indicators met**	**A**	**4 indicators met**	**A**			
Eyre Square / Forster Street / Station Road / Frenchville Lane Signalised JCT (QGIS ID: 24)	Pedestrian Routing:	Signalised crossing available on eastern, western and northern arms	×	Signalised crossing available on all arms.	✓	High	High	Profound and Long-Term
	Pedestrian Directness:	Crossings are in one stage	✓	Crossings will be in one stage	✓			
	Accessibility:	Adequate tactile paving, dropped kerbs present but inadequate road markings at existing crossing point on Frenchville Lane.	×	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 2m wide. Crossings are 1.2m wide on southern arm.	×	New geometry to be fully compliant with design standard.	✓			
	Overall LoS	**1 indicator met**	**D**	**4 indicators met**	**A**			
Eyre Square / Victoria Place	Pedestrian Routing:	Signalised crossing available on two arms	×	Same as DoMinimum	×	Negligible	Medium	Not Significant and Long-Term
	Pedestrian Directness:	Crossings are in one stage	✓	Same as DoMinimum	✓			

Junctions	Criteria	Do Minimum		Do Something		Impact	Sensitivity	Significance of Effect
		Comment	Criteria Met	Comment	Criteria Met			
	Accessibility:	Adequate tactile paving, dropped kerbs and road markings at existing crossing points.	×	Same as DoMinimum	×			
	Footpath and Crossing Widths:	Existing footpaths and crossings are approximately 2.4m wide.	✓	Same as DoMinimum	✓			
	Overall LoS	**2 indicators met**	**C**	**2 indicators met**	**C**			
Eyre Square / Prospect Hill Signalised JCT	Pedestrian Routing:	Signalised crossing available on all arms.	✓	Signalised crossing available on all arms.	✓	Low	High	Positive Moderate and Long-Term
	Pedestrian Directness:	Crossings are staggered in two stages on all arms.	×	Crossings will be in one stage	✓			
	Accessibility:	Adequate tactile paving, dropped kerbs and road markings at existing crossing points.	✓	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths and crossings are approximately 2.4m wide.	✓	Kerb will be realigned to provide wider footpaths and improved pedestrian facilities.	✓			
	Overall LoS	**3 indicators met**	**B**	**4 indicators met**	**A**			
Section 5								
College Road / Loyola Park / Lough Atalia Road Signalised JCT	Pedestrian Routing:	Signalised crossing on College Road and Lough Atalia Road, no crossings available on Loyola Park	×	The junction will be rationalised and a separate priority controlled junction links to Loyola Park. Signalised crossing available on both arms.	✓	Medium	Low	Positive Moderate and Long-Term
	Pedestrian Directness:	Crossings are staggered in two to three stages.	×	Crossings are in one stage	✓			
	Accessibility:	Adequate tactile paving, dropped kerbs and road markings at existing crossing points.	✓	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths and crossings are approximately 2m wide.	✓	New geometry to be fully compliant with design standard.	✓			
	Overall LoS	**2 indicators met**	**C**	**4 indicators met**	**A**			
Section 6								
College Road / Moneenageisha Road / Wellpark Road / Old Dublin Road Signalised JCT	Pedestrian Routing:	Signalised crossing on all arms	✓	Signalised crossing on all arms	✓	Negligible	Low	Not Significant and Long-Term
	Pedestrian Directness:	Crossings are staggered in two stages on Moneenageisha Road and three stages on other arms.	×	Crossings are staggered in two stages on all arms.	×			

Junctions	**Criteria**	**Do Minimum**		**Do Something**		**Impact**	**Sensitivity**	**Significance of Effect**
		Comment	**Criteria Met**	**Comment**	**Criteria Met**			
	Accessibility:	Adequate tactile paving, dropped kerbs and road markings at existing crossing points.	✓	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths and crossings are approximately 2.4m wide.	✓	New geometry to be fully compliant with design standard.	✓			
	Overall LoS	**3 indicators met**	**B**	**3 indicators met**	**B**			
Old Dublin Road / Sáilín Uncontrolled JCT	Pedestrian Routing:	Uncontrolled crossing on Sáilín arm, no crossings available on Old Dublin Road	✗	Toucan crossing available on Old Dublin Road and raised entry treatment with tactile paving available on Sáilín	✓	High	High	Positive Profound and Long-Term
	Pedestrian Directness:	Crossings are staggered in two stages due to presence of island	✗	Crossings are in one stage on Old Dublin Road and staggered in two stages on Sáilín	✓			
	Accessibility:	Tactile paving and dropped kerbs present. No road markings at existing crossing points on Sáilín.	✗	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 2m wide. Crossings are 1.6m wide.	✓	New geometry to be fully compliant with design standard.	✓			
	Overall LoS	**1 indicator met**	**D**	**4 indicators met**	**A**			
Section 8								
Prospect Hill / Bóthar Bhreandain Uí Eithir Uncontrolled JCT	Pedestrian Routing:	Uncontrolled crossing provided on all arms.	✓	Signalised crossing will be available on all arms.	✓	Low	Medium	Positive Moderate and Long-Term
	Pedestrian Directness:	Crossings are staggered in two stages due to presence of an island.	✗	Crossings will be in one stage on all arms.	✓			
	Accessibility:	Tactile paving and dropped kerbs present and road markings present on all arms.	✓	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 2m wide.	✓	Existing footpath width to be retained. Crossing width to be provided up to standard.	✓			
	Overall LoS	**3 indicators met**	**B**	**4 indicators met**	**A**			
Bóthar Bhreandain Uí Eithir / Forster Street /	Pedestrian Routing:	Signalised crossing available on all arms.	✓	Similar to do minimum	✓	Low	Medium	Positive Moderate

Junctions	**Criteria**	**Do Minimum**		**Do Something**		**Impact**	**Sensitivity**	**Significance of Effect**
		Comment	**Criteria Met**	**Comment**	**Criteria Met**			
Fairgreen Road Signalised JCT	Pedestrian Directness:	Crossings are in one stage on northern and eastern arms, staggered in two stages on southern arm and three stages on western arm.	×	Crossings will be in one stage on all arms.	✓			and Long-Term
	Accessibility:	Adequate tactile paving, dropped kerbs and road markings at existing crossing points.	✓	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths and crossings are approximately 2m wide.	✓	Kerb will be realigned to provide wider footpaths and improved pedestrian facilities.	✓			
	Overall LoS	**3 indicators met**	**B**	**4 indicators met**	**A**			
Section 9								
Bóthar Na mBan / Prospect Hill / Bohemore Road Uncontrolled JCT	Pedestrian Routing:	Crossing available on the Bóthar Na mBan arm only. Prospect Hill and Bohemore Road do not contain crossings.	×	Signalised crossing will be provided on Bóthar Na mBan and raised entry treatment will be provided on Prospect Hill.	✓	Medium	Medium	Positive Significant and Long-Term
	Pedestrian Directness:	Crossings are staggered in two stages due to presence of an island.	×	Crossings will be in one stage	✓			
	Accessibility:	Tactile paving and dropped kerbs present and road markings present on all arms.	✓	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 3m wide. Crossings are 2m wide.	✓	New geometry to be fully compliant with design standard.	✓			
	Overall LoS	**2 indicators met**	**C**	**4 indicators met**	**A**			
Headford Road / St Brendan’s Avenue / Dyke Road Signalised JCT	Pedestrian Routing:	Signalised crossings available on all arms.	✓	Similar to do minimum	✓	Low	High	Positive Moderate and Long-Term
	Pedestrian Directness:	Crossings are in one stage.	✓	Similar to do minimum	✓			
	Accessibility:	Adequate tactile paving, dropped kerbs and road markings at existing crossing points.	✓	Similar to do minimum	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 1m wide. Crossings are 1.6m wide.	×	Existing footpaths to be improved. New footpath provided; junction will be realigned with improved pedestrian facilities.	✓			

Junctions	Criteria	Do Minimum		Do Something		Impact	Sensitivity	Significance of Effect
		Comment	**Criteria Met**	**Comment**	**Criteria Met**			
	Overall LoS	**3 indicators met**	**B**	**4 indicators met**	**A**			
Dyke Road / Headford Road / St Bridget's Place Uncontrolled JCT	Pedestrian Routing:	Uncontrolled crossings on Dyke Road and St Bridget's Place arms only.	×	Signalised pedestrian crossings will be available on northern, eastern and southern arms.	×	Negligible	High	Not Significant and Long-Term
	Pedestrian Directness:	Crossings are direct.	✓	Crossings will be in one stage.	✓			
	Accessibility:	Tactile paving and dropped kerbs provided. Road markings present	✓	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 1.6m wide and crossings are only 1.2m wide.	×	Crossing width to be provided up to standard. Footpath constraints on northern side of St Brigdet's Place.	×			
	Overall LoS	**2 indicators met**	**C**	**2 indicators met**	**C**			
Dyke Road/ Dyke Road Uncontrolled JCT	Pedestrian Routing:	No crossings provided.	×	Signalised crossing will be available on all arms.	✓	High	Low	Positive Moderate and Long-Term
	Pedestrian Directness:	No crossings provided.	×	Crossings will be in one stage on all arms.	✓			
	Accessibility:	No crossings provided.	×	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	No crossings provided. No footpath on eastern side of Dyke Road (south).	×	Existing footpath width to be widened. Crossing width to be provided up to standard.	✓			
	Overall LoS	**0 indicator met**	**E**	**4 indicators met**	**A**			
Section 10								
Headford Road at Headford Road / Riverside Signalised Pedestrian Crossing	Pedestrian Routing:	Signalised crossings available on Headford Road but not Woodquay Street.	×	Existing signalised pedestrian crossing on Headford Road will be retained. New raised table junction with tactile paving will be provided on Woodquay Street.	✓	Medium	High	Positive Very Significant and Long-Term
	Pedestrian Directness:	Crossings are in one stage.	✓	Crossings will be in one stage on all arms.	✓			
	Accessibility:	Adequate tactile paving, dropped kerbs and road markings at existing crossing points.	✓	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			

Junctions	Criteria	Do Minimum		Do Something		Impact	Sensitivity	Significance of Effect
		Comment	Criteria Met	Comment	Criteria Met			
	Footpath and Crossing Widths:	Existing footpaths are approximately 1.6m wide. Crossings are 2.4m wide.	×	Widening works proposed to the 1.6m wide footpath along Headford Road eastbound	✓			
	Overall LoS	**2 indicators met**	**C**	**4 indicators met**	**A**			
Section 11								
Merchants Road / Forthill Street Uncontrolled JCT	Pedestrian Routing:	Uncontrolled crossing on Forthill Street, no crossings available on Merchants Street	×	Signalised crossing available on Forthill Street and raised entry treatment available on Merchants Street (east)	✓	Medium	Medium	Positive Significant and Long-Term
	Pedestrian Directness:	Crossing is in one stage	✓	Crossings are in one stage	✓			
	Accessibility:	Adequate tactile paving dropped kerbs present. Road markings suitable.	×	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 1.6m wide. Crossings are 1.2m wide.	✓	New geometry to be fully compliant with design standard.	✓			
	Overall LoS	**2 indicators met**	**C**	**4 indicators met**	**A**			
Forthill Street / Queen Street Uncontrolled JCT	Pedestrian Routing:	No crossings present.	×	Signalised crossing available on Forthill Street and raised entry treatment available on Queen Street	✓	High	Low	Positive Moderate and Long-Term
	Pedestrian Directness:	No crossings present.	×	Crossings are in one stage	✓			
	Accessibility:	Tactile paving and dropped kerbs present on one side of the road only.	×	Fully compliant tactile paving, dropped kerbs, road markings at all crossing points.	✓			
	Footpath and Crossing Widths:	Existing footpaths are approximately 2m wide. Crossings are 1.2m wide.	×	New geometry to be fully compliant with design standard.	✓			
	Overall LoS	**0 indicators met**	**E**	**4 indicators met**	**A**			

6.2 Cycling Infrastructure

Location	Cyclist Impact	Do Minimum		Do Something		Impact	Sensitivity of Environment	Significance of Effect
		Description	LoS	Description	LoS			
Section 1								
University Road /Newcastle Road to University Road / Gaol Road (east)	Segregation	No specific bicycle facilities	D	No specific bicycle facilities	D	Negligible	Medium	Not Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Overall		**D**		**D**			
Goal Road / Goal Road (incorporating orbital route)	Segregation	No specific bicycle facilities	D	No specific bicycle facilities	D	Negligible	Low	Not Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Overall		**D**		**D**			
Salmon Weir Bridge to Waterside	Segregation	No specific bicycle facilities	D	Bicycles share traffic or bus lanes	C	Medium	Medium	Positive Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Each cycle lane has capacity for cycling two abreast and / or overtaking (>/= 2.5m, 2+1)	A+			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities at junctions.	D			
	Overall		**D**		**B**			
Newtownsmith from Corrib Bridge to Waterside	Segregation	No specific bicycle facilities	D	High degree of separation. Minimal delay	A+	Medium	Low	Positive Moderate and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Each one-way cycle lane has capacity for cycling one cyclist only (1.25m, 1+0)	C			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities at junctions.	D			
	Overall		**D**		**B**			
St Vincent’s Ave from Waterside to St Francis St	Segregation	No specific bicycle facilities	D	Bicycles share traffic or bus lanes	C	Medium	High	Positive Very Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Each cycle lane has capacity for cycling two abreast and / or overtaking (>/= 2.5m, 2+1)	A+			

Location	Cyclist Impact	Do Minimum		Do Something		Impact	Sensitivity of Environment	Significance of Effect
		Description	LoS	Description	LoS			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities at junctions.	D			
	Overall		**D**		**B**			
Section 2								
St Francis St from Courthouse Square to Dalys Place	Segregation	No specific bicycle facilities	D	Bicycles share traffic or bus lanes	C	Medium	High	Positive Very Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Each cycle lane has capacity for cycling two abreast and / or overtaking (>/= 2.5m, 2+1)	A+			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities at junctions.	D			
	Overall		**D**		**B**			
Eglinton / Williamsgate St from Mary St to Eyre Square	Segregation	No specific bicycle facilities	D	Bicycles share traffic or bus lanes	C	Medium	High	Positive Very Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Each cycle lane has capacity for cycling two abreast and / or overtaking (>/= 2.5m, 2+1)	A+			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities at junctions.	D			
	Overall		**D**		**B**			
Section 3								
An Fhaiche Mhor from Rosemary Ave to Eyre St	Segregation	No specific bicycle facilities	D	Bicycles share traffic or bus lanes	C	Medium	High	Positive Very Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Each cycle lane has capacity for cycling two abreast and / or overtaking (>/= 2.5m, 2+1)	A+			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities at junctions.	D			
	Overall		**D**		**B**			
Williamsgate Street / Eglington Street to Prospect Hill / Bothar Na mBan	Segregation	No specific bicycle facilities	D	No specific bicycle facilities	D	Negligible	High	Not Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Overall		**D**		**D**			
Eyre Square East	Segregation	No specific bicycle facilities	D	No specific bicycle facilities	D	Negligible	High	

Location	**Cyclist Impact**	**Do Minimum**		**Do Something**		**Impact**	**Sensitivity of Environment**	**Significance of Effect**
		Description	**LoS**	**Description**	**LoS**			
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	No specific bicycle facilities	D			Not Significant and Long-Term
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Overall		**D**		**D**			
Eyre Square West	Segregation	No specific bicycle facilities	D	No specific bicycle facilities	D	Negligible	High	Not Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Overall		**D**		**D**			
Eyre Square / Forster St from Victoria Pl to Fairgreen Rd	Segregation	No specific bicycle facilities	D	Bicycles share traffic or bus lanes	C	Medium	High	Positive Very Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Each cycle lane has capacity for cycling two abreast and / or overtaking (>/= 2.5m, 2+1)	A+			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities at junctions.	D			
	Overall		**D**		**B**			
Section 4								
Forster St/ College Rd from Fairgreen Rd to / Lough Atalia Rd	Segregation	No specific bicycle facilities	D	Carriageway designated as ‘quiet cycle route’	B	Medium	Medium	Positive Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Each cycle lane has capacity for cycling two abreast and / or overtaking (>/= 2.5m, 2+1)	A+			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities at junctions.	D			
	Overall		**D**		**B**			
Section 5								
College Rd from Lough Atalia Rd to Old Dublin Rd	Segregation	No specific bicycle facilities	D	Bicycles share bus lane for Eastbound direction, while Westbound direction has segregated one-way cycle lane	B	Medium	Low	Positive Moderate and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Bikes sharing Bus Lane have more then 2,5m, while cycle lane is circa	B			

Location	**Cyclist Impact**	**Do Minimum**		**Do Something**		**Impact**	**Sensitivity of Environment**	**Significance of Effect**
		Description	**LoS**	**Description**	**LoS**			
				1,5m wide for one-way cycling only.				
	Junction Treatment	No specific bicycle facilities	D	Toucan crossings at signalised junctions for cyclists along CBC / Protected junctions not already classified as A+ for junction treatment.	A			
	Overall		**D**		**B**			
Section 6								
Old Dublin Road from College Road to Sáilín	Segregation	No specific bicycle facilities	D	On Old Dublin Road there are fully segregated one-way cycle lanes for both Northbound and Southbound directions.	A+	High	Low	Positive Moderate and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Each cycle lane has capacity for cycling two abreast and / or overtaking (>/= 2.5m, 2+1)	A+			
	Junction Treatment	No specific bicycle facilities	D	Toucan crossings at signalised junctions for cyclists along CBC / Protected junctions not already classified as A+ for junction treatment.	A			
	Overall		**D**		**A+**			
Section 7								
Bóthar Bhreandain Uí Eithir / Forster Street to Fairegeen Road / Lough Atalia Road	Segregation	No specific bicycle facilities	D	No specific bicycle facilities	D	Negligible	Medium	Not Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Overall		**D**		**D**			
Section 8								
Bóthar na mBan / Prospect Hill to Prospect Hill / Bóthar Bhreandain Uí Eithir	Segregation	No specific bicycle facilities	D	No specific bicycle facilities	D	Negligible	Medium	Not Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities	D			

Location	**Cyclist Impact**	**Do Minimum**		**Do Something**		**Impact**	**Sensitivity of Environment**	**Significance of Effect**
		Description	**LoS**	**Description**	**LoS**			
	Overall		**D**		**D**			
Prospect Hill / Bóthar Bhreandain Uí Eithir to Bóthar Bhreandain Uí Eithir / Forster	Segregation	Bicycles share traffic or bus lanes	C	Bicycles share traffic or bus lanes	C	Negligible	Medium	Not Significant and Long-Term
	Number of Adjacent Cyclists / Width	Each cycle lane has capacity for cycling two abreast and / or overtaking (>/= 2.5m, 2+1)	A+	Each cycle lane has capacity for cycling two abreast and / or overtaking (>/= 2.5m, 2+1)	A+			
	Junction Treatment	No specific bicycle facilities at junctions.	D	No specific bicycle facilities at junctions.	D			
	Overall		**B**		**B**			
Section 9								
Headford Road / St Brendan's Avenue / Dyke Road to Bothar na mBan/ Prospect Hill	Segregation	No specific bicycle facilities	D	No specific bicycle facilities	D	Negligible	Low	Not Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Overall		**D**		**D**			
Headford Rd from St Brendan's Ave to St Bridget's Place	Segregation	No specific bicycle facilities	D	Bicycles share traffic or bus lanes	C	Medium	High	Positive Very Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Each cycle lane has capacity for cycling two abreast and / or overtaking (>/= 2.5m, 2+1)	A+			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities at junctions.	D			
	Overall		**D**		**B**			
Dyke Road to Dyke Road	Segregation	No specific bicycle facilities	D	No specific bicycle facilities	D	Negligible	Low	Not Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Overall		**D**		**D**			
Dyke Road from St Brendan's Avenue to Dyke Road	Segregation	No specific bicycle facilities	D	Well separated at mid-link with some conflict at intersections and parking alongside cycle lane	A	Medium	Medium	Positive Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Each cycle lane has capacity for cycling two abreast and / or overtaking (1.75, 1+1)	B			

Location	**Cyclist Impact**	**Do Minimum**		**Do Something**		**Impact**	**Sensitivity of Environment**	**Significance of Effect**
		Description	**LoS**	**Description**	**LoS**			
	Junction Treatment	No specific bicycle facilities	D	Cyclists share green time with general traffic with cycle facilities (advanced stacking locations / cycle lanes) available up to the junction but don't continue through.	C			
	Overall		**D**		**B**			
Headford Road / St Brendan's Avenue / Dyke Road to The Plots Road	Segregation	No specific bicycle facilities	D	No specific bicycle facilities	D	Negligible	Medium	Not Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Overall		**D**		**D**			
Section 10								
St Vincent's Ave / Headford Rd from St Francis St to Dyke Rd	Segregation	No specific bicycle facilities	D	Bicycles share traffic or bus lanes	C	Medium	High	Positive Very Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Each cycle lane has capacity for cycling two abreast and / or overtaking (>/= 2.5m, 2+1)	A+			
	Junction Treatment	No specific bicycle facilities	D	Cyclists share green time with general traffic with cycle facilities (advanced stacking locations / cycle lanes) available up to the junction but don't continue through.	C			
	Overall		**D**		**B**			
Mary St / Woodquay Street from Newtownsmith to Headford Rd	Segregation	No specific bicycle facilities	D	Well separated at mid-link with some conflict with parked vehicles and at intersections	A	Medium	Low	Positive Moderate and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	Each one-way cycle lane has capacity for cycling one cyclist only (</=1.25m, 1+0)	D			
	Junction Treatment	No specific bicycle facilities	D	Cyclists share green time with general traffic with cycle facilities (advanced stacking locations / cycle lanes) available up to the junction but don't continue through.	C			
	Overall		**D**		**B**			

Location	**Cyclist Impact**	**Do Minimum**		**Do Something**		**Impact**	**Sensitivity of Environment**	**Significance of Effect**
		Description	**LoS**	**Description**	**LoS**			
Section 11								
Victoria Place / Eyre Square to Queen Street / Bóthar Na nDuganna / Dock Road	Segregation	No specific bicycle facilities	D	No specific bicycle facilities	D	Negligible	Medium	Not Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Overall		**D**		**D**			
Victoria Place / Merchant's Road to Merchant's Road	Segregation	No specific bicycle facilities	D	No specific bicycle facilities	D	Negligible	Low	Not Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Overall		**D**		**D**			
Merchants Road / Forthill Street to Queen Street / Forthill Street	Segregation	No specific bicycle facilities	D	No specific bicycle facilities	D	Negligible	Medium	Not Significant and Long-Term
	Number of Adjacent Cyclists / Width	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Junction Treatment	No specific bicycle facilities	D	No specific bicycle facilities	D			
	Overall		**D**		**D**			

6.3 General Traffic Redistribution – Junction Assessment

6.3.1 2023 AM

Road Name	Junction Name	Junction Sensitivity	Flow Change	Max VoC (%)		Magnitude of Impact	Significance of Effects
				DM	DS		
Headford Road	Headford Road / Bothar Na Dtreabh	Negligible	306	101.6	106.9	Negligible	Imperceptible
Headford Road	Headford Road / Dun Na Coiribe	Low	306	64.3	67.2	Negligible	Not Significant
Quincentenary Bridge	Quincentenary Bridge Approach Road / Headford Road	Low	729	100.8	113.7	Negligible	Not Significant
Quincentenary Bridge	Quincentenary Bridge Approach Road / Upper Newcastle Road	Low	729	104.1	112.1	Negligible	Not Significant
Quincentenary Bridge	Thomas Hynes Road / Seamus Quirke Road	Low	729	98.0	110.7	Medium	Negative Moderate
Circular Road	Circular Road / Siabhan Mckenna Road	Medium	145	65.6	67.3	Negligible	Not Significant
Circular Road	Rahoon Road / Circular Road	Low	145	105.9	109.6	Negligible	Not Significant
Bushypark	Bushypark / Corcullen Road	High	110	10.9	10.9	Negligible	Not Significant
Bushypark	Upper Clybaun Road / Corcullen Road	High	110	73.2	92.0	Low	Negative Moderate
Western Distributor Road	Rahoon Road / Unnamed	Medium	102	35.2	42.3	Negligible	Not Significant
Western Distributor Road	Unnamed / Galway West Business Park	High	102	16.9	24.0	Negligible	Not Significant
Bothar Le Cheile	Bothar Le Cheile / Seamus Quirke Road	Low	175	100.1	105.2	Negligible	Not Significant
Siobhan Mckenna Road	Bothar Le Cheile / Siabhan Mckenna Road	High	228	62.5	67.8	Negligible	Not Significant
Siobhan Mckenna Road	Siobhan Mckenna Road / Thomas Hynes Road	Low	228	94.5	68.5	Low Positive	Positive Slight
Moyola Park	Moyola Park / Upper Newcastle Road	Low	109	47.9	101.7	High	Negative Moderate
Moyola Park	Thomas Hynes Road / Moyola Park	Low	109	23.8	21.7	Negligible	Not Significant
N83 Tuam Road	N83 Tuam Road / Bothar Na Mine	Negligible	164	67.4	70.5	Negligible	Imperceptible
N83 Tuam Road	N83 Tuam Road / Parkmore Road	Negligible	164	99.2	93.7	Negligible	Imperceptible
Wellpark	Tuam Road / Wellpark	Low	123	112.1	107.6	Negligible	Not Significant
Wellpark	Wellpark Road / Connolly Avenue	Medium	123	91.3	58.0	Low Positive	Positive Moderate

Road Name	Junction Name	Junction Sensitivity	Flow Change	Max VoC (%)		Magnitude of Impact	Significance of Effects
				DM	DS		
Ballybane Road	Ballybane Road / Beechwood Park	Low	228	43.8	42.4	Negligible	Not Significant
Ballybane Road	Ballybane Road / Castlepark Road	Low	228	33.2	29.0	Negligible	Not Significant
Ballybane Road	Ballybane Road / Glasan	Low	228	41.7	52.4	Negligible	Not Significant
Ballybane Road	Ballybane Road / Monivea Road	Low	228	35.7	41.0	Negligible	Not Significant
Ballybane Road	Ballybane Road / Rahylin Glebe	Low	228	52.5	52.4	Negligible	Not Significant
Dublin Road	Dublin Road / Ballybane Road	Low	235	59.1	66.9	Negligible	Not Significant
Dublin Road	Dublin Road / Ballyloughane Road	Low	235	51.4	54.6	Negligible	Not Significant
Dublin Road	Dublin Road / Michael Collins Road	Low	235	97.4	79.3	Low Positive	Positive Slight
Dublin Road	Dublin Road / Renmore Park	Low	235	75.2	91.3	Low	Negative Slight
Dublin Road	Dublin Road / Renmore Road	Low	235	96.6	96.2	Negligible	Not Significant
Moneenageisha Road	Moneenageisha Road / Wellpark Road	Low	301	109.1	99.0	Negligible	Not Significant
Bohermore	Bohermore / Cookes Terrace	Low	136	35.4	54.9	Negligible	Not Significant
Bohermore	Bohermore / Saint Anthonys Terrace	High	136	39.5	49.2	Negligible	Not Significant
Lough Atalia Road	Fairgreen Road / Lough Atalia Road	Low	944	53.8	102.8	High	Negative Moderate
Lough Atalia Road	Lough Atalia Road / Bothar Na Long	Low	944	42.2	109.4	High	Negative Moderate
Lough Atalia Road	Lough Atalia Road / College Road	Low	944	50.3	100.7	High	Negative Moderate
Bothar Na Long	Bothar Na Long / Dock Road	Low	869	34.4	103.5	High	Negative Moderate
Bothar Na Long	Bothar Na Long / Queen Street	Low	869	68.2	102.9	High	Negative Moderate
Fairgreen Road	Fairgreen Road / Station Road	High	719	14.4	32.2	Negligible	Not Significant
Fairgreen Road	Forster Street / Bothar Bhreandan Ui Eithir	Low	719	78.8	95.0	Low	Negative Slight
Bothar Na Mban	Bothar Na Mban / Bothar Irwin	High	434	14.5	37.6	Negligible	Not Significant
Forthill Street	Forthill Street / Queen Street	Low	313	100.1	76.8	Medium Positive	Positive Moderate
Forthill Street	Merchants Road / Forthill Street	Low	313	44.5	70.6	Negligible	Not Significant
Merchants Road (Saint Nicholas St - Forthill St)	Merchants Road / Lower Abbeygate Street	Low	305	22.6	30.6	Negligible	Not Significant

Road Name	**Junction Name**	**Junction Sensitivity**	**Flow Change**	**Max VoC (%)**		**Magnitude of Impact**	**Significance of Effects**
				DM	**DS**		
Merchants Road (Saint Nicholas St - Forthill St)	New Dock Street / Merchants Road	Low	305	65.0	97.2	Low	Negative Slight
New Dock Street	New Dock Street / Dock Road	Low	175	27.7	29.6	Negligible	Not Significant
Flood Street	Flood Street / New Dock Street	Low	219	73.4	84.2	Negligible	Not Significant
Flood Street	Wolfe Tone Bridge / Spanish Parade	Low	219	86.6	90.7	Negligible	Not Significant
Taylors Hill Road	Taylors Hill Road / Ardmore	Low	146	30.7	32.9	Negligible	Not Significant
Taylors Hill Road	Taylors Hill Road / Bishop O'Donnell Road	Low	146	100.2	100.3	Negligible	Not Significant
Taylors Hill Road	Taylors Hill Road / Maunsell'S Road	Low	146	65.3	83.4	Negligible	Not Significant
Taylors Hill Road	Taylors Hill Road / Rosary Lane	Low	146	89.9	97.8	Negligible	Not Significant
Rahoon Road	Rahoon Road / Highfield Park	Medium	122	28.6	35.7	Negligible	Not Significant
Rahoon Road	Rahoon Road / Seamus Quirke Road	Low	122	64.3	72.6	Negligible	Not Significant
Old Seamus Quirke Road	Old Seamus Quirke Road / Ashe Road	High	249	16.2	30.3	Negligible	Not Significant
Old Seamus Quirke Road	Old Seamus Quirke Road / Weatherly Lodge	High	249	14.7	17.1	Negligible	Not Significant
Old Seamus Quirke Road	Seamus Quirke Road / Old Seamus Quirke Road	Low	249	91.8	89.3	Negligible	Not Significant
Ashe Road	Ashe Road / Costello Road	High	120	5.5	13.4	Negligible	Not Significant
Shantalla Road	Rahoon Road / Old Seamus Quirke Road	Medium	250	45.8	81.9	Negligible	Not Significant
Shantalla Road	Shantalla Road / Colmcille Road	Medium	250	46.9	52.8	Negligible	Not Significant
Shantalla Road	Shantalla Road / Mc Dara Road	Medium	250	47.5	53.9	Negligible	Not Significant
Shantalla Road	Shantalla Road / Rahoon Road	Medium	250	91.9	89.9	Negligible	Not Significant
Seamus Quirke Road (Lower Newcastle Rd - Browne Rbt)	Seamus Quirke Road / Lower Newcastle Road	Medium	411	76.5	82.2	Negligible	Not Significant
Seamus Quirke Road (Lower Newcastle Rd - Browne Rbt)	Seamus Quirke Road / Snipe Lawn	High	411	29.4	32.2	Negligible	Not Significant
Lower Newcastle Road (University Rd - Seamus Quirke Road)	Lower Newcastle Road / Newcastle Avenue	Medium	373	58.3	48.9	Negligible	Not Significant
Lower Newcastle Road (University Rd - Seamus Quirke Road)	Newcastle Road / University Road	Medium	373	95.8	97.5	Negligible	Not Significant

Road Name	Junction Name	Junction Sensitivity	Flow Change	Max VoC (%)		Magnitude of Impact	Significance of Effects
				DM	DS		
Newcastle Road	Costello Road / Newcastle Road	Medium	372	49.5	65.4	Negligible	Not Significant
Newcastle Road	Newcastle Road / Presentation Road	Medium	372	23.9	57.8	Negligible	Not Significant
Newcastle Road	St Mary'S Road / Shantalla Road	Medium	372	56.1	69.5	Negligible	Not Significant
St Mary'S Road	St Mary'S Road / Palmyra Avenue	Medium	104	26.8	32.4	Negligible	Not Significant
St Mary'S Road	The Crescent / Lower Salthill Road	Low	104	90.7	96.7	Negligible	Not Significant
Gaol Road (South Of University Rd)	Gaol Road / Gaol Road	High	172	22.4	17.1	Negligible	Not Significant
Gaol Road (South Of University Rd)	University Road / Gaol Road	Medium	172	35.3	12.2	Negligible	Not Significant
Presentation Road	Presentation Road / New Road	High	148	12.5	14.1	Negligible	Not Significant
Presentation Road	Presentation Road / Parkavara	High	148	13.8	11.4	Negligible	Not Significant
Bothar Na Dtreabh (N83-N84)	Bothar Na Dtreabh / Glenburren Park	Negligible	273	148.6	150.7	Negligible	Imperceptible
Bothar Na Dtreabh (N83-N84)	Bothar Na Dtreabh / Tuam Road	Negligible	273	103.3	101.4	Negligible	Imperceptible

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Road Name	Junction Name	Junction Sensitivity	Flow Change	Max VoC (%)		Magnitude of Impact	Significance of Effects
				DM	DS		
Quincentenary Bridge	Quincentenary Bridge Approach Road / Headford Road	Low	486	102.1	122.3	Negligible	Not Significant
Quincentenary Bridge	Quincentenary Bridge Approach Road / Upper Newcastle Road	Low	486	96.4	97.4	Negligible	Not Significant
Quincentenary Bridge	Thomas Hynes Road / Seamus Quirke Road	Low	486	71.5	96.7	Low	Negative Slight
Circular Road	Circular Road / Siabhan Mckenna Road	Medium	132	86.3	85.4	Negligible	Not Significant
Circular Road	Rahoon Road / Circular Road	Low	132	104.8	95.0	Low Positive	Positive Slight
Siobhan Mckenna Road	Bothar Le Cheile / Siabhan Mckenna Road	High	119	30.0	54.6	Negligible	Not Significant
Siobhan Mckenna Road	Siobhan Mckenna Road / Thomas Hynes Road	Low	119	49.1	65.9	Negligible	Not Significant
N84 Headford Road	Headford Road / Bothar Na Dtreabh	Negligible	307	110.4	107.3	Negligible	Imperceptible
N84 Headford Road	N84 Headford Road / Ballinfoile Park	Negligible	307	69.8	63.8	Negligible	Imperceptible

Road Name	**Junction Name**	**Junction Sensitivity**	**Flow Change**	**Max VoC (%)**		**Magnitude of Impact**	**Significance of Effects**
				DM	**DS**		
N84 Headford Road	N84 Headford Road / Bothar An Choiste	Negligible	307	51.8	49.3	Negligible	Imperceptible
N84 Headford Road	N84 Headford Road / Brookdale	Negligible	307	62.2	58.6	Negligible	Imperceptible
N84 Headford Road	N84 Headford Road / Monument Road	Negligible	307	72.2	70.2	Negligible	Imperceptible
N84 Headford Road	N84 Headford Road / Tirellan Heights	Negligible	307	61.6	58.3	Negligible	Imperceptible
Doughiska Road	Doughiska Road / An Fiodan	High	113	23.9	31.4	Negligible	Not Significant
Doughiska Road	Doughiska Road / Dublin Road	Low	113	107.6	103.8	Negligible	Not Significant
Doughiska Road	Doughiska Road / Fearann Ri	High	113	48.7	53.5	Negligible	Not Significant
Doughiska Road	Doughiska Road / Merlin Park Lane	High	113	22.3	18.1	Negligible	Not Significant
Sandy Road	Sandy Road / Glen Na Tra	High	182	34.3	36.8	Negligible	Not Significant
Sandy Road	Sandy Road / Gort Na Glaise	High	182	13.2	23.1	Negligible	Not Significant
Sandy Road	Sandy Road / Maldron Hotel	High	182	20.0	33.8	Negligible	Not Significant
Lough Atalia Road	Fairgreen Road / Lough Atalia Road	Low	1,111	44.4	99.8	Low	Negative Slight
Lough Atalia Road	Lough Atalia Road / College Road	Low	1,111	37.0	93.8	Low	Negative Slight
College Road (Lough Atalia Rd - Dublin Rd)	Moneenageisha Road / Wellpark Road	Low	100	87.4	101.0	Medium	Negative Moderate
Bothar Na Long	Bothar Na Long / Dock Road	Low	1,179	28.6	102.3	High	Negative Moderate
Bothar Na Long	Bothar Na Long / Queen Street	Low	1,179	56.6	103.0	High	Negative Moderate
Bothar Na Long	Lough Atalia Road / Bothar Na Long	Low	1,179	50.3	172.3	High	Negative Moderate
Fairgreen Road	Fairgreen Road / Station Road	High	760	10.8	28.2	Negligible	Not Significant
Fairgreen Road	Forster Street / Bothar Bhreandan Ui Eithir	Low	760	69.5	79.7	Negligible	Not Significant
Bothar Bhreandan Ui Eithir	Bothar Bhreandan Ui Eithir / Foster Court	Low	158	24.0	25.4	Negligible	Not Significant
Bothar Bhreandan Ui Eithir	Prospect Hill / Bothar Bhreandan Ui Eithir	Low	158	36.6	92.4	Low	Negative Slight
Bothar Na Mban	Bothar Na Mban / Bothar Irwin	High	335	11.6	19.7	Negligible	Not Significant
Forthill Street	Forthill Street / Queen Street	Low	502	92.6	71.9	Low Positive	Positive Slight
Forthill Street	Merchants Road / Forthill Street	Low	502	21.6	63.5	Negligible	Not Significant

Road Name	Junction Name	Junction Sensitivity	Flow Change	Max VoC (%)		Magnitude of Impact	Significance of Effects
				DM	DS		
Merchants Road (Saint Nicholas St - Forthill St)	Merchants Road / Lower Abbeygate Street	Low	230	24.1	26.0	Negligible	Not Significant
Merchants Road (Saint Nicholas St - Forthill St)	New Dock Street / Merchants Road	Low	230	35.5	48.8	Negligible	Not Significant
St Francis Street	St Francis Street / Mary Street	Medium	119	74.0	33.0	Negligible	Not Significant
St Francis Street	St Vincents Avenue / Saint Francis Street	Medium	119	71.5	83.4	Negligible	Not Significant
New Dock Street	New Dock Street / Dock Road	Low	173	30.6	34.1	Negligible	Not Significant
Wolfe Tone Bridge	Father Griffin Road / Claddagh Quay	Low	171	54.3	52.6	Negligible	Not Significant
Flood Street	Flood Street / New Dock Street	Low	225	41.0	55.2	Negligible	Not Significant
Flood Street	Wolfe Tone Bridge / Spanish Parade	Low	225	94.4	93.5	Negligible	Not Significant
Shantalla Road	Rahoon Road / Old Seamus Quirke Road	Medium	165	51.8	41.5	Negligible	Not Significant
Shantalla Road	Shantalla Road / Colmcille Road	Medium	165	32.8	34.4	Negligible	Not Significant
Shantalla Road	Shantalla Road / Mc Dara Road	Medium	165	30.7	32.0	Negligible	Not Significant
Shantalla Road	Shantalla Road / Rahoon Road	Medium	165	39.7	40.6	Negligible	Not Significant
Seamus Quirke Road (Lower Newcastle Rd - Browne Rbt)	Seamus Quirke Road / Snipe Lawn	High	295	19.8	28.4	Negligible	Not Significant
Lower Newcastle Road (Seamus Quirke Road - Snipe Av)	Lower Newcastle Road / Distillery Road	Medium	203	97.4	86.7	Negligible	Not Significant
Lower Newcastle Road (University Rd - Seamus Quirke Road)	Lower Newcastle Road / Newcastle Avenue	Medium	406	33.7	49.1	Negligible	Not Significant
Lower Newcastle Road (University Rd - Seamus Quirke Road)	Newcastle Road / University Road	Medium	406	93.7	96.0	Negligible	Not Significant
Lower Newcastle Road (University Rd - Seamus Quirke Road)	Seamus Quirke Road / Lower Newcastle Road	Medium	406	48.5	59.0	Negligible	Not Significant
Newcastle Road	Costello Road / Newcastle Road	Medium	287	62.1	38.0	Negligible	Not Significant
Newcastle Road	Newcastle Road / Presentation Road	Medium	287	30.3	66.0	Negligible	Not Significant
Newcastle Road	St Mary'S Road / Shantalla Road	Medium	287	59.3	69.2	Negligible	Not Significant

Road Name	Junction Name	Junction Sensitivity	Flow Change	Max VoC (%)		Magnitude of Impact	Significance of Effects
				DM	DS		
Gaol Road (South Of University Rd)	Gaol Road / Gaol Road	High	220	28.8	22.6	Negligible	Not Significant
Gaol Road (South Of University Rd)	University Road / Gaol Road	Medium	220	30.1	17.1	Negligible	Not Significant
Father Griffin Road	Father Griffin Road / Father Burke Road	Low	163	33.3	35.2	Negligible	Not Significant
Father Griffin Road	Father Griffin Road / Father Griffin Avenue	Low	163	42.3	53.6	Negligible	Not Significant
Father Griffin Road	Father Griffin Road / Grattan Court	High	163	15.8	21.9	Negligible	Not Significant
Father Griffin Road	Father Griffin Road / Lower Salthill Road	Medium	163	32.3	61.9	Negligible	Not Significant
Father Griffin Road	Father Griffin Road / Munster Avenue	Low	163	31.7	33.8	Negligible	Not Significant
Father Griffin Road	Father Griffin Road / Whitestrand Road	Medium	163	23.5	35.3	Negligible	Not Significant
Presentation Road	Presentation Road / New Road	High	232	12.1	15.1	Negligible	Not Significant
Presentation Road	Presentation Road / Parkavara	High	232	11.2	13.8	Negligible	Not Significant
Mill Street	Mill Street / Presentation Road	High	153	15.7	16.5	Negligible	Not Significant
Henry Street	Henry Street / William Street West	Medium	257	39.2	52.5	Negligible	Not Significant
Henry Street	St Helen’s Street / New Road	Medium	257	17.9	18.8	Negligible	Not Significant
Lower Road Fairhill	Dominick Street Upper / Lower Fairhill Road	Medium	181	41.1	61.4	Negligible	Not Significant
Lower Road Fairhill	Father Griffin Road / Lower Fairhill Road	Low	181	88.1	76.7	Negligible	Not Significant

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Road Name	Junction Name	Junction Sensitivity	Flow Change	Max VoC (%)		Magnitude of Impact	Significance of Effects
				DM	DS		
Headford Road	Headford Road / Bothar Na Dtreabh	Negligible	306	100.7	100.6	Negligible	Imperceptible
Headford Road	Headford Road / Dun Na Coiribe	Low	306	57.9	57.2	Negligible	Not Significant
Quincentenary Bridge	Quincentenary Bridge Approach Road / Headford Road	Low	729	96.4	106.4	Medium	Negative Moderate
Quincentenary Bridge	Quincentenary Bridge Approach Road / Upper Newcastle Road	Low	729	101.8	119.9	Negligible	Not Significant
Quincentenary Bridge	Thomas Hynes Road / Seamus Quirke Road	Low	729	105.3	121.3	Negligible	Not Significant
Circular Road	Circular Road / Siabhan Mckenna Road	Medium	145	55.6	51.2	Negligible	Not Significant
Circular Road	Rahoon Road / Circular Road	Low	145	103.6	103.4	Negligible	Not Significant
Bushypark	Bushypark / Corcullen Road	High	110	12.0	12.0	Negligible	Not Significant
Bushypark	Upper Clybaun Road / Corcullen Road	High	110	34.7	38.3	Negligible	Not Significant
Western Distributor Road	Rahoon Road / Unnamed	Medium	102	31.3	38.2	Negligible	Not Significant
Western Distributor Road	Unnamed / Galway West Business Park	High	102	23.9	25.7	Negligible	Not Significant
Bothar Le Cheile	Bothar Le Cheile / Seamus Quirke Road	Low	175	49.7	88.5	Low	Negative Slight
Siobhan Mckenna Road	Bothar Le Cheile / Siabhan Mckenna Road	High	228	46.2	44.8	Negligible	Not Significant
Siobhan Mckenna Road	Siobhan Mckenna Road / Thomas Hynes Road	Low	228	109.9	125.6	Negligible	Not Significant
Moyola Park	Moyola Park / Upper Newcastle Road	Low	109	15.4	11.6	Negligible	Not Significant
Moyola Park	Thomas Hynes Road / Moyola Park	Low	109	44.4	46.3	Negligible	Not Significant
N83 Tuam Road	N83 Tuam Road / Bothar Na Mine	Negligible	164	52.8	52.8	Negligible	Imperceptible
N83 Tuam Road	N83 Tuam Road / Parkmore Road	Negligible	164	85.8	84.3	Low Positive	Not Significant
Wellpark	Tuam Road / Wellpark	Low	123	76.0	72.0	Negligible	Not Significant
Wellpark	Wellpark Road / Connolly Avenue	Medium	123	56.0	59.2	Negligible	Not Significant
Ballybane Road	Ballybane Road / Beechwood Park	Low	228	47.5	50.6	Negligible	Not Significant
Ballybane Road	Ballybane Road / Castlepark Road	Low	228	40.0	33.9	Negligible	Not Significant

Road Name	Junction Name	Junction Sensitivity	Flow Change	Max VoC (%)		Magnitude of Impact	Significance of Effects
				DM	DS		
Ballybane Road	Ballybane Road / Glasan	Low	228	35.2	41.8	Negligible	Not Significant
Ballybane Road	Ballybane Road / Monivea Road	Low	228	42.3	40.5	Negligible	Not Significant
Ballybane Road	Ballybane Road / Rahylin Glebe	Low	228	62.2	57.9	Negligible	Not Significant
Dublin Road	Dublin Road / Ballybane Road	Low	235	84.3	88.1	Low	Negative Slight
Dublin Road	Dublin Road / Ballyloughane Road	Low	235	53.5	49.2	Negligible	Not Significant
Dublin Road	Dublin Road / Michael Collins Road	Low	235	94.9	99.9	Negligible	Not Significant
Dublin Road	Dublin Road / Renmore Park	Low	235	96.9	88.0	Negligible	Not Significant
Dublin Road	Dublin Road / Renmore Road	Low	235	98.8	98.4	Negligible	Not Significant
Moneenageisha Road	Moneenageisha Road / Wellpark Road	Low	301	98.0	100.7	Medium	Negative Moderate
Bohermore	Bohermore / Cookes Terrace	Low	136	48.4	58.2	Negligible	Not Significant
Bohermore	Bohermore / Saint Anthonys Terrace	High	136	43.3	53.0	Negligible	Not Significant
Lough Atalia Road	Fairgreen Road / Lough Atalia Road	Low	944	50.5	109.9	High	Negative Moderate
Lough Atalia Road	Lough Atalia Road / Bothar Na Long	Low	944	48.4	147.7	High	Negative Moderate
Lough Atalia Road	Lough Atalia Road / College Road	Low	944	47.0	110.1	High	Negative Moderate
Bothar Na Long	Bothar Na Long / Dock Road	Low	869	30.5	153.4	High	Negative Moderate
Bothar Na Long	Bothar Na Long / Queen Street	Low	869	64.4	102.9	High	Negative Moderate
Fairgreen Road	Fairgreen Road / Station Road	High	719	14.5	30.4	Negligible	Not Significant
Fairgreen Road	Forster Street / Bothar Bhreandan Ui Eithir	Low	719	79.9	101.6	High	Negative Moderate
Bothar Na Mban	Bothar Na Mban / Bothar Irwin	High	434	13.8	33.6	Negligible	Not Significant
Forthill Street	Forthill Street / Queen Street	Low	313	100.1	85.7	Low Positive	Positive Slight
Forthill Street	Merchants Road / Forthill Street	Low	313	38.9	78.0	Negligible	Not Significant
Merchants Road (Saint Nicholas St - Forthill St)	Merchants Road / Lower Abbeygate Street	Low	305	33.8	30.1	Negligible	Not Significant
Merchants Road (Saint Nicholas St - Forthill St)	New Dock Street / Merchants Road	Low	305	65.2	96.3	Low	Negative Slight
New Dock Street	New Dock Street / Dock Road	Low	175	25.9	28.7	Negligible	Not Significant

Road Name	Junction Name	Junction Sensitivity	Flow Change	Max VoC (%)		Magnitude of Impact	Significance of Effects
				DM	DS		
Flood Street	Flood Street / New Dock Street	Low	219	74.3	78.0	Negligible	Not Significant
Flood Street	Wolfe Tone Bridge / Spanish Parade	Low	219	82.1	93.9	Low	Negative Slight
Taylors Hill Road	Taylors Hill Road / Ardmore	Low	146	20.3	20.8	Negligible	Not Significant
Taylors Hill Road	Taylors Hill Road / Bishop O'Donnell Road	Low	146	102.8	101.4	Negligible	Not Significant
Taylors Hill Road	Taylors Hill Road / Maunsell'S Road	Low	146	42.7	48.2	Negligible	Not Significant
Taylors Hill Road	Taylors Hill Road / Rosary Lane	Low	146	90.7	86.8	Negligible	Not Significant
Rahoon Road	Rahoon Road / Highfield Park	Medium	122	43.1	44.6	Negligible	Not Significant
Rahoon Road	Rahoon Road / Seamus Quirke Road	Low	122	85.2	86.4	Negligible	Not Significant
Old Seamus Quirke Road	Old Seamus Quirke Road / Ashe Road	High	249	37.9	40.3	Negligible	Not Significant
Old Seamus Quirke Road	Old Seamus Quirke Road / Weatherly Lodge	High	249	15.8	20.9	Negligible	Not Significant
Old Seamus Quirke Road	Seamus Quirke Road / Old Seamus Quirke Road	Low	249	90.6	98.9	Negligible	Not Significant
Ashe Road	Ashe Road / Costello Road	High	120	34.5	33.5	Negligible	Not Significant
Shantalla Road	Rahoon Road / Old Seamus Quirke Road	Medium	250	68.1	84.8	Negligible	Not Significant
Shantalla Road	Shantalla Road / Colmcille Road	Medium	250	57.4	56.9	Negligible	Not Significant
Shantalla Road	Shantalla Road / Mc Dara Road	Medium	250	58.7	58.4	Negligible	Not Significant
Shantalla Road	Shantalla Road / Rahoon Road	Medium	250	94.8	96.3	Negligible	Not Significant
Seamus Quirke Road (Lower Newcastle Rd - Browne Rbt)	Seamus Quirke Road / Lower Newcastle Road	Medium	411	60.4	96.1	Low	Negative Moderate
Seamus Quirke Road (Lower Newcastle Rd - Browne Rbt)	Seamus Quirke Road / Snipe Lawn	High	411	9.1	7.8	Negligible	Not Significant
Lower Newcastle Road (University Rd - Seamus Quirke Road)	Lower Newcastle Road / Newcastle Avenue	Medium	373	102.7	105.3	Negligible	Not Significant
Lower Newcastle Road (University Rd - Seamus Quirke Road)	Newcastle Road / University Road	Medium	373	100.2	96.2	Low Positive	Positive Moderate
Newcastle Road	Costello Road / Newcastle Road	Medium	372	87.4	88.0	Negligible	Not Significant
Newcastle Road	Newcastle Road / Presentation Road	Medium	372	72.9	64.2	Negligible	Not Significant

Road Name	Junction Name	Junction Sensitivity	Flow Change	Max VoC (%)		Magnitude of Impact	Significance of Effects
				DM	DS		
Newcastle Road	St Mary'S Road / Shantalla Road	Medium	372	93.3	93.7	Negligible	Not Significant
St Mary'S Road	St Mary'S Road / Palmyra Avenue	Medium	104	33.5	33.9	Negligible	Not Significant
St Mary'S Road	The Crescent / Lower Salthill Road	Low	104	99.1	98.7	Negligible	Not Significant
Gaol Road (South Of University Rd)	Gaol Road / Gaol Road	High	172	25.6	23.7	Negligible	Not Significant
Gaol Road (South Of University Rd)	University Road / Gaol Road	Medium	172	33.1	12.6	Negligible	Not Significant
Presentation Road	Presentation Road / New Road	High	148	29.0	16.9	Negligible	Not Significant
Presentation Road	Presentation Road / Parkavara	High	148	25.9	13.8	Negligible	Not Significant
Bothar Na Dtreabh (N83-N84)	Bothar Na Dtreabh / Glenburren Park	Negligible	273	56.1	45.8	Negligible	Imperceptible
Bothar Na Dtreabh (N83-N84)	Bothar Na Dtreabh / Tuam Road	Negligible	273	102.1	100.8	Negligible	Imperceptible

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Road Name	Junction Name	Junction Sensitivity	Flow Change	Max VoC (%)		Magnitude of Impact	Significance of Effects
				DM	DS		
Quincentenary Bridge	Quincentenary Bridge Approach Road / Headford Road	Low	486	109.6	118.7	Negligible	Not Significant
Quincentenary Bridge	Quincentenary Bridge Approach Road / Upper Newcastle Road	Low	486	97.2	104.1	Medium	Negative Moderate
Quincentenary Bridge	Thomas Hynes Road / Seamus Quirke Road	Low	486	62.3	104.7	High	Negative Moderate
Circular Road	Circular Road / Siabhan Mckenna Road	Medium	132	101.1	100.4	Negligible	Not Significant
Circular Road	Rahoon Road / Circular Road	Low	132	102.3	100.9	Negligible	Not Significant
Siobhan Mckenna Road	Bothar Le Cheile / Siabhan Mckenna Road	High	119	46.1	74.1	Negligible	Not Significant
Siobhan Mckenna Road	Siobhan Mckenna Road / Thomas Hynes Road	Low	119	70.1	82.3	Negligible	Not Significant
N84 Headford Road	Headford Road / Bothar Na Dtreabh	Negligible	307	96.3	103.0	Medium	Not Significant
N84 Headford Road	N84 Headford Road / Ballinfoile Park	Negligible	307	102.6	107.9	Negligible	Imperceptible
N84 Headford Road	N84 Headford Road / Bothar An Choiste	Negligible	307	79.5	89.2	Low	Not Significant
N84 Headford Road	N84 Headford Road / Brookdale	Negligible	307	75.9	85.5	Low	Not Significant

Road Name	Junction Name	Junction Sensitivity	Flow Change	Max VoC (%)		Magnitude of Impact	Significance of Effects
				DM	DS		
N84 Headford Road	N84 Headford Road / Monument Road	Negligible	307	94.6	92.9	Negligible	Imperceptible
N84 Headford Road	N84 Headford Road / Tirellan Heights	Negligible	307	65.4	71.3	Negligible	Imperceptible
Doughiska Road	Doughiska Road / An Fiodan	High	113	33.7	31.4	Negligible	Not Significant
Doughiska Road	Doughiska Road / Dublin Road	Low	113	107.1	107.8	Negligible	Not Significant
Doughiska Road	Doughiska Road / Fearann Ri	High	113	56.5	54.7	Negligible	Not Significant
Doughiska Road	Doughiska Road / Merlin Park Lane	High	113	17.6	18.3	Negligible	Not Significant
Sandy Road	Sandy Road / Glen Na Tra	High	182	31.5	31.8	Negligible	Not Significant
Sandy Road	Sandy Road / Gort Na Glaise	High	182	2.8	2.7	Negligible	Not Significant
Sandy Road	Sandy Road / Maldron Hotel	High	182	39.1	38.4	Negligible	Not Significant
Lough Atalia Road	Fairgreen Road / Lough Atalia Road	Low	1,111	57.3	104.5	High	Negative Moderate
Lough Atalia Road	Lough Atalia Road / College Road	Low	1,111	35.5	103.7	High	Negative Moderate
College Road (Lough Atalia Rd - Dublin Rd)	Moneenageisha Road / Wellpark Road	Low	100	100.3	95.8	Low Positive	Positive Slight
Bothar Na Long	Bothar Na Long / Dock Road	Low	1,179	24.8	142.1	High	Negative Moderate
Bothar Na Long	Bothar Na Long / Queen Street	Low	1,179	53.8	98.7	Low	Negative Slight
Bothar Na Long	Lough Atalia Road / Bothar Na Long	Low	1,179	80.5	228.3	High	Negative Moderate
Fairgreen Road	Fairgreen Road / Station Road	High	760	18.3	33.5	Negligible	Not Significant
Fairgreen Road	Forster Street / Bothar Bhreandan Ui Eithir	Low	760	70.4	99.9	Low	Negative Slight
Bothar Bhreandan Ui Eithir	Bothar Bhreandan Ui Eithir / Foster Court	Low	158	22.5	24.1	Negligible	Not Significant
Bothar Bhreandan Ui Eithir	Prospect Hill / Bothar Bhreandan Ui Eithir	Low	158	43.1	86.8	Low	Negative Slight
Bothar Na Mban	Bothar Na Mban / Bothar Irwin	High	335	11.7	18.1	Negligible	Not Significant
Forthill Street	Forthill Street / Queen Street	Low	502	71.5	80.2	Negligible	Not Significant
Forthill Street	Merchants Road / Forthill Street	Low	502	32.0	73.4	Negligible	Not Significant
Merchants Road (Saint Nicholas St - Forthill St)	Merchants Road / Lower Abbeygate Street	Low	230	39.7	32.6	Negligible	Not Significant
Merchants Road (Saint Nicholas St - Forthill St)	New Dock Street / Merchants Road	Low	230	41.6	52.3	Negligible	Not Significant

Road Name	**Junction Name**	**Junction Sensitivity**	**Flow Change**	**Max VoC (%)**		**Magnitude of Impact**	**Significance of Effects**
				DM	**DS**		
St Francis Street	St Francis Street / Mary Street	Medium	119	93.9	33.0	Low Positive	Positive Moderate
St Francis Street	St Vincents Avenue / Saint Francis Street	Medium	119	75.1	58.6	Negligible	Not Significant
New Dock Street	New Dock Street / Dock Road	Low	173	28.1	33.9	Negligible	Not Significant
Wolfe Tone Bridge	Father Griffin Road / Claddagh Quay	Low	171	53.7	53.1	Negligible	Not Significant
Flood Street	Flood Street / New Dock Street	Low	225	51.3	62.4	Negligible	Not Significant
Flood Street	Wolfe Tone Bridge / Spanish Parade	Low	225	90.3	89.6	Negligible	Not Significant
Shantalla Road	Rahoon Road / Old Seamus Quirke Road	Medium	165	52.7	62.7	Negligible	Not Significant
Shantalla Road	Shantalla Road / Colmcille Road	Medium	165	48.8	52.2	Negligible	Not Significant
Shantalla Road	Shantalla Road / Mc Dara Road	Medium	165	62.5	61.6	Negligible	Not Significant
Shantalla Road	Shantalla Road / Rahoon Road	Medium	165	56.2	59.5	Negligible	Not Significant
Seamus Quirke Road (Lower Newcastle Rd - Browne Rbt)	Seamus Quirke Road / Snipe Lawn	High	295	5.3	5.3	Negligible	Not Significant
Lower Newcastle Road (Seamus Quirke Road - Snipe Av)	Lower Newcastle Road / Distillery Road	Medium	203	104.0	104.5	Negligible	Not Significant
Lower Newcastle Road (University Rd - Seamus Quirke Road)	Lower Newcastle Road / Newcastle Avenue	Medium	406	34.8	45.8	Negligible	Not Significant
Lower Newcastle Road (University Rd - Seamus Quirke Road)	Newcastle Road / University Road	Medium	406	95.5	97.2	Negligible	Not Significant
Lower Newcastle Road (University Rd - Seamus Quirke Road)	Seamus Quirke Road / Lower Newcastle Road	Medium	406	53.0	64.0	Negligible	Not Significant
Newcastle Road	Costello Road / Newcastle Road	Medium	287	54.1	40.0	Negligible	Not Significant
Newcastle Road	Newcastle Road / Presentation Road	Medium	287	34.9	57.2	Negligible	Not Significant
Newcastle Road	St Mary'S Road / Shantalla Road	Medium	287	66.5	78.1	Negligible	Not Significant
Gaol Road (South Of University Rd)	Gaol Road / Gaol Road	High	220	35.9	41.6	Negligible	Not Significant
Gaol Road (South Of University Rd)	University Road / Gaol Road	Medium	220	40.7	20.4	Negligible	Not Significant

Road Name	Junction Name	Junction Sensitivity	Flow Change	Max VoC (%)		Magnitude of Impact	Significance of Effects
				DM	DS		
Father Griffin Road	Father Griffin Road / Father Burke Road	Low	163	15.8	15.3	Negligible	Not Significant
Father Griffin Road	Father Griffin Road / Father Griffin Avenue	Low	163	73.9	78.5	Negligible	Not Significant
Father Griffin Road	Father Griffin Road / Grattan Court	High	163	8.1	9.1	Negligible	Not Significant
Father Griffin Road	Father Griffin Road / Lower Salthill Road	Medium	163	30.5	31.9	Negligible	Not Significant
Father Griffin Road	Father Griffin Road / Munster Avenue	Low	163	15.8	17.8	Negligible	Not Significant
Father Griffin Road	Father Griffin Road / Whitestrand Road	Medium	163	17.1	20.1	Negligible	Not Significant
Presentation Road	Presentation Road / New Road	High	232	20.6	20.4	Negligible	Not Significant
Presentation Road	Presentation Road / Parkavara	High	232	17.1	16.9	Negligible	Not Significant
Mill Street	Mill Street / Presentation Road	High	153	19.4	16.1	Negligible	Not Significant
Henry Street	Henry Street / William Street West	Medium	257	40.3	46.4	Negligible	Not Significant
Henry Street	St Helen’s Street / New Road	Medium	257	38.3	32.6	Negligible	Not Significant
Lower Road Fairhill	Dominick Street Upper / Lower Fairhill Road	Medium	181	41.5	51.9	Negligible	Not Significant
Lower Road Fairhill	Father Griffin Road / Lower Fairhill Road	Low	181	76.3	94.3	Low	Negative Slight

Galway City Council

BusConnects Galway: Cross-City Link Preliminary Parking Survey Report

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Appendices

1 Introduction

1.1 Background

The BusConnects Cross City Link aims to transform Galway’s Public transport System, so that journeys by bus will be fast, reliable, punctual, convenient and affordable. A key aspect of the Cross City Link proposal is the provision of a public transport priority corridor, encompassing pedestrian crossings, upgraded footpaths, enhanced cycle facilities and additional bus priority measures, from University Road to Dublin Road (east of the Moneenageisha junction). Provision of high-quality footpaths, cycle tracks and bus lanes involve some local road widening, but also necessarily requires reallocation of road space where corridor width is heavily constrained by adjacent buildings. In some cases, reallocation of road space involves removal of on-street parking bays. This report investigates the impact on local parking activity and supply associated with the proposed scheme. The impact on loading / unloading activities is also assessed.

This Preliminary Parking Survey Report is a high-level desktop study to understand the impacts of BusConnects in terms of parking along the Cross-City Link - University Road to Dublin Road. Parking duration surveys were originally planned to assist in parking investigations; however, the COVID-19 outbreak and associated restrictions on movement meant that any surveys carried out during this period would not reflect typical parking patterns. A ‘desktop’ study was therefore carried out to assess the impact of the BusConnects Cross City Link infrastructure proposals on parking.

The purpose of this Preliminary Parking Survey Report is hence to:

- Quantify the current and proposed on-street parking bays;
- Identify the current parking regulations;
- Establish the dominant local land uses and expected parking characteristics; and
- Assess the potential impact of the Cross City Link on parking supply and activity.

The report contains separate analyses of a number of ‘self-contained’ corridor sections, where groups of parking bays can be considered to provide a local parking supply. The change in on-street parking supply has been identified and assessed in the context of the local needs and adjacent land uses. The local off-street parking supply and characteristics have also been noted. The self-contained sections where changes are proposed to parking supply are listed below and are illustrated in Appendix A:

- University Road (Newcastle Road to Salmon Weir Bridge);
- Salmon Weir Bridge to Forster Street;
- College Road and Dublin Road;
- Lough Atalia Road to Headford road;

- Galway Cathedral;
- Woodquay and Newtownsmith;
- Eyre Square North and Prospect Hill; and
- Merchants Road / Dock Road

1.2 Assumptions and Approach

The approach adopted to quantifying and assessing parking impacts is based on utilising the design team's knowledge of the (including historical data from local authority, site visits and observations) typical parking behaviours to identify the current scale of parking activity. Although detailed parking surveys have not been undertaken due to the atypical parking activity during the Covid-19 pandemic, the approach adopted provides a robust basis for an assessment of the effect of changes to on-street parking supply as a result of the Cross City Link. Key assumptions in the assessment are:

- That the existing parking regulations at each group of parking spaces will continue to apply to parking spaces provided at or close to the same location in the Proposed Scheme.

It should be noted that this report does not include consideration of cycle parking; this will be addressed during the scheme design development. It should also be noted the operation of bus lanes as '24 hour' lanes or for a lesser period of the day has not been considered in this study.

2 Methodology

2.1 Introduction

The approach adopted to quantifying and assessing parking impacts is based on utilising the design team's knowledge of the scheme area (including site visits and observations) and typical parking behaviours to identify the current scale of parking activity. The approach adopted involves identifying both the baseline parking situation and the future parking provision with the Proposed Scheme infrastructure in place, and comparing the two scenarios in respect of the number of spaces available. A qualitative assessment of the impact was then carried out and associated mitigations identified.

2.2 Baseline Parking and Loading

In order to understand the baseline parking situation along the proposed Cross City Link, the following information was collated via desktop analysis (making use of both local authority data on parking regulations, using 'street view' images from online resources and examination of topographical survey information):

- On-street parking regulations and spaces along the Cross City Link corridor;
- Location of time-limited bus lanes/cycle lanes which allow parking during unregulated periods;
- Loading bays; and
- On-street parking regulations and spaces on the side.

The existing parking regulations for each group of parking bays were classified as follows:

- Designated Paid Parking;
- Disabled Permit Parking;
- Designated Loading Bays;
- Designated Taxi Ranks; and
- Informal / Unregulated Parking (free parking).

For both the existing and future parking supply, where continuous multiple parallel parking spaces are present, it has been assumed that parking bays are 6m in length. Illegal parking, where observed, has been noted where it appears to occur on a regular basis but has not been included in the baseline parking supply.

Land uses on and surrounding the Cross City Link have also been reviewed in order to fully understand local parking characteristics, and off-street parking provision noted where relevant.

2.3 Future Parking and Loading

The future on-street parking supply with the Proposed Scheme in place has been identified from the final scheme drawings. For the purposes of this report, it has been assumed that the existing parking regulations at each group of parking spaces will continue to apply to parking spaces provided at or close to the same location in the Proposed Scheme.

3 Parking Impact on University Road (Newcastle Road to Salmon Weir Bridge)

3.1 Baseline Parking and Loading Analysis

3.1.1 Corridor On-Street Parking Bays and Regulation

This section begins at University Road to the east of the junction with Newcastle Road and continues along University Road to the Salmon Weir Bridge.

This section of the route contains 17 designated paid parking spaces at the following locations:

- Approximately 12 pay and display spaces on the southern side of the road between the James Mitchell Geology Museum and opposite the entrance to NUI Galway with a restriction of up to 2 hours. These parking spaces are available from 08:30 to 18:30 from Monday to Saturday ; and
- Approximately 5 pay and display spaces on the northern side of the road on the approach to Goal Road and opposite the Millennium Children's Park and Playground, with a restriction of up to 2 hours. These parking spaces are available from 08:30 to 18:30 from Monday to Saturday.

The designated Pay & Display parking spaces above have a tariff of €2.00 per hour with a restriction of up to two hours, and a minimum charge of 50c.

The route also contains 1 Loading Bay (3 spaces) in the vicinity of the James Mitchell Geology Museum.

University Road between Newcastle Road and the Salmon Weir Bridge does not have a bus lane in either direction, there are currently an inbound and outbound bus stop on University Road located on either side of the entrance to NUI Galway.

A summary of existing parking and loading supply on University Road, from Newcastle Road to the Salmon Weir Bridge is presented in **Table 1**.

Table 1: Existing On-Street Parking and Loading Spaces on University Road

Sub-section	Existing Parking / Loading Facilities	Number of Spaces
University Road (Newcastle Road to Salmon Weir Bridge)	Designated Paid Parking	17 spaces
	Loading Bay	1 bay (3 spaces)

3.1.2 Loading Bays

As shown in **Table 1**, there is a total 1 loading bay with space for approximately three cars or vans in this section of the corridor, located on University Road in the vicinity of the James Mitchell Geology Museum. This is designated as a loading bay from 06:30 to 08:30 from Monday to Saturday with a maximum duration of stay being 30 minutes.

3.1.3 On-Street Parking Bays and Regulation on Local Side Streets

There are a small number of side streets and some off-street surface car-parking which are able to be used by local residents and visitors/businesses. These spaces are likely to be utilised by visitors to premises along University Road, as well as NUI Galway, as an alternative to parking on the corridor itself.

There are designated Pay & Display parking spaces with approximately 39 spaces (1 of which is designated disabled parking) on the local side streets, within 200m from the corridor and in the vicinity of the on-street parking directly on the corridor, which are located on Ash Grove, University Park, Canal Road Upper.

The designated Pay & Display parking spaces above have a tariff of €2.00 per hour with a restriction of up to two hours, and a minimum charge of 50c. These parking spaces are available from 08:30 to 18:30 from Monday to Saturday.

However, it should be noted that there would also be informal parking on local side streets where there are no double yellow lines in place.

There is a large off street surface carpark to the west of the University Road and Newcastle Road junction at University Hospital Galway. This Carpark is visitors only with 172 spaces, including 6 disabled parking bays.

There are also a number of visitors only parking spaces on the premises of NUI Galway, which are intended for use of visitors to the University only.

3.1.4 Land Use and Parking Demand

University Road from Newcastle Road to the Salmon Weir Bridge is a corridor that has a range of land uses illustrated in **Appendix B**. University Road has some large sites with private parking within their premises, such as:

- NUI Galway;
- NUIG Rowing Club;
- Inland Fisheries Ireland; and
- Galway Cathedral.

There is also a shop and a museum located on the west of the road and a restaurant located at the junction with Canal Road Upper for which on-street parking activities may be limited.

3.2 Cross City Link Parking Proposals

3.2.1 Proposed On-Street Parking and Loading Bay Supply

With BusConnects Cross City Link infrastructure in place, there is an associated need to remove some parking spaces to provide improved facilities for pedestrians, cyclists, and buses. The planned changes in on-street parking on University Road are illustrated in **Figure 1** and **Figure 2**, and summarised in **Table 2**.

The overall proposed design of BusConnects along University Road (between Newcastle Road and The Salmon Weir Bridge) has resulted in the retention of approximately 13 designated parking spaces, all in the vicinity of existing parking spaces.

Table 2: Existing and Proposed Parking and Loading Supply Summary (University Road)

Sub-section	Parking / Loading Facilities	Existing	Proposed	Loss of Parking / Loading
University Road (Newcastle Road to Salmon Weir Bridge)	Designated Paid Parking	17 spaces	13 spaces	-4 spaces
	Designated Loading Bay	1 bay (3 spaces)	1 bay (3 spaces)	0

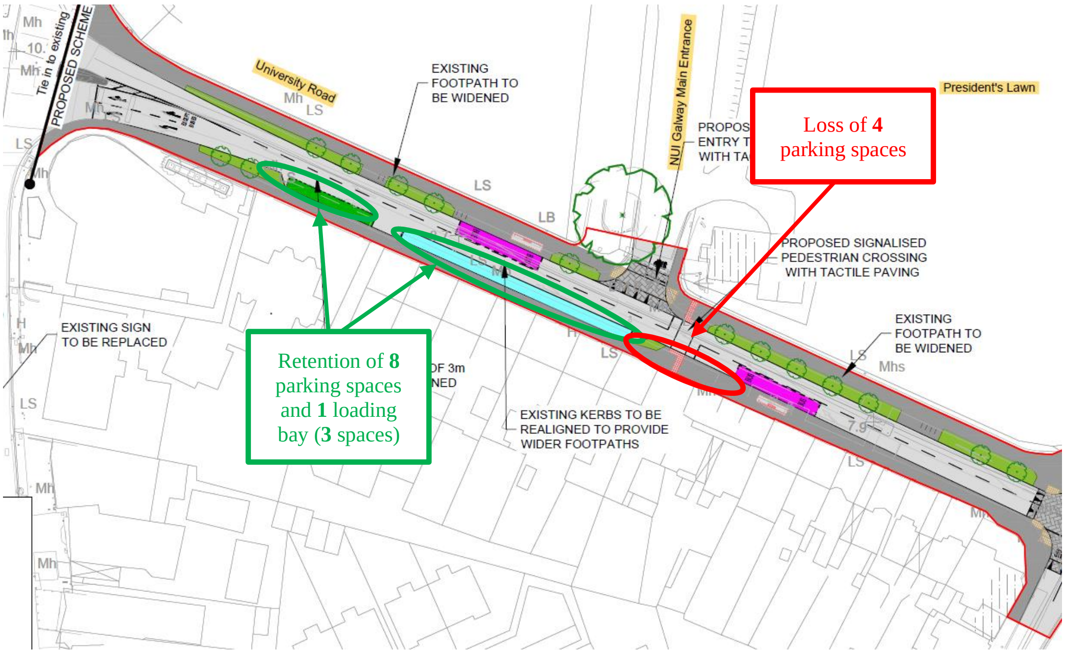


Figure 1: Proposed scheme design on University Road (opposite NUI Galway)

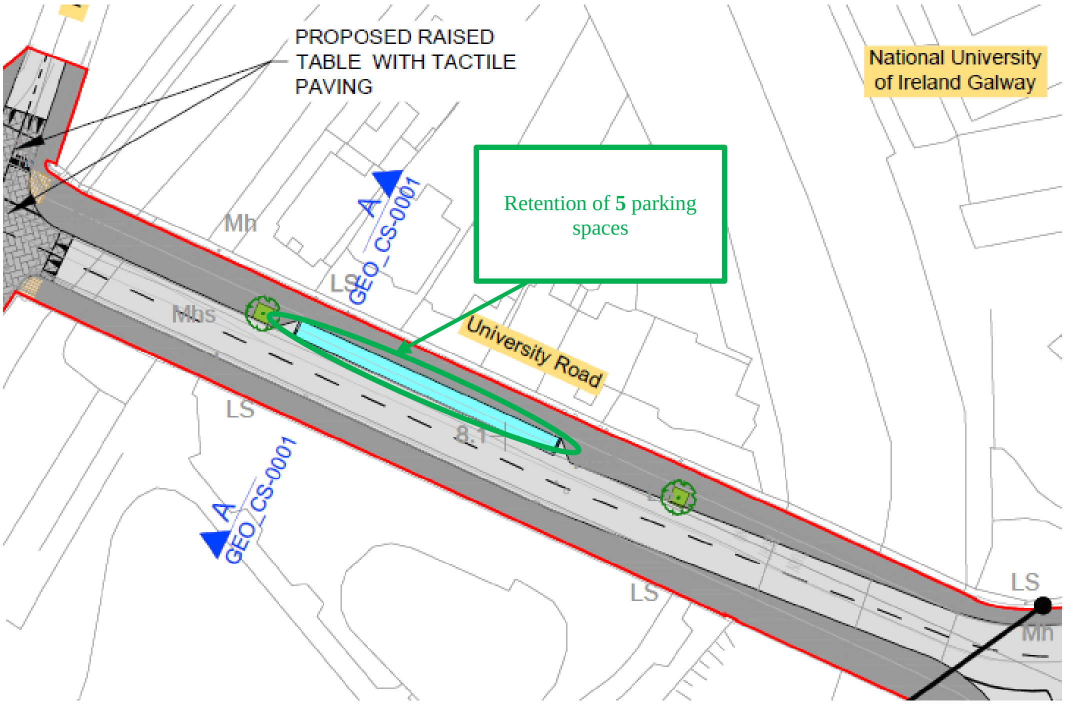


Figure 2: Proposed scheme design on University Road (opposite Millennium Children's Park and Playground)

3.3 Overall Parking Impact

A summary of the parking impact with respect to the change in overall parking supply on the Proposed Scheme corridor at (University Road) is shown in **Table 3**, which includes consideration of spaces on adjacent streets within an approximate 200m distance.

Table 3: Impact of Parking and Loading Changes for University Road

Location	Type of Parking		No. of Spaces		
			Baseline	Scheme	Change
University Road	Pay and Display	Residential	17	13	-4
University Road	Loading Bay	Commercial	3	3	0
Approx. adjacent parking of type within 200m			211	211	0
Total			231	227	-4

4 Parking Impact Salmon Weir Bridge to Forster Street

4.1 Baseline Parking and Loading Analysis

4.1.1 Corridor On-Street Parking Bays and Regulation

This section begins at the Salmon Weir Bridge and travels east along St. Vincent's Avenue, south along St. Francis Street and Eglinton Street, north east on Williamsgate Street and south along the eastern aspect of Eyre Square to the junction with Forster Street.

There is currently no existing on-street parking along this section of the route between Salmon Weir Bridge and St. Francis Street.

Eglinton Street (between St. Francis Street and Williamsgate Street) has no designated on-street parking. There is however one designated loading bay on the northern aspect of the street in the vicinity of the Eglinton Casino and a number of restaurants and shops.

It should be noted that the desktop analysis showed that informal parking occurs along a time-plated clearway on the northern aspect of Eglinton Street. This section can potentially fit up to 8 spaces, where parking activities may occur outside of Clearway hours 11:00 to 19:30 Monday to Saturday.

Williamsgate Street (between Eglinton Street and Eyre Square North) currently has no existing designated on-street parking. There is a loading bay / Clearway located in the vicinity of Logues and the GBC Galway Bakery Company.

Eyre Square east (between Eyre Square north and Forster Street) has no designated on-street parking. The eastern aspect of the road is predominantly made up of two sections of designated loading bays and taxi rank which can potentially fit up to 14 spaces in total (6 loading / 8 taxi rank). The western aspect of the road is predominantly made up of a Bus set down zone spanning approximately 90 metres.

Forster Street (Between Eyre Square and College Road) has designated on street parking on the northern aspect of the road of 8 spaces in the vicinity of Mace and Aran Island Ferries. These are Pay and Display spaces with a 2hr stay duration. The designation is in place from 08:30 to 18:30 Monday to Saturday and 13:00 to 18:00 on Sunday. There are also 2 designated disabled parking spaces located either side of the entrance to the Parish of Saint Patrick Church. There is a Section of bus lane which operates from 16:00 to 19:00 Monday to Saturday. And also a section of designated loading / taxi bay on the western aspect of the road opposite the Park House Hotel which operates from 08:30 to 15:30 Monday to Saturday.

Therefore, due to Clearways and loading bay / taxi rank designations listed above, on-street parking activities in the daytime are limited, with the exception of where designated on-street parking is available.

A summary of existing parking and loading supply the Salmon Weir Bridge and Forster Street is presented in **Table 4**.

Table 4: Existing On-Street Parking Supply Salmon Weir Bridge to Forster Street

Sub-section	Existing Parking / Loading Facilities	Number of Spaces
Eglinton Street (between St. Francis Street and Williamsgate Street)	Loading Bay / Clearway	1 Bay (6 spaces)
	Informal Parking	1 Clearway (9 spaces)
Williamsgate Street (between Eglinton Street and Eyre Square North)	Loading Bay / Clearway	1 Bay (3 spaces)
Eyre Square east (between Eyre Square north and Forster Street)	Loading Bay / Taxi Rank	2 Bays (6 spaces)
	Taxi Rank	2 Bays (8 spaces)
	Bus Set Down	1 Bay (5 spaces)
Forster Street (Between Eyre Square and College Road)	Designated Paid Parking	8 spaces
	Designated Disabled Parking	2 spaces
	Loading Bay / Taxi Rank	6 spaces

4.1.2 Loading Bays

As shown in **Table 4**, there are a number of loading bays throughout this section of the scheme.

Eglinton Street (between St. Francis Street and Williamsgate Street) has one designated loading bay on the northern aspect of the street in the vicinity of the Eglinton Casino and a number of restaurants and shops which can potentially fit up to 6 vehicles and operates from 6:00 to 11:00 Monday to Saturday and as a clearway from 11:00 to 19:30 Monday to Saturday.

Williamsgate Street (between Eglinton Street and Eyre Square North) has a loading bay / Clearway located in the vicinity of Logues and the GBC Galway Bakery Company which can potentially fit 3 vehicles and operates as a loading bay from 06:00 to 11:00 Monday to Saturday and as a clearway from 11:00 to 19:30 Monday to Saturday.

The eastern aspect Eyre Square east (between Eyre Square north and Forster Street) is predominantly made up of two sections of designated loading bay and taxi rank which can fit up to 14 spaces in total.

The first of which is located on the northern half of the route of which 3 spaces operates as a loading bay from 06:00 to 11:00 Monday to Sunday and all 8 spaces operates as a taxi rank from 11:00 to 06:00 Monday to Sunday. The second is located on the southern half of the route, of which 3 spaces operate as a loading bay from 06:00 to 18:00 Monday to Friday and all 8 spaces operate as a taxi rank from 18:30 to 06:00 Monday to Sunday. The western aspect of the road is predominantly made up of a Bus set down zone spanning approximately 90 metres.

Forster Street (Between Eyre Square and College Road) has a designated loading / taxi bay on the western aspect of the road opposite the Park House Hotel with a maximum stay duration of 30 minute which is in operation 08:30 to 15:30 Monday to Saturday.

4.1.3 On-Street Parking Bays and Regulation on Local Side Streets

There are several side streets which are able to be used by local residents and visitors/businesses. These spaces are likely to be utilised by visitors to premises along the route between The Salmon Weir Bridge and Forster Street due to the lack of available parking directly on the corridor, or visitors to Galway City in general. There are 1298 designated Pay & Display parking spaces with on the local side streets and designated car-parks, within 200m from the corridor, such as:

- Newtownsmith - 10 spaces, 2hr 8:30 to 18:30 Monday to Saturday, 13:00 to 16:00 Sunday;
- Newtownsmith Surface Car-Park – 40 spaces, Mon-Sat 08:30-18:30, Sun 13:00-18:00, 1 Hour €2.00, Max €20.00, Free outside these hours
- Waterside - 4 designated disabled, 21 pay and display 2hr 08:30- 18:30 Mon-Sat + 6 unsigned / Court Avenue - 5 unsigned / Court Lane - 8 pay and display 2hr 08:30- 18:30 Mon-Sat 13:00-18:00 Sun
- Market Street; 7 pay and display 2hr 08:30- 18:30 Mon-Sat 13:00-18:00 Sun, 2 designated disabled
- Market Street Surface Car-Park – 87 spaces, Mon-Sun - All day, 1 Hour €2.70, 24 Hours €20.00, Overnight €10.00 (In after 18:00 Out by 09:00)
- Eyre Street; 12 pay and display 2hr 08:30- 18:30 Mon-Sat 13:00-18:00 Sun + 2 designated disabled
- St. Patrick’s Avenue; 9 spaces (possibly unsigned, Google street view doesn’t display any signs)
- Corrib Centre Car-Park - 576 spaces Mon-Sun - All day,10 Mins Free, 1 Hour €2.40, 2 Hours €4.80, 3 Hours €7.20, 4 Hours €9.60, 5 Hours €12.00, 10 Hours €15.00, 24 Hours €20.00. Opening Times Mon-Wed, Sat 08:30-19:00, Thu-Fri 08:30-21:00, Sun 10:30-18:30
- Frenchville Lane - 11 spaces 2hr 8:30 to 18:30 Monday to Saturday, 7 spaces unregulated/informal

- Fairgreen Road Car-Park – 410 spaces, Mon-Sun - All day, 1 Hour €2.70, 24 Hours €20.00, Overnight €10.00 (In after 18:00 Out by 09:00), Week €84.00, 4 Weeks €95.00, Quarter €300.00, 6 Months €600.00, Year €1150.00. Opening Times Mon-Sun All day
- Ceannt Station Car-Park – 90 spaces, Mon-Sun - All day 24 Hours €6.50 (Customers Only)

4.1.4 Land Use and Parking Demand

The route from the Salmon Weir Bridge to Forster Street contains a large range of land uses illustrated in Appendix B. There is a site which has surface level off street parking for residents on their premises to the south of Galway Circuit Court. There is also off street parking at the Parish of Saint Patrick Church.

The route runs through large trip attractors in Galway City Centre, some of which include the following:

- Galway Courthouse;
- Town Hall Theatre;
- Mercy Primary School;
- Franciscan Abbey;
- Financial Institutions;
- Multiple Hotels, Bars and Restaurants;
- St. Patricks Church

The route from the Salmon Weir Bridge to Forster Street has a range of shops, restaurants/takeaways, pubs/bars located and other commercial and residential properties throughout the route through Galway City Centre.

4.2 Bus Corridor Parking Proposals

4.2.1 Proposed On-Street Parking and Loading Bay Supply

With BusConnects Cross City Link infrastructure in place, there is an associated need to remove some parking spaces to provide improved facilities for pedestrians, cyclists, and buses. The planned changes in on-street parking on this section of the route between the Salmon Weir Bridge and Forster Street are illustrated in **Figure 3** to **Figure 6Error! Reference source not found.**, and summarised in **Table 5**.

Table 5: Existing and Proposed Parking Supply Summary (Salmon Weir Bridge to Forster Street)

Sub-section	Parking / Loading Facilities	Existing	Proposed	Loss of Parking / Loading
Eglinton Street (between St. Francis Street and Williamsgate Street)	Loading Bay / Clearway	1 Bay (6 spaces)	1 Bay (4 spaces)	-2 spaces
	Informal Parking	1 Clearway (9 spaces)	0	-9 spaces
Williamsgate Street (between Eglinton Street and Eyre Square North)	Loading Bay / Clearway	1 Bay (3 spaces)	1 Bay (3 spaces)	0
Eyre Square east (between Eyre Square north and Forster Street)	Loading Bay / Taxi Rank	2 Bays (6 spaces)	2 Bays (12 spaces)	+6 spaces
	Taxi Rank	2 Bays (8 spaces)	0	-8 spaces
	Bus Set Down	1 Bay (5 spaces)	1 Bay (5 spaces)	0
Forster Street (Between Eyre Square and College Road)	Designated Paid Parking	8 spaces	0	-8 spaces
	Designated Disabled Parking	2 spaces	0	-2 spaces
	Loading Bay	1 bay (6 spaces)	1 bay (6 spaces)	0

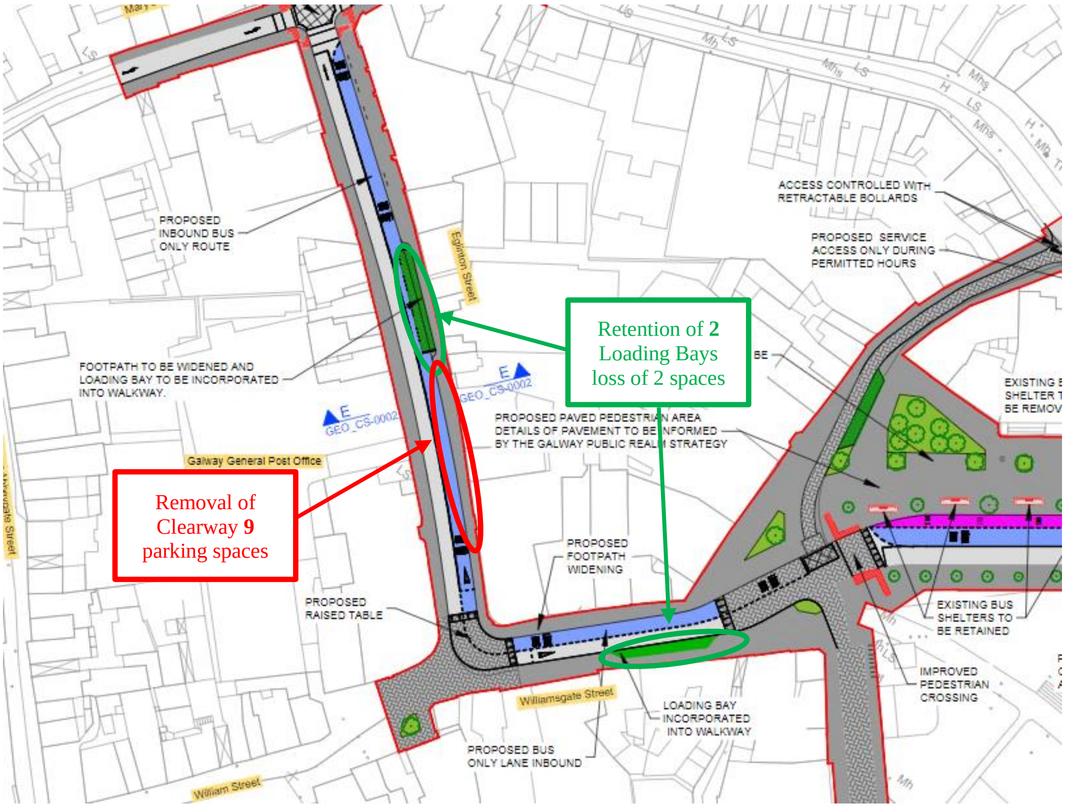


Figure 3: Proposed scheme design on Eglinton Street and Williamsgate Street

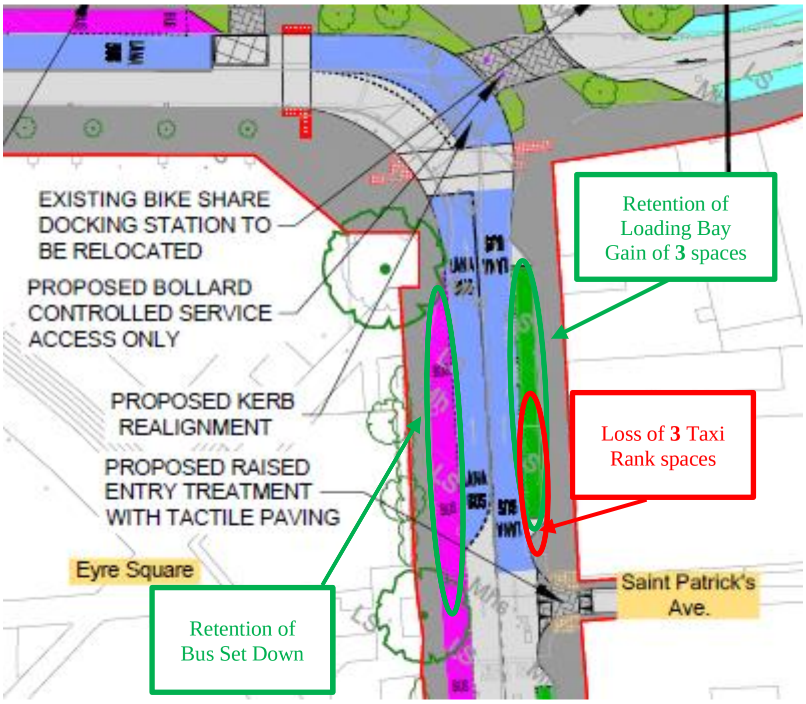


Figure 4: Proposed scheme design Eyre Square East

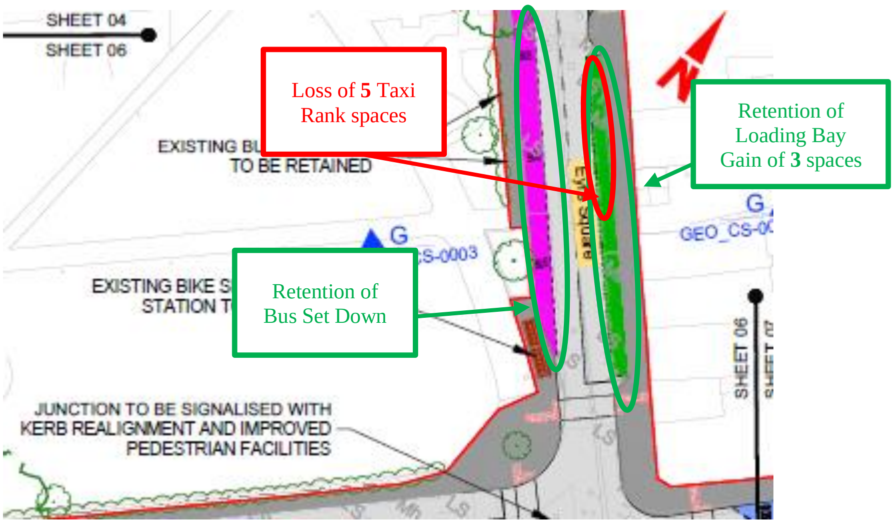


Figure 5: **Proposed scheme design Eyre Square East**

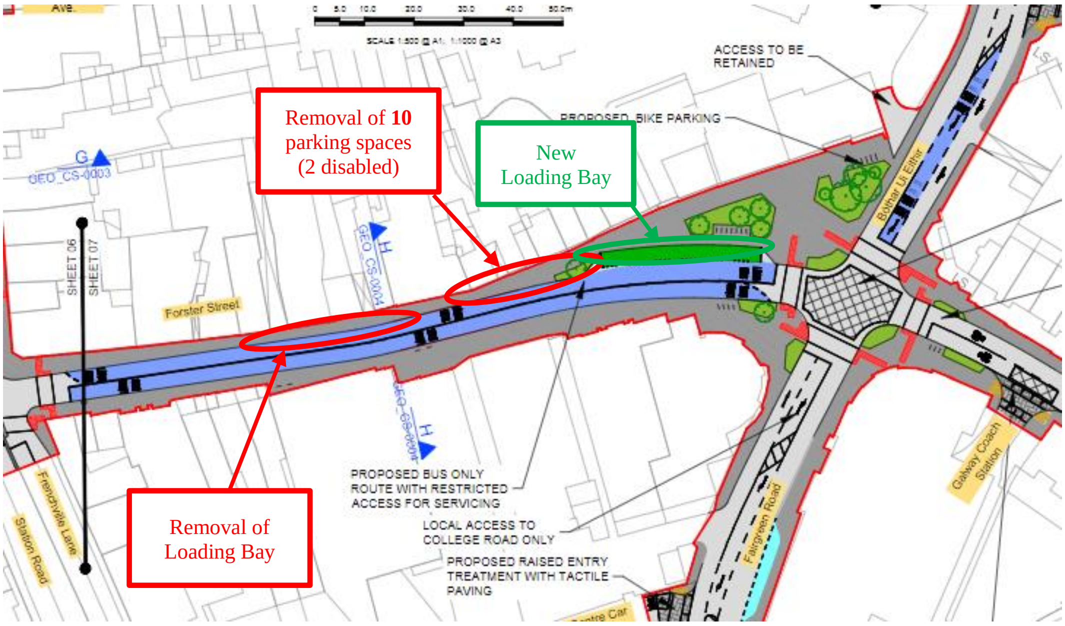


Figure 6: Proposed scheme design on Forster Street

4.3 Overall Parking Impact

A summary of the parking impact with respect to the change in overall parking supply on the Proposed Scheme corridor from the Salmon Weir Bridge to Forster Street is shown in **Table 6**, which includes consideration of spaces on adjacent streets within an approximate 200m distance.

Table 6: Impact of Parking Changes for Salmon Weir Bridge to Forster Street

Location	Type of Parking		No. of Spaces		
			Baseline	Scheme	Change
Eglinton Street (between St. Francis Street and Williamsgate Street)	Loading / Clearway	Commercial	6	4	-2
Eglinton Street (between St. Francis Street and Williamsgate Street)	Informal Parking	Commercial	9	0	-9
Williamsgate Street (between Eglinton Street and Eyre Square North)	Loading / Clearway	Commercial	3	3	0
Eyre Square east (between Eyre Square north and Forster Street)	Loading / Taxi Rank	Commercial	6	12	+6
Eyre Square east (between Eyre Square north and Forster Street)	Taxi Rank	Commercial	8	0	-8
Eyre Square east (between Eyre Square north and Forster Street)	Bus Set Down	Commercial	5	5	0
Forster Street (Between Eyre Square and College Road)	Designated Paid	Commercial	8	0	-8
Forster Street (Between Eyre Square and College Road)	Designated Disabled	Commercial	2	0	-2
Forster Street (Between Eyre Square and College Road)	Loading Bay	Commercial	6	6	0
Approx. adjacent parking of type within 200m			1298	1298	0
Total			1351	1328	-23

5 Parking Impact on College Road and Dublin Road

5.1 Baseline Parking and Loading Analysis

5.1.1 Corridor On-Street Parking Bays and Regulation

This section travels east on College Road from the junction with Forster Street to the junction with Lough Atalia Road then continues east to the junction with Dublin Road and southbound along Dublin Road.

This section of the route contains 64 designated paid parking spaces at the following locations:

- Approximately 22 pay and display spaces scattered throughout the northern side of the road with a restriction of up to 2 hours. These parking spaces are available from 08:30 to 18:30 from Monday to Saturday, and 13:00 to 18:00 on Sundays; and
- Approximately 43 pay and display spaces on the southern side of the road with a restriction of up to 2 hours. These parking spaces are available from 08:30 to 18:30 from Monday to Saturday, and 13:00 to 18:00 on Sundays.

The designated Pay & Display parking spaces above have a tariff of €2.00 per hour with a restriction of up to two hours, and a minimum charge of 50c.

There is a set down only area outside Yeats College to the west of College Road on the northern aspect with space available for 2 vehicles.

There is a loading bay on the southern aspect of the route at the College Road Florist on the eastern end of College Road with space available for 2 vehicles. This loading bay has a max stay duration of 30 minutes and is in operation from 08:30 to 18:30 Monday to Saturday.

There are 3 designated disabled parking spaces on the southern aspect of College Road, two of which are located opposite Aaron House B&B, and the third located further east opposite Connacht Rugby sports grounds.

In addition to the public on street parking, there is also privately owned parking which will be impacted by the proposed scheme. All of these are located along College Road, between the Lough Atalia Road junction and the Moneenageisha Junction:

- Approximately 58 parking spaces designated for residents and visitors to the Gleann Noinin residential development;
- Approximately 11 parking spaces designated for customers to the Circle K Petrol Filling Station development;
- Approximately 24 parking spaces designated for residents and visitors to the Moneenageisha Court residential development;

- Approximately 12 parking spaces designated for residents and visitors to the Bayview B&B development;

There is currently no existing on-street parking or loading along Dublin Road between the junction with College Road and the end of the proposed scheme.

A summary of the existing parking supply from College Road to Dublin Road is presented in **Table 7**.

Table 7: Existing On-Street Parking and Loading Spaces on College Road to Dublin Road

Sub-section	Existing Parking Facilities	Number of Spaces
College Road (Forster Street to Lough Atalia Road)	Designated Paid Parking	64 spaces
	Designated Disabled Parking	3 spaces
	Loading Bay / Set Down	2 bays (4 spaces)
College Road (Lough Atalia Road to Dublin Road)	Gleann Noinin	58 spaces
	Circle K	11 spaces
	Moneenageisha Court	24 spaces
	Bayview B&B	12 spaces
Dublin Road (College Road to end of scheme)	Designated Paid Parking	0
	Loading Bay	0

5.1.2 Loading Bays

There is one loading bay, offering space for 2 vehicles, available on College Road. It is located on the southern aspect of the road in the vicinity of College Road Florists. It is designated as a loading bay from 08:30 to 18:00 from Monday to Saturday with a maximum stay of 30 minutes. This would primarily provide loading activities for the College Road Florist shop with frontage College Road.

There is also a set down only are of 2 spaces on the northern aspect of College Road, at Yeats College. This bay operates as a set down only area for Yeats College and appears to operate for 24 hours a day Monday to Sunday.

As loading activities occur 24hrs throughout the day, loading bays should be available for loading most of the time.

5.1.3 On-Street Parking Bays and Regulation on Local Side Streets

There are several side streets which are able to be used by local residents and visitors/businesses. These spaces are most likely to be utilised by residents and residential visitors rather than visitors to premises along the route as an alternative to parking directly on the corridor. These side streets are all residential cul-de-sacs and parking is therefore largely informal and unregulated. These residential cul-de-sacs are within 100m from the corridor and in the vicinity of the on-street parking directly on the corridor, such as:

- The Elms (residential);
- Glenmore (residential);
- The Green (residential); and
- Loyola Park (residential);

The availability of parking spaces on all the streets listed above is restricted, as all have signs and notices in place stating parking is for residents only and that fines/clamping is in place for non-residents.

5.1.4 Land Use and Parking Demand

The route from College Road to Dublin Road contains a large range of land uses illustrated in Appendix B. There are a number of sites which have surface level off street parking on their premises such as Galway City Council, Yeats College, Connacht Rugby Sports Grounds, the Huntsman Inn, the G Hotel & Spa, Wellpark Retail and various B&B’s and Hostels throughout the route. Therefore, it can be assumed that parking activities are within their premises and would not require on-street parking along the corridor.

The route from College Road to Dublin Road runs through large trip attractors in Galway City, which include the following:

- Galway City Council;
- Galway Greyhound Stadium;
- Connacht Rugby Sports Ground;
- The G Hotel and Spa; and
- Wellpark Retail Centre.

Generally, there are a range of B&B’s, shops, restaurants/takeaways, pubs/bars located along the route from College Road to Dublin Road.

5.2 Cross City Link Parking Proposals

5.2.1 Proposed On-Street Parking and Loading Bay Supply

With BusConnects Cross City Link infrastructure in place, there is an associated need to remove some parking spaces to provide improved facilities for pedestrians, cyclists, and buses. The planned changes in on-street parking along the route from College Road to Dublin are illustrated in **Table 8**.

Table 8: Existing and Proposed Parking Supply Summary (College Road to Dublin Road)

Sub-section	Parking / Loading Facilities	Existing	Proposed	Loss of Parking / Loading
College Road (Forster Street to Lough Atalia Road)	Designated Paid Parking	64 spaces	46 spaces	-18 spaces
	Designated Disabled Parking	3 spaces	4 spaces	0
	Loading / Set Down	2 bays (4 spaces)	2 Bays (4 spaces)	0
College Road (Lough Atalia Road to Dublin Road)	Gleann Noinin	58 spaces	52 spaces	-6 spaces
	Circle K	11 spaces	7 spaces	-4 spaces
	Moneenageisha Court	24 spaces	24 spaces	0
	Bayview B&B	12 spaces	7 spaces	-5 spaces
Dublin Road (College Road to end of scheme)	Designated Paid Parking	0	0	0
	Loading Bay	0	0	0

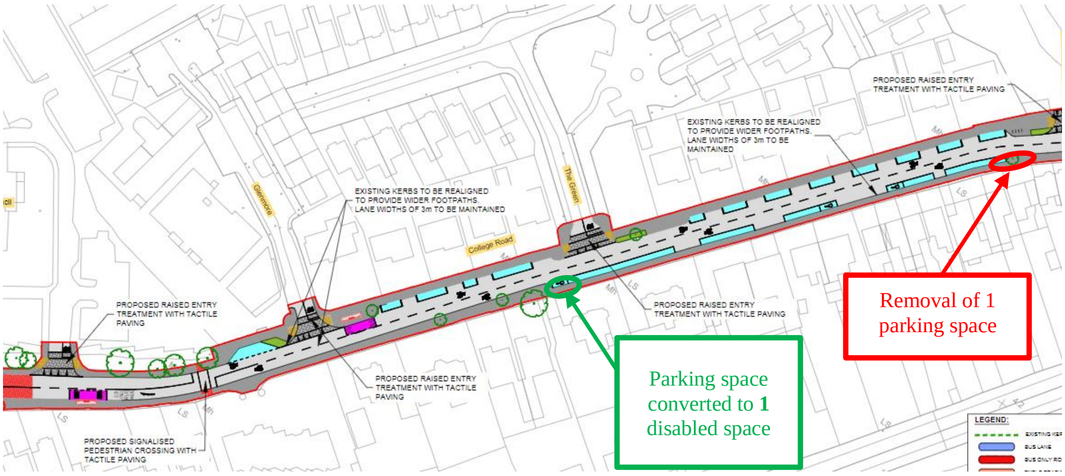


Figure 7: Proposed scheme design on College Road

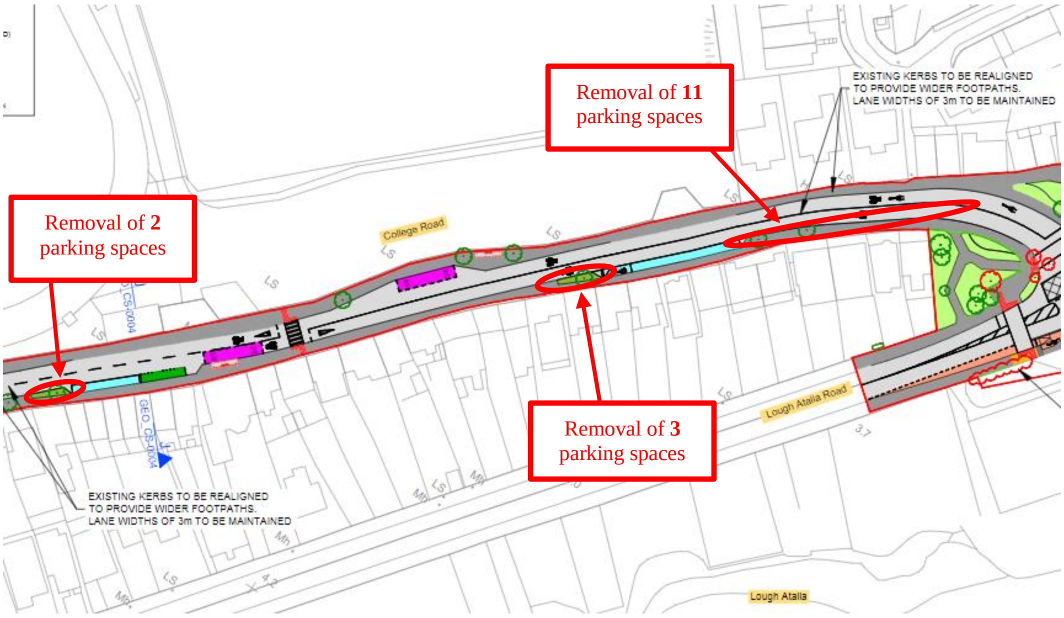
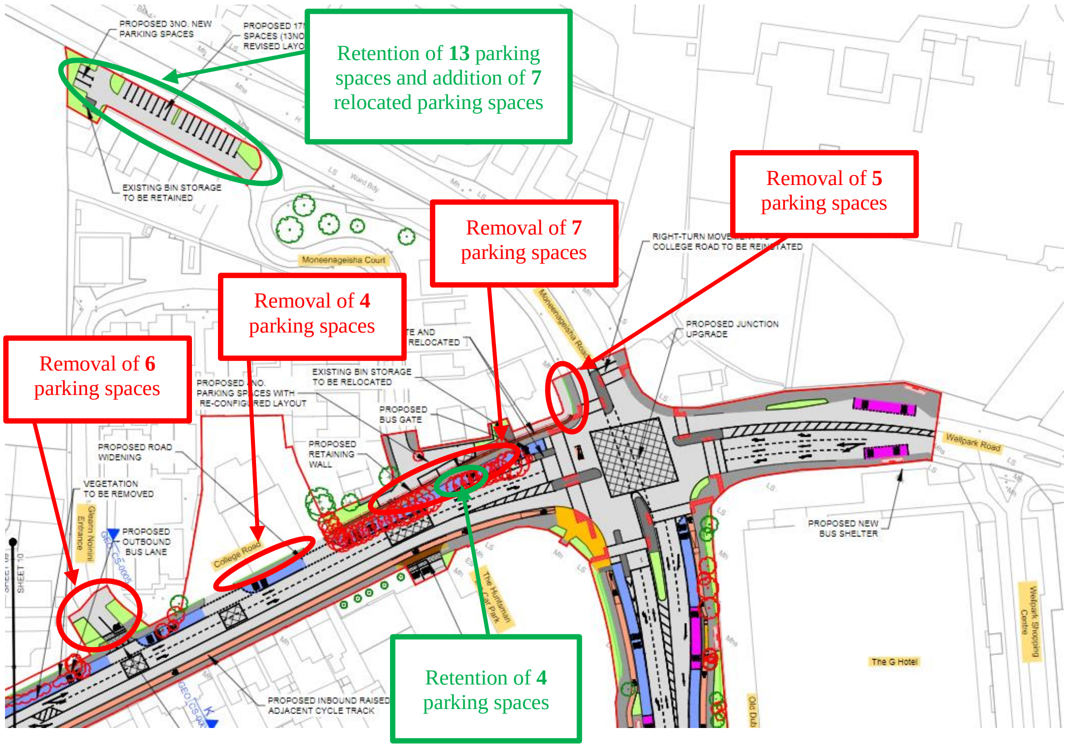


Figure 8: Proposed scheme design on College Road



Retention of **13** parking spaces and addition of **7** relocated parking spaces

Removal of **5** parking spaces

Removal of **7** parking spaces

Removal of **4** parking spaces

Removal of **6** parking spaces

Retention of **4** parking spaces

Figure 9: Proposed scheme design on College Road

5.3 Overall Parking Impact

A summary of the parking impact with respect to the change in overall parking supply on the Proposed Scheme corridor in section is shown in **Table 9**, which includes consideration of spaces on adjacent streets within an approximate 100m distance, all of which are in the public carpark on College Road adjacent to the Sportsground.

Table 9: Impact of Parking and Loading Changes from College Road to Dublin Road

Location	Type of Parking		No. of Spaces		
			Baseline	Scheme	Change
College Road (from Forster Street to Lough Atalia Road)	Designated Paid	Residential	64	46	-18
College Road (from Forster Street to Lough Atalia Road)	Designated Disabled	Commercial	3	4	+1
College Road (from Forster Street to Lough Atalia Road)	Loading / Set Down	Commercial	2 bays (4 spaces)	2 bays (4 spaces)	0
College Road (Lough Atalia Road to Dublin Road)	Private (Gleann Noinin)	Residential	58	52	-6

Location	Type of Parking		No. of Spaces		
			Baseline	Scheme	Change
College Road (Lough Atalia Road to Dublin Road)	Private (Circle K)	Commercial	11	7	-4
College Road (Lough Atalia Road to Dublin Road)	Private (Moneenageisha Court)	Residential	24	24	0
College Road (Lough Atalia Road to Dublin Road)	Private (Bayview B&B)	Commercial	12	7	-5
Dublin Road (College Road to end of scheme)	Designated Paid	Residential	0	0	0
Approx. adjacent parking of type within 200m			90	90	0
Total			266	234	-32

6 Parking Impact on Lough Atalia Road to Headford Road / Dyke Road

6.1 Baseline Parking and Loading Analysis

6.1.1 Corridor On-Street Parking Bays and Regulation

This section travels south west on the Headford Road and Dyke Road, along St Brendan’s Avenue and Bóthar Na mBan, north east along Prospect Hill to Bóthar Bhreandáin Ui Eithir and south along Fairgreen Road to Lough Atalia Road.

Headford Road (from St Bridget’s Place to St Brendan’s Avenue) has an unregulated / informal bay at Richard Walsh Cycles, where free parking / loading is available for 2 vehicles.

The Dyke Road car-park is a large public surface car-park containing 510 parking spaces. This operates on a pay & display arrangement with a fixed fee of €5 08:30 – 18:30 Mon – Sat and 13:00 – 18:00 Sunday.

St Brendan’s Avenue and Bóthar Na mBan (from Headford Road to Prospect Hill) has no designated on-street parking. There is a bus set down and pick up only bay on the northern aspect of the road at Galway County Council with space for 2 buses, and a loading bay with approximately 3 spaces on the southern aspect of the road in the same location.

There is currently no existing on-street parking along Prospect Hill between Bóthar Na mBan and Bóthar Bhreandáin Ui Eithir.

Bóthar Bhreandáin Ui Eithir (from Prospect Hill to Fairgreen Road) has a bus lane in the southbound direction which operates for 24 hours a day from Monday to Sunday. There are no dedicated on-street parking spaces on this section of the route.

Fairgreen Road (from Bóthar Bhreandáin Ui Eithir to Lough Atalia Road) there are two drop off areas on the eastern aspect of the route opposite the Park House Hotel, at the Galway Coach Station. Each area has space for 3 vehicles, with a max stay of 5 minutes. There is also a restriction sign stating no taxis. It should be noted that the desktop analysis showed taxis utilising this drop off area. There is also a designated taxi rank on the southern aspect of the route, in the vicinity of the Revenue Regional Office, with space for 10 vehicles. As well as a 24 hour Loading Bay / Clearway of 5 spaces. It should be noted that the desktop analysis showed an area of informal parking which occurred on a section of footpath between the taxi rank and the roadway, of 7 vehicles.

A summary of the existing parking supply from Lough Atalia Road to Headford Road and Dyke Road is presented in **Table 10**.

Table 10: Existing On-Street Parking and Loading Spaces on Lough Atalia Road to Headford Road

Sub-section	Existing Parking Facilities	Number of Spaces
Headford Road (from St Bridget's Place to St Brendan's Avenue)	Informal Free Parking	2 spaces
Dyke Road Car Park	Pay & Display	510 spaces
St. Brendan's Avenue	Designated Paid Parking	48 spaces
Bóthar Na mBan (from Headford Road to Prospect Hill)	Bus Set down	1 Bay (2 spaces)
	Loading Bay	1 Bay (3 spaces)
Fairgreen Road (from Bóthar Bhreandáin Ui Eithir to Lough Atalia Road)	Set Down Area	1 Bay (3 spaces)
	Set Down Area	1 Bay (3 spaces)
	Taxi Rank	1 Bay (10 spaces)
	Loading Bay / Clearway	1 Bay (5 spaces)

6.1.2 Loading Bays

There is one loading bay, offering space for 3 car parking spaces, available on Bóthar Na mBan. It is located on the southern aspect of the road in the vicinity of Galway County Council. It is designated as a loading bay for 24hrs of the day from Monday to Saturday with a maximum stay of 30 minutes. This would primarily provide loading activities for the shops with frontage to Bóthar Na mBan such as TK Maxx.

There is also a loading bay / clearway of 5 spaces on the southern aspect of Fairgreen Road, opposite the Revenue Regional Office. While the road markings suggest that this is a loading bay, the signage suggests that this is clearway for 24 hours a day Monday to Sunday.

6.1.3 On-Street Parking Bays and Regulation on Local Side Streets

There are several side streets which are able to be used by local residents and visitors/businesses. These spaces are likely to be utilised by visitors to premises along the route as an alternative to parking directly on the corridor.

There are designated Pay & Display and Permit Parking with almost 106 spaces (3 of which are designated disabled) on the local side streets within 200m from the corridor and in the vicinity of the on-street parking directly on the corridor, such as:

- St Brendan's Avenue;
- Bóthar Irwin;
- Bohermore;
- St. Bridget's Place;
- St. Bridget's Terrace and
- Forster Street.

The availability of parking spaces on all the streets listed above, except for, have time plates of 08:30 to 18:30 Monday to Saturday and 13:00 to 18:00 Sunday. The designated Pay & Display parking spaces above have a tariff of €2.00 per hour with a restriction of up to two hours, and a minimum charge of 50c.

6.1.4 Land Use and Parking Demand

The route from Lough Atalia Road to Headford Road contains a large range of land uses illustrated in Appendix B. There are a number of sites which have surface level off street parking on their premises such as Galway County Council, to the rear of On Yer Bike Cycles, and the residencies behind Sherry FitzGerald. Therefore, it can be assumed that parking activities are within their premises and would not require on-street parking along the corridor.

There are also a number of multistorey carparks along the route such as:

- Corrib Shopping Centre Car Park, which operates 24 hours a day Monday to Sunday with 576 spaces. The car park operates at a cost of €2.40 per hour up to 5 hours, €15.00 for 10 hours and €20.00 for 24 hours.
- Park House Hotel car park for guests, with costs included in room rates and the City Centre Car Park at Fairgreen House.
- City Park at Fairgreen Road, with 410 spaces, which operates 24 hours a day Monday to Sunday at a cost of €2.70 an hour and €20.00 for 24 hours. The carpark also offers 20 day, quarterly and yearly passes.
- Galway Coach Station, with 168 spaces, which operates 24 hours a day Monday to Sunday at a cost of €2.70 an hour and €20.00 for 24 hours.
- The Galmont Hotel & Spa, with 240 spaces, which operates from Monday to Sunday 08:00 to 19:00 at a rate of €2.50 per hour and €20.00 for 24 hours, and 17:00 to 11:00 at a flat rate of €15.00. as well as a rate of €9.00 for 24 hours offered to customers.

The route from Lough Atalia Road to Headford Road runs through large trip attractors in Galway City, which include the following:

- The Galmont Hotel & Spa;

- Revenue Regional Office;
- The Western Hotel;
- Galway County Council;
- TK Maxx;
- Car Wash Galway (previously Great Gas Filling Station)

Generally, there are a range of shops, restaurants/takeaways, pubs/bars located along the route from Lough Atalia Road to Headford Road.

6.2 Cross City Link Parking Proposals

6.2.1 Proposed On-Street Parking and Loading Bay Supply

With BusConnects Cross City Link infrastructure in place, there is an associated need to remove some parking spaces to provide improved facilities for pedestrians, cyclists, and buses. The planned changes in on-street parking along the route from Lough Atalia Road to Headford Road are illustrated in **Figure 9** and summarised in **Table 11**.

Table 11: Existing and Proposed Parking Supply Summary (Lough Atalia Road to Headford Road)

Sub-section	Parking / Loading Facilities	Existing	Proposed	Loss of Parking / Loading
Headford Road (from St Bridget's Place to St Brendan's Avenue)	Informal Free Parking	2 spaces	0	-2 spaces
Dyke Road Car Park	Designated Paid Parking	510 spaces	500 spaces	-10 spaces
St. Brendan's Avenue	Designated Paid Parking	48 spaces	46 spaces	-2 spaces
Bóthar Na mBan (from Headford Road to Prospect Hill)	Bus Set Down	1 Bay (2 spaces)	1 Bay (2 spaces)	0
	Loading Bay	1 Bay (3 spaces)	1 Bay (3 spaces)	0

Sub-section	Parking / Loading Facilities	Existing	Proposed	Loss of Parking / Loading
Fairgreen Road (from Bóthar Bhreandáin Ui Eithir to Lough Atalia Road)	Set Down Area	1 Bay (3 spaces)	1 Bay (3 spaces)	0
	Set Down Area	1 Bay (3 spaces)	1 Bay (3 spaces)	0
	Taxi Rank	1 Bay (10 spaces)	1 Bay (10 spaces)	0
	Loading Bay / Clearway	1 Bay (5 spaces)	1 Bay (5 spaces)	0
	Informal / Unregulated Parking	7 spaces	0	-7 spaces

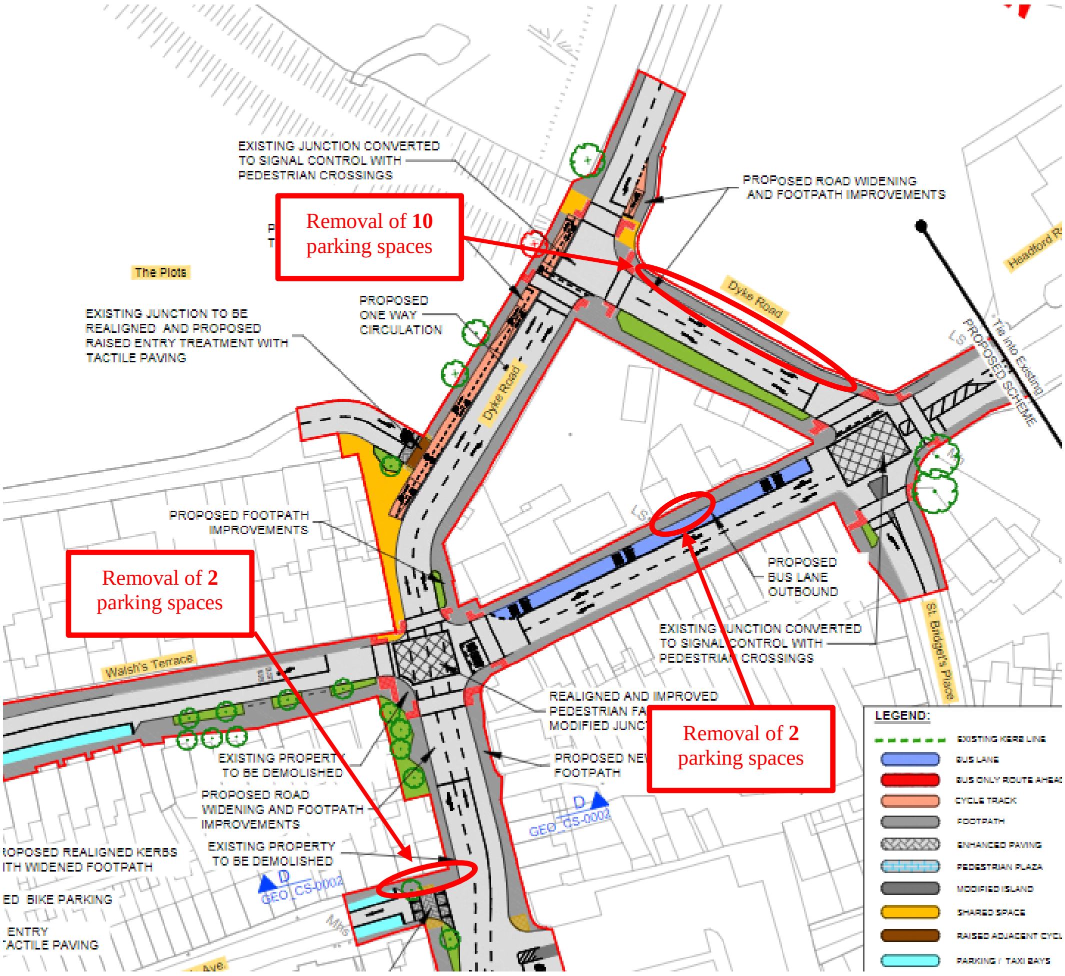


Figure 9: Proposed scheme design on Dyke Road and Headford Road

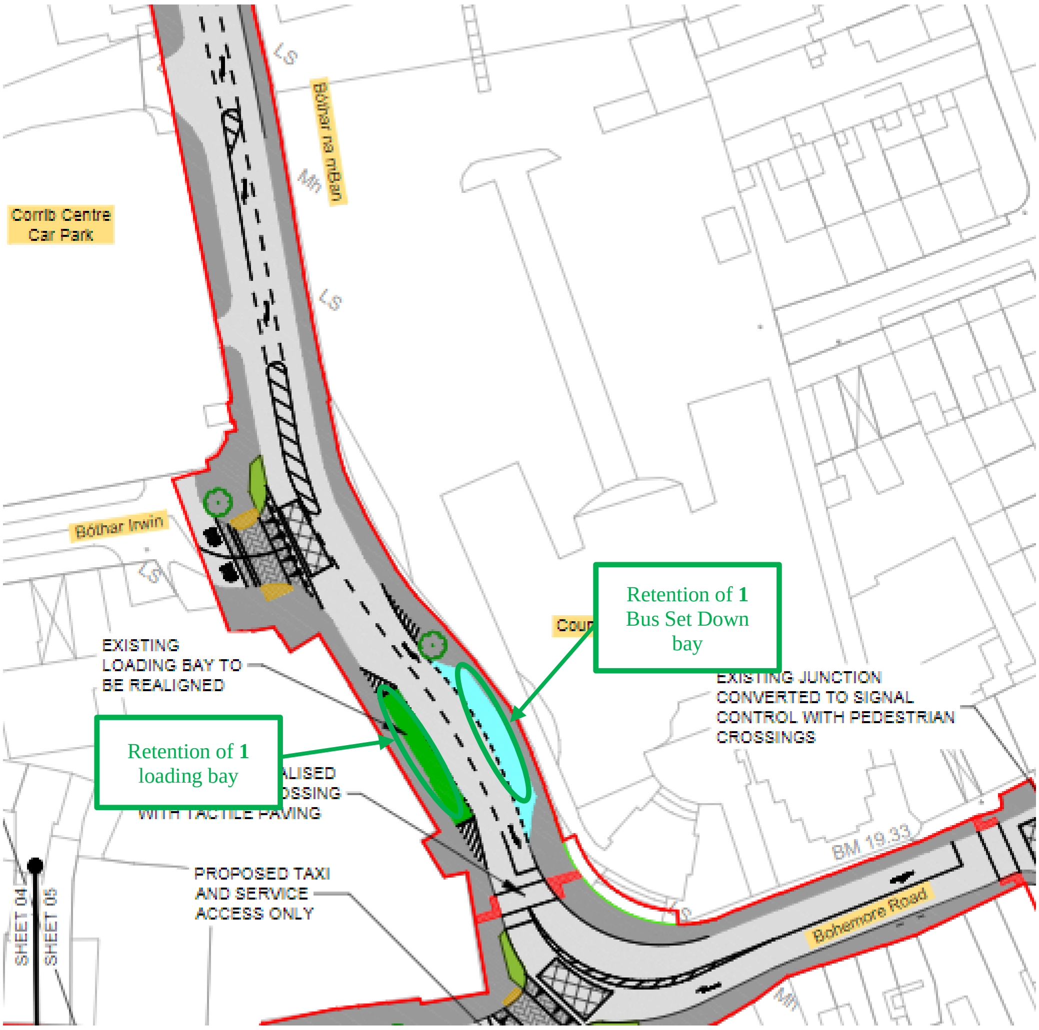


Figure 10: Proposed scheme design on Bóthar Na mBan

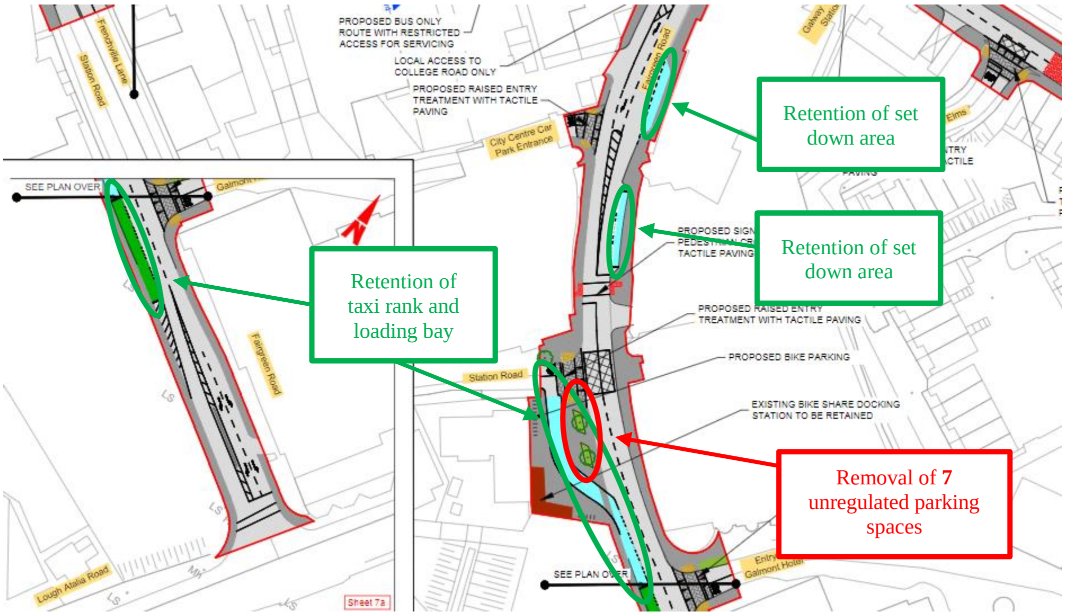


Figure 11: Proposed scheme design on Fairgreen Road

6.3 Overall Parking Impact

A summary of the parking impact with respect to the change in overall parking supply on the Proposed Scheme corridor in section is shown in **Table 12**, which includes consideration of spaces on adjacent streets within an approximate 200m distance.

Table 12: Impact of Parking and Loading Changes from Lough Atalia Road to Headford Road

Location	Type of Parking		No. of Spaces		
			Baseline	Scheme	Change
Headford Road (from St Bridget's Place to St Brendan's Avenue)	Informal / Unregulated Parking	Commercial	2	0	-2
Dyke Road Car-Park	Designated Paid Parking	Commercial	510	500	-10
St Brendan's Avenue	Designated Paid Parking	Residential	48	46	-2
Bóthar Na mBan (from Headford Road to Prospect Hill)	Bus Set Down	Commercial	2	2	0
Bóthar Na mBan (from Headford Road to Prospect Hill)	Loading Bay	Commercial	3	3	0
Fairgreen Road (from Bóthar Bhreandáin Ui Eithir to Lough Atalia Road)	Set Down Area	Commercial	3	3	0
Fairgreen Road (from Bóthar Bhreandáin Ui Eithir to Lough Atalia Road)	Set Down Area	Commercial	3	3	0
Fairgreen Road (from Bóthar Bhreandáin Ui Eithir to Lough Atalia Road)	Taxi Rank	Commercial	10	10	0
Fairgreen Road (from Bóthar Bhreandáin Ui Eithir to Lough Atalia Road)	Loading Bay	Commercial	5	5	0
Fairgreen Road (from Bóthar Bhreandáin Ui Eithir to Lough Atalia Road)	Informal / Unregulated Parking	Commercial	7	0	-7
Approx. adjacent parking of type within 200m			106	106	0
Total			699	678	-21

7 Parking Impact at Galway Cathedral

7.1 Baseline Parking and Loading Analysis

7.1.1 Corridor On-Street Parking Bays and Regulation

This section runs along Gaol Road from the junction with University Road to the Salmon Weir Bridge.

At the end of this section, towards the Salmon Weir Bridge, the proposed design includes the removal of a section of Gaol Road to be replaced by a pedestrian plaza, including amendments to an existing coach parking area.

There are two surface carparks in the vicinity of Galway Cathedral, these are the Parish of the Cathedral Carpark, and Cathedral Square Carpark. The Cathedral Square Carpark contains 152 spaces (5 designated disabled) and operates a flat rate of €5.00 for 2 hours from 08:30 to 18:30 Monday to Saturday and from 13:00 to 18:00 on Sundays. There is no cost to parking outside of operation hours in either carpark.

Gaol Road (from University Road to Nun’s Island) currently has 2 designated disabled parking spaces at the entrance to Island House. It should be noted that the desktop analysis showed that informal parking occurs along the western aspect of Gaol Road in the vicinity of Island House. This section can potentially fit up to 10 spaces, where parking activities may occur in an informal and unregulated nature.

Gaol Road (from Nun’s Island to the Salmon Weir Bridge) currently has no designated on street parking spaces. There is however 2 designated bus set-down only bays along the eastern aspect of the route with space for approximately 9 buses. Both bays operate from 08:00 to 18:00 seven days a week, with a maximum stay of 30 minutes.

A summary of existing parking and loading supply on Gaol Road from the junction with University Road to the Salmon Weir Bridge is presented in **Table 13**.

Table 13: Existing Parking and Loading Spaces in the vicinity of Galway Cathedral

Sub-section	Existing Parking Facilities	Number of Spaces
Gaol Road (from University Road to Nun's Island)	Tour Bus Stop	4 spaces
	Designated Disabled Parking	2 spaces
	Informal Parking	10 spaces
Gaol Road (from Nun's Island to the Salmon Weir Bridge)	Bus set-down only	2 Bays (9 spaces)
Galway Cathedral Parking	Bus Parking	0
	Designated Paid Parking	158 spaces
	Disabled Paid Parking	5 spaces

7.1.2 Loading Bays

As shown in **Table 13**, there are no loading bays along this section of the Proposed Scheme, there are however 2 bus set down only bays which can accommodate up to 9 busses. All set down bays are designated as such from 08:00 to 18:00 seven days a week, with a maximum stay of 30 minutes.

7.1.3 On-Street Parking Bays and Regulation on Local Side Streets

There is a single side street, Nun's Island, which is able to be used for parking by local residents and visitors/businesses. These spaces are likely to be utilised by residents and visitors to premises along the street itself. There are designated Pay & Display and Permit Parking with approximately 25 spaces on the local side street, within 200m from the corridor and in the vicinity of the on-street parking directly on the corridor.

The availability of parking spaces along Nuns Island are designated as Pay and Display Parking from 08:30 to 18:30 from Monday to Saturday and 13:00 to 18:00 on Sunday with a 2 hour stay duration.

7.1.4 Land Use and Parking Demand

This section of the Proposed is predominantly a single use area. Which is illustrated in **Appendix B**.

There is one site which has surface level off street parking on their premises, this is the Parish of the Cathedral carpark.

The Parish of the Cathedral Carpark contains 150 spaces and operates 24 hours a day at a rate of €1.50 and hour or €8.00 for 24 hours, Monday to Saturday, with no cost on Sundays. There is no cost to parking outside of operation hours in either carpark.

There are three key trip attractors along Gaol Road from the junction with University Road to the Salmon Weir Bridge. These are:

- Galway Cathedral;
- NUIG Buildings; and
- Island House.

7.2 Cross City Link Parking Proposals

7.2.1 Proposed On-Street Parking and Loading Bay Supply

With BusConnects Cross City Link infrastructure in place, there is an associated need to remove some parking spaces to provide improved facilities for pedestrians, cyclists, and buses. The planned changes in the vicinity of Galway Cathedral are illustrated in **Figure 12** and is summarized in **Table 14**.

Table 14: Existing and Proposed Parking and Loading Supply (Galway Cathedral)

Sub-section	Parking / Loading Facilities	Existing Spaces	Proposed	Loss of Parking / Loading
Gaol Road (from University Road to Nun’s Island)	Tour Bus Stop	4 spaces	0	-4 spaces
	Designated Disabled Parking	2 spaces	2 spaces	0
	Informal Parking	10 spaces	0	-10 spaces
Gaol Road (from Nun’s Island to the Salmon Weir Bridge)	Bus Set Down	2 Bays (9 spaces)	4 spaces	-5 spaces
Galway Cathedral Parking	Bus Parking	0	10 spaces	+10 spaces
	Designated Disabled Parking	5 spaces	5 spaces	0
	Designated Paid Parking	158 spaces	42 spaces	-116 spaces

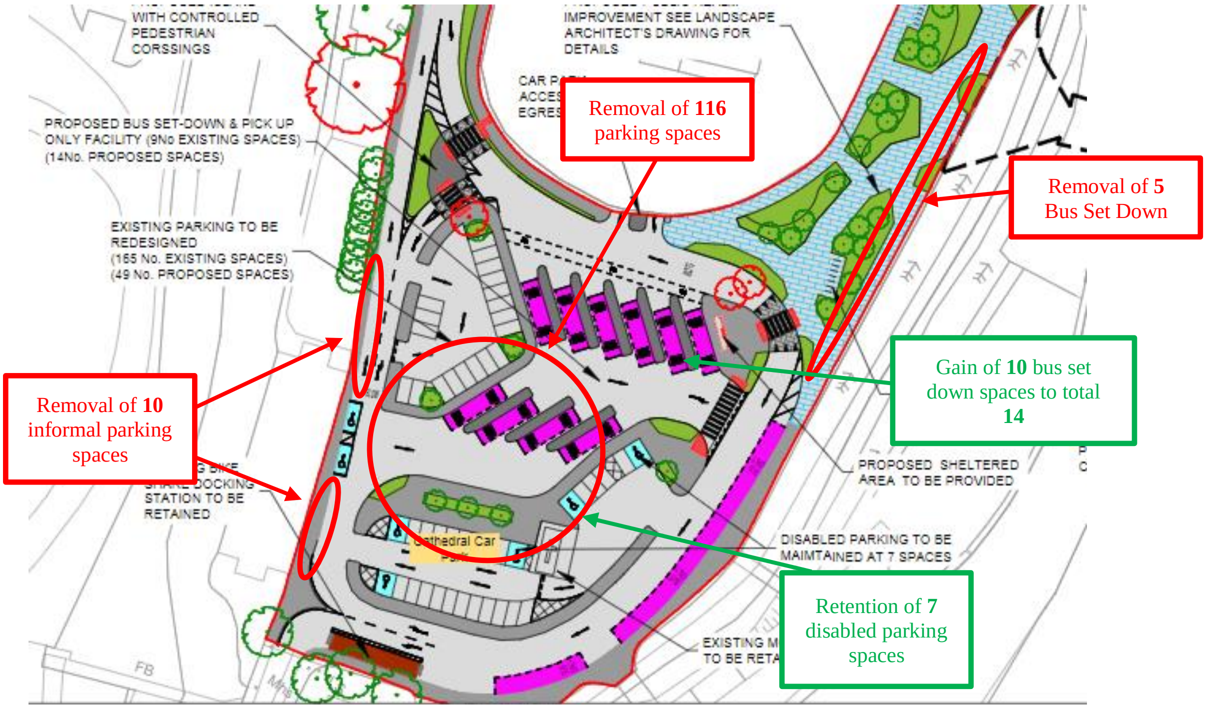


Figure 12: Proposed scheme design on Gaol Road and Galway Cathedral Carpark

7.3 Overall Parking Impact

A summary of the parking impact with respect to the change in overall parking supply on the Proposed Scheme corridor on this section of the Proposed Scheme is shown in **Table 15**, which includes consideration of spaces on adjacent streets within an approximate 200m distance.

Table 15: Impact of Parking and Loading Changes for Galway Cathedral

Location	Type of Parking		No. Spaces		
			Baseline	Scheme	Change
Gaol Road (from University Road to Nun's Island)	Tour Bus Stop	Commercial	4	0	-4
Gaol Road (from University Road to Nun's Island)	Designated Disabled Parking	Commercial	2	2	0
Gaol Road (from University Road to Nun's Island)	Informal Parking	Commercial	10	0	-10
Gaol Road (from Nun's Island to the Salmon Weir Bridge)	Bus Set Down	Commercial	9	4	-5
Galway Cathedral Parking	Bus Parking	Commercial	0	10	+10
Galway Cathedral Parking	Designated Disabled Parking	Commercial	5	5	0
Galway Cathedral Parking	Designated Paid	Commercial	158	42	-116
Approx. adjacent parking of type within 200m			175	175	0
Total			363	238	-125

8 Parking Impact on Woodquay and Newtownsmith

8.1 Baseline Parking and Loading Analysis

8.1.1 Corridor On-Street Parking Bays and Regulation

Woodquay (from Headford Road to Eglinton Street) has designated on-street Pay & Display spaces throughout located on both the eastern and western aspects of the route as well as centrally between the northbound and southbound lanes. It has a total of approximately 66 parking spaces (including 2 disabled spaces) which are in operation from 08:30 to 18:30 from Monday to Saturday and 13:00 to 18:00 on Sunday with a duration of 2 hours. The designated Pay & Display parking spaces above have a tariff of €2.00 per hour with a restriction of up to two hours, and a minimum charge of 50c.

There is also a loading bay / taxi bay and a taxi bay on the western side of the route in the vicinity of Barr An Chaladh, with a total of four spaces, 2 of which operate as pay and display parking spaces between the 08:30 to 18:30 from Monday to Saturday and 13:00 to 18:00 on Sunday.

Newtownsmith (from the Salmon Weir Bridge to Mary Street) has designated on-street Pay & Display spaces throughout located on the eastern aspect of the route. It has a total of approximately 10 parking spaces which are in operation from 08:30 to 18:30 from Monday to Saturday and 13:00 to 18:00 on Sunday with a duration of 2 hours. There is also a loading bay in the vicinity of Our Lady's College Galway, which has space for 3 vehicles and operates 24hrs a day.

The existing parking supply on Woodquay and Newtownsmith is summarised in **Table 16.**

Table 16: Existing Parking and Loading Spaces on Woodquay Street and Newtownsmith

Sub-section	Existing Parking Facilities	Number of Spaces
Woodquay Street (from Headford Road to Eglinton Street)	Designated Paid Parking	64 spaces
	Disabled Paid Parking	2 spaces
	Loading Bay / Taxi Rank	1 bay (2 spaces)
	Taxi Rank / Paid Parking	1 bay (2 spaces)
Walsh's Terrace	Designated Paid Parking	5 spaces
	Designated Paid Parking	10 spaces

Sub-section	Existing Parking Facilities	Number of Spaces
Newtownsmith (from the Salmon Weir Bridge to Bowling Green)	Designated Paid Parking	10 spaces
	Loading Bay	1 bay (3 spaces)

8.1.2 Loading Bays

There is one loading bay of 2 spaces on Woodquay Street outside Barr An Chaladh which is designated as a loading bay between 05:30 and 18:30 and as a taxi bay between 18:30 and 05:30 Monday to Sunday. This loading bay is likely to be used by the number of bars, restaurants and other retail units located within close vicinity.

There is also a loading bay of 3 spaces located outside Our Lady's College Galway, which has space for 3 vehicles and operates 24hrs a day. This loading bay is likely to be used by the large clothing shop Born.

8.1.3 On-Street Parking Bays and Regulation on Local Side Streets

There are a number of side streets which are able to be used by local residents and visitors / businesses. These spaces are likely to be utilised by some residents and visitors to premises on Woodquay Street and on Newtownsmith as an alternative to parking directly on the corridor.

There are Pay & Display and Permit Parking areas for approximately 120 spaces (5 designated disabled parking, 2 designated EV parking) within 200m from the corridor and in the vicinity of the on-street parking directly on the corridor, at the following locations:

- Eyre Street;
- Riverside;
- Corrib Terrace;
- Waterside;
- Court Avenue;
- Bowling Green; and
- Market Street.

The parking spaces on the streets listed above have varying time plates, including 08:30 to 18:30 from Monday to Saturday at Waterside, and 08:30 to 18:30 from Monday to Saturday and 13:00 to 18:00 on Sunday on all other streets. The designated Pay & Display parking spaces above have a tariff of €2.00 per hour with a restriction of up to two hours, and a minimum charge of 50c.

8.1.4 Land Use and Parking Demand

Woodquay Street and Newtownsmith both consist of different land uses throughout, as shown in **Appendix B**.

Woodquay Street has no sites along its route with private off street parking. The route runs through large trip attractors in Galway City, which include numerous bar, restaurants and retail premises.

There are two sites along Newtownsmith which have non-residential on-site parking such as:

- Newtownsmith Carpark at the south west of the road, which is a Pay and Display Carpark which operates from 08:30 to 18:30 Monday to Saturday and 13:00 to 18:00 on Sundays. The site consists of 40 spaces (one of which is designated disabled parking; and
- Our Lady's College Galway, which is permit parking only during school hours but operates as a Pay and Display parking outside of school hours, from 18:00 to 21:00 Monday to Friday and 08:00 to 21:00 Saturday to Sunday (during academic term) and from 08:00 to 21:00 Monday to Sunday (outside of academic term). The site consists of 50 spaces (one of which is designated disabled).

The key trip attractors that have access to Newtownsmith include Our Lady's College Galway and Born Clothing Store. While Our Lady's College Galway has parking within their premises, Born Clothing Store does not. Therefore, parking overspill may occur and visitors may use on-street parking within the surrounding areas.

8.2 Cross City Link Parking Proposals

8.2.1 Proposed On-Street Parking and Loading Bay Supply

With BusConnects Cross City Link infrastructure in place, there is an associated need to remove some parking space to provide improved facilities for pedestrians, cyclists, and buses. The planned changes in on-street parking on Woodquay and Newtownsmith are summarised in **Figure 13** to **Figure 15** and illustrated in **Table 17.**

Table 17: Existing and Proposed Parking and Loading Spaces (Woodquay and Newtownsmith)

Sub-section	Parking / Loading Facilities	Existing	Proposed	Loss of Parking / Loading
Woodquay Street (from Headford Road to Eglinton Street)	Designated Paid Parking	64 spaces	22 spaces	-42 spaces
	Disabled Paid Parking	2 spaces	0	-2 spaces

Sub-section	Parking / Loading Facilities	Existing	Proposed	Loss of Parking / Loading
	Loading Bay / Taxi Rank	1 bay (2 spaces)	1 bay (5 spaces)	+3 spaces
	Taxi Rank / Paid Parking	1 bay (2 spaces)	0	-2 spaces
Walsh's Terrace	Designated Paid Parking	5 spaces	10 spaces	+5 spaces
Newtownsmith (from the Salmon Weir Bridge to Bowling Green)	Designated Paid Parking	10 spaces	6 spaces	-4 spaces
	Loading Bay	1 bay (3 spaces)	1 bay (3 spaces)	0

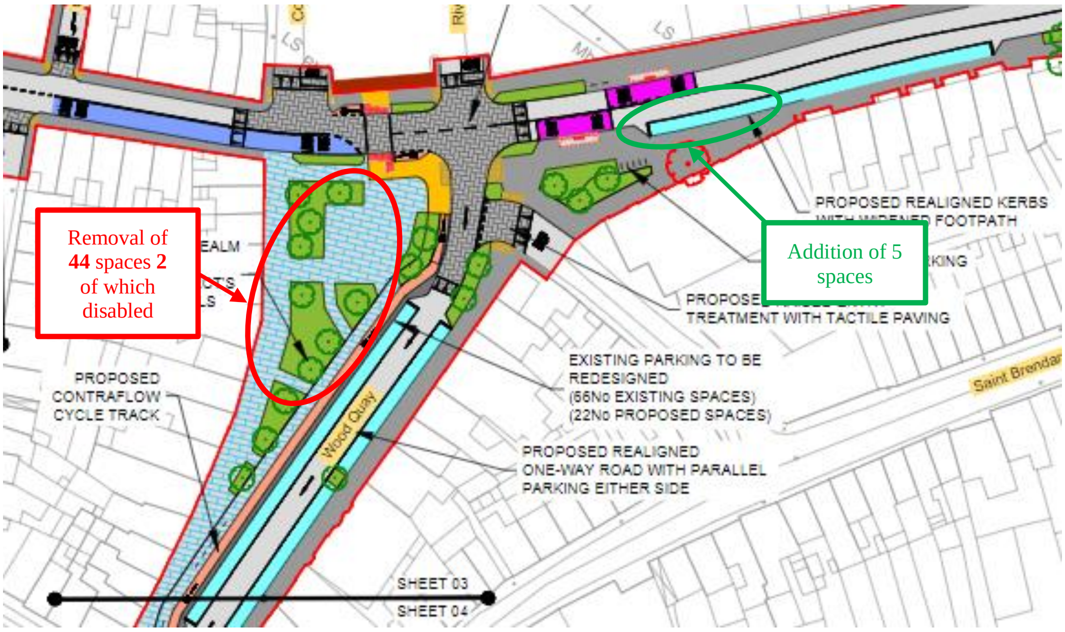


Figure 13: Proposed scheme design on Woodquay

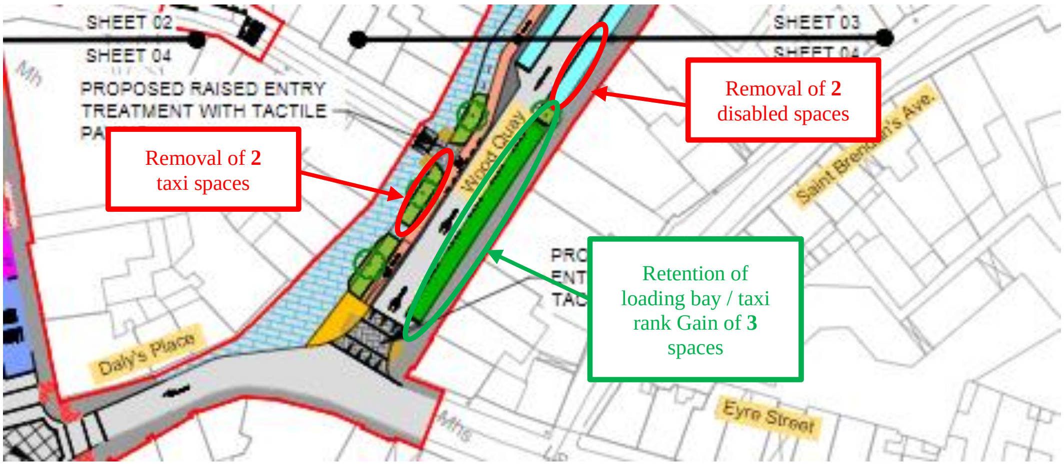


Figure 14: Proposed scheme design on Woodquay

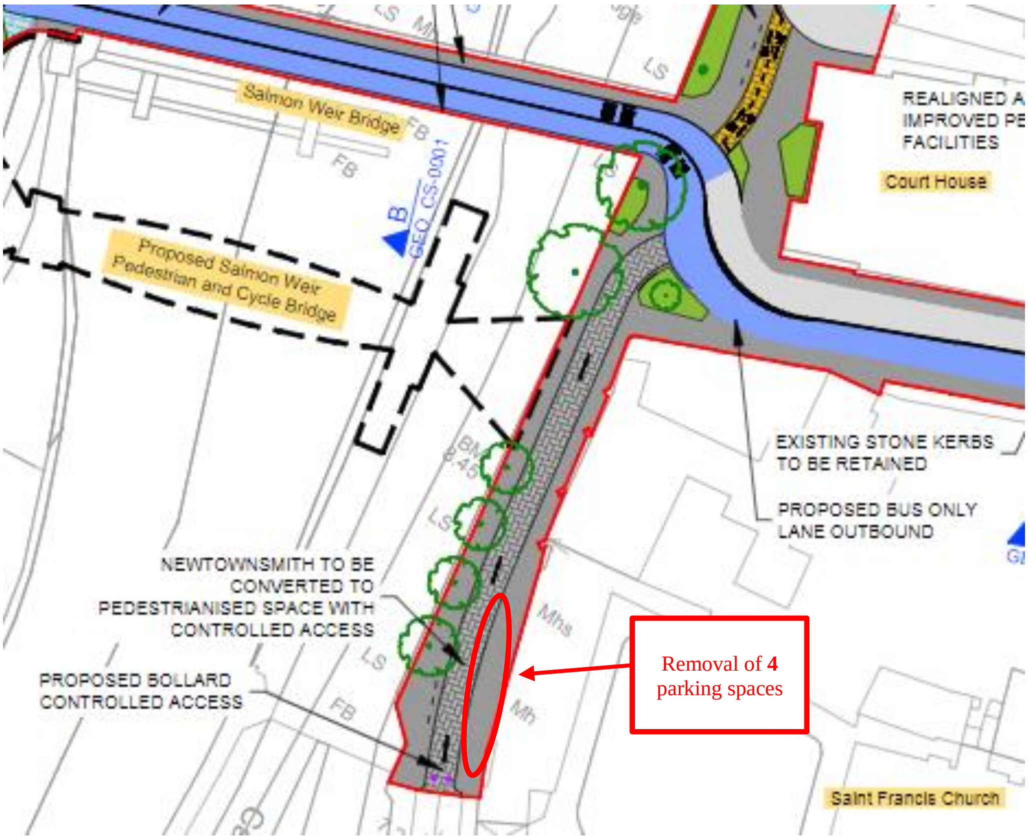


Figure 15: Proposed scheme design on Newtownsmith

8.3 Overall Parking Impact

A summary of the parking impact with respect to the change in overall parking supply on the Proposed Scheme corridor on Woodquay Street and Newtownsmith is shown in **Table 18**, which includes consideration of spaces on adjacent streets within an approximate 200m distance.

Table 18: Impact of Parking and Loading Changes for Woodquay and Newtownsmith

Location	Type of Parking		No. of Spaces		
			Baseline	Scheme	Change
Woodquay Street (from Headford Road to Eglinton Street)	Designated Paid	Commercial	64	22	-42
Woodquay Street (from Headford Road to Eglinton Street)	Disabled Designated Paid Parking	Commercial	2	0	-2
Woodquay Street (from Headford Road to Eglinton Street)	Loading Bay / Taxi Rank	Commercial	2	5	+3
Woodquay Street (from Headford Road to Eglinton Street)	Taxi Rank / Paid Parking	Commercial	2	0	-2
Walsh’s Terrace (Bóthar na mBan to Woodquay)	Designated Paid	Commercial	5	10	+5
Newtownsmith (from the Salmon Weir Bridge to Bowling Green)	Designated Paid Parking	Commercial	10	6	-4
Newtownsmith (from the Salmon Weir Bridge to Bowling Green)	Loading Bay	Commercial	3	3	0
Approx. adjacent parking of type within 200m			120	120	0
Total			208	166	-42

9 Parking Impact on Eyre Square North and Prospect Hill

9.1 Baseline Parking and Loading Analysis

9.1.1 Corridor On-Street Parking Bays and Regulation

Eyre Square North has no designated paid on street parking. The street has a bus set down bay (5 spaces) along the northern aspect of the route throughout operating 24hrs a day Monday to Sunday. To the north of this set down area, behind a pedestrian island with bus shelters, is another lane which consists of a large taxi rank bay on the southern aspect, as well as a loading bay, a hackney carriage set down bay, a bus set down bay and 2 designated disabled permit parking spaces, all on the northern aspect of the route.

While the taxi and loading bays appear to operate 24hrs a day, the bus set down bay is time plated. The bus set down bay has space for 1 large bus.

Prospect Hill has two taxi rank bays on the north western aspect of the road with space for 10 vehicles which operates 24hrs, as well as 2 designated disabled parking spaces. A loading bay with 3 spaces is located adjacent to these two disabled parking spaces. There are 2 designated disabled permit parking spaces located outside Paddy’s Bar & Lounge on the south eastern aspect of the road. There is also a loading bay with approximately 5 spaces operating from 06:00 to 18:00 Monday to Friday.

It should be noted that the desktop analysis showed that informal parking occurs along a time-plated clearway with space for 1 vehicle on Prospect Hill, despite the clearway being of 24hrs designation. The clearway is located between the loading bay and a bike share stand in the vicinity of Mapfre Assistance.

A summary of the existing parking supply on Eyre Square North and Prospect Hill is provided in **Table 19.**

Table 19: Existing On-Street Parking and Loading Spaces on Eyre Square North and Prospect Hill

Sub-section	Existing Parking Facilities	Number of Spaces
Eyre Square North	Bus Set Down	2 Bays (6 spaces)
	Loading Bay	1 Bay (2 spaces)
	Taxi Rank	1 Bay (14 spaces)
	Designated Disabled Parking	2 spaces
	Hackney Carriage set-down	1 bay (1 space)
Prospect Hill	Designated Disabled permit Parking	4 spaces
	Loading Bay	2 bays (8 spaces)
	Taxi Rank	2 Bay (11 spaces)
Bóthar Irwin	Designated Paid Parking	3 spaces
	Designated Disabled Parking	1 space

9.1.2 Loading Bays

As shown in **Table 19**, there is a total of 3 loading bays with space for a total of 10 cars or small vans in this section of the corridor, located on the Eyre Square North and Prospect Hill. Both loading bays on Eyre Square North appear to be in operation 24hrs a day Monday to Sunday, whereas the loading bay at Prospect Hill is designated as a loading bay from 06:00 to 18:00 from Monday to Friday.

9.1.3 On-Street Parking Bays and Regulation on Local Side Streets

There are several side streets which are able to be used by local residents and visitors/businesses. These spaces are likely to be utilised by visitors to premises in the vicinity of Eyre Square, as an alternative to the lack of parking on the corridor itself. There are designated Pay & Display parking spaces with approximately 30 spaces on the local side streets, 3 of which are designated disabled parking, within 200m from the corridor and in the vicinity of the on-street parking directly on the corridor, which are located on Eyre Street and Bóthar Irwin.

The designated Pay & Display parking spaces above are available from 08:30 to 18:30 from Monday to Saturday and 13:00 to 18:00 Sundays with a maximum stay duration of 2 hours.

9.1.4 Land Use and Parking Demand

Eyre Square North and Prospect Hill is a corridor that has a range of land uses illustrated in **Appendix B**. There are multiple sites where there is surface level off street parking is available such as Galway County Council and to the rear of On Yer Bike Cycles. Therefore, it can be assumed that parking activities are within their premises and would not require on-street parking along the corridor. The route is also in close proximity to the Corrib Centre Car park, which has up to 576 spaces which are free for the first 10 minutes and €2.40 per hour thereafter up to 5 hours, with a 10 hour stay of €15.00 and a 24 hour stay of €20.00.

Eyre Square North and Prospect Hill also run through a number of large trip attractors in Galway City, which include the following:

- Ulster Bank Eyre Square;
- Dunnes Stores;
- Bank of Ireland Eyre Square;
- The Quincentennial Fountain;
- TK Maxx;
- Galway County Council; and
- The Western Hotel.

Generally, the route contains a range of shops, restaurants/takeaways, pubs/bars located along Eyre Square North and Prospect Hill.

An illustration of land use on Eyre Square North and Prospect Hill can be found in Appendix B

9.2 Cross City Link Parking Proposals

9.2.1 Proposed On-Street Parking and Loading Bay Supply

With BusConnects Cross City Link infrastructure in place, there is an associated need to remove some parking space to provide improved facilities for pedestrians, cyclists, and buses. The planned changes in on-street parking on Eyre Square North and Prospect Hill are illustrated in **Figure 16** and **Figure 17** and summarised in **Table 20.**

Table 20: Existing and Proposed Parking and Loading Spaces (Eyre Square North and Prospect Hill)

Sub-section	Parking / Loading Facilities	Existing	Proposed	Loss of Parking / Loading
Eyre Square North	Bus Set Down	2 bays (6 spaces)	1 bay (4 spaces)	-2 spaces
	Loading Bay	1 bays (2 spaces)	1 bay (4 space)	+2 spaces
	Taxi Rank	1 bay (14 spaces)	0	-14 spaces
	Designated Disabled Parking	2 spaces	0	-2 spaces
	Hackney Carriage set-down	1 bay (1 space)	0	-1 spaces
Prospect Hill	Designated Disabled Permit Parking	4 spaces	4 spaces	0
	Loading Bay	2 bays (8 spaces)	2 bay (9 spaces)	+1 space
	Taxi Rank	2 bays (11 spaces)	2 bays (7 spaces)	-4 spaces
Bóthar Irwin	Designated Paid Parking	3 spaces	0	-3 spaces
	Designated Disabled Parking	1 space	3 spaces	+2 spaces

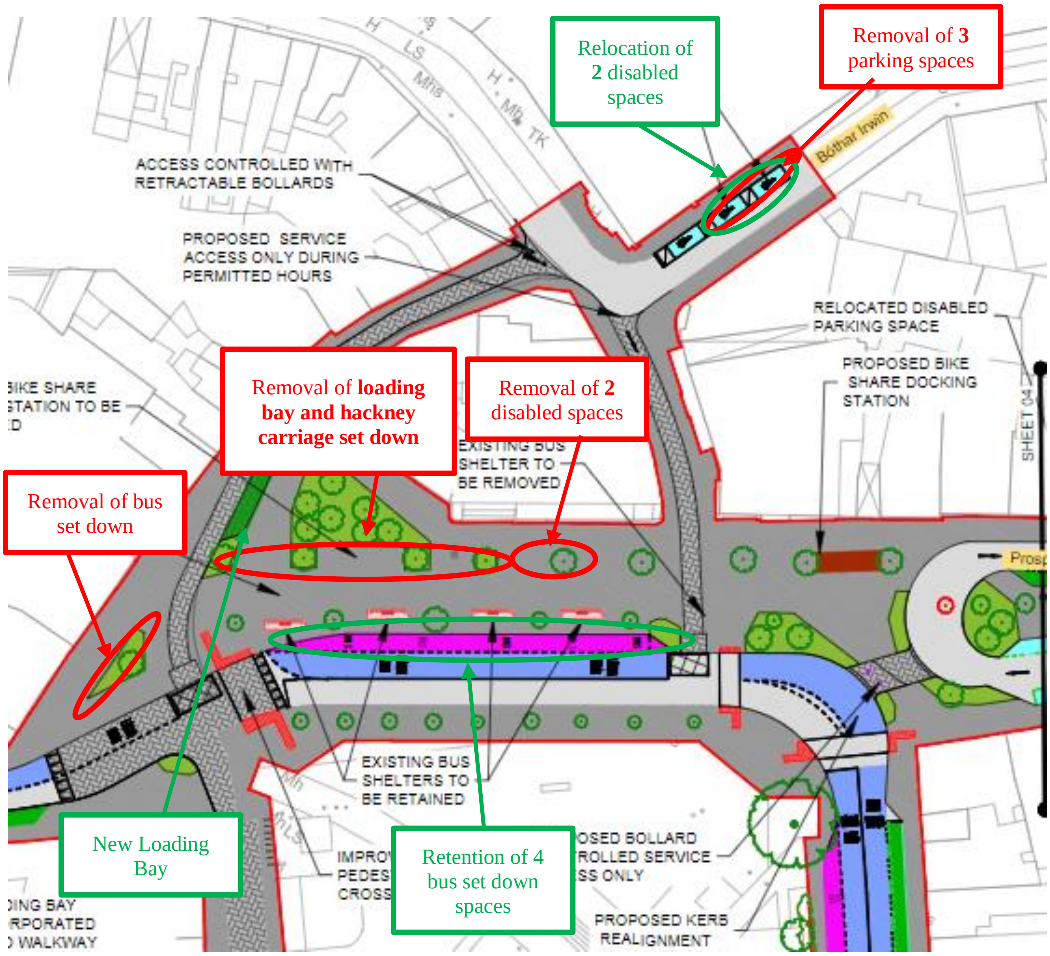


Figure 16: Proposed scheme design on Eyre Square North

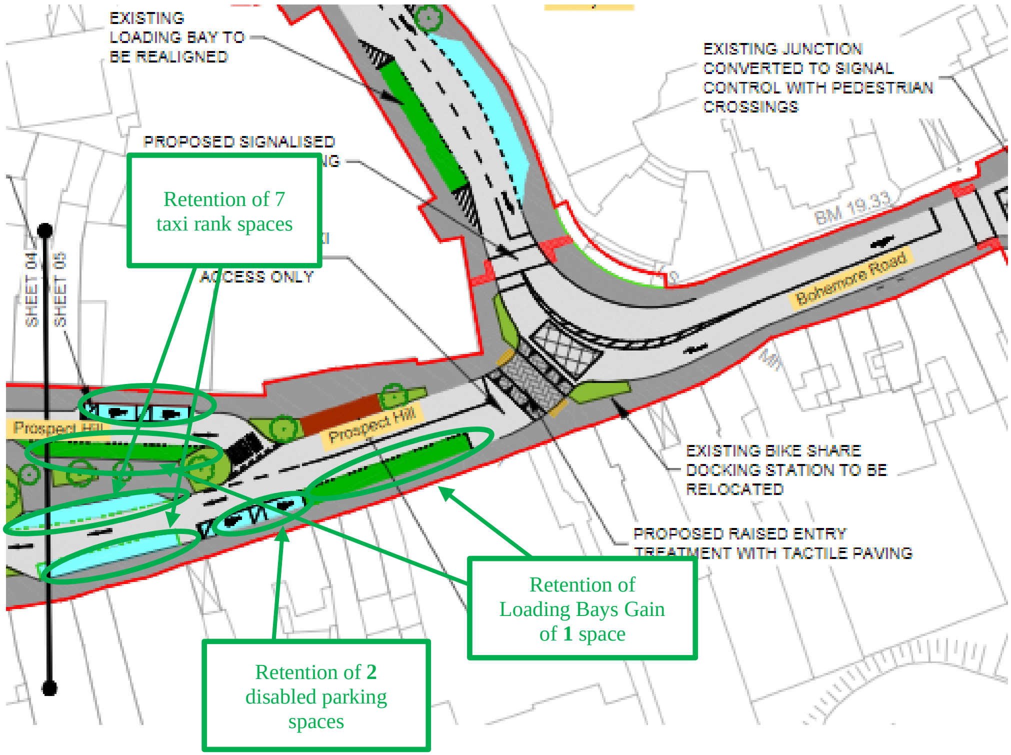


Figure 17: Proposed scheme design on Prospect Hill

9.3 Overall Parking Impact

A summary of the parking impact with respect to the change in overall parking supply on the Proposed Scheme corridor on Eyre Square North and Prospect Hill is shown in **Table 21**, which includes consideration of spaces on adjacent streets within an approximate 200m distance.

Table 21: Impact of Parking and Loading Changes for Eyre Square North and Prospect Hill

Location	Type of Parking		No. of Spaces		
			Baseline	Scheme	Change
Eyre Square North	Bus Set Down	Commercial	6	4	-2
Eyre Square North	Loading Bay	Commercial	2	4	+2
Eyre Square North	Taxi Rank	Commercial	14	0	-14
Eyre Square North	Disabled Designated Parking	Commercial	2	0	-2
Eyre Square North	Hackney carriage Set-down	Commercial	1	0	-1
Prospect Hill	Designated Disabled Parking	Commercial	4	4	0
Prospect Hill	Loading Bay	Commercial	8	9	+1
Prospect Hill	Taxi Rank	Commercial	11	7	-4
Bóthar Irwin	Designated Paid Parking	Commercial	3	0	-3
Bóthar Irwin	Designated Disabled Parking	Commercial	1	3	+2
Approx. adjacent parking of type within 200m			606	606	0
Total			658	637	-21

10 Parking Impact on Merchants Road to Dock Road

10.1 Baseline Parking and Loading Analysis

10.1.1 Corridor On-Street Parking Bays and Regulation

Merchants Road currently has a tour bus set down bay, with 2 spaces, on the western aspect of the route, which is also signed as a 24hr clearway. There is a city bus stop adjacent to the tour bus set down. Two taxi bays to the eastern aspect of the route which operate as Pay and Display parking from the hours of 08:30 to 18:30 Monday to Saturday and 13:00 to 18:00 on Sundays, and as a taxi bay from 18:30 to 05:30 Monday to Sunday. The two bays combined can accommodate 6 vehicles. There are also 2 designated disabled permit parking spaces on the eastern aspect of the route towards the junction with Forthill Street.

Forthill Street (From Merchants Road to Dock Road) currently has 17 designated Pay and Display parking spaces, along its southern aspect, which operate from 08:30 to 18:30 Monday to Saturday and 13:00 to 18:00 on Sundays. There are a further 2 designated Pay and Display parking spaces, with the same operation as above, on the opposite side of the route, it should be noted that the desktop analysis has identified that these spaces are being used to display used cars for sale from VP Motors. There is also a bus set down bay on the northern aspect of the route sufficient to accommodate 1 bus.

A summary of the existing parking supply from Merchants Road to Dock Road is in **Table 22**.

Table 22: Existing On-Street Parking and Loading Spaces Merchants Road to Dock Road

Sub-section	Existing Parking Facilities	Number of Spaces
Merchants Road	Designated Disabled Parking	2 spaces
	Tour Bus set down	1 bay (2 space)
	Designated Paid Parking / Taxi Rank	2 bays (6 spaces)
Forthill Street (From Merchants Road to Dock Road)	Designated Paid Parking	19 spaces
	Bus Set Down	1 bay (1 space)

10.1.2 Loading Bays

There are no loading bays on this section of the route between Merchants Road and Dock Road. Therefore, it is assumed that loading activities occur within the premises of businesses, or during early morning and evening periods.

10.1.3 On-Street Parking Bays and Regulation on Local Side Streets

There are several side streets which are able to be used by local residents and visitors/businesses. These spaces are likely to be utilised by visitors to premises along the route from Merchants Road and Dock Road as an alternative to parking directly on the corridor. There are designated Pay & Display and Permit Parking with approximately 62 spaces (4 of which are designated disables permit parking) on the local side streets, within 200m from the corridor and in the vicinity of the on-street parking directly on the corridor, such as:

- Merchants Road; 08:30 to 18:30 Monday to Saturday, 13:00 to 18:00 Sunday
- St. Nicholas Street; 08:30 to 18:30 Monday to Saturday, 13:00 to 18:00 Sunday
- Dock Road; 22 (4 disabled) 24 hour Monday to Sunday

10.1.4 Land Use and Parking Demand

The route from Merchants Road and Dock Road contains a range of land uses illustrated in Appendix B. There is one site along the route which has private parking on its premises. This parking is located to the rear of Ross House Office Centre with spaces for approximately 10 vehicles.

There is also a large Q Park car park with 444 spaces located on the north western aspect of Merchants Road at the Eyre Square Shopping Centre. The car park operates Monday to Sunday 24hrs a day at a cost of €2.70 an hour, or €22.00 for 24 hours. The carpark also offers monthly, quarterly and yearly pricing offers.

There is a multistorey carpark with 480 spaces to the south of Dock Road at Hynes Yard. The carpark operates from 05:30 to 00:00 Monday to Sunday at a rate of €2.70 per hour, or €20.00 for 24 hours. The carpark also offers a customer rate of €9.00 for 24 hours.

The route runs through a number of trip attractors in Galway City, which include the following:

- Eyre Square Shopping Centre;
- Kinlay Hostel Galway; and
- Ross House.

Generally, Merchants Road and Dock Road has a range of shops, restaurants, residential apartments, and office spaces located along the route.

An illustration of land use on from Merchants Road and Dock Road can be found in Appendix B.

10.2 Cross City Link Parking Proposals

10.2.1 Proposed On-Street Parking and Loading Bay Supply

With BusConnects Cross City Link infrastructure in place, there is an associated need to remove some parking spaces to provide improved facilities for pedestrians, cyclists, and buses. The planned changes in on-street parking along the route from Merchants Road to Dock Road are illustrated in **Figure 18** and summarised in **Table 23**.

Table 23: Existing and Proposed Parking and Loading Spaces (Merchants Road to Dock Road)

Sub-section	Parking / Loading Facilities	Existing	Proposed	Loss of Parking / Loading
Merchants Road	Designated Disabled Parking	2 spaces	2 spaces	0
	Bus Set Down	1 bay (2 spaces)	2 bays (3 spaces)	+1 space
	Designated Paid Parking / Taxi Rank	2 bays (6 spaces)	2 bays (5 spaces)	-1 space
Forthill Street (From Merchants Road to Dock Road)	Designated Paid Parking	19 spaces	6 spaces	-13 spaces
	Bus Set Down	1 bay (1 space)	1 space	0

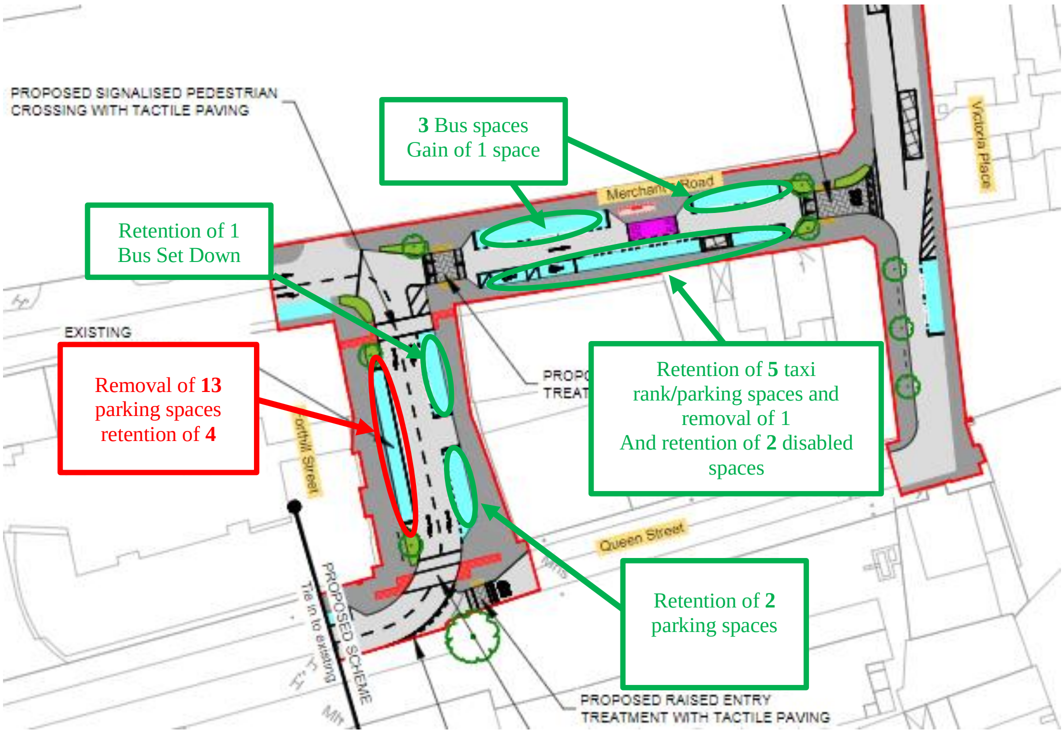


Figure 18: Proposed scheme design on Merchants Road, Forthill Street and Dock Road

10.3 Overall Parking Impact

A summary of the parking impact with respect to the change in overall parking supply on the Proposed Scheme corridor in section is shown in **Table 24**, which includes consideration of spaces on adjacent streets within an approximate 200m distance.

Table 24: Impact of Parking and Loading Changes (Merchants Road to Dock Road)

Location	Type of Parking		No. of Spaces		
			Baseline	Scheme	Change
Merchants Road	Designated Disabled Parking	Commercial	2	2	0
Merchants Road	Bus Set Down	Commercial	2	3	+1
Merchants Road	Designated Paid Parking / Taxi Rank	Commercial	6	5	-1
Forthill Street (From Merchants Road to Dock Road)	Designated Paid Parking	Commercial	19	6	-13
Forthill Street (From Merchants Road to Dock Road)	Bus Set Down	Commercial	1	1	0
Approx. adjacent parking of type within 200m			986	986	0
Total			1016	1003	-13

11 Summary and Conclusions

11.1 Summary of Parking Changes

With the proposed scheme in place, there is an associated need to remove some parking space to provide improved facilities for pedestrians, cyclists, and buses – which inevitably requires some reallocation of parking road space. Where there is an area acting as both a loading bay and taxi rank, it will be counted as a loading bay in Table 26. The proposed changes in parking and loading provision along the Cross City Link are summarised in **Table 25** and **Table 26** below:

Table 25: Summary of Parking Changes

Location	No. of Spaces				
	Baseline		Proposed		Change
	Corridor	Adjacent	Corridor	Adjacent	
University Road (Newcastle Road to Salmon Weir Bridge)	17	211	13	211	-4
Salmon Weir Bridge to Forster Street	32	1298	5	1298	-27
College Road and Dublin Road	172	90	139	90	-33
Lough Atalia Road to Headford Road	585	106	564	106	-21
Galway Cathedral	188	175	63	175	-125
Woodquay and Newtownsmith	83	120	38	120	-45
Eyre Square and Prospect Hill	42	606	18	606	-24
Merchants Road / Dock Road	30	986	17	986	-13

Table 26: Summary of Loading Changes

Location	No. of Spaces		
	Loading Bays		Change
	Baseline Spaces	Proposed Spaces	
University Road (Newcastle Road to Salmon Weir Bridge)	3	3	0
Salmon Weir Bridge to Forster Street	21	25	+4
College Road and Dublin Road	4	4	0
Lough Atalia Road to Headford Road	8	8	0
Galway Cathedral	0	0	0
Woodquay and Newtownsmith	5	8	+3
Eyre Square and Prospect Hill	10	13	+3
Merchants Road / Dock Road	0	0	0

11.2 Summary of Parking Impact and Mitigation

With BusConnects infrastructure in place, the impacts of the change in on-street parking have been considered and are itemised below (in summary); the associated mitigation effects of the BusConnects plan and other measures are also summarised:

- The Cross City Link Scheme will have a moderate impact to parking on the road network along and within the vicinity of the scheme with an expected reduction in approximately 220 of parking space provision. This equates to approximately 5% of the surrounding available parking provision available for public use.
- Aspects of the Cross City Link scheme and network proposals are expected to mitigate the reduction in parking by reducing reliance on private cars due to availability of an improved bus network with journey reliability, by availability of improved cycling infrastructure, and by continued and managed use of private off-street parking.
- The overall provision of loading spaces within the scheme will be increased by 10 no. spaces.
- Improved compliance with parking and loading bay regulations, and management of loading activities will also assist in offsetting the reduction in on-street parking spaces. It is concluded that the overall impact of loss of parking space on these streets is limited and will be largely offset by the cumulative effect of mitigations.

Other issues and design considerations will also have an impact on parking availability and usage:

- Commercial premises will need to consider adapting their loading arrangements – for example by loading at night-time or hours outside of operation of the Cross-City Link.
- Cycle parking is to be incorporated in the Cross City Link scheme – which will enhance the ability of residents to cycle instead of driving and parking a car to use local services

Appendix A

Scheme Section Map

Appendix B

Existing Land Use

Chapter 07

(Air Quality) Appendices

AXIS
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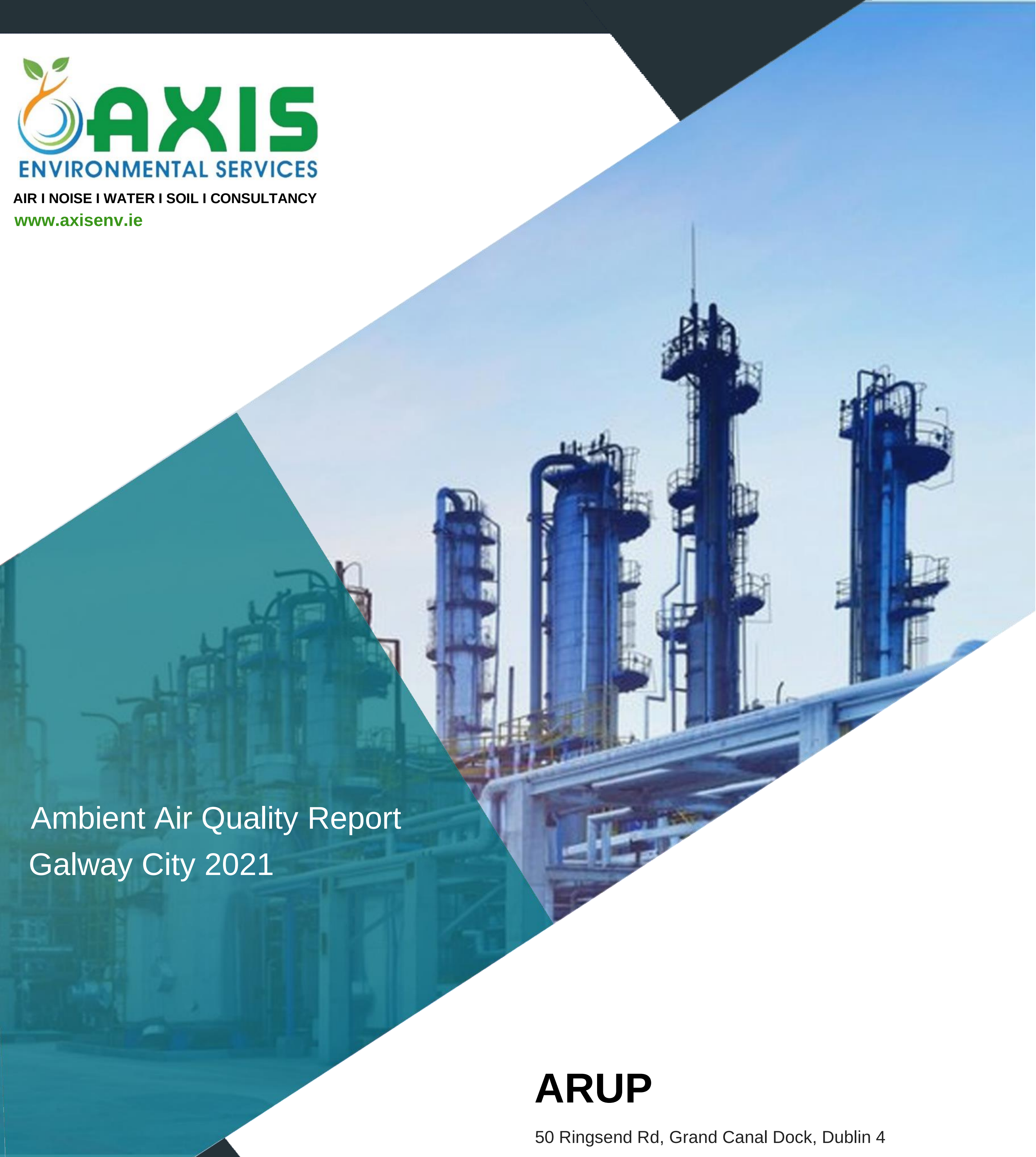

Ambient Air Quality Report
Galway City 2021

ARUP

50 Ringsend Rd, Grand Canal Dock, Dublin 4

Unit 3 Westlink Business Park,
Clondrinagh,
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Contents

Document Sign Off			
Document Number:	4110-21-04		
Reason for Issue:	NO_2 Quality Monitoring Galway City: September – December 2021		
Issue Number:	1	**Date:**	21-01-2022
Originator:	**Signature:**	**Reviewer:**	**Customer Contact:**
Mark McGarry		Niamh McMahon	Sinead Whyte
Document History:			
Report Revision Number	**Revision Date**	**Section Revised**	**Reason for Revision**

Executive Summary

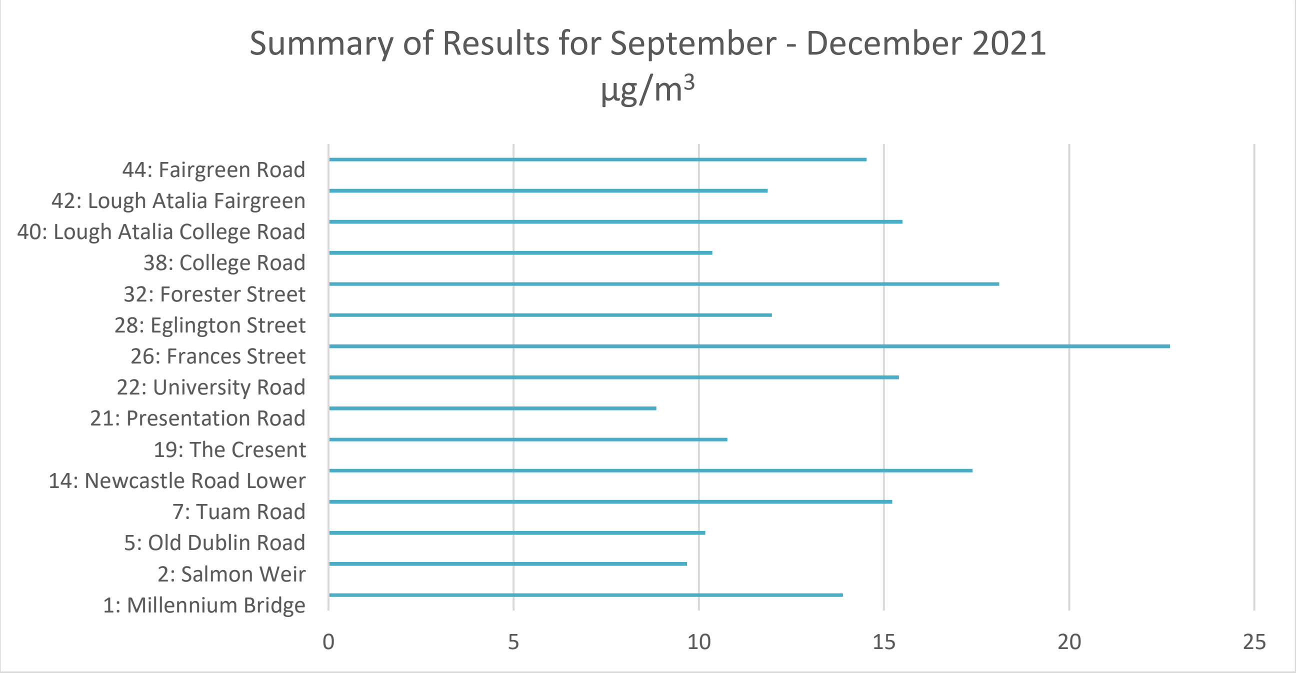
Ambient air quality monitoring was carried out at various locations around Galway City for Nitrogen Dioxide (NO_2). 15 locations were tested on a monthly basis over 3 months and in triplicate to ascertain general NO_2 concentrations around Galway City.

Samples were tested using diffusion tubes (20% TEA / Water) and analysed by SP01 Photometer in an accredited laboratory. The test method used is itself accredited.

Bias for the tubes was determined by assessment against a reference analyser calibrated with ISO 17025 gases. Diffusion tubes were installed beside an analyser owned an operated by AXIS environmental services and used for collation of data under the CAFÉ Directive. Bias was determined in accordance with the AEA_DifTPAB_V04.xls spreadsheet designed by the AEA Energy and Environment to assist Diffusion tubes users in calculating precision and accuracy. It also assists in adjusting diffusion tube results using the bias adjustment calculated.

All 15 monitoring points were tested in triplicate for three months. As the only limits in the CAFÉ Directive are for hourly and annual averages, the monthly averages of each location were compared against the annual limit of 40 µg/m³. All samples during this assessment were lower than the associated annual limit.

Graph 1-1: Summary of Results (adjusted for Bias)



1. Introduction

AXIS environmental services were commissioned by ARUP Consulting Engineers to complete ambient air quality monitoring at various locations around Galway City for Nitrogen Dioxide (NO_2). 15 locations were tested on a monthly basis over 3 months, each sample in triplicate to ascertain general NO_2 concentrations in Galway City.

2. Main Activities:

All samples were located on roadside lamp or electrical posts approximately 2.5 meters above ground level. The main activities in the predetermined areas were passing traffic, commercial, light industrial and residential activities.

3. Objective:

The objectives of this assessment were to:

- Assess the concentrations of Nitrogen Dioxide at 15 predetermined locations around Galway City;
- Compare the measured concentrations with the current limits applied in the European Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe;
- Undertake visual observations of the practices on site and comment on any deviation from normal practices at each location;
- Summarise the test results and report to our Client, ARUP.

4. Method Summary:

Sampling and analysis of Nitrogen dioxide was carried out by diffusion tube with passive sampling into a 20% TEA / Water tube and analysed in an accredited lab in Switzerland by Photometer.

Samples were collected and transported to the laboratory under controlled chain of custody at the correct temperatures, timeframes and conditions.

5. Monitoring Personnel:

Round 1	Name	Mark McGarry
Sample Out	Date	19th September 2021
Round 1 / Round 2	Name	Mark McGarry
Sample In / Sample Out	Date	17th October 2021
Round 2 / Round 3	Name	Mark McGarry
Sample In / Sample Out	Date	14th November 2021
Round 3	Name	Mark McGarry
Sample In	Date	12th December 2021

6. Results Summary:

Location	Round Number	Average Result µg/m^3	Adjusted for BIAS µg/m^3	Round 1 - 3 Average µg/m^3	CAFÉ Directive Limit for NO_2 Annual Limit µg/m^3
1: Millennium Bridge	1	16.6	11.8	13.9	40 µg/m^3
	2	18.7	13.3		
	3	23.4	16.6		
2: Salmon Weir	1	11.7	8.3	9.7	
	2	13.0	9.2		
	3	16.2	11.5		
5: Old Dublin Road	1	11.3	8.0	10.2	
	2	13.4	9.5		
	3	18.3	13.0		
7: Tuam Road	1	20.3	14.4	15.2	
	2	21.9	15.5		
	3	22.1	15.7		
14: Newcastle Road Lower	1	30.4	21.6	17.4	
	2	21.7	15.4		
	3	21.4	15.2		
19: The Crescent	1	12.9	9.2	10.8	
	2	15.4	10.9		
	3	17.2	12.2		
21: Presentation Road	1	9.7	6.9	8.9	
	2	11.4	8.1		
	3	16.3	11.6		
22: University Road	1	21.2	15.1	15.4	
	2	21.6	15.3		
	3	22.3	15.8		
26: Frances Street	1	31.2	22.2	22.7	
	2	33.4	23.7		
	3	31.4	22.3		
28: Eglington Street	1	14.8	10.5	12.0	
	2	16.2	11.5		
	3	19.6	13.9		
32: Forester Street	1	22.4	15.9	18.1	
	2	25.4	18.0		
	3	28.7	20.4		
38: College Road	1	12.2	8.7	10.4	
	2	14.3	10.2		
	3	17.3	12.3		
40: Lough Atalia College Road	1	19.4	13.8	15.5	
	2	20.0	14.2		
	3	26.1	18.5		
42: Lough Atalia Fairgreen	1	13.6	9.7	11.9	
	2	16.9	12.0		
	3	19.6	13.9		
44: Fairgreen Road	1	18.6	13.2	14.5	
	2	19.2	13.6		
	3	23.6	16.8		

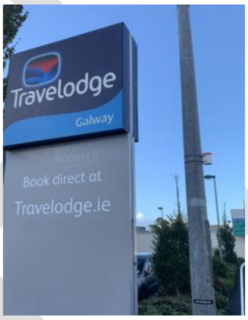
7. Monitoring Locations – Site Pictures

Location 1: Millennium Bridge
53°16'57.30"N   9° 3'38.04"W

Location 2: Salmon Weir
53°16'32.05"N   9° 3'21.70"W

Location 5: Old Dublin Road
53°16'50.96"N   9° 1'51.67"W

Location 7: Tuam Road
53°17'3.21"N 9° 2'6.48"W



Location 14: Newcastle Road Lower
53°16'47.28"N   9° 3'49.11"W

Location 19: The Crescent
53°16'4.99"N   9° 3'46.99"W

Location 21: Presentation Road
53°16'24.25"N   9° 3'41.48"W

Location 22: University Road
53°16'35.46"N   9° 3'41.80"W

Location 26: St Frances St
53°16'31.35"N 9° 3'13.04"W

Location 28: Eglington Street
53°16'27.89"N 9° 3'6.94"W

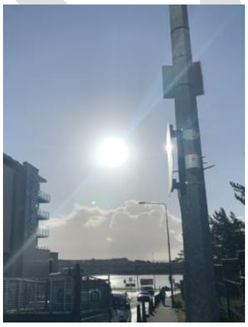
Location 32: Forster Street
53°16'30.34"N 9° 2'46.43"W

Location 38: College Road Central
53°16'37.65"N 9° 2'26.78"W

Location 40: Lough Atalia College Road
53°16'36.52"N 9° 2'22.28"W

Location 42: Lough Atalia Fairgreen
53°16'17.49"N 9° 2'44.55"W

Location 44: Fairgreen Road
53°16'26.78"N 9° 2'41.99"W



8. Monitoring Locations – Overview Map

9. Target Parameter 2008/50/EC Limits

Ground Level Concentrations	µg.m^{-3}	Notes
NO_2	200	Hourly average not to be exceeded more than 18 times in a calendar year
NO_2	40	Annual mean in a calendar year

10. Sample Location Details

Location	Millennium Bridge
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Mainly commercial properties
Elevation above GL	2.5
Location	Salmon Weir Bridge
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Church and commercial
Elevation above GL	2.5
Location	Old Dublin Road
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Commercial / Residential
Elevation above GL	2.5
Location	Tuam Road
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Commercial / Light Industrial
Elevation above GL	2.5
Location	Newcastle Road Lower north of University Road
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Mainly residential
Elevation above GL	2.5
Location	The Crescent
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Mainly residential / commercial
Elevation above GL	2.5
Location	Presentation Road
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Mainly residential
Elevation above GL	2.5
Location	University Road
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Mainly residential
Elevation above GL	2.5

Location	St Francis Street
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Commercial properties
Elevation above GL	2.5
Location	Eglinton Street
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Commercial properties
Elevation above GL	2.5
Location	Forster Street
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Commercial / Residential
Elevation above GL	2.5
Location	College Road Central
Description	Roadside location with high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Residential
Elevation above GL	2.5
Location	Lough Atalia Road south of College Road
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Residential
Elevation above GL	2.5
Location	Lough Atalia Road south of Fairgreen Road
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Mainly residential / commercial
Elevation above GL	2.5
Location	Fairgreen Road
Description	Roadside location with very high volumes of traffic. Monitor on light post c. 2.5m above ground level
Adjacent Roads	Yes
Adjacent Industries	Mainly Commercial
Elevation above GL	2.5

11. Summary of Test Results

Round 1: 19th September to 17th October 2021

Measuring site	Passive sampler		Measuring period					Result	
	label	lot no.	start		end		exp. time	m analyte/ sampler	C NO$_2$
			date	time	date	time	[h]	[ug]	[ug/m^3]
1: Millennium Bridge	ILA-68	44418	19/09/2021	10:00	17/10/2021	10:00	672.0	0.50	16.9
1: Millennium Bridge	75	44418	19/09/2021	10:00	17/10/2021	10:00	672.0	0.49	16.7
1: Millennium Bridge	87	44418	19/09/2021	10:00	17/10/2021	10:00	672.0	0.48	16.4
2: Salmon Weir	65	44418	19/09/2021	09:50	17/10/2021	09:50	672.0	0.33	11.3
2: Salmon Weir	66	44418	19/09/2021	09:50	17/10/2021	09:50	672.0	0.36	12.2
2: Salmon Weir	83	44418	19/09/2021	09:50	17/10/2021	09:50	672.0	0.35	11.8
5: Old Dublin Road	103	44418	19/09/2021	07:30	17/10/2021	07:30	672.0	0.33	11.0
5: Old Dublin Road	106	44418	19/09/2021	07:30	17/10/2021	07:30	672.0	0.34	11.3
5: Old Dublin Road	113	44418	19/09/2021	07:30	17/10/2021	07:30	672.0	0.34	11.6
7: Tuam Road	93	44418	19/09/2021	07:40	17/10/2021	07:40	672.0	0.60	20.3
7: Tuam Road	94	44418	19/09/2021	07:40	17/10/2021	07:40	672.0	0.59	19.8
7: Tuam Road	95	44418	19/09/2021	07:40	17/10/2021	07:40	672.0	0.62	20.9
14: Newcastle Road Lower	69	44418	19/09/2021	09:40	17/10/2021	09:40	672.0	0.90	30.5
14: Newcastle Road Lower	72	44418	19/09/2021	09:40	17/10/2021	09:40	672.0	0.86	28.9
14: Newcastle Road Lower	208	44418	19/09/2021	09:40	17/10/2021	09:40	672.0	0.94	31.7
19: The Crescent	76	44418	19/09/2021	09:30	17/10/2021	09:30	672.0	0.39	13.3
19: The Crescent	78	44418	19/09/2021	09:30	17/10/2021	09:30	672.0	0.37	12.6
19: The Crescent	79	44418	19/09/2021	09:30	17/10/2021	09:30	672.0	0.38	12.8
21: Presentation Road	64	44418	19/09/2021	09:20	17/10/2021	09:20	672.0	0.27	9.2
21: Presentation Road	77	44418	19/09/2021	09:20	17/10/2021	09:20	672.0	0.30	10.1
21: Presentation Road	92	44418	19/09/2021	09:20	17/10/2021	09:20	672.0	0.29	9.8
22: University Road	74	44418	19/09/2021	09:10	17/10/2021	09:10	672.0	0.65	22.0
22: University Road	96	44418	19/09/2021	09:10	17/10/2021	09:10	672.0	0.60	20.3
22: University Road	97	44418	19/09/2021	09:10	17/10/2021	09:10	672.0	0.63	21.3
26: Frances Street	67	44418	19/09/2021	09:00	17/10/2021	09:00	672.0	0.95	32.1
26: Frances Street	71	44418	19/09/2021	09:00	17/10/2021	09:00	672.0	0.94	31.6
26: Frances Street	86	44418	19/09/2021	09:00	17/10/2021	09:00	672.0	0.88	29.9
28: Eglington Street	70	44418	19/09/2021	08:50	17/10/2021	08:50	672.0	0.44	14.8
28: Eglington Street	81	44418	19/09/2021	08:50	17/10/2021	08:50	672.0	0.44	14.7
28: Eglington Street	110	44418	19/09/2021	08:50	17/10/2021	08:50	672.0	0.44	14.9
32: Forester Street	73	44418	19/09/2021	08:20	17/10/2021	08:20	672.0	0.63	21.2
32: Forester Street	82	44418	19/09/2021	08:20	17/10/2021	08:20	672.0	0.71	24.1
32: Forester Street	85	44418	19/09/2021	08:20	17/10/2021	08:20	672.0	0.65	21.9
38: College Road	88	44418	19/09/2021	08:30	17/10/2021	08:30	672.0	0.38	12.8
38: College Road	100	44418	19/09/2021	08:30	17/10/2021	08:30	672.0	0.34	11.6
38: College Road	101	44418	19/09/2021	08:30	17/10/2021	08:30	672.0	0.36	12.1
40: Lough Atalia College Road	91	44418	19/09/2021	07:50	17/10/2021	07:50	672.0	0.57	19.1
40: Lough Atalia College Road	98	44418	19/09/2021	07:50	17/10/2021	07:50	672.0	0.57	19.4
40: Lough Atalia College Road	112	44418	19/09/2021	07:50	17/10/2021	07:50	672.0	0.58	19.6

Measuring site	Passive sampler		Measuring period					Result	
	label	lot no.	start		end		exp. time	m analyte/ sampler	C NO$_2$
			date	time	date	time	[h]	[ug]	[ug/m^3]
42: Lough Atalia Fairgreen	80	44418	19/09/2021	08:00	17/10/2021	08:00	672.0	0.41	13.9
42: Lough Atalia Fairgreen	90	44418	19/09/2021	08:00	17/10/2021	08:00	672.0	0.41	13.7
42: Lough Atalia Fairgreen	99	44418	19/09/2021	08:00	17/10/2021	08:00	672.0	0.39	13.3
44: Fairgreen Road	84	44418	19/09/2021	08:10	17/10/2021	08:10	672.0	0.54	18.1
44: Fairgreen Road	89	44418	19/09/2021	08:10	17/10/2021	08:10	672.0	0.57	19.2
44: Fairgreen Road	102	44418	19/09/2021	08:10	17/10/2021	08:10	672.0	0.55	18.5

Round 2: 17th October to 14th November

Measuring site	Passive sampler		Measuring period					Result	
			start		end		exp. time	m analyte/ sampler	C NO_2
	label	lot no.	date	time	date	time	[h]	[ug]	[ug/m^3]
1. Millennium Bridge	ILA-134	44418	17/10/2021	10:00	14/11/2021	09:05	671.1	0.56	19.1
1. Millennium Bridge	130	44418	17/10/2021	10:00	14/11/2021	09:05	671.1	0.56	18.8
1. Millennium Bridge	120	44418	17/10/2021	10:00	14/11/2021	09:05	671.1	0.54	18.2
2. Salmon Weir	115	44418	17/10/2021	09:50	14/11/2021	09:00	671.2	0.38	12.8
2. Salmon Weir	122	44418	17/10/2021	09:50	14/11/2021	09:00	671.2	0.40	13.4
2. Salmon Weir	118	44418	17/10/2021	09:50	14/11/2021	09:00	671.2	0.38	12.7
5: Old Dublin Road	163	44418	17/10/2021	07:30	14/11/2021	07:00	671.5	0.39	13.3
5: Old Dublin Road	158	44418	17/10/2021	07:30	14/11/2021	07:00	671.5	0.41	13.9
5: Old Dublin Road	116	44418	17/10/2021	07:30	14/11/2021	07:00	671.5	0.38	13.0
7: Tuam Road	143	44418	17/10/2021	07:40	14/11/2021	07:10	671.5	0.67	22.8
7: Tuam Road	144	44418	17/10/2021	07:40	14/11/2021	07:10	671.5	0.60	20.4
7: Tuam Road	147	44418	17/10/2021	07:40	14/11/2021	07:10	671.5	0.67	22.7
14: Newcastle Road Lower	119	44418	17/10/2021	09:40	14/11/2021	07:55	670.3	0.64	21.8
14: Newcastle Road Lower	150	44418	17/10/2021	09:40	14/11/2021	07:55	670.3	0.63	21.5
14: Newcastle Road Lower	140	44418	17/10/2021	09:40	14/11/2021	07:55	670.3	0.65	21.9
19: The Crescent	159	44418	17/10/2021	09:30	14/11/2021	08:50	671.3	0.46	15.6
19: The Crescent	146	44418	17/10/2021	09:30	14/11/2021	08:50	671.3	0.45	15.2
19: The Crescent	126	44418	17/10/2021	09:30	14/11/2021	08:50	671.3	0.45	15.3
21: Presentation Road	162	44418	17/10/2021	09:20	14/11/2021	08:40	671.3	0.35	12.0
21: Presentation Road	114	44418	17/10/2021	09:20	14/11/2021	08:40	671.3	0.40	13.5
21: Presentation Road	138	44418	17/10/2021	09:20	14/11/2021	08:40	671.3	0.26	8.6
22: University Road	196	44418	17/10/2021	09:10	14/11/2021	08:30	671.3	0.64	21.4
22: University Road	187	44418	17/10/2021	09:10	14/11/2021	08:30	671.3	0.63	21.5
22: University Road	170	44418	17/10/2021	09:10	14/11/2021	08:30	671.3	0.65	21.8
26: Frances Street	151	44418	17/10/2021	09:00	14/11/2021	08:20	671.3	0.94	31.9
26: Frances Street	148	44418	17/10/2021	09:00	14/11/2021	08:20	671.3	1.00	33.7
26: Frances Street	124	44418	17/10/2021	09:00	14/11/2021	08:20	671.3	1.02	34.7
28: Eglington Street	121	44418	17/10/2021	08:50	14/11/2021	08:10	671.3	0.46	15.7
28: Eglington Street	135	44418	17/10/2021	08:50	14/11/2021	08:10	671.3	0.49	16.5
28: Eglington Street	136	44418	17/10/2021	08:50	14/11/2021	08:10	671.3	0.49	16.5
32: Forester Street	156	44418	17/10/2021	08:20	14/11/2021	07:35	671.3	0.70	23.7
32: Forester Street	142	44418	17/10/2021	08:20	14/11/2021	07:35	671.3	0.78	26.5
32: Forester Street	123	44418	17/10/2021	08:20	14/11/2021	07:35	671.3	0.77	25.9
38: College Road	152	44418	17/10/2021	08:30	14/11/2021	07:45	671.3	0.43	14.5
38: College Road	133	44418	17/10/2021	08:30	14/11/2021	07:45	671.3	0.44	14.9
38: College Road	153	44418	17/10/2021	08:30	14/11/2021	07:45	671.3	0.40	13.5
40: Lough Atalia College Road	155	44418	17/10/2021	07:50	14/11/2021	07:15	671.4	0.59	20.0
40: Lough Atalia College Road	149	44418	17/10/2021	07:50	14/11/2021	07:15	671.4	0.60	20.4
40: Lough Atalia College Road	201	44418	17/10/2021	07:50	14/11/2021	07:15	671.4	0.58	19.5

Measuring site	Passive sampler		Measuring period					Result	
			start		end		exp. time	m analyte/ sampler	C NO_2
	label	lot no.	date	time	date	time	[h]	[ug]	[ug/m^3]
42: Lough Atalia Fairgreen	139	44418	17/10/2021	08:00	14/11/2021	07:20	671.3	0.52	17.6
42: Lough Atalia Fairgreen	129	44418	17/10/2021	08:00	14/11/2021	07:20	671.3	0.47	15.9
42: Lough Atalia Fairgreen	128	44418	17/10/2021	08:00	14/11/2021	07:20	671.3	0.50	17.1
44: Fairgreen Road	137	44418	17/10/2021	08:10	14/11/2021	07:25	671.3	0.59	19.8
44: Fairgreen Road	141	44418	17/10/2021	08:10	14/11/2021	07:25	671.3	0.57	19.4
44: Fairgreen Road	131	44418	17/10/2021	08:10	14/11/2021	07:25	671.3	0.54	18.3

Round 3: 14th November to 12th December

Measuring site	Passive sampler		Measuring period					Result	
			start		end		exp. time	m analyte/ sampler	C NO_2
	label	lot no.	date	time	date	time	[h]	[ug]	[ug/m^3]
1: Millennium Bridge	ILA-167	44418	14/11/2021	09:05	12/12/2021	09:05	672.0	0.71	24.0
1: Millennium Bridge	183	44418	14/11/2021	09:05	12/12/2021	09:05	672.0	0.67	22.7
1: Millennium Bridge	190	44418	14/11/2021	09:05	12/12/2021	09:05	672.0	0.69	23.4
2: Salmon Weir	182	44418	14/11/2021	09:00	12/12/2021	09:00	672.0	0.47	15.8
2: Salmon Weir	191	44418	14/11/2021	09:00	12/12/2021	09:00	672.0	0.48	16.3
2: Salmon Weir	194	44418	14/11/2021	09:00	12/12/2021	09:00	672.0	0.49	16.7
5: Old Dublin Road	171	44418	14/11/2021	07:00	12/12/2021	07:00	672.0	0.53	17.9
5: Old Dublin Road	186	44418	14/11/2021	07:00	12/12/2021	07:00	672.0	0.55	18.6
5: Old Dublin Road	216	44411	14/11/2021	07:00	12/12/2021	07:00	672.0	0.55	18.5
7: Tuam Road	176	44418	14/11/2021	07:10	12/12/2021	07:10	672.0	0.67	22.5
7: Tuam Road	188	44418	14/11/2021	07:10	12/12/2021	07:10	672.0	0.63	21.3
7: Tuam Road	205	44418	14/11/2021	07:10	12/12/2021	07:10	672.0	0.67	22.6
14: Newcastle Road Lower	175	44418	14/11/2021	07:55	12/12/2021	07:55	672.0	0.64	21.5
14: Newcastle Road Lower	189	44418	14/11/2021	07:55	12/12/2021	07:55	672.0	0.64	21.8
14: Newcastle Road Lower	193	44418	14/11/2021	07:55	12/12/2021	07:55	672.0	0.62	21.0
19: The Crescent	164	44418	14/11/2021	08:50	12/12/2021	08:50	672.0	0.50	16.9
19: The Crescent	177	44418	14/11/2021	08:50	12/12/2021	08:50	672.0	0.52	17.6
19: The Crescent	181	44418	14/11/2021	08:50	12/12/2021	08:50	672.0	0.51	17.2
21: Presentation Road	168	44418	14/11/2021	08:40	12/12/2021	08:40	672.0	0.49	16.4
21: Presentation Road	202	44418	14/11/2021	08:40	12/12/2021	08:40	672.0	0.45	15.1
21: Presentation Road	206	44418	14/11/2021	08:40	12/12/2021	08:40	672.0	0.52	17.5
22: University Road	117	44418	14/11/2021	08:30	12/12/2021	08:30	672.0	0.64	21.9
22: University Road	127	44418	14/11/2021	08:30	12/12/2021	08:30	672.0	0.67	22.6
22: University Road	132	44418	14/11/2021	08:30	12/12/2021	08:30	672.0	0.67	22.5
26: Frances Street	185	44418	14/11/2021	08:20	12/12/2021	08:20	672.0	0.90	30.3
26: Frances Street	207	44418	14/11/2021	08:20	12/12/2021	08:20	672.0	0.89	30.1
26: Frances Street	209	44411	14/11/2021	08:20	12/12/2021	08:20	672.0	1.00	33.9
28: Eglington Street	165	44418	14/11/2021	08:10	12/12/2021	08:10	672.0	0.62	21.0
28: Eglington Street	173	44418	14/11/2021	08:10	12/12/2021	08:10	672.0	0.60	20.2
28: Eglington Street	180	44418	14/11/2021	08:10	12/12/2021	08:10	672.0	0.53	17.8
32: Forester Street	166	44418	14/11/2021	07:35	12/12/2021	07:35	672.0	0.87	29.4
32: Forester Street	179	44418	14/11/2021	07:35	12/12/2021	07:35	672.0	0.80	27.0
32: Forester Street	195	44418	14/11/2021	07:35	12/12/2021	07:35	672.0	0.88	29.8
38: College Road	196	44418	14/11/2021	07:45	12/12/2021	07:45	672.0	0.54	18.3
38: College Road	200	44418	14/11/2021	07:45	12/12/2021	07:45	672.0	0.50	16.8
38: College Road	203	44418	14/11/2021	07:45	12/12/2021	07:45	672.0	0.50	16.8
40: Lough Atalia College Road	172	44418	14/11/2021	07:15	12/12/2021	07:15	672.0	0.76	25.6
40: Lough Atalia College Road	192	44418	14/11/2021	07:15	12/12/2021	07:15	672.0	0.77	26.1
40: Lough Atalia College Road	197	44418	14/11/2021	07:15	12/12/2021	07:15	672.0	0.78	26.5

Measuring site	Passive sampler		Measuring period					Result	
	label	lot no.	start		end		exp. time	m analyte/ sampler	C NO_2
			date	time	date	time	[h]	[ug]	[ug/m^3]
42: Lough Atalia Fairgreen	174	44418	14/11/2021	07:20	12/12/2021	07:20	672.0	0.62	20.9
42: Lough Atalia Fairgreen	199	44418	14/11/2021	07:20	12/12/2021	07:20	672.0	0.59	19.8
42: Lough Atalia Fairgreen	204	44418	14/11/2021	07:20	12/12/2021	07:20	672.0	0.54	18.2
44: Fairgreen Road	169	44418	14/11/2021	07:25	12/12/2021	07:25	672.0	0.72	24.5
44: Fairgreen Road	178	44418	14/11/2021	07:25	12/12/2021	07:25	672.0	0.66	22.5
44: Fairgreen Road	184	44418	14/11/2021	07:25	12/12/2021	07:25	672.0	0.70	23.7

12. Monitoring, Equipment & Analytical Methods

Parameter	Standard	Technical Procedure	Analytical Technique	Equipment / Media	Uncertainty
Nitrogen Dioxide	Diffusion Tubes by UV Spectrophotometry	2104	SP01 Photometer in an accredited laboratory.	Diffusion Tubes 20% TEA / Water	<25%

13. Associated Definitions

Uncertainty of Measurement

The expanded uncertainty associated with diffusive sampler method for oxides of nitrogen is included in this report. All analytical measurements have a level of uncertainty around the measured value. The uncertainty is a quantity defining a level of confidence about the result of a measurement that may be expected to encompass a specific fraction of the distribution of values that could reasonably be attributed to a measurand. The uncertainty is calculated by the laboratory which combined and expands uncertainty for equipment, analytical technique and analytical measurement. Directive 2008/50/EC requires the uncertainty of the test below 25% for indicative measurements.

Bias

Where diffusion tubes are used, it is essential that the data are adjusted for 'bias'. This is dependent on the laboratory that prepared the tubes, and the method of preparation that was used. Suitable bias adjustment factors may be derived locally (by collocating tubes with an automatic analyser) or default factors may be obtained from DEFRA. Bias was determined by assessment in close proximity to an EPA registered Air Quality Station for reference. Diffusion tubes were installed beside the Swords Council Depot which has an EPA monitoring station used for collation of data under the CAFÉ Directive. Bias was determined in accordance with the AEA_DifTPAB_V04.xls spreadsheet designed by the AEA Energy and Environment to assist Diffusion tubes users in calculating precision and accuracy. It also assists in adjusting diffusion tube results using the bias adjustment calculated.

Appendix

7.2 Detailed Modelling Report

Contents

1. Model results for Human Receptors

The model results for human receptors are presented in Table 1 and Table 2 this appendix.

Table 1: 2019 Baseline Model Results for Annual Mean NO_2, PM_{10} and $PM_{2.5}$ Concentrations

Receptor	Height (m)	Annual mean concentrations (µg/m^3)		
		NO_2	PM_{10}	$PM_{2.5}$
R1	1.5	18.0	17.2	12.7
R2	1.5	18.3	17.3	12.8
R3	1.5	17.3	17.2	12.7
R4	1.5	15.7	16.8	12.5
R5	1.5	17.7	17.0	12.6
R6	1.5	17.3	17.0	12.6
R7	1.5	19.9	17.3	12.8
R8	1.5	18.2	17.1	12.7
R9	1.5	16.8	17.0	12.6
R10	1.5	24.5	18.1	13.3
R11	1.5	15.5	16.7	12.5
R12	1.5	17.0	16.9	12.6
R13	1.5	18.2	17.1	12.7
R14	1.5	18.8	17.3	12.8
R15	1.5	18.8	17.2	12.8
R16	1.5	16.2	17.0	12.6
R17	1.5	17.5	17.1	12.7
R18	1.5	17.1	17.0	12.6
R19	1.5	17.3	17.1	12.7
R20	1.5	16.4	16.9	12.6
R21	1.5	14.3	16.6	12.4
R22	1.5	14.1	16.6	12.4
R23	1.5	14.2	16.7	12.4
R24	1.5	13.9	16.6	12.4
R25	1.5	13.7	16.5	12.3
R26	1.5	14.0	16.6	12.4
R27	1.5	13.2	16.5	12.3
R28	1.5	14.2	16.6	12.4
R29	1.5	15.3	16.8	12.5
R30	1.5	16.7	17.1	12.7
R31	1.5	16.0	16.9	12.6
R32	1.5	13.8	16.6	12.4
R33	1.5	15.7	16.9	12.5
R34	1.5	14.5	16.6	12.4

Receptor	Height (m)	Annual mean concentrations (µg/m^3)		
		NO_2	PM_{10}	$PM_{2.5}$
R35	1.5	15.2	16.8	12.5
R36	1.5	16.6	17.0	12.6
R37	1.5	16.9	17.0	12.6
R38	1.5	17.1	17.0	12.6
R39	1.5	20.5	17.5	12.9
R40	1.5	15.9	16.8	12.5
R41	1.5	15.8	16.8	12.5
R42	1.5	14.7	16.6	12.4
R43	1.5	13.6	16.5	12.3
R44	1.5	14.2	16.6	12.4
R45	4.5	19.5	17.2	12.8
R46	1.5	18.6	17.1	12.7
R47	4.5	15.2	16.7	12.5
R48	1.5	16.8	16.9	12.6
R49	1.5	13.5	16.5	12.3
R50	1.5	15.4	16.8	12.5
R51	1.5	13.3	16.5	12.3
R52	1.5	13.2	16.5	12.3
R53	1.5	13.7	16.6	12.4
R54	1.5	13.2	16.5	12.3
R55	1.5	14.3	16.6	12.4
R56	1.5	14.1	16.6	12.4
R57	1.5	16.8	16.9	12.6
R58	1.5	17.9	17.0	12.6
R59	1.5	23.6	17.4	12.9
R60	1.5	16.4	16.8	12.5
R61	1.5	15.2	16.7	12.4
R62	1.5	18.3	17.1	12.7
R63	4.5	14.6	16.6	12.4
R64	1.5	17.0	16.9	12.6
R65	4.5	16.5	16.8	12.5
R66	4.5	15.9	16.7	12.5
R67	1.5	16.2	16.8	12.5
R68	4.5	17.1	16.9	12.6
R69	4.5	17.0	16.9	12.5
R70	4.5	16.9	16.9	12.6
R71	4.5	15.2	16.7	12.4
R72	1.5	17.0	16.9	12.6
R73	4.5	15.5	16.8	12.5
R74	4.5	15.3	16.7	12.5
R75	4.5	16.3	16.8	12.5
R76	1.5	21.3	17.5	12.9

Receptor	**Height (m)**	**Annual mean concentrations (µg/m^3)**		
		NO$_2$	**PM$_{10}$**	**PM$_{2.5}$**
R77	4.5	15.3	16.7	12.5
R78	1.5	17.8	17.0	12.6
R79	1.5	18.3	17.1	12.7
R80	1.5	22.1	17.7	13.0
R81	4.5	16.2	16.8	12.5
R82	1.5	24.8	18.1	13.3
R83	1.5	17.9	17.0	12.6
R84	1.5	34.5	19.1	13.9
R85	1.5	15.6	16.7	12.5
R86	1.5	14.9	16.7	12.4
R87	1.5	16.0	16.8	12.5
R88	4.5	15.7	16.8	12.5
R89	1.5	18.0	17.1	12.7
R90	1.5	15.2	16.7	12.5
R91	4.5	14.5	16.6	12.4
R92	4.5	14.8	16.7	12.4
R93	1.5	19.5	17.2	12.8
R94	1.5	19.5	17.3	12.8
R95	4.5	18.6	17.1	12.7
R96	1.5	15.3	16.7	12.4
R97	1.5	14.2	16.6	12.4
R98	1.5	14.4	16.6	12.4
R99	4.5	16.1	16.8	12.5
R100	1.5	21.6	17.5	12.9
R101	1.5	15.2	16.7	12.4
R102	1.5	18.3	17.1	12.7
R103	1.5	15.6	16.7	12.5
R104	1.5	18.9	17.2	12.7
R105	1.5	18.2	17.1	12.7
R106	1.5	20.1	17.4	12.8
R107	4.5	17.2	16.9	12.6
R108	4.5	14.3	16.6	12.4
R109	1.5	16.8	17.0	12.6
R110	1.5	14.7	16.7	12.5
R111	1.5	19.4	17.4	12.8
R112	1.5	19.2	17.5	12.9
R113	1.5	18.7	17.2	12.7
R114	1.5	14.4	16.7	12.4
R115	1.5	14.8	16.7	12.4
R116	1.5	19.5	17.3	12.8
R117	1.5	22.7	17.6	13.0
R118	1.5	21.8	17.5	12.9

Receptor	**Height (m)**	**Annual mean concentrations (µg/m^3)**		
		NO$_2$	**PM$_{10}$**	**PM$_{2.5}$**
R119	1.5	19.5	17.3	12.8
R120	1.5	19.3	17.3	12.8
R121	1.5	19.1	17.5	12.9
R122	1.5	15.0	16.8	12.5
R123	1.5	13.1	16.5	12.3
R124	1.5	13.1	16.5	12.3
R125	1.5	16.7	17.0	12.6
R126	1.5	14.7	16.7	12.4
R127	1.5	19.5	17.4	12.9
R128	1.5	15.2	16.8	12.5
R129	1.5	15.2	16.8	12.5
R130	1.5	15.3	16.9	12.6
R131	1.5	19.2	17.4	12.8
R132	1.5	14.8	16.8	12.5
R133	1.5	13.6	16.5	12.3
R134	1.5	13.3	16.5	12.3
R135	1.5	15.1	16.8	12.5
R136	1.5	14.6	16.7	12.4
R137	1.5	15.3	16.8	12.5
R138	1.5	15.6	16.8	12.5
R139	1.5	13.2	16.5	12.3
R140	1.5	13.2	16.5	12.3
R141	1.5	14.8	16.7	12.4
R142	1.5	15.9	16.9	12.5
R143	1.5	15.8	16.9	12.6
R144	1.5	17.6	17.2	12.7
R145	1.5	15.1	16.7	12.5
R146	1.5	16.5	17.0	12.6
R147	1.5	15.0	16.8	12.5
R148	1.5	14.2	16.7	12.4
R149	1.5	14.0	16.7	12.4
R150	1.5	13.9	16.6	12.4
R151	1.5	13.9	16.6	12.4
R152	1.5	14.1	16.6	12.4
R153	1.5	13.2	16.5	12.3
R154	1.5	14.9	16.9	12.5

Table 2: 2023 Model Results for Annual Mean NO$_2$ Concentrations

Receptor	**Height (m)**	**Annual mean NO$_2$ concentrations (µg/m^3)**		**Impact**
		2023 DM	**2023 DS**	
R1	1.5	18.5	15.9	Negligible

Receptor	Height (m)	Annual mean NO_2 concentrations (µg/m^3)		Impact
		2023 DM	2023 DS	
R2	1.5	18.6	17.8	Negligible
R3	1.5	17.6	16.8	Negligible
R4	1.5	15.9	16.1	Negligible
R5	1.5	20.9	22.2	Negligible
R6	1.5	16.1	17.6	Negligible
R7	1.5	17.9	20.1	Negligible
R8	1.5	16.9	18.1	Negligible
R9	1.5	15.8	16.7	Negligible
R10	1.5	22.4	23.9	Negligible
R11	1.5	15.1	13.7	Negligible
R12	1.5	16.4	15.1	Negligible
R13	1.5	16.9	18.0	Negligible
R14	1.5	18.0	19.2	Negligible
R15	1.5	18.1	19.4	Negligible
R16	1.5	15.9	16.2	Negligible
R17	1.5	16.9	17.6	Negligible
R18	1.5	16.8	18.0	Negligible
R19	1.5	16.4	16.4	Negligible
R20	1.5	15.6	15.8	Negligible
R21	1.5	13.9	14.1	Negligible
R22	1.5	13.7	14.0	Negligible
R23	1.5	14.0	14.2	Negligible
R24	1.5	13.9	14.3	Negligible
R25	1.5	13.7	14.0	Negligible
R26	1.5	13.8	14.0	Negligible
R27	1.5	13.1	13.2	Negligible
R28	1.5	13.8	13.9	Negligible
R29	1.5	14.8	14.9	Negligible
R30	1.5	15.9	16.6	Negligible
R31	1.5	15.2	15.6	Negligible
R32	1.5	13.4	13.6	Negligible
R33	1.5	15.0	15.2	Negligible
R34	1.5	15.1	15.6	Negligible
R35	1.5	15.0	15.9	Negligible
R36	1.5	16.3	17.5	Negligible
R37	1.5	16.7	18.0	Negligible
R38	1.5	17.1	18.4	Negligible
R39	1.5	20.6	21.6	Negligible
R40	1.5	16.2	16.5	Negligible
R41	1.5	15.7	16.2	Negligible
R42	1.5	14.3	14.8	Negligible

Receptor	Height (m)	Annual mean NO_2 concentrations ($\mu g/m^3$)		Impact
		2023 DM	2023 DS	
R43	1.5	13.6	15.0	Negligible
R44	1.5	14.1	15.5	Negligible
R45	4.5	18.4	16.4	Negligible
R46	1.5	17.6	16.3	Negligible
R47	4.5	14.7	14.6	Negligible
R48	1.5	15.8	15.8	Negligible
R49	1.5	15.4	15.5	Negligible
R50	1.5	14.8	14.6	Negligible
R51	1.5	13.1	12.9	Negligible
R52	1.5	13.0	12.9	Negligible
R53	1.5	13.4	13.2	Negligible
R54	1.5	13.0	12.9	Negligible
R55	1.5	14.3	14.1	Negligible
R56	1.5	13.6	13.7	Negligible
R57	1.5	17.0	14.4	Negligible
R58	1.5	16.9	16.8	Negligible
R59	1.5	25.5	24.1	Negligible
R60	1.5	16.8	16.8	Negligible
R61	1.5	14.8	13.7	Negligible
R62	1.5	17.5	17.0	Negligible
R63	4.5	14.3	14.0	Negligible
R64	1.5	16.2	15.4	Negligible
R65	4.5	16.8	16.3	Negligible
R66	4.5	16.3	15.5	Negligible
R67	1.5	16.8	15.7	Negligible
R68	4.5	18.2	16.0	Negligible
R69	4.5	18.1	16.0	Negligible
R70	4.5	17.3	17.2	Negligible
R71	4.5	14.9	14.3	Negligible
R72	1.5	17.1	15.7	Negligible
R73	4.5	15.1	14.6	Negligible
R74	4.5	15.0	14.5	Negligible
R75	4.5	15.7	16.4	Negligible
R76	1.5	20.1	22.5	Slight adverse
R77	4.5	15.0	14.5	Negligible
R78	1.5	16.8	18.0	Negligible
R79	1.5	17.2	18.6	Negligible
R80	1.5	20.2	22.3	Negligible
R81	4.5	15.5	16.0	Negligible
R82	1.5	22.4	21.9	Negligible
R83	1.5	16.9	16.8	Negligible

Receptor	**Height (m)**	**Annual mean NO_2 concentrations ($\mu g/m^3$)**		**Impact**
		2023 DM	**2023 DS**	
R84	1.5	30.5	33.9	Slight adverse
R85	1.5	15.0	16.5	Negligible
R86	1.5	14.4	14.3	Negligible
R87	1.5	15.3	15.6	Negligible
R88	4.5	15.1	15.4	Negligible
R89	1.5	17.3	21.6	Slight adverse
R90	1.5	14.8	14.6	Negligible
R91	4.5	14.2	14.2	Negligible
R92	4.5	14.3	14.2	Negligible
R93	1.5	18.2	16.8	Negligible
R94	1.5	19.8	20.9	Negligible
R95	4.5	18.5	16.2	Negligible
R96	1.5	15.4	17.2	Negligible
R97	1.5	14.3	15.0	Negligible
R98	1.5	14.5	14.9	Negligible
R99	4.5	16.4	15.6	Negligible
R100	1.5	21.3	18.6	Negligible
R101	1.5	15.1	15.0	Negligible
R102	1.5	18.0	16.3	Negligible
R103	1.5	15.6	15.6	Negligible
R104	1.5	18.4	15.9	Negligible
R105	1.5	17.7	16.4	Negligible
R106	1.5	19.5	17.2	Negligible
R107	4.5	17.5	16.5	Negligible
R108	4.5	14.4	16.7	Negligible
R109	1.5	16.5	20.3	Negligible
R110	1.5	14.5	15.2	Negligible
R111	1.5	19.4	23.5	Slight adverse
R112	1.5	19.1	18.5	Negligible
R113	1.5	19.4	23.8	Slight adverse
R114	1.5	14.8	15.0	Negligible
R115	1.5	15.3	14.6	Negligible
R116	1.5	20.8	16.7	Slight beneficial
R117	1.5	24.3	20.3	Slight beneficial
R118	1.5	20.9	20.8	Negligible
R119	1.5	18.5	18.4	Negligible
R120	1.5	18.2	18.3	Negligible
R121	1.5	18.2	18.3	Negligible
R122	1.5	15.1	15.4	Negligible
R123	1.5	13.3	13.2	Negligible
R124	1.5	13.4	13.1	Negligible

Receptor	Height (m)	Annual mean NO_2 concentrations (μg/m^3)		Impact
		2023 DM	2023 DS	
R125	1.5	15.5	15.6	Negligible
R126	1.5	15.3	15.5	Negligible
R127	1.5	18.6	18.8	Negligible
R128	1.5	14.8	14.5	Negligible
R129	1.5	14.8	14.4	Negligible
R130	1.5	14.8	14.4	Negligible
R131	1.5	18.1	17.8	Negligible
R132	1.5	14.6	14.3	Negligible
R133	1.5	13.5	13.4	Negligible
R134	1.5	13.2	13.2	Negligible
R135	1.5	14.8	14.8	Negligible
R136	1.5	14.3	14.4	Negligible
R137	1.5	15.0	15.3	Negligible
R138	1.5	15.3	15.6	Negligible
R139	1.5	13.2	13.1	Negligible
R140	1.5	13.2	13.0	Negligible
R141	1.5	14.7	14.3	Negligible
R142	1.5	15.4	14.9	Negligible
R143	1.5	15.3	15.7	Negligible
R144	1.5	17.1	17.4	Negligible
R145	1.5	14.7	15.1	Negligible
R146	1.5	16.0	16.5	Negligible
R147	1.5	14.7	14.9	Negligible
R148	1.5	13.9	13.8	Negligible
R149	1.5	13.7	13.6	Negligible
R150	1.5	13.4	13.3	Negligible
R151	1.5	13.3	13.2	Negligible
R152	1.5	13.7	13.8	Negligible
R153	1.5	13.1	13.1	Negligible
R154	1.5	14.5	14.6	Negligible

2. Model results for ecological receptors

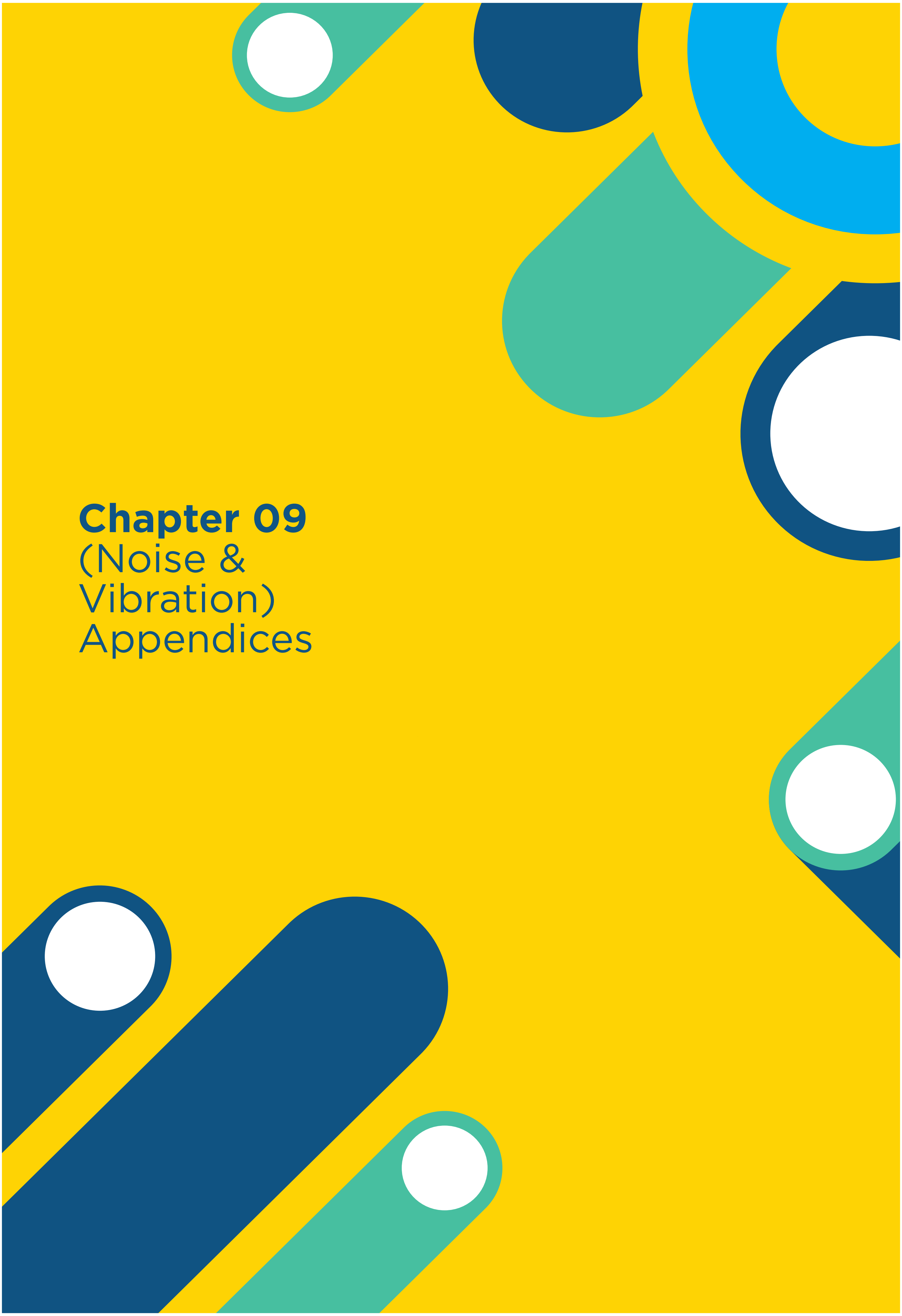
The model results for ecological receptors are presented in Table 3 this appendix.

Table 3: 2022 Model Results for Annual Mean NO_2 Concentrations (modelled at 0 m)

Receptor	Annual mean NO_2 concentrations (μg/m^3)		DS-DS
	2023 DM	2023 DS	
Galway Bay Complex SAC/Inner Galway Bay SPA_1_1	13.3	13.1	-0.2

Receptor	Annual mean NO$_2$ concentrations (µg/m^3)		DS-DS
	2023 DM	2023 DS	
Galway Bay complex SAC/Inner Galway Bay SPA _1_2	12.7	12.7	-0.1
Galway Bay complex SAC/Inner Galway Bay SPA _1_3	12.6	12.5	-0.1
Galway Bay complex SAC/Inner Galway Bay SPA _1_4	12.5	12.5	0.0
Galway Bay complex SAC/Inner Galway Bay SPA _1_5	12.4	12.4	0.0
Galway Bay complex SAC/Inner Galway Bay SPA _1_6	12.4	12.4	0.0
Galway Bay complex SAC/Inner Galway Bay SPA _1_7	12.4	12.3	0.0
Galway Bay complex SAC/Inner Galway Bay SPA _1_8	12.3	12.3	0.0
Galway Bay complex SAC/Inner Galway Bay SPA _1_9	12.3	12.3	0.0
Galway Bay complex SAC/Inner Galway Bay SPA _1_10	12.3	12.3	0.0
Galway Bay Complex SAC/Inner Galway Bay SPA _2_1	13.5	13.3	-0.1
Galway Bay Complex SAC/Inner Galway Bay SPA _2_2	12.7	12.6	-0.1
Galway Bay Complex SAC/Inner Galway Bay SPA _2_3	12.5	12.5	0.0
Galway Bay Complex SAC/Inner Galway Bay SPA _2_4	12.4	12.4	0.0
Galway Bay Complex SAC/Inner Galway Bay SPA _2_5	12.3	12.3	0.0
Galway Bay Complex SAC/Inner Galway Bay SPA _2_6	12.3	12.3	0.0
Galway Bay Complex SAC/Inner Galway Bay SPA _2_7	12.3	12.2	0.0
Galway Bay Complex SAC/Inner Galway Bay SPA _2_8	12.2	12.2	0.0
Galway Bay Complex SAC/Inner Galway Bay SPA _2_9	12.2	12.2	0.0
Galway Bay Complex SAC/Inner Galway Bay SPA _2_10	12.2	12.2	0.0
Lough Corrib SAC_1_1	13.7	13.5	-0.2
Lough Corrib SAC_1_2	13.3	13.3	0.0
Lough Corrib SAC_1_3	13.2	13.2	0.0
Lough Corrib SAC_1_4	13.1	13.1	0.0
Lough Corrib SAC_1_5	13.1	13.1	0.0
Lough Corrib SAC_1_6	13.0	13.0	0.0
Lough Corrib SAC_1_7	13.0	13.0	0.0
Lough Corrib SAC_1_8	13.0	13.0	0.0

Receptor	**Annual mean NO_2 concentrations ($\mu g/m^3$)**		**DS-DS**
	2023 DM	**2023 DS**	
Lough Corrib SAC_1_9	13.0	13.0	0.0
Lough Corrib SAC_1_10	13.0	13.0	0.0
Lough Corrib SAC_2_1	14.0	13.4	-0.6
Lough Corrib SAC_2_2	13.9	13.4	-0.6
Lough Corrib SAC_2_3	13.9	13.4	-0.5
Lough Corrib SAC_3_1	14.8	14.3	-0.5
Lough Corrib SAC_3_2	13.5	13.5	0.0
Lough Corrib SAC_3_3	13.2	13.3	0.1
Lough Corrib SAC_3_4	13.1	13.2	0.1
Lough Corrib SAC_3_5	13.1	13.2	0.1
Lough Corrib SAC_3_6	13.0	13.1	0.1
Lough Corrib SAC_3_7	13.0	13.1	0.1
Lough Corrib SAC_3_8	12.9	13.1	0.1
Lough Corrib SAC_3_9	12.9	13.1	0.1
Lough Corrib SAC_3_10	12.9	13.0	0.1



Chapter 09

(Noise & Vibration) Appendices

Galway City Council

BusConnects Galway: Cross-City Link

Noise and Vibration Assessment

235532-04-03-02

Issue | 12 August 2022

Job number 235532

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Contents

Appendix

9.1 Noise Survey

1 Baseline Noise Monitoring

1.1 Introduction

This report includes the relevant survey details and results associated with baseline noise monitoring undertaken as part of the Proposed Scheme. The survey has been undertaken to inform the noise chapter of the Proposed Scheme EIAR.

Survey details and results for each of the noise monitoring locations are included within this report.

1.2 Survey Methodology

1.2.1 Study Area

A full description of the Proposed Scheme can be found in Chapter 4 (Proposed Scheme) in Volume 2 of this EIAR.

The key noise and vibration sensitive properties are residential dwellings, directly adjacent to roads on the Proposed Scheme and roads affected by the Proposed Scheme. Residential dwellings adjacent to these roads have facades located between 2 and 25 m from the road edge.

Noise sensitive locations are distributed throughout the study area, including suburbs near the city centre and residents in the city centre itself.

1.2.2 Survey Locations

Baseline noise surveys have been conducted at locations representative of the nearest noise sensitive areas that have the potential to be impacted by construction works and/or those likely to be impacted during the Operational Phase of the Proposed Scheme. Short-term baseline noise measurements were made at 16 locations across the Proposed Scheme.

Figure 9.2 in Volume 3 of this EIAR illustrates the baseline noise monitoring locations.

The noise monitoring locations are described in Table 1.

Table 1: Noise monitoring locations

Location	Description of Survey Location
University Road	On pavement outside residential receptor to the south of University Road. 1 m from road edge. Cars parallel parked on street with traffic beyond that.
232 Corrib Park	On pavement outside terrace houses. Approximately 15 m north of Seamus Quirke Road. Corrib Park is a quiet, residential street. Seamus Quirke Road is a heavily trafficked road. The houses on Corrib Park are slightly screened from Seamus Quirke Road by a small earth berm.

Location	**Description of Survey Location**
81 Ardiluan Road	On pavement outside houses. Approximately 17 m east of Thomas Hynes Road. Ardilaun Road is a quiet, residential street. Thomas Hynes Road is a busy road. This location is representative of Moyola Park.
24 Inchagill Road	On pavement outside houses. Approximately 13 m south-east of R338. Inchagill Road is a quiet cul-de-sac. The R338 is a heavily trafficked road. The houses on Inchagill Road are screen from the R338 by a 1.5 m high wall.
N6/Upper Newcastle Road	On pavement outside terrace houses approximately 1 m from the road edge, north-east of the junction. Upper Newcastle and the N6 are both busy roads.
188 Dun Na Coiribe	On pavement outside houses. Approximately 30 m north of N6. Dun Na Coiribe is a residential street with a constant stream of pedestrian traffic. The N6 is a heavily trafficked road.
120 College Road	On pavement outside residential receptor to the south of College Road. 1 m from road edge. Cars parallel parked on street with traffic beyond that.
Lough Atalia Road (behind 118 College Road)	On pavement outside residential receptor to the north of Lough Atalia Road. 3 m from road edge.
Presentation Road/Mill Street	On pavement outside residential receptor to the east of Mill St, just south of the junction with New Road. 1 m from road edge.
Woodquay	On pavement outside residential receptor to the south of Dalys Place. 1 m from road edge.
Eyre Street	On pavement outside residential receptor to the south of Eyre Street. 1 m from road edge. Cars parallel parked on street with traffic beyond.
Bothar na mBan	On pavement outside Sleepzone Galway Hostel to the west of Bothar na mBan. 1 m from road edge.
Coach Station	On pavement outside the Forster Court Hotel to the west of Fairgreen Road, opposite Galway Coach Station. 1 m from road edge.
Fairgreen Rd/ Lough Atalia Road	On pavement outside the Galmont Hotel to the north of Lough Atalia Road. 2 m from road edge.
Middle Street	On pavement outside the residential receptor to the south of Middle Street. 1 m from road edge.

1.2.3 Survey Periods

Noise measurements were undertaken on 27 and 28 January 2022, between 10:00 and 17:00.

1.2.4 Survey Equipment and Personnel

Equipment used to undertake the noise surveys is presented in Table 2.

Table 2: Measurement equipment details

Equipment Manufacturer	**Equipment Type**	**Serial Number**	**Calibration Date (details TBC)**
Bruel & Kjaer	2250 Sound Level Meter	3028791	9-11-2021
Bruel & Kjaer	2250 Light Sound Level Meter	2620701	13-02-2020
Bruel & Kjaer	4231 Calibrator	3011816	9-11-2021

Calibration certificate of the monitoring equipment are included at the end of this Appendix.

The surveys were undertaken by Mhairi Riddet (Senior Acoustic Consultant) and Zak Henderson (Project Engineer) of Arup.

1.2.5 Survey Parameters

The following noise parameters were measured and are discussed within this report.

$L_{Aeq,T}$ is the A-weighted equivalent continuous steady sound level during the sample period and effectively represents an average value of the defined measurement period, T.

$L_{Aeq,16hr}$ refers to the ambient daytime period between 07:00 and 23:00hrs.

$L_{A10,T}$ is the A-weighted sound level that is exceeded for 10% of the sample period; this parameter gives an indication of the upper limit of fluctuating noise such as that from road traffic. The T is the sample period the parameter is measured over.

$L_{A10,18hr}$ is the L_{A10} parameter between 06:00 and 00:00hrs as defined within the Calculation of Road Traffic Noise (hereafter referred to as CRTN) (UK Department of Transport 1998).

$L_{A90,T}$ is the A-weighted sound level that is exceeded for 90% of the sample period; generally used to quantify background noise. The T is the sample period the parameter is measured over.

$L_{A90,16hr}$, refers to the background daytime noise level between 07:00 and 23:00hrs

$L_{A90,8hr}$, refers to the background night-time noise level between 23:00 and 07:00hrs

The L_{den} parameter is also discussed within the report. For long-term survey locations, this parameter is derived from the L_{Aeq} data over each 24 hour period as is defined as follows:

L_{den} is the 24hour noise rating level determined by the averaging of the L_{day} with the $L_{evening}$ (plus a 5dB penalty) and the L_{night} (plus a 10dB penalty). L_{den} is calculated using the following formula, as defined within the Environmental Noise Regulations (S.I.140 / 2006):

$$L_{den} = 10log\left(\frac{1}{24}\right)\left(12 * \left(10^{\frac{Lday}{10}}\right) + 4 * \left(10^{\frac{Levening+5}{10}}\right) + 8 * \left(10^{\frac{Lnight+10}{10}}\right)\right)$$

Where:

L_{day} is the A-weighted long-term average sound level as defined in ISO 1996-2:2017 Part 2: Determination of sound pressure levels (hereafter referred to as ISO 1996-2) (ISO 2017), determined over all the day periods of a year. The 12hr daytime period is between 07:00 to 19:00hrs.

$L_{evening}$ is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the evening periods of a year. The 4hr evening period is between 19:00 to 23:00hrs.

L_{night} is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the night periods of a year. The 8hr night-time period is between 23:00 to 07:00hrs.

1.2.6 Survey Procedure

Attended noise surveys were undertaken at public locations at positions representative of the adjacent noise sensitive locations (e.g. on green areas in residential areas, footpaths, parks etc.). For all attended surveys, the microphone was positioned at height of approximately 1.2m above ground.

The attended surveys were undertaken in accordance with the shortened measurement procedure described in CRTN (UK Department of Transport 1998) and Transport Infrastructure Ireland’s (TII) document Guidelines for the Treatment of Noise and Vibration on National Road (TII 2004).

This methodology involves a method whereby $L_{A10(18hour)}$ and L_{den} values are obtained through a combination of measurement and calculation as follows:

- Noise level measurements are undertaken at the chosen location over three hours between 10:00 and 17:00hrs.
- Each sample period was measured over a 15-minute duration.
- The $L_{A10,18hr}$ for the location is derived by subtracting 1 dB from the arithmetic average of the three hourly sample values, i.e.

  $L_{A10(18hour)} = ((\sum L_{A10(15\ minutes)}) \div 3) - 1$ dB.
- The derived L_{den} value is calculated from the $L_{A10(18hour)}$ value, i.e.

$L_{den} = 0.86 \times L_{A10(18hr)} + 9.86$ dB.

1.3 Survey Results

Attended noise survey results are presented in Table 3.

Table 3: Noise monitoring results

Location	Date	Start time	LAeq,15min (dB)	LA10 (dB)	LA90 (dB)	Lden dB	Comments
University Rd	27 Jan 2022	11:28	67 – 69	70 – 72	57 – 58	71	Traffic noise dominant
232 Corrib Park	27 Jan 2022	15:31	58 – 59	61	49 – 52	61	Traffic noise dominant
81 Ardiluan Rd	27 Jan 2022	15:54	63	65 – 66	57 – 58	65	Traffic noise dominant
24 Inchagill Rd	27 Jan 2022	13:11	61 – 63	63 – 65	56 – 59	64	Traffic noise dominant
N6/Upper Newcastle Rd	27 Jan 2022	13:42	70 – 71	72 – 75	62 – 63	72	Traffic noise dominant
188 Dun Na Coiribe	27 Jan 2022	14:09	62 – 64	64 – 66	57 – 60	65	Traffic noise dominant. Steady stream of pedestrians.
120 College Rd	28 Jan 2022	10:43	66 – 67	69 – 71	53 – 55	70	Traffic noise dominant
Lough Atalia Rd (behind 118 College Rd)	28 Jan 2022	11:00	76	79 – 80	63 – 64	77	Traffic noise dominant
Presentation Rd	27 Jan 2022	10:32	63 – 66	66 – 70	46 – 47	68	Relatively quiet street. Intermittent cars and pedestrians
Woodquay	27 Jan 2022	11:12	61 – 63	64 – 66	55	66	Intermittent traffic, frequent pedestrians
Eyre Street	27 Jan 2022	11:31	60 – 61	63 – 64	49 – 53	63	Intermittent traffic, frequent pedestrians
Bothar na mBan	27 Jan 2022	11:23	67 – 70	71 – 73	52 – 57	72	Traffic noise dominant. Frequent pedestrian traffic
Coach Station	27 Jan 2022	12:21	64 – 70	67 – 70	55 – 59	68	Intermittent traffic, frequent pedestrians
Fairgreen Rd/Lough Atalia Rd	27 Jan 2022	12:51	76 – 77	80	62 – 64	78	Heavy traffic.
Middle Street	27 Jan 2022	13:22	58 – 60	59 – 62	51	61	Intermittent traffic, frequent pedestrians

2 References

British Standard Institute (BSI) (1990). British Standard (BS) 7385: 1990: Evaluation and measurement for vibration in buildings. Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings.

BSI (2008). BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings. Part 1 Vibration sources other than blasting.

ISO (2016). ISO 1996-1:2016 Acoustics - Description, measurement and assessment of environmental noise. Part 1: Basic quantities and assessment procedures.

ISO (2017). ISO 1996-2:2017 - Description, measurement and assessment of environmental noise - Part 2: Determination of sound pressure levels.

Transport Infrastructure Ireland (TII) (previously National Roads Authority (NRA)) (2014). Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Revision 1.

UK Department of Transport (1998). The UK Department of Transport Calculation of Road Traffic Noise.

Directives and Legislation

S.I. No. 140/2006 – European Communities (Environmental Noise) Regulations 2006.

3 Calibration Certificates for Monitoring Equipment

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

ilac-MRA

DANAK
CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: CDK2000488

CALIBRATION OF

Sound Level Meter:	Brüel & Kjær Type 2250	No: 2620701	Id: - 2654662
Microphone:	Brüel & Kjær Type 4950	No: 2606551	
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 6822	
Supplied Calibrator:	Brüel & Kjær Type 4231	No: 2460008	

Software version:	BZ7222 Version 2.1	Pattern Approval:	PTB1.63-4046158
Instruction manual:	BE1712-18		

CUSTOMER

Enfonic Ltd
Unit 2A
Century Business Park
Dublin
D11 T0HV
Ireland

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23°C ± 3°C

Environment conditions: *See actual values in* ***Environmental conditions*** *sections.*

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 has been calibrated in accordance with the requirements as specified in IEC61672-1:2002 class 1. Procedures from IEC 61672-3:2006 were used to perform the periodic tests. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 4.9 - DB: 4.90) by using procedure 2250-4189.

RESULTS

Calibration Mode: **Calibration as received.**

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2020-02-13

Date of issue: 2020-02-13

M. Önder
Mikail Önder
Calibration Technician

Susanne Jørgensen
Susanne Jørgensen
Approved Signatory

CALIBRATION CERTIFICATE

Date of issue: 09-11-2021 **Certificate No:** 1500975-1 **Page:** 1/6

OBJECT OF CALIBRATION

Manufacturer: **B&K**
Model: **2250**
Serial No.: 3028791
Description: Sound Level Meter

SENSOR

Manufacturer:	**B&K**	**B&K**
Model:	**4189**	**ZC0032**
Serial No.:	3195848	29128
Description:	Microphone	Preamplifier

APPLICANT

Arup
Level 3 Asta House, 55-65 Whitfield Street W1T 4BQ

ENVIRONMENTAL CONDITIONS

Temperature:	22.60 – 22.70	°C
Humidity:	49.70 – 52.10	%
Pressure:	101.11 – 101.18	kPa

DATE OF CALIBRATION 09-11-2021

APPROVED BY B. Hunt

AcSoft Calibration | Bedford Technology Park
Thurleigh | Bedford | MK44 2YA

+44 (0) 1234 639550

www.acsoft.co.uk

CALIBRATION METHOD

Method described in instruction IN-02 “Calibration of the sound level meter”, issue number 11 date 27.01.2016, written on the basis of international standard EN IEC 61672-3:2013 Electroacoustics. Part 3: Periodic tests.

CALIBRATION RESULTS

The sound level meter submitted for testing has successfully completed the Class 1 periodic tests of IEC 61672-3:2013 (BS EN 61672-3:2013), for the environmental conditions under which the tests were performed.

The results are presented on pages 3 to 6 of this certificate (including measurement uncertainty).

CONFORMITY WITH REQUIREMENTS

On the basis of the calibration results, it has been found that, the sound level meter meets metrological requirements specified in the standard IEC 61672-1:2013 Electroacoustics – Sound level meters. Part 1: Specifications, for class 1.

UNCERTAINTY OF MEASUREMENTS

Uncertainty of measurement has been evaluated in compliance with EA-4/02:2013. The expanded uncertainty assigned corresponds to a coverage probability of 95 % and the coverage factor $k = 2$.

NOTES

1. *The information appearing on this certificate has been compiled specifically for this instrument. This calibration certificate is produced with traceable and advanced equipment which permit comprehensive quality assurance verification of all data supplied herein.*
2. *The measurements in this document are traceable to GUM (Central Office of Measures), Poland*
3. *This calibration certificate shall not be reproduced except in full, without written permission from AcSoft Ltd.*

REFERENCE EQUIPMENT

Description	Manufacturer	Model	Serial Number	Last Calibrated
Signal Generator	Svantek	SV401	124	27.08.2021
Sound & Vibration Analyser	Svantek	SV912AE	15909	22.09.2021
Thermo-Barometer	LAB-EL	LB-706B	912	27.08.2021
Acoustical Calibrator	Svantek	SV30A	83782	17.09.2021

CALIBRATION CERTIFICATE

Issued by AcSoft Calibration

Date of issue: 09-11-2021 **Certificate No:** 1500975-1 **Page:** 3/6

CALIBRATION RESULTS Calibration results are as follows:

1. Indication at the calibration check frequency

The sound level meter was calibrated in compliance with the instruction manual. During this process, the indication of this SLM was adjusted to the sound pressure level of the sound level calibrator type SV 30A, No 44775, from SVANTEK. The sound pressure level was corrected by the free-field factor.

Deviation of the acoustic pressure measurement of the A-weighted sound level using the sound calibrator type SV 30A, No 44775, from SVANTEK, was made according to the standard reference conditions: for static pressure 1003 hPa, for temperature 24 ºC and for relative humidity 60 %, results:

0.0 ± 0.2 dB

The deviation was determined as a difference between the measured sound level and the sound level corrected by the free-field factor appropriate to mentioned sound calibrator.

2. Self-generated noise with microphone installed

Frequency weighting	A
The highest level of self-generated noise stated in the instruction manual [dB]	n/a
Indication [dB]	n/a

3. Self-generated noise with microphone replaced by the electrical input signal device

Frequency weighting	A	C	Z
Level of self-generated noise [dB]	12.3	12.1	16.8

4. Acoustical signal tests of a frequency weighting C

Frequency	Relative frequency-weighted free-field response	Design-goal frequency weighting	The deviation of frequency weighting	Expanded uncertainty	Acceptable limits
Hz	dB	dB	dB	dB	dB
125.0	-0.20	-0,2	0.0	0.3	±1.5
1000.0	0.00	0,0	0.0	0.3	±1.1
8000.0	-3.12	-3,0	-0.1	0.4	-3.1; +2.5

5. Electrical signal tests of frequency weightings

Frequency	Design-goal frequency weighting			The deviation of frequency weighting			Expanded uncertainty	Acceptable limits
	A	C	Z	A	C	Z		
Hz	dB	dB	dB	dB	dB	dB	dB	dB
63	-26,2	-0,8	0,0	0.0	0.0	0.0	0,3	±1,5
125	-16,1	-0,2	0,0	0.0	0.0	0.0	0,3	±1,5
250	-8,6	0,0	0,0	0.0	0.0	0.0	0,3	±1,4
500	-3,2	0,0	0,0	0.0	0.0	0.0	0,3	±1,4
1000	0,0	0,0	0,0	0.0	0.0	0.0	0,3	±1,1
2000	1,2	-0,2	0,0	0.0	0.0	0.0	0,3	±1,6
4000	1,0	-0,8	0,0	0.0	0.0	0.0	0,3	±1,6
8000	-1,1	-3,0	0,0	0.0	0.0	0.0	0,4	-3,1; +2,1
16000	-6,6	-8,5	0,0	-1.0	-1.0	-0.9	0,6	-17,0; +3,5

6. Frequency and time weightings at 1 kHz

	Sound level				Time-averaged sound level
Frequency weighting	A	A	C	Z	A
Time weighting	Fast	Slow	Fast	Fast	-
Indication [dB]	94.00	94.00	94.00	94.00	94.00
The deviation of indication from the indication of A-weighted sound level with Fast time weighting [dB]		0.0	0.0	0.0	0.0
Expanded uncertainty [dB]		-			
Acceptable limits[dB]		±0.3	±0.4	±0.4	±0.3

7. Level linearity

Reference level range: -

Expected sound level	Indication	Level linearity error	Expanded uncertainty	Acceptable limits
dB	dB	dB	dB	dB
138.0	138.00	0.0	0.2	±1.1
137.0	137.00	0.0		
136.0	136.00	0.0		
135.0	135.00	0.0		
134.0	134.00	0.0		
129.0	129.00	0.0		
124.0	124.00	0.0		
119.0	119.00	0.0		
114.0	114.00	0.0		
109.0	109.00	0.0		
104.0	104.00	0.0		
99.0	99.00	0.0		
94.0	94.00	0.0		
89.0	89.00	0.0		
84.0	84.00	0.0		
79.0	79.00	0.0		
74.0	74.00	0.0		
69.0	69.00	0.0		
64.0	64.00	0.0		
59.0	59.00	0.0		
54.0	54.00	0.0		
49.0	49.00	0.0		
44.0	44.00	0.0		
39.0	39.00	0.0		
34.0	34.00	0.0		
29.0	29.00	0.0		
28.0	28.10	0.1		
27.0	27.10	0.1		
26.0	26.10	0.1		

8. Toneburst response

Measurement quantity	Time weighting	Toneburst duration	The indications in response to toneburst relative to steady sound level	Reference toneburst response relative to steady sound level	Deviation of measured toneburst response from reference toneburst	Expanded uncertainty	Acceptable limits
		ms	dB	dB	dB	dB	dB
Time-weighted sound level	Fast	200	-1.00	-1.0	0.0	-	±0.8
		2	-18.10	-18.0	-0.1		-1.8; +1.3
		0.25	-27.17	-27.0	-0.2		-3.3; +1.3
Time-weighted sound level	Slow	200	-7.50	-7.4	-0.1		±0.8
		2	-27.00	-27.0	0.0		-1.8; +1.3
Sound exposure level	-	200	-7.02	-7.0	0.0		±0.8
		2	-27.02	-27.0	0.0		-1.8; +1.3
		0.25	-36.12	-36.0	-0.1		-3.3; +1.3

9. Peak C sound level

Numbers of cycles in test signal	Frequency of test signal	The deviation of indication	Expanded uncertainty	Acceptable limits
	Hz	dB	dB	dB
One	8000	0.0	0.2	±2.4
Positive half-cycle	500	-0.3		±1.4
Negative half-cycle	500	-0.3		

10. Overload indication

Frequency weighting A

The difference between the levels of the positive and negative one-half-cycles input signals that first cause the displays of overload indication	Expanded uncertainty	Maximum value of the difference
dB	dB	dB
0.0	0.3	1.8

CALIBRATION CERTIFICATE

Date of issue: 2021-11-09 **Certificate No:** 1500975-2 **Page:** 1/3

OBJECT OF CALIBRATION	Manufacturer:	**B&K**
	Model:	**4231**
	Serial No.:	3011816
	Description:	Acoustical Calibrator accuracy class 1 with nominal level $L_{p,nom1}$ = 94 dB, $L_{p,nom2}$ = 114 dB and nominal frequency f_{n1} = 1000 Hz.

APPLICANT

Arup
Level 3 Asta House, 55-65 Whitfield Street W1T 4BQ

ENVIRONMENTAL CONDITIONS	Temperature:	22.8	^{o}C
	Humidity:	50.0	%
	Pressure:	101.11	kPa

DATE OF CALIBRATION 2021-11-09

APPROVED BY B. Hunt

AcSoft Calibration | Bedford Technology Park
Thurleigh | Bedford | MK44 2YA

+44 (0) 1234 639550

www.acsoft.co.uk

CALIBRATION RESULTS

The calibrator submitted for testing has successfully completed the Periodic tests of IEC 60942:2003 (BS EN 60942:2003) (Annex B), for class 1 sound calibrators, for the environmental conditions under which the tests were performed.

The results are presented on page 3 of this certificate (including measurement uncertainty).

UNCERTAINTY OF MEASUREMENTS

Level:	0.15	dB
Frequency:	0.1	Hz
Distortion:	0.1	%

NOTES

1. *The information appearing on this certificate has been compiled specifically for this instrument. This calibration certificate is produced with traceable and advanced equipment which permit comprehensive quality assurance verification of all data supplied herein.*
2. *The measurements in this document are traceable to GUM (Central Office of Measures), Poland*
3. *This calibration certificate shall not be reproduced except in full, without written permission from AcSoft Ltd.*

REFERENCE EQUIPMENT

Description	Manufacturer	Model	Serial Number
Pistonphone	GRAS	42AP	236167
Acoustical Calibrator	Svantek	SV30A	83782
Sound & Vibration Analyser	Svantek	SV912AE	15909
Digital Multimeter	Keithley	2015THD	1065133
Reference Microphone	GRAS	40AG	235709
Thermo-Barometer	LAB-EL	LB-706B	912

CALIBRATION RESULTS

Calibration results are as follows:

SPL

n	L_{pn}	ΔL_p	$U(L_p)$	$\Delta L_{p,dop}$, dB	
	dB	dB	dB	class 1	class 2
1	**94.24**	0.24	0.15	±0.25	±0.4
2	**114.21**	0.21			

Frequency

n	f_n	δf	$U(f)$	δf_{dop}, w %	
	Hz	Hz	Hz	class 1	class 2
1	**1000.00**	0.00	0.1	±0.7 (±7Hz)	±1.7 (±17Hz)
2	**999.94**	-0.06			

THD

n	h_n	$U(h)$	δh_{dop}, %	
	%	%	class 1	class 2
1	**0.11**	0.1	2.5	3.0
2	**0.07**			

Galway City Council

BusConnects Galway: Cross-City Link

Operational Traffic

235532-04-03-02

Issue | 12 August 2022

Job number 235532

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ARUP

Contents

Appendix

9.2 Operational Phase Traffic Noise Assessment

1 Introduction

The results of traffic noise impact assessment for the Proposed Scheme are included in Table 1 to Table 2. The results in these tables supplement the significance ratings associated with each of the road sections assessed across the proposed scheme.

The results are calculated for each of the road sections (AB Road Link reference) included within the traffic model for the Proposed Scheme.

The results are presented in terms of the following parameters:

$L_{A10,18hr}$	The noise level exceeded for 10% of a sample period. $L_{10,1hr}$ is therefore the noise level exceeded for 10% of the time over a period of 1 hour. $L_{10,18hr}$ is the arithmetic average of the eighteen $L_{10,1hr}$ values between 06:00 and 24:00
L_{den}	is the 24-hour noise rating level determined by the averaging of the L_{day} with the $L_{evening}$ (plus a 5 dB penalty) and the L_{night} (plus a 10 dB penalty). L_{den} is calculated using the following formula, as defined within the Noise Regulations:

$$L_{\mathrm{den}} = 10log\left(\frac{1}{24}\right)\left(12*\left(10^{\frac{Lday}{10}}\right)+4*\left(10^{\frac{Levening+5}{10}}\right)+8*\left(10^{\frac{Lnight+10}{10}}\right)\right)$$

Where:

L_{day} is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the day periods of a year. The 12 hour daytime period is between 07:00hrs and 19:00hrs;

$L_{evening}$ is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the evening periods of a year. The four-hour evening period is between 19:00hrs and 23:00hrs; and

L_{night} is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the night periods of a year. The eight-hour night-time period is between 23:00hrs and 07:00hrs.

The magnitude of change, noise level rating and overall significance ratings tables are taken from the relevant criteria tables set out in Chapter 9 of Volume 3 of the EIAR.

2 Operational Phase Results

Table 1: Operational Results Including Significance Ratings for Short Term Operational Phase Traffic Noise Impacts – Opening Year 2022

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
40000	53324	58	56	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
40001	53324	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
40002	51358	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
40004	40005	61	59	61	59	Negligible	Low - Medium	Not Significant
40004	50860	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
40004	51378	73	74	73	74	Negligible	High	Not Significant - Slight
40005	40004	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
40006	50158	60	59	60	59	Negligible	Low - Medium	Not Significant
40007	52636	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
40008	52691	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
40009	40010	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
40009	50895	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
40009	51363	69	68	69	69	Negligible	Medium - High	Not Significant
40010	40009	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
40018	40019	62	61	62	61	Negligible	Low - Medium	Not Significant
40018	50871	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
40018	51357	74	74	74	74	Negligible	High	Not Significant - Slight
40019	40018	60	59	60	59	Negligible	Low - Medium	Not Significant
40020	40021	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
40020	50910	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
40020	51411	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
40021	40020	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
48006	50754	70	70	70	70	Negligible	Medium - High	Not Significant
48006	50766	72	72	72	73	Negligible	High	Not Significant - Slight
48006	52688	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
48006	52954	73	73	73	73	Negligible	High	Not Significant - Slight
50035	50107	69	68	69	68	Negligible	Medium - High	Not Significant
50035	52081	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50043	50049	70	70	70	70	Negligible	Medium - High	Not Significant
50043	51372	71	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50044	52742	68	68	68	68	Negligible	Medium - High	Not Significant
50044	53394	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50048	51347	73	74	73	74	Negligible	High	Not Significant - Slight
50049	50050	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50050	50044	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50050	52742	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50107	50035	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50107	50353	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50107	50421	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50107	52395	73	74	73	74	Negligible	High	Not Significant - Slight
50108	50110	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50108	52614	71	71	72	72	Negligible	Medium - High	Not Significant
50108	52778	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50110	52427	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50111	52778	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50112	50601	68	67	68	67	Negligible	Medium - High	Not Significant
50112	52696	72	72	72	72	Negligible	High	Not Significant - Slight
50112	52703	72	72	72	72	No change/Reduction	High	Imperceptible/ Positive
50114	50966	69	69	69	69	Negligible	Medium - High	Not Significant
50114	52771	73	73	73	73	Negligible	High	Not Significant - Slight
50116	50118	65	64	65	64	Negligible	Medium	Not Significant
50116	52466	66	65	66	65	Negligible	Medium	Not Significant
50117	50896	71	71	71	71	Negligible	Medium - High	Not Significant
50117	50897	64	63	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50117	53097	71	71	71	72	Negligible	Medium - High	Not Significant
50118	50116	66	65	66	65	Negligible	Medium	Not Significant
50118	52778	65	64	66	65	Negligible	Medium	Not Significant
50118	53020	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50134	52570	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50137	52119	75	76	75	76	No change/Reduction	High	Imperceptible/ Positive
50138	51379	68	67	68	68	Negligible	Medium - High	Not Significant
50139	52780	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50140	50144	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50141	50140	68	68	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50141	50142	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50142	50140	66	66	66	66	Negligible	Medium	Not Significant
50142	52691	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50143	50139	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50143	52635	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50144	50139	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50144	50143	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50145	50141	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50146	52780	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50147	51377	72	72	72	72	Negligible	High	Not Significant - Slight
50147	52634	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50147	52687	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50148	50149	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50148	52622	67	67	67	67	Negligible	Medium - High	Not Significant
50149	50148	67	67	67	67	Negligible	Medium - High	Not Significant
50149	51374	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50150	52536	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50150	52597	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50150	53022	67	66	67	66	Negligible	Medium - High	Not Significant
50155	50043	72	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50155	50156	71	71	71	71	Negligible	Medium - High	Not Significant
50156	50155	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50156	50157	70	70	70	70	Negligible	Medium - High	Not Significant
50157	50156	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50157	52353	70	70	70	70	Negligible	Medium - High	Not Significant
50157	53326	65	65	65	65	Negligible	Medium	Not Significant
50158	40006	61	59	61	59	Negligible	Low - Medium	Not Significant
50158	50165	74	75	74	75	Negligible	High	Not Significant - Slight

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50158	51349	74	74	74	74	Negligible	High	Not Significant - Slight
50164	52352	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50164	52515	68	68	68	68	Negligible	Medium - High	Not Significant
50165	50158	74	74	74	74	Negligible	High	Not Significant - Slight
50165	50164	67	66	67	66	Negligible	Medium	Not Significant
50165	52515	70	70	70	70	Negligible	Medium - High	Not Significant
50353	50107	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50420	50421	73	73	73	73	Negligible	High	Not Significant - Slight
50420	51357	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50420	53344	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50421	50107	69	68	69	69	Negligible	Medium - High	Not Significant
50421	50420	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50486	50760	76	77	77	78	Negligible	High	Not Significant - Slight
50486	50942	75	76	76	77	Negligible	High	Not Significant - Slight
50487	50761	75	75	74	75	No change/Reduction	High	Imperceptible/ Positive
50487	59000	74	75	74	75	Negligible	High	Not Significant - Slight
50489	52256	66	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50489	52274	68	67	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50490	50691	Flow too low	Flow too low	60	58	Flow too low	Low - Medium	Flow too low
50490	50696	Flow too low	Flow too low	59	58	Flow too low	Low - Medium	Flow too low
50491	50577	71	71	72	72	Negligible	Medium - High	Not Significant
50491	50578	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50492	50657	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50492	50931	62	61	63	61	Negligible	Medium	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50492	52312	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50493	50915	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50493	50916	58	56	61	60	Moderate	Low - Medium	Slight - Moderate
50493	50917	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50494	50521	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50494	50917	70	69	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50494	53252	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50495	50497	74	74	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50495	50741	70	70	73	74	Moderate	High	Significant
50495	52333	74	74	72	72	No change/Reduction	High	Imperceptible/ Positive
50497	50495	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50497	50498	71	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50498	50497	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50498	50738	71	71	72	72	Negligible	Medium - High	Not Significant
50498	50741	Flow too low	Flow too low	72	72	Flow too low	Medium - High	Flow too low
50499	50558	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50499	50625	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50499	50626	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50500	51368	67	67	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
50500	52471	67	66	67	66	Negligible	Medium	Not Significant
50501	50836	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50501	52123	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
50502	51335	68	67	68	67	Negligible	Medium - High	Not Significant
50502	52592	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50503	50506	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50503	51333	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50503	52676	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50504	52690	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50506	50503	70	70	70	70	Negligible	Medium - High	Not Significant
50506	50851	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50507	50835	63	61	63	62	Negligible	Medium	Not Significant
50507	50836	73	73	73	73	Negligible	High	Not Significant - Slight
50507	52683	73	73	73	73	Negligible	High	Not Significant - Slight
50508	50796	61	59	63	62	Minor	Medium	Slight
50508	50802	61	60	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50508	53275	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50509	50510	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50509	50797	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50510	50509	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50510	50796	Flow too low	Flow too low	68	67	Flow too low	Medium - High	Flow too low
50510	50798	72	73	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50510	52280	72	72	73	73	Minor	High	Slight - Moderate
50510	60001	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50511	50512	71	71	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50511	50962	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50512	50511	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50512	50747	71	71	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50512	52665	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50513	50551	68	68	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50513	50921	68	67	68	68	Negligible	Medium - High	Not Significant
50513	53268	63	61	63	61	No change/Reduction	Medium	Imperceptible/ Positive
50514	50515	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50514	50636	72	72	72	72	No change/Reduction	High	Imperceptible/ Positive
50514	55000	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50515	50514	68	67	68	68	Negligible	Medium - High	Not Significant
50515	52318	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50515	53353	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50516	50785	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50516	52276	69	69	69	69	Negligible	Medium - High	Not Significant
50516	53046	69	68	69	69	Negligible	Medium - High	Not Significant
50517	50518	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50517	50785	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50517	50789	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50517	53046	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50518	50517	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50518	50519	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50518	50936	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50519	50518	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50519	50788	Flow too low	Flow too low	59	57	Flow too low	Low - Medium	Flow too low
50519	52272	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50520	50524	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50520	50941	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50521	50494	70	69	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50521	50776	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50522	50775	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50522	50776	70	69	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50522	53254	60	58	60	58	Negligible	Low - Medium	Not Significant
50523	50914	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50523	53047	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
50523	53398	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50524	50520	71	71	71	71	Negligible	Medium - High	Not Significant
50524	50771	68	68	68	68	Negligible	Medium - High	Not Significant
50524	53253	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
50525	50768	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50525	50770	65	65	66	65	Negligible	Medium	Not Significant
50525	50945	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50526	50729	68	68	68	68	Negligible	Medium - High	Not Significant
50526	50748	70	69	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50526	52232	69	69	69	69	Negligible	Medium - High	Not Significant
50527	50746	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50527	50958	72	72	72	72	Negligible	High	Not Significant - Slight
50527	52599	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50528	50743	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50528	50745	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50528	53360	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50529	50729	70	70	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50529	53160	71	71	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50530	52269	67	67	68	67	Negligible	Medium - High	Not Significant
50530	52804	68	68	70	69	Minor	Medium - High	Slight
50531	50722	69	69	69	69	Negligible	Medium - High	Not Significant
50531	53263	65	64	65	64	Negligible	Medium	Not Significant
50532	50533	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50532	52246	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50533	50532	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50533	50534	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50533	50715	62	61	62	61	Negligible	Medium	Not Significant
50533	52806	69	68	69	68	Negligible	Medium - High	Not Significant
50534	50533	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50534	50717	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50536	50703	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50536	50704	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50536	52292	65	64	65	64	Negligible	Medium	Not Significant
50537	50538	69	69	69	69	Negligible	Medium - High	Not Significant
50537	50540	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50537	50698	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50537	50719	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50538	50537	69	69	69	69	Negligible	Medium - High	Not Significant
50538	50699	69	69	69	69	Negligible	Medium - High	Not Significant
50539	50698	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50539	52285	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50539	53231	62	61	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive
50540	50537	67	66	67	67	Negligible	Medium - High	Not Significant
50540	50695	68	67	68	68	Negligible	Medium - High	Not Significant
50540	52601	Flow too low	#DIV/0!	Flow too low	#DIV/0!	Flow too low	Flow too low	Flow too low
50541	50656	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50541	50689	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50541	52311	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50542	50667	69	68	69	69	Negligible	Medium - High	Not Significant
50542	52243	67	67	68	67	Negligible	Medium - High	Not Significant
50542	52319	68	68	68	68	Negligible	Medium - High	Not Significant
50543	50666	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50543	52579	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50543	53247	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50544	50658	60	59	61	59	Negligible	Low - Medium	Not Significant
50544	50659	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50544	70009	66	66	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50545	50641	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50545	50645	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50545	70006	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50546	50647	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50546	50648	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50546	50702	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50547	50653	67	67	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50547	50927	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50548	50641	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50548	50644	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50549	50550	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50549	52253	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50549	52260	65	65	66	65	Negligible	Medium	Not Significant
50550	50549	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50550	50632	68	68	69	68	Negligible	Medium - High	Not Significant
50550	53220	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50551	50513	67	67	68	67	Negligible	Medium - High	Not Significant
50551	50665	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50551	55003	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50552	50631	72	72	72	73	Negligible	High	Not Significant - Slight
50552	52041	71	71	72	72	Negligible	Medium - High	Not Significant
50553	50625	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50553	50908	71	72	72	72	Negligible	Medium - High	Not Significant
50554	50615	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50554	50618	63	62	63	62	Negligible	Medium	Not Significant
50554	50628	64	62	64	62	No change/Reduction	Medium	Imperceptible/ Positive
50555	50556	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50555	50558	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50555	50912	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50556	50555	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50556	50557	60	59	60	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50556	50627	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50557	50556	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
50557	50976	60	59	60	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50558	50499	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50558	50555	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50558	52598	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50559	50616	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50559	50617	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50559	50618	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50560	50614	65	64	65	64	Negligible	Medium	Not Significant
50560	52041	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50561	50562	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50561	53049	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50561	53375	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50562	50561	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50562	50563	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50563	50562	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50563	50612	66	66	67	66	Negligible	Medium	Not Significant
50563	50614	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50564	50595	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50564	50597	67	67	68	67	Negligible	Medium - High	Not Significant
50565	50620	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50565	50912	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50565	52039	67	67	67	67	Negligible	Medium - High	Not Significant
50566	50584	67	66	67	66	Negligible	Medium	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50566	52242	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50567	50583	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50567	52259	68	68	68	68	Negligible	Medium - High	Not Significant
50568	50569	73	74	72	73	No change/Reduction	High	Imperceptible/ Positive
50568	50582	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
50568	50957	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50569	50568	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50569	50570	73	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50570	50569	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
50570	50753	73	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50570	52675	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50571	50572	73	74	72	73	No change/Reduction	High	Imperceptible/ Positive
50571	52248	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50572	50571	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
50572	50581	68	67	68	67	Negligible	Medium - High	Not Significant
50572	50582	73	74	72	73	No change/Reduction	High	Imperceptible/ Positive
50575	50624	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50575	53050	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50576	50579	71	71	72	72	Negligible	Medium - High	Not Significant
50576	50604	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50576	50605	68	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50576	52248	69	69	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50577	50491	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50577	52561	72	72	72	73	Negligible	High	Not Significant - Slight

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50577	53051	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50578	50491	71	71	72	72	Negligible	Medium - High	Not Significant
50578	50579	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50578	53052	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50579	50576	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50579	50578	71	71	72	72	Minor	High	Slight - Moderate
50579	50580	63	61	64	63	Minor	Medium	Slight
50580	50579	62	61	62	61	Negligible	Medium	Not Significant
50580	50581	63	61	64	63	Minor	Medium	Slight
50581	50572	67	67	68	68	Negligible	Medium - High	Not Significant
50581	50580	62	61	62	61	Negligible	Medium	Not Significant
50581	53298	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50582	50568	73	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50582	50572	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
50583	50567	68	68	68	68	Negligible	Medium - High	Not Significant
50583	51375	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50583	52538	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50584	50566	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50584	50593	67	66	67	66	Negligible	Medium	Not Significant
50585	50587	70	69	70	70	Negligible	Medium - High	Not Significant
50585	50629	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50586	50585	71	71	71	71	Negligible	Medium - High	Not Significant
50587	52808	71	71	71	71	Negligible	Medium - High	Not Significant
50588	50629	70	70	70	70	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50588	52612	68	68	68	68	Negligible	Medium - High	Not Significant
50588	52663	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50588	53301	64	63	64	64	Negligible	Medium	Not Significant
50589	50590	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50589	50613	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50589	52663	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50590	50589	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50590	50591	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50590	52275	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50591	50590	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50591	50592	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50591	50974	64	62	64	62	Negligible	Medium	Not Significant
50592	50591	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50592	52696	72	73	72	72	No change/Reduction	High	Imperceptible/ Positive
50592	53053	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50593	50584	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50593	50594	60	58	60	58	Negligible	Low - Medium	Not Significant
50593	52470	65	64	65	64	Negligible	Medium	Not Significant
50594	50593	61	59	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50594	50596	60	58	60	58	Negligible	Low - Medium	Not Significant
50595	50564	67	67	68	67	Negligible	Medium - High	Not Significant
50595	50596	63	62	63	62	Negligible	Medium	Not Significant
50595	50885	64	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50596	50594	61	59	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50596	50595	61	59	61	59	Negligible	Low - Medium	Not Significant
50596	53306	65	64	65	64	Negligible	Medium	Not Significant
50597	50564	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50597	50598	67	67	68	67	Negligible	Medium - High	Not Significant
50598	50597	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50598	50599	67	67	68	67	Negligible	Medium - High	Not Significant
50599	50598	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50599	52259	67	67	68	67	Negligible	Medium - High	Not Significant
50600	50601	68	68	68	68	Negligible	Medium - High	Not Significant
50600	52259	67	67	67	67	Negligible	Medium - High	Not Significant
50600	53309	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50601	50112	68	68	68	68	Negligible	Medium - High	Not Significant
50601	50600	68	67	68	67	Negligible	Medium - High	Not Significant
50603	50909	70	70	71	71	Minor	Medium - High	Slight
50603	52703	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50604	50576	70	70	71	71	Minor	Medium - High	Slight
50604	50606	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50604	50909	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50605	50576	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50605	52249	68	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50606	50604	65	64	65	64	Negligible	Medium	Not Significant
50606	50607	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50606	50810	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50607	50606	65	64	65	64	Negligible	Medium	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50607	50608	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50607	53303	64	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50608	50607	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50608	53053	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50609	50610	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50609	50810	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50610	50609	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50610	50611	68	68	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50610	52249	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50611	50610	67	66	67	66	Negligible	Medium	Not Significant
50611	50612	68	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50612	50563	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50612	50611	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50612	52275	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50613	50589	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50613	53049	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50614	50560	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50614	50563	64	63	65	64	Negligible	Medium	Not Significant
50615	50554	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50615	50616	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50616	50559	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50616	50615	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50617	50559	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50617	53054	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50618	50554	64	62	64	62	No change/Reduction	Medium	Imperceptible/ Positive
50618	50559	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50618	50619	63	62	63	62	Negligible	Medium	Not Significant
50619	50618	64	62	64	62	No change/Reduction	Medium	Imperceptible/ Positive
50619	50620	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50619	53289	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50620	50565	67	67	67	67	Negligible	Medium - High	Not Significant
50620	50619	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50621	50620	64	63	64	63	Negligible	Medium	Not Significant
50621	50623	Flow too low	#DIV/0!	Flow too low	#DIV/0!	Flow too low	Flow too low	Flow too low
50621	53054	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50622	50623	64	63	64	63	Negligible	Medium	Not Significant
50622	50932	73	73	73	74	Negligible	High	Not Significant - Slight
50622	70007	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50623	50621	64	63	64	63	Negligible	Medium	Not Significant
50623	50622	Flow too low	#DIV/0!	Flow too low	#DIV/0!	Flow too low	Flow too low	Flow too low
50624	50575	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50624	50626	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50624	50976	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
50625	50499	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50625	50553	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50625	53293	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50626	50499	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50626	50624	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50627	50556	61	59	60	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50627	53055	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
50628	50554	63	62	63	62	Negligible	Medium	Not Significant
50628	53055	61	59	60	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50628	53290	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50629	50587	67	66	67	66	Negligible	Medium - High	Not Significant
50629	50588	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50630	50586	69	69	70	70	Negligible	Medium - High	Not Significant
50630	50631	72	72	72	73	Negligible	High	Not Significant - Slight
50631	50552	71	71	72	72	Negligible	Medium - High	Not Significant
50631	50630	73	73	73	73	Negligible	High	Not Significant - Slight
50631	52598	62	61	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive
50632	50550	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50632	50634	71	71	71	71	Negligible	Medium - High	Not Significant
50632	50643	71	71	71	71	Negligible	Medium - High	Not Significant
50632	50664	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50633	50639	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50633	50660	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50634	50632	71	71	71	71	Negligible	Medium - High	Not Significant
50634	50822	71	71	71	71	Negligible	Medium - High	Not Significant
50635	50901	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50635	52549	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50635	53218	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50636	50514	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50636	52628	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50636	55001	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50637	50668	68	67	68	67	Negligible	Medium - High	Not Significant
50637	50903	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50638	50675	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50639	50633	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50639	52253	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50640	50641	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50640	52548	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50640	53209	63	61	63	61	No change/Reduction	Medium	Imperceptible/ Positive
50641	50545	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50641	50548	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50641	50640	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50642	50654	71	71	70	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50642	52260	66	65	66	65	Negligible	Medium	Not Significant
50642	53057	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50643	50632	70	70	70	71	Negligible	Medium - High	Not Significant
50643	50679	68	68	68	68	Negligible	Medium - High	Not Significant
50644	50548	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50644	50657	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50644	50660	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50645	50821	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50645	50931	61	59	61	59	Negligible	Low - Medium	Not Significant
50645	52829	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50646	50926	67	67	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50646	52311	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50646	52604	66	65	66	65	Negligible	Medium	Not Significant
50647	50546	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50647	53063	68	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50647	53224	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50648	50546	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50648	53059	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50650	52812	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50650	53059	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50651	50653	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50651	52814	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50652	50651	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50653	50547	65	64	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50653	52814	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50654	50642	71	71	71	71	Negligible	Medium - High	Not Significant
50654	52548	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50654	70006	71	71	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50655	50820	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50655	52847	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50656	50541	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50656	50689	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50656	52312	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50657	50492	63	61	63	61	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50657	50644	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50657	52320	64	63	64	63	Negligible	Medium	Not Significant
50658	50544	62	61	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50658	50662	60	59	61	59	Negligible	Low - Medium	Not Significant
50659	50544	67	66	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
50659	50661	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50659	52320	63	62	63	62	Negligible	Medium	Not Significant
50660	50633	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50660	50644	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50660	70009	66	65	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50661	50659	67	67	67	67	Negligible	Medium - High	Not Significant
50661	50690	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50661	53208	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50662	50658	62	61	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50662	50663	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50662	53205	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50663	50662	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50663	52253	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50664	50632	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50664	50697	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50664	53201	62	61	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50665	50551	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50665	52243	67	67	68	68	Minor	Medium - High	Slight
50665	53060	62	61	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50665	55004	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50666	50543	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50666	50667	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50666	52006	65	64	65	65	Negligible	Medium	Not Significant
50667	50542	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50667	50666	68	67	68	67	Negligible	Medium - High	Not Significant
50667	50907	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50668	50637	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50668	50905	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50668	53202	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50669	50670	72	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50669	50905	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50669	53200	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50669	59010	73	74	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50670	50669	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50670	50678	72	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50671	50680	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50671	50904	72	72	72	72	No change/Reduction	High	Imperceptible/ Positive
50671	70001	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50672	50678	71	71	71	71	Negligible	Medium - High	Not Significant
50672	52815	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
50673	50672	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50674	50673	68	68	68	68	Negligible	Medium - High	Not Significant
50674	50680	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50675	50674	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50676	50638	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50676	50675	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50677	52773	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50677	53061	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50678	50670	72	73	72	73	Negligible	High	Not Significant - Slight
50678	52815	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50679	50676	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50680	50671	72	73	72	72	No change/Reduction	High	Imperceptible/ Positive
50680	50673	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50681	50683	71	71	74	74	Minor	High	Slight - Moderate
50681	50741	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50681	52325	68	67	72	72	Moderate	Medium - High	Moderate - Significant
50682	50683	72	72	74	74	Minor	High	Slight - Moderate
50682	52252	70	70	73	74	Moderate	High	Significant
50682	52669	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50683	50681	72	72	74	75	Minor	High	Slight - Moderate
50683	50682	70	70	73	74	Moderate	High	Significant
50683	50985	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50684	50772	68	67	69	68	Minor	Medium - High	Slight
50684	50937	70	69	72	72	Minor	Medium - High	Slight
50684	50938	70	70	70	70	Negligible	Medium - High	Not Significant
50685	50687	66	65	66	65	Negligible	Medium	Not Significant
50685	50688	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50685	52844	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50686	50685	67	66	67	66	Negligible	Medium	Not Significant
50687	50701	68	68	68	68	Negligible	Medium - High	Not Significant
50687	52844	65	64	65	65	Negligible	Medium	Not Significant
50688	50685	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50689	50541	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50689	50656	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50689	53208	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50690	50661	67	67	67	67	Negligible	Medium - High	Not Significant
50690	50691	Flow too low	Flow too low	59	58	Flow too low	Low - Medium	Flow too low
50690	50692	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50691	50490	Flow too low	Flow too low	59	58	Flow too low	Low - Medium	Flow too low
50691	50690	Flow too low	Flow too low	60	58	Flow too low	Low - Medium	Flow too low
50691	50692	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50692	50690	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50692	50691	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50692	50693	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50693	50692	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50693	50694	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50694	50693	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50694	50696	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50694	50701	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50695	50540	68	67	68	68	Negligible	Medium - High	Not Significant
50695	52315	68	68	68	68	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50695	53225	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50696	50490	Flow too low	Flow too low	60	58	Flow too low	Low - Medium	Flow too low
50696	50694	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50696	52550	Flow too low	Flow too low	59	58	Flow too low	Low - Medium	Flow too low
50697	50664	69	69	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50697	52313	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50698	50537	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50698	50539	70	69	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50698	52290	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50699	50538	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50699	50700	69	69	69	69	Negligible	Medium - High	Not Significant
50700	50699	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50700	52292	64	63	64	63	Negligible	Medium	Not Significant
50700	52601	70	70	70	70	Negligible	Medium - High	Not Significant
50700	53396	65	65	66	65	Negligible	Medium	Not Significant
50701	50687	68	68	68	68	Negligible	Medium - High	Not Significant
50701	50694	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50701	52600	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50702	50546	61	59	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
50702	52816	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50703	50536	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50703	50928	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50704	50536	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50704	50710	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50704	53224	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50706	50708	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50707	50711	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50707	52308	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50707	53048	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50708	50706	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50708	53048	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50708	53063	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50709	50717	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50709	50929	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50709	52288	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50710	50704	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50710	53063	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50711	50707	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50711	50712	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50711	50713	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50712	50711	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50712	52246	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50713	50711	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50713	50715	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50713	53227	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50714	50715	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50714	52307	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50714	52308	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50715	50533	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50715	50713	62	61	62	61	Negligible	Medium	Not Significant
50715	50714	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50716	50717	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50716	52307	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50716	53226	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50717	50534	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50717	50709	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50717	50716	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50718	50933	63	62	63	61	No change/Reduction	Medium	Imperceptible/ Positive
50718	52257	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50718	52289	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50719	50537	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50719	50538	61	59	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50719	50935	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50720	52301	63	62	66	65	Minor	Medium	Slight
50721	52556	65	64	67	66	Minor	Medium - High	Slight
50721	52805	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50722	50721	70	70	71	71	Negligible	Medium - High	Not Significant
50723	50722	65	64	66	66	Minor	Medium	Slight
50723	50726	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50724	50809	70	71	71	71	Negligible	Medium - High	Not Significant
50724	53064	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50725	53386	69	68	70	70	Minor	Medium - High	Slight

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50726	50531	58	56	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50726	50925	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50727	50933	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50728	52329	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
50729	50526	65	64	68	68	Moderate	Medium - High	Moderate - Significant
50729	50529	71	71	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50729	50748	68	68	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50730	52329	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50731	50734	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50731	52233	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50731	52270	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50732	50733	Flow too low	Flow too low	67	66	Flow too low	Medium	Flow too low
50732	50918	71	72	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50732	50920	72	73	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50732	50920	68	68	71	71	Moderate	Medium - High	Moderate - Significant
50733	50732	Flow too low	Flow too low	66	66	Flow too low	Medium	Flow too low
50733	59006	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50734	50529	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50735	50737	Flow too low	Flow too low	69	69	Flow too low	Medium - High	Flow too low
50735	52232	71	72	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50735	52233	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50736	50737	67	67	72	72	Major	Medium - High	Significant
50736	52326	68	67	72	72	Moderate	Medium - High	Moderate - Significant
50736	53273	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50737	50735	Flow too low	Flow too low	69	69	Flow too low	Medium - High	Flow too low
50737	50736	68	68	72	72	Moderate	Medium - High	Moderate - Significant
50737	50740	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50737	52941	72	72	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50737	52942	70	70	72	73	Minor	High	Slight - Moderate
50738	50498	70	70	72	72	Minor	Medium - High	Slight
50738	50739	71	71	72	72	Negligible	Medium - High	Not Significant
50739	50738	70	70	72	72	Minor	Medium - High	Slight
50739	50740	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50739	53283	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50740	50737	71	71	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50740	50739	70	70	71	71	Negligible	Medium - High	Not Significant
50740	50797	Flow too low	Flow too low	68	67	Flow too low	Medium - High	Flow too low
50740	53278	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50741	50495	69	69	72	72	Moderate	High	Significant
50741	50497	68	68	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50741	50498	Flow too low	Flow too low	72	72	Flow too low	Medium - High	Flow too low
50741	50681	72	72	72	72	Negligible	High	Not Significant - Slight
50742	50743	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50742	50744	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50743	50528	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50743	50742	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50744	50742	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50744	50745	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50744	52603	72	73	73	73	Negligible	High	Not Significant - Slight
50745	50528	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50745	50744	72	72	72	73	Negligible	High	Not Significant - Slight
50745	50959	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50746	50527	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50746	50749	71	71	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50746	52943	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50747	50512	70	70	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50747	52284	70	70	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50747	52304	68	68	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50747	52599	68	68	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50748	50749	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50749	50746	72	72	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50749	52305	67	66	69	69	Minor	Medium - High	Slight
50750	50755	69	68	69	69	Negligible	Medium - High	Not Significant
50750	50966	69	69	70	69	Negligible	Medium - High	Not Significant
50750	53287	61	59	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50751	50114	72	73	73	73	Negligible	High	Not Significant - Slight
50752	52332	72	72	72	73	Negligible	High	Not Significant - Slight
50752	52772	72	72	72	73	Negligible	High	Not Significant - Slight
50753	50570	73	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50753	52771	72	73	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50753	53382	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50754	48006	70	70	70	70	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50754	52672	70	69	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50754	52674	67	66	68	68	Minor	Medium - High	Slight
50755	50750	68	68	69	68	Negligible	Medium - High	Not Significant
50755	52674	67	66	68	68	Minor	Medium - High	Slight
50755	53284	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50760	50486	76	77	77	78	Negligible	High	Not Significant - Slight
50760	50761	75	76	76	77	Negligible	High	Not Significant - Slight
50761	50487	74	75	74	75	Negligible	High	Not Significant - Slight
50761	50760	76	77	77	78	Negligible	High	Not Significant - Slight
50761	50961	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50761	52820	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50762	50763	67	66	67	66	Negligible	Medium	Not Significant
50762	50767	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50762	53285	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50763	50762	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50763	50945	65	65	66	65	Negligible	Medium	Not Significant
50763	50954	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50766	48006	73	73	73	73	Negligible	High	Not Significant - Slight
50766	50767	66	65	67	67	Minor	Medium - High	Slight
50766	70008	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50767	50762	68	68	69	69	Negligible	Medium - High	Not Significant
50767	50766	68	68	68	68	Negligible	Medium - High	Not Significant
50768	50525	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50768	50947	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50769	52367	65	65	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50769	52584	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50770	50525	65	64	64	64	No change/Reduction	Medium	Imperceptible/ Positive
50770	51400	64	63	64	63	Negligible	Medium	Not Significant
50770	53313	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50771	50524	70	70	70	70	Negligible	Medium - High	Not Significant
50771	50775	69	69	70	69	Negligible	Medium - High	Not Significant
50771	52553	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50772	50684	66	65	68	68	Moderate	Medium - High	Moderate - Significant
50772	50773	68	67	69	68	Minor	Medium - High	Slight
50773	50772	66	65	68	68	Moderate	Medium - High	Moderate - Significant
50773	52827	68	67	69	69	Minor	Medium - High	Slight
50773	53251	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50774	50916	63	62	64	63	Negligible	Medium	Not Significant
50774	50941	70	70	70	70	Negligible	Medium - High	Not Significant
50774	50942	70	70	70	70	Negligible	Medium - High	Not Significant
50775	50522	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50775	50771	70	70	70	70	Negligible	Medium - High	Not Significant
50775	52245	72	72	72	72	No change/Reduction	High	Imperceptible/ Positive
50776	50521	70	69	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50776	50522	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50777	50779	69	69	69	69	Negligible	Medium - High	Not Significant
50777	50915	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50778	50779	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50778	52319	69	69	69	69	Negligible	Medium - High	Not Significant
50778	52628	65	65	66	65	Negligible	Medium	Not Significant
50779	50777	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50779	50778	69	69	69	69	Negligible	Medium - High	Not Significant
50779	53250	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50780	50940	63	61	63	62	Negligible	Medium	Not Significant
50780	52568	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50780	53364	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50781	52770	73	73	73	74	Negligible	High	Not Significant - Slight
50782	50781	72	72	72	73	Negligible	High	Not Significant - Slight
50782	50914	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50783	50782	73	73	73	74	Negligible	High	Not Significant - Slight
50784	52781	73	73	73	73	Negligible	High	Not Significant - Slight
50785	50516	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50785	50517	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50785	52272	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50786	50789	64	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50786	50790	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50786	50793	65	64	65	64	Negligible	Medium	Not Significant
50787	50790	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50787	50936	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50787	58002	66	65	66	66	Negligible	Medium	Not Significant
50788	50519	Flow too low	Flow too low	61	60	Flow too low	Low - Medium	Flow too low
50788	52318	Flow too low	Flow too low	59	57	Flow too low	Low - Medium	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50789	50517	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50789	50786	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
50789	53235	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50790	50786	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50790	50787	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50790	50791	65	64	64	64	No change/Reduction	Medium	Imperceptible/ Positive
50791	50790	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50791	52250	71	71	72	72	Minor	Medium - High	Slight
50791	52251	70	70	72	72	Minor	Medium - High	Slight
50792	52285	68	67	69	68	Negligible	Medium - High	Not Significant
50792	52309	60	58	60	58	Negligible	Low - Medium	Not Significant
50792	52611	67	66	69	68	Minor	Medium - High	Slight
50793	50786	67	66	67	66	Negligible	Medium	Not Significant
50793	52285	67	67	67	67	Negligible	Medium - High	Not Significant
50793	53046	69	68	69	69	Negligible	Medium - High	Not Significant
50794	52305	67	66	70	70	Moderate	Medium - High	Moderate - Significant
50794	53270	67	66	68	68	Minor	Medium - High	Slight
50795	50796	71	71	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50795	50800	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50795	52284	70	70	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50796	50508	62	61	63	62	Minor	Medium	Slight
50796	50510	Flow too low	Flow too low	72	72	Flow too low	High	Flow too low
50796	50795	70	70	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50796	50797	70	70	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50796	50800	Flow too low	Flow too low	65	65	Flow too low	Medium	Flow too low
50797	50509	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50797	50796	70	70	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50797	50802	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50797	50967	Flow too low	#DIV/0!	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50798	50510	72	73	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50798	50799	61	59	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50798	50918	73	73	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50798	52297	64	63	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50799	50798	63	62	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50799	50802	61	59	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50800	52052	Flow too low	Flow too low	65	65	Flow too low	Medium	Flow too low
50801	52294	Flow too low	Flow too low	65	65	Flow too low	Medium	Flow too low
50802	50508	60	58	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50802	50797	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50802	50799	63	62	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50803	50804	64	63	67	66	Moderate	Medium	Moderate
50803	50919	64	63	71	71	Major	Medium - High	Significant
50803	52309	61	59	62	60	Negligible	Low - Medium	Not Significant
50804	50803	64	62	68	68	Major	Medium - High	Significant
50804	53233	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50804	53402	64	63	66	65	Minor	Medium	Slight
50805	52256	67	67	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50805	52310	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50805	52949	66	65	68	67	Minor	Medium - High	Slight
50806	50807	74	74	74	75	Negligible	High	Not Significant - Slight
50806	51362	70	70	71	71	Negligible	Medium - High	Not Significant
50806	51363	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50807	50806	72	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50807	51371	74	74	74	75	Negligible	High	Not Significant - Slight
50808	50809	62	61	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50808	53064	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50808	53265	63	62	63	61	No change/Reduction	Medium	Imperceptible/ Positive
50809	50723	71	71	71	71	Negligible	Medium - High	Not Significant
50809	50808	63	62	63	61	No change/Reduction	Medium	Imperceptible/ Positive
50810	50606	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50810	50609	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50811	50814	65	64	65	65	Negligible	Medium	Not Significant
50811	50815	64	63	65	64	Negligible	Medium	Not Significant
50811	53211	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50812	50813	64	63	65	64	Negligible	Medium	Not Significant
50812	50815	64	63	65	64	Negligible	Medium	Not Significant
50813	50812	64	63	65	64	Negligible	Medium	Not Significant
50813	50823	71	71	71	71	Negligible	Medium - High	Not Significant
50813	50824	70	70	70	70	Negligible	Medium - High	Not Significant
50814	50811	65	64	65	64	Negligible	Medium	Not Significant
50814	53067	65	64	65	65	Negligible	Medium	Not Significant
50815	50811	64	63	65	64	Negligible	Medium	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50815	50812	64	63	65	64	Negligible	Medium	Not Significant
50816	52708	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50816	53057	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50817	50819	69	69	69	69	Negligible	Medium - High	Not Significant
50817	53067	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50818	50819	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50818	50841	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50818	52255	69	69	69	69	Negligible	Medium - High	Not Significant
50819	50817	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50819	50818	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50819	53242	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50820	50652	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50820	52846	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50821	50655	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50821	52830	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50822	50634	71	71	71	71	Negligible	Medium - High	Not Significant
50822	50823	70	70	70	70	Negligible	Medium - High	Not Significant
50822	53203	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50823	50813	70	70	70	70	Negligible	Medium - High	Not Significant
50823	50822	71	71	71	71	Negligible	Medium - High	Not Significant
50824	50813	71	71	71	71	Negligible	Medium - High	Not Significant
50824	50825	67	67	67	67	Negligible	Medium - High	Not Significant
50824	52255	69	69	69	69	Negligible	Medium - High	Not Significant
50825	50824	68	67	68	67	Negligible	Medium - High	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50825	50877	67	67	67	67	Negligible	Medium - High	Not Significant
50829	50876	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50835	50507	64	63	66	66	Minor	Medium	Slight
50835	51331	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50835	51332	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50836	50501	73	74	73	74	Negligible	High	Not Significant - Slight
50836	50507	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50836	53362	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50841	50818	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50851	50506	70	70	70	70	Negligible	Medium - High	Not Significant
50851	52677	63	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50851	52702	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50857	50860	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50857	52695	72	73	72	73	Negligible	High	Not Significant - Slight
50858	50859	72	72	72	72	Negligible	High	Not Significant - Slight
50858	51376	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50859	50858	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50859	50860	72	72	72	72	Negligible	Medium - High	Not Significant
50860	40004	73	74	73	74	Negligible	High	Not Significant - Slight
50860	50857	73	74	73	74	Negligible	High	Not Significant - Slight
50860	50859	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50862	50866	68	68	68	68	Negligible	Medium - High	Not Significant
50863	50864	70	70	70	70	Negligible	Medium - High	Not Significant
50864	50863	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50864	50865	70	70	70	70	Negligible	Medium - High	Not Significant
50865	50862	67	66	67	66	Negligible	Medium	Not Significant
50865	50864	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50866	50867	67	66	67	66	Negligible	Medium	Not Significant
50866	50868	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50867	52839	68	68	68	68	Negligible	Medium - High	Not Significant
50868	50867	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50868	50872	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50869	52529	65	64	65	64	Negligible	Medium	Not Significant
50869	52569	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50870	50871	72	72	72	72	Negligible	High	Not Significant - Slight
50870	51378	74	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50870	53348	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50871	40018	72	73	73	73	Negligible	High	Not Significant - Slight
50871	50870	74	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50871	52452	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50872	50868	67	66	67	66	Negligible	Medium	Not Significant
50872	52529	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50873	50862	64	63	64	63	Negligible	Medium	Not Significant
50873	50865	66	65	66	65	Negligible	Medium	Not Significant
50874	50873	68	67	68	68	Negligible	Medium - High	Not Significant
50875	52518	65	64	65	64	Negligible	Medium	Not Significant
50875	52520	64	63	65	64	Negligible	Medium	Not Significant
50876	50829	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50876	50877	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50877	50825	68	67	68	67	Negligible	Medium - High	Not Significant
50877	50876	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50877	52518	62	60	62	61	Negligible	Medium	Not Significant
50885	50595	66	65	66	66	Negligible	Medium	Not Significant
50885	52467	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50885	52469	64	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50886	50892	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50887	50886	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50887	52528	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50888	50889	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50888	52842	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50889	50888	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50889	50890	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50890	50889	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50890	50898	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50891	52843	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50892	50891	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50892	50893	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50893	50891	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50893	51325	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
50894	51374	67	67	67	67	Negligible	Medium - High	Not Significant
50894	52534	68	67	68	67	Negligible	Medium - High	Not Significant
50894	53390	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50895	40009	68	68	68	68	Negligible	Medium - High	Not Significant
50895	52474	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50895	52533	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50896	50117	72	73	72	73	Negligible	High	Not Significant - Slight
50896	51364	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50896	52613	70	70	70	70	Negligible	Medium - High	Not Significant
50897	50117	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50897	52348	64	63	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50898	50899	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50898	50900	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50899	50902	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50899	52549	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50900	50898	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50900	52545	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50901	50635	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50901	50900	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50902	50904	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50902	52523	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50903	50637	68	68	68	68	Negligible	Medium - High	Not Significant
50903	51329	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50904	50671	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50904	50902	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50905	50668	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50905	50669	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50906	55004	73	74	73	74	Negligible	High	Not Significant - Slight
50906	59010	73	74	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50907	50667	64	63	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50907	52609	60	58	63	61	Moderate	Medium	Moderate
50907	53249	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50908	50586	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50908	50630	70	70	70	70	Negligible	Medium - High	Not Significant
50909	50603	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50909	50604	70	70	71	71	Minor	Medium - High	Slight
50910	40020	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50910	50911	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50910	51403	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50911	50910	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50911	51402	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50912	50555	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50912	50565	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50912	53292	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50914	50523	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50914	50781	67	67	67	67	Negligible	Medium - High	Not Significant
50915	50493	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50915	50777	69	69	69	69	Negligible	Medium - High	Not Significant
50915	53398	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50916	50493	63	62	64	63	Negligible	Medium	Not Significant
50916	50774	58	56	61	60	Moderate	Low - Medium	Slight - Moderate

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50917	50493	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50917	50494	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50917	53357	57	55	57	55	No change/Reduction	Low - Medium	Imperceptible/ Positive
50918	50732	72	72	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50918	50798	73	73	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50918	59008	68	68	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50919	50803	64	63	71	71	Major	Medium - High	Significant
50919	52251	64	63	71	71	Major	Medium - High	Significant
50920	50732	72	72	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50920	50944	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50921	50513	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50921	52273	67	67	67	67	Negligible	Medium - High	Not Significant
50922	50923	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50922	55000	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50923	50783	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50923	50922	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50924	52299	65	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50925	50531	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50925	52246	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50926	50646	65	64	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50926	52845	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50927	50926	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50928	50703	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50928	50929	69	69	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50928	53396	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50929	50709	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50929	50928	69	69	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50929	52254	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50930	52583	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50930	53383	73	73	73	73	Negligible	High	Not Significant - Slight
50931	50492	61	59	61	59	Negligible	Low - Medium	Not Significant
50931	50645	62	61	63	61	Negligible	Medium	Not Significant
50932	50622	72	73	73	73	Negligible	High	Not Significant - Slight
50932	52039	70	70	70	70	Negligible	Medium - High	Not Significant
50932	52041	72	73	73	73	Negligible	High	Not Significant - Slight
50933	50718	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50933	50934	63	62	63	61	No change/Reduction	Medium	Imperceptible/ Positive
50934	50933	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50934	50935	63	62	63	61	No change/Reduction	Medium	Imperceptible/ Positive
50935	50719	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50935	50934	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50935	52254	64	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50936	50518	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50936	50787	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50937	50684	71	71	72	72	Negligible	Medium - High	Not Significant
50937	52234	70	69	72	72	Minor	Medium - High	Slight
50938	50684	69	69	70	70	Minor	Medium - High	Slight
50938	50939	70	70	70	70	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50938	59011	67	67	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50939	50938	69	69	70	70	Minor	Medium - High	Slight
50939	52235	70	70	70	70	Negligible	Medium - High	Not Significant
50940	50780	64	63	65	64	Negligible	Medium	Not Significant
50940	53259	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50940	59011	63	62	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50941	50520	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50941	50774	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50941	52568	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50942	50486	76	77	77	78	Negligible	High	Not Significant - Slight
50942	50774	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50942	52235	69	69	70	70	Minor	Medium - High	Slight
50942	52770	75	76	75	76	Negligible	High	Not Significant - Slight
50943	50784	Flow too low	Flow too low	66	65	Flow too low	Medium	Flow too low
50943	52032	68	67	68	68	Negligible	Medium - High	Not Significant
50944	50920	72	72	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50944	52230	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50944	58001	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50945	50525	66	65	66	65	Negligible	Medium	Not Significant
50945	50763	65	65	65	65	Negligible	Medium	Not Significant
50945	52585	65	65	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50946	50948	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50946	50949	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50946	52011	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50947	50768	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50947	52011	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50948	50946	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50948	52009	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50949	50946	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50949	50950	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50950	50949	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50950	50953	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50951	50953	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50951	50955	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50952	50955	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50952	52360	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50953	50950	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50953	50951	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50954	50763	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50954	52011	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50954	53070	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50955	50951	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50955	50952	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50955	53070	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50956	52120	72	73	72	72	No change/Reduction	High	Imperceptible/ Positive
50956	52564	72	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50957	50568	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50958	50527	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50958	50959	72	72	72	72	Negligible	High	Not Significant - Slight
50959	50745	71	71	72	72	Negligible	Medium - High	Not Significant
50959	50958	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50960	50961	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50960	50962	71	71	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50960	52665	69	68	69	69	Negligible	Medium - High	Not Significant
50961	50761	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50961	50960	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50962	50511	71	71	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50962	50960	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50963	52688	74	75	74	75	Negligible	High	Not Significant - Slight
50963	53004	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
50964	50751	71	71	71	71	Negligible	Medium - High	Not Significant
50964	52686	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50965	50964	73	73	73	74	Negligible	High	Not Significant - Slight
50965	52603	73	73	72	72	No change/Reduction	High	Imperceptible/ Positive
50966	50114	69	69	70	69	Negligible	Medium - High	Not Significant
50966	50750	69	69	69	69	Negligible	Medium - High	Not Significant
50967	50797	63	62	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50967	50800	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50968	51327	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
50968	52546	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50968	53219	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
50969	51332	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
50969	51397	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50974	50591	64	63	64	63	Negligible	Medium	Not Significant
50976	50557	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
50976	50624	60	59	60	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50984	53325	65	65	65	65	Negligible	Medium	Not Significant
50984	53394	73	74	74	74	Negligible	High	Not Significant - Slight
50984	53400	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50985	50683	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
51325	50893	58	56	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
51325	52544	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
51325	52546	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51326	52570	65	64	65	65	Negligible	Medium	Not Significant
51326	52602	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
51327	50968	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
51327	51328	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
51328	51327	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
51328	51415	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
51328	52007	67	66	67	66	Negligible	Medium	Not Significant
51329	50903	68	68	68	68	Negligible	Medium - High	Not Significant
51329	52007	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
51329	52549	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
51330	51402	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
51330	52245	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
51330	53334	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
51331	50835	58	56	58	56	Negligible	Low - Medium	Not Significant
51331	52605	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
51332	50835	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51332	50969	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51333	50503	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
51333	53311	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
51334	51335	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
51334	52539	68	68	68	68	Negligible	Medium - High	Not Significant
51335	50502	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
51335	51334	68	68	68	68	Negligible	Medium - High	Not Significant
51335	53366	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
51336	52471	67	67	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
51336	52472	67	66	67	66	Negligible	Medium	Not Significant
51337	51368	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
51337	51369	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
51344	52515	71	71	71	71	Negligible	Medium - High	Not Significant
51347	50155	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
51349	50158	74	75	74	75	Negligible	High	Not Significant - Slight
51349	51351	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
51349	53096	73	73	73	73	Negligible	High	Not Significant - Slight
51350	51351	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
51350	51360	66	65	66	65	Negligible	Medium	Not Significant
51351	51349	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
51351	51350	66	65	66	65	Negligible	Medium	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
51351	51358	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
51352	51361	73	73	73	73	Negligible	High	Not Significant - Slight
51352	53096	73	73	73	73	Negligible	High	Not Significant - Slight
51357	40018	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
51357	50420	72	73	72	73	Negligible	High	Not Significant - Slight
51358	40002	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51358	51351	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
51358	51359	67	67	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
51358	53324	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
51359	51358	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
51359	52451	67	67	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
51360	51350	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
51360	53020	66	65	66	65	Negligible	Medium	Not Significant
51361	51352	74	75	74	75	Negligible	High	Not Significant - Slight
51361	53097	73	73	73	73	Negligible	High	Not Significant - Slight
51362	50806	69	69	69	69	Negligible	Medium - High	Not Significant
51362	52613	70	70	71	71	Negligible	Medium - High	Not Significant
51363	40009	70	69	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
51363	50806	69	68	69	69	Negligible	Medium - High	Not Significant
51363	52348	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
51363	52614	72	73	72	73	Negligible	High	Not Significant - Slight
51364	50896	63	61	63	62	Negligible	Medium	Not Significant
51364	51370	61	60	62	60	Negligible	Low - Medium	Not Significant
51364	53098	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
51367	51368	73	74	73	74	Negligible	High	Not Significant - Slight
51367	52038	74	75	75	75	Negligible	High	Not Significant - Slight
51368	50500	67	66	67	66	Negligible	Medium	Not Significant
51368	51337	75	76	75	76	Negligible	High	Not Significant - Slight
51368	51367	74	75	75	75	Negligible	High	Not Significant - Slight
51369	51337	75	76	75	76	Negligible	High	Not Significant - Slight
51369	51371	74	74	74	74	Negligible	High	Not Significant - Slight
51370	51364	61	60	62	61	Minor	Medium	Slight
51370	53099	61	60	62	60	Negligible	Low - Medium	Not Significant
51371	50807	75	76	75	76	Negligible	High	Not Significant - Slight
51371	51369	71	71	72	72	Negligible	Medium - High	Not Significant
51371	53099	61	60	62	61	Minor	Medium	Slight
51372	50108	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
51374	50149	67	67	67	67	Negligible	Medium - High	Not Significant
51374	50894	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
51374	51375	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51375	50583	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51375	51374	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51376	50858	72	72	72	72	Negligible	High	Not Significant - Slight
51376	51377	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
51376	53319	61	59	61	59	Negligible	Low - Medium	Not Significant
51377	50147	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
51377	51376	72	72	72	72	Negligible	Medium - High	Not Significant
51378	40004	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
51378	50870	74	74	74	74	Negligible	High	Not Significant - Slight
51378	51379	67	66	67	67	Negligible	Medium - High	Not Significant
51379	50138	67	66	67	67	Negligible	Medium - High	Not Significant
51379	51378	67	67	67	67	Negligible	Medium - High	Not Significant
51379	53323	58	56	58	56	Negligible	Low - Medium	Not Significant
51389	51391	72	73	72	73	Negligible	High	Not Significant - Slight
51391	51389	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
51391	52123	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
51391	52636	68	67	68	67	Negligible	Medium - High	Not Significant
51392	51394	68	68	68	68	Negligible	Medium - High	Not Significant
51394	51392	68	68	69	69	Negligible	Medium - High	Not Significant
51394	52123	68	68	68	68	Negligible	Medium - High	Not Significant
51394	53322	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
51397	50969	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51400	50770	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
51400	53145	64	63	64	63	Negligible	Medium	Not Significant
51401	51414	65	64	65	65	Negligible	Medium	Not Significant
51401	52006	64	63	64	63	Negligible	Medium	Not Significant
51402	50911	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
51402	51330	71	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
51402	52324	60	59	60	59	Negligible	Low - Medium	Not Significant
51403	50910	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
51410	51413	66	65	66	66	Negligible	Medium	Not Significant
51411	40020	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
51411	51413	60	58	60	58	Negligible	Low - Medium	Not Significant
51411	52323	58	56	58	56	Negligible	Low - Medium	Not Significant
51412	51413	65	64	65	65	Negligible	Medium	Not Significant
51412	51414	64	63	64	63	Negligible	Medium	Not Significant
51413	51410	67	66	67	67	Negligible	Medium - High	Not Significant
51413	51411	59	57	59	57	Negligible	Low - Medium	Not Significant
51413	51412	64	63	64	63	Negligible	Medium	Not Significant
51413	51415	64	63	65	64	Negligible	Medium	Not Significant
51414	51401	64	63	64	63	Negligible	Medium	Not Significant
51414	51412	65	64	65	65	Negligible	Medium	Not Significant
51415	51328	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
51415	51413	64	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
51415	51416	65	64	65	64	Negligible	Medium	Not Significant
51415	52602	65	64	65	65	Negligible	Medium	Not Significant
51416	51415	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52006	50666	64	63	64	63	Negligible	Medium	Not Significant
52006	51401	65	64	65	65	Negligible	Medium	Not Significant
52007	51328	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52007	51329	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52007	52008	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52008	52007	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52008	52579	62	61	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive
52008	53149	63	61	63	61	No change/Reduction	Medium	Imperceptible/ Positive
52009	50948	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52009	52010	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
52009	53296	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52010	52009	64	63	64	63	Negligible	Medium	Not Significant
52010	52564	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
52011	50946	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52011	50947	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52011	50954	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52012	52537	68	67	68	68	Negligible	Medium - High	Not Significant
52012	52541	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52012	53150	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52031	52032	68	67	68	68	Negligible	Medium - High	Not Significant
52031	52037	65	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52031	52234	68	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52032	50943	68	67	68	68	Negligible	Medium - High	Not Significant
52032	52031	68	67	68	68	Negligible	Medium - High	Not Significant
52034	52230	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52037	52031	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52038	51367	75	76	75	76	Negligible	High	Not Significant - Slight
52038	52807	70	70	70	70	Negligible	Medium - High	Not Significant
52039	50565	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52039	50932	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52039	53291	67	67	67	67	Negligible	Medium - High	Not Significant
52041	50552	73	73	73	73	Negligible	High	Not Significant - Slight
52041	50560	65	64	65	64	Negligible	Medium	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52041	50932	72	73	73	73	Negligible	High	Not Significant - Slight
52052	50967	63	62	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52052	52306	62	60	65	65	Moderate	Medium	Moderate
52081	50035	72	72	72	72	Negligible	Medium - High	Not Significant
52118	52119	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52118	52363	72	72	72	72	Negligible	Medium - High	Not Significant
52119	50137	75	76	75	75	No change/Reduction	High	Imperceptible/ Positive
52119	52118	72	72	72	72	Negligible	Medium - High	Not Significant
52119	53367	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52120	50956	72	73	72	73	No change/Reduction	High	Imperceptible/ Positive
52120	52565	72	73	72	72	No change/Reduction	High	Imperceptible/ Positive
52123	50501	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
52123	51391	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
52123	51394	69	69	70	70	Negligible	Medium - High	Not Significant
52230	50944	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52230	52034	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52230	52234	72	72	72	73	Negligible	High	Not Significant - Slight
52230	52250	71	71	72	72	Minor	Medium - High	Slight
52231	52278	69	69	70	69	Negligible	Medium - High	Not Significant
52231	52306	63	61	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52231	53160	70	70	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52232	50526	71	72	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52232	50735	69	69	70	69	Negligible	Medium - High	Not Significant
52233	50731	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52233	50735	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52233	53271	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52234	50937	71	71	72	72	Negligible	Medium - High	Not Significant
52234	52031	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52234	52230	71	72	73	73	Minor	High	Slight - Moderate
52235	50939	69	69	70	70	Minor	Medium - High	Slight
52235	50942	70	70	70	70	Negligible	Medium - High	Not Significant
52241	52242	67	66	67	66	Negligible	Medium	Not Significant
52241	52663	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52242	50566	67	66	67	66	Negligible	Medium	Not Significant
52242	52241	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52243	50542	67	67	68	68	Minor	Medium - High	Slight
52243	50665	67	67	68	67	Negligible	Medium - High	Not Significant
52244	52245	60	58	63	61	Moderate	Medium	Moderate
52244	52609	59	57	61	60	Minor	Low - Medium	Slight
52245	50775	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52245	51330	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52245	52244	59	57	61	60	Minor	Low - Medium	Slight
52246	50532	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52246	50712	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52246	50925	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52248	50571	73	74	72	73	No change/Reduction	High	Imperceptible/ Positive
52248	50576	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52248	52707	74	75	74	74	No change/Reduction	High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52249	50605	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52249	50610	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52250	50791	71	71	72	72	Minor	Medium - High	Slight
52250	52230	71	71	72	72	Minor	Medium - High	Slight
52250	53234	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52251	50791	70	70	72	72	Minor	Medium - High	Slight
52251	50919	64	63	71	71	Major	Medium – High	Significant
52251	52285	70	70	71	71	Negligible	Medium - High	Not Significant
52252	50682	71	71	74	74	Minor	High	Slight - Moderate
52252	52322	71	71	74	74	Minor	High	Slight - Moderate
52252	53266	62	61	63	61	Negligible	Medium	Not Significant
52253	50549	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52253	50639	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52253	50663	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52254	50929	64	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52254	50935	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52255	50818	69	69	69	69	Negligible	Medium - High	Not Significant
52255	50824	69	69	70	69	Negligible	Medium - High	Not Significant
52256	50489	68	67	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52256	50805	65	64	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52256	53232	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52257	50718	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52257	52274	68	68	69	69	Negligible	Medium - High	Not Significant
52257	52611	68	68	68	68	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52258	50725	Flow too low	Flow too low	66	66	Flow too low	Medium	Flow too low
52259	50567	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52259	50599	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52259	50600	68	67	68	67	Negligible	Medium - High	Not Significant
52260	50549	65	64	65	65	Negligible	Medium	Not Significant
52260	50642	65	64	65	64	Negligible	Medium	Not Significant
52269	52270	67	67	68	67	Negligible	Medium - High	Not Significant
52270	50731	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52270	52848	68	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52272	50519	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52272	50785	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52272	53369	60	59	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
52273	50921	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52273	52277	70	70	70	70	Negligible	Medium - High	Not Significant
52273	53399	67	67	68	68	Negligible	Medium - High	Not Significant
52274	50489	66	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52274	52257	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52274	52806	69	68	69	69	Negligible	Medium - High	Not Significant
52275	50590	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52275	50612	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52276	50516	69	68	69	69	Negligible	Medium - High	Not Significant
52276	52277	69	69	69	69	Negligible	Medium - High	Not Significant
52277	52273	69	69	70	70	Negligible	Medium - High	Not Significant
52277	52276	69	68	69	69	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52277	52314	69	68	69	68	Negligible	Medium - High	Not Significant
52278	52231	72	72	73	73	Minor	High	Slight - Moderate
52278	52279	69	69	70	69	Negligible	Medium - High	Not Significant
52279	52278	72	72	73	73	Minor	High	Slight - Moderate
52279	52280	69	69	70	69	Negligible	Medium - High	Not Significant
52280	50510	69	69	70	69	Negligible	Medium - High	Not Significant
52280	52279	72	72	73	73	Minor	High	Slight - Moderate
52284	50747	71	71	73	73	Minor	High	Slight - Moderate
52284	50795	71	71	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52284	52293	65	64	66	65	Negligible	Medium	Not Significant
52284	52303	64	63	66	65	Minor	Medium	Slight
52285	50539	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52285	50792	67	67	69	69	Minor	Medium - High	Slight
52285	50793	68	68	69	68	Negligible	Medium - High	Not Significant
52285	52251	70	70	70	70	Negligible	Medium - High	Not Significant
52288	50709	63	61	63	61	No change/Reduction	Medium	Imperceptible/ Positive
52288	52289	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52288	53228	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
52289	50718	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52289	52288	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52290	52291	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
52290	53229	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
52291	50727	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
52292	50536	63	62	64	63	Negligible	Medium	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52292	50700	64	63	64	63	Negligible	Medium	Not Significant
52293	52284	66	65	67	67	Minor	Medium - High	Slight
52293	53066	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52293	53270	65	64	66	65	Negligible	Medium	Not Significant
52294	50794	Flow too low	Flow too low	65	65	Flow too low	Medium	Flow too low
52296	52231	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52296	70003	63	62	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52297	50798	65	64	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52297	70003	64	63	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52299	52300	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52299	53264	64	63	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52300	50730	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52300	52296	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52301	50924	65	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52301	52310	66	66	68	67	Minor	Medium - High	Slight
52302	50720	62	61	65	65	Moderate	Medium	Moderate
52302	50728	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
52303	52284	64	63	66	66	Moderate	Medium	Moderate
52303	52304	64	63	66	65	Minor	Medium	Slight
52304	50747	63	62	65	64	Minor	Medium	Slight
52304	52303	64	63	66	66	Moderate	Medium	Moderate
52304	52684	67	67	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52305	50749	67	66	70	70	Moderate	Medium - High	Moderate - Significant
52305	50794	67	66	69	69	Minor	Medium - High	Slight

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52306	50801	Flow too low	Flow too low	65	65	Flow too low	Medium	Flow too low
52306	52052	62	61	63	62	Negligible	Medium	Not Significant
52306	52231	64	62	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52307	50714	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52307	50716	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52307	53048	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52308	50707	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52308	50714	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52309	50792	61	59	62	60	Negligible	Low - Medium	Not Significant
52309	50803	60	58	60	58	Negligible	Low - Medium	Not Significant
52310	50805	66	66	68	67	Minor	Medium - High	Slight
52310	52301	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52311	50541	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52311	50646	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52311	53207	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52312	50492	66	65	66	65	Negligible	Medium	Not Significant
52312	50656	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52312	53221	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52313	50697	69	69	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52313	52550	Flow too low	Flow too low	60	58	Flow too low	Low - Medium	Flow too low
52313	53225	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52314	52277	68	68	68	68	Negligible	Medium - High	Not Significant
52314	52316	69	68	69	68	Negligible	Medium - High	Not Significant
52315	50695	69	68	69	68	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52315	52316	68	68	68	68	Negligible	Medium - High	Not Significant
52315	53240	63	62	63	61	No change/Reduction	Medium	Imperceptible/ Positive
52316	52314	68	68	68	68	Negligible	Medium - High	Not Significant
52316	52315	69	68	69	68	Negligible	Medium - High	Not Significant
52318	50515	68	67	69	68	Negligible	Medium - High	Not Significant
52318	50788	Flow too low	Flow too low	61	60	Flow too low	Low - Medium	Flow too low
52318	53399	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52319	50542	69	69	69	69	Negligible	Medium - High	Not Significant
52319	50778	68	68	68	68	Negligible	Medium - High	Not Significant
52320	50657	63	62	63	62	Negligible	Medium	Not Significant
52320	50659	64	63	64	63	Negligible	Medium	Not Significant
52322	52252	72	72	74	74	Minor	High	Slight - Moderate
52322	53388	71	71	72	72	Minor	High	Slight - Moderate
52323	51411	59	57	59	57	Negligible	Low - Medium	Not Significant
52323	52324	59	58	59	58	Negligible	Low - Medium	Not Significant
52323	53333	58	56	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
52324	51402	59	58	59	58	Negligible	Low - Medium	Not Significant
52324	52323	60	59	60	59	Negligible	Low - Medium	Not Significant
52325	50681	67	66	71	71	Moderate	Medium - High	Moderate - Significant
52325	52326	68	67	72	72	Moderate	Medium - High	Moderate - Significant
52326	50736	67	66	72	72	Major	Medium - High	Significant
52326	52325	67	66	71	71	Moderate	Medium - High	Moderate - Significant
52326	52819	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52329	70004	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52331	52332	71	71	72	72	Negligible	Medium - High	Not Significant
52331	52560	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52332	50752	72	73	73	73	Negligible	High	Not Significant - Slight
52332	52331	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52332	52333	73	74	74	74	Negligible	High	Not Significant - Slight
52332	52811	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52333	50495	73	74	73	74	Negligible	High	Not Significant - Slight
52333	52332	74	74	73	73	No change/Reduction	High	Imperceptible/ Positive
52348	50897	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52348	51363	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52348	52350	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52349	52351	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52350	52348	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52350	52351	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52351	52349	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52351	52350	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52352	50164	70	70	70	70	Negligible	Medium - High	Not Significant
52352	52353	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52353	50157	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52353	52352	70	70	70	70	Negligible	Medium - High	Not Significant
52360	50952	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52360	52563	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
52360	70008	72	73	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52363	52118	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52363	52565	72	72	72	72	Negligible	Medium - High	Not Significant
52367	50769	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52367	52685	65	65	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52392	59001	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
52393	52961	69	69	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52393	53013	76	76	75	76	No change/Reduction	High	Imperceptible/ Positive
52394	52393	72	72	72	72	No change/Reduction	High	Imperceptible/ Positive
52395	50107	71	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52395	52399	73	74	73	74	Negligible	High	Not Significant - Slight
52396	52400	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52396	53400	73	74	73	74	Negligible	High	Not Significant - Slight
52397	52398	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52397	52401	71	71	71	71	Negligible	Medium - High	Not Significant
52398	52399	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52399	52395	74	75	74	74	No change/Reduction	High	Imperceptible/ Positive
52399	52963	70	69	70	69	Negligible	Medium - High	Not Significant
52400	52401	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52400	52450	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52401	52397	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52401	52962	68	67	68	67	Negligible	Medium - High	Not Significant
52402	52398	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52402	52425	75	76	75	76	No change/Reduction	High	Imperceptible/ Positive
52425	59002	76	77	76	77	No change/Reduction	High	Imperceptible/ Positive
52427	52394	72	72	72	72	No change/Reduction	High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52450	59003	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
52451	51359	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52451	52452	67	67	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
52452	50871	66	65	66	65	Negligible	Medium	Not Significant
52452	52451	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52466	50116	65	64	65	64	Negligible	Medium	Not Significant
52467	50885	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52467	53169	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52468	52469	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52468	53169	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52469	50885	66	65	66	66	Negligible	Medium	Not Significant
52469	52468	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52469	52470	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52470	50593	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52470	52469	65	64	65	64	Negligible	Medium	Not Significant
52471	50500	67	67	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
52471	51336	67	66	67	66	Negligible	Medium	Not Significant
52472	51336	67	67	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
52472	53170	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52472	53315	66	66	66	66	Negligible	Medium	Not Significant
52473	52474	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52473	53170	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52474	50895	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52474	52473	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52515	50164	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52515	50165	70	70	70	70	Negligible	Medium - High	Not Significant
52515	51344	71	71	71	71	Negligible	Medium - High	Not Significant
52518	50875	64	63	65	64	Negligible	Medium	Not Significant
52518	50877	61	60	62	61	Minor	Medium	Slight
52519	50874	62	61	63	61	Negligible	Medium	Not Significant
52519	52520	65	64	65	64	Negligible	Medium	Not Significant
52520	50875	65	64	65	64	Negligible	Medium	Not Significant
52520	52519	65	64	65	65	Negligible	Medium	Not Significant
52520	53215	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
52523	50890	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52526	50886	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52526	50887	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52527	52526	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52527	53174	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52528	50887	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52528	52841	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52529	50869	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52529	50872	67	66	67	66	Negligible	Medium	Not Significant
52529	53216	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52533	50895	68	67	68	68	Negligible	Medium - High	Not Significant
52533	52537	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52534	50894	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52534	52592	68	67	68	67	Negligible	Medium - High	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52535	52536	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52535	52541	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52536	50150	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52536	52535	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52537	52012	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52537	52533	68	67	68	68	Negligible	Medium - High	Not Significant
52538	50583	68	68	68	68	Negligible	Medium - High	Not Significant
52538	52539	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52538	53310	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52539	51334	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52539	52538	68	68	68	68	Negligible	Medium - High	Not Significant
52541	52012	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52541	52535	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52544	51325	58	56	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
52544	52545	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52544	53217	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
52545	50901	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52545	52544	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52546	50968	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52546	51325	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52548	50640	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
52548	50654	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52548	53371	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52549	50635	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52549	50899	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52549	51329	64	63	64	63	Negligible	Medium	Not Significant
52550	50696	Flow too low	Flow too low	60	58	Flow too low	Low - Medium	Flow too low
52550	52313	Flow too low	Flow too low	59	58	Flow too low	Low - Medium	Flow too low
52551	52552	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52551	52568	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52552	52551	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52552	52553	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52553	50771	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52553	52552	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52553	53256	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52556	52302	66	65	67	67	Minor	Medium - High	Slight
52557	52558	69	69	71	71	Minor	Medium - High	Slight
52558	50530	70	70	71	72	Minor	Medium - High	Slight
52560	52331	72	72	72	73	Negligible	High	Not Significant - Slight
52560	52561	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52560	53299	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52561	50577	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52561	52560	71	71	72	72	Negligible	Medium - High	Not Significant
52563	52360	73	73	73	73	Negligible	High	Not Significant - Slight
52563	52564	72	72	72	73	Negligible	High	Not Significant - Slight
52563	53297	62	61	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive
52564	50956	72	73	72	72	No change/Reduction	High	Imperceptible/ Positive
52564	52010	64	63	64	63	Negligible	Medium	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52564	52563	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52565	52120	72	73	72	73	No change/Reduction	High	Imperceptible/ Positive
52565	52363	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52565	52576	67	67	67	67	Negligible	Medium - High	Not Significant
52566	59000	68	68	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52567	52680	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52567	52681	70	70	70	70	Negligible	Medium - High	Not Significant
52567	53308	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52568	50780	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52568	50941	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52568	52551	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52569	50869	65	64	65	64	Negligible	Medium	Not Significant
52569	52580	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52570	50134	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
52570	51326	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52570	52580	65	64	65	64	Negligible	Medium	Not Significant
52576	52565	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52576	52577	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52576	52588	67	67	67	67	Negligible	Medium - High	Not Significant
52577	52588	61	60	61	60	Negligible	Low - Medium	Not Significant
52577	52605	58	56	58	56	Negligible	Low - Medium	Not Significant
52579	50543	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52579	52008	62	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
52579	53176	62	61	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52580	52569	65	64	65	64	Negligible	Medium	Not Significant
52580	52570	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52583	52662	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52584	50769	65	65	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52584	52585	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52585	50945	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52585	52584	65	65	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52586	52587	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52586	53145	62	60	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
52586	53335	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
52587	52586	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52588	52576	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52588	52589	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52589	52588	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52589	53312	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52592	50502	68	67	68	67	Negligible	Medium - High	Not Significant
52592	52534	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52597	50150	67	67	67	67	Negligible	Medium - High	Not Significant
52597	52622	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52598	50558	62	61	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive
52598	50631	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
52599	50527	67	66	68	67	Negligible	Medium - High	Not Significant
52599	50747	68	68	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52599	53276	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52600	50701	70	70	70	70	Negligible	Medium - High	Not Significant
52600	52601	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52601	50540	62	61	63	62	Negligible	Medium	Not Significant
52601	50700	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52601	52600	70	70	70	70	Negligible	Medium - High	Not Significant
52602	51326	65	64	65	65	Negligible	Medium	Not Significant
52602	51415	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52603	50744	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52603	50965	72	72	72	73	Negligible	High	Not Significant - Slight
52604	50646	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52604	50686	64	63	64	63	Negligible	Medium	Not Significant
52605	51331	58	56	58	56	Negligible	Low - Medium	Not Significant
52605	52577	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
52609	50907	59	57	61	60	Minor	Low - Medium	Slight
52609	52244	60	58	63	61	Moderate	Medium	Moderate
52611	50792	67	67	68	68	Negligible	Medium - High	Not Significant
52611	52257	67	67	69	68	Minor	Medium - High	Slight
52611	53230	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52612	50588	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52613	50896	70	70	71	71	Negligible	Medium - High	Not Significant
52613	51362	70	70	70	70	Negligible	Medium - High	Not Significant
52614	50108	71	71	71	71	Negligible	Medium - High	Not Significant
52614	51363	71	71	71	71	Negligible	Medium - High	Not Significant
52622	50148	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52622	52597	67	67	67	67	Negligible	Medium - High	Not Significant
52623	53014	76	76	75	76	No change/Reduction	High	Imperceptible/ Positive
52623	59004	76	77	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52628	50636	67	66	67	66	Negligible	Medium	Not Significant
52628	50778	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52628	53248	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52630	52954	73	73	73	73	Negligible	High	Not Significant - Slight
52630	53403	74	74	74	74	Negligible	High	Not Significant - Slight
52634	50147	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52634	53365	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52634	59013	66	65	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52635	50143	69	68	69	68	Negligible	Medium - High	Not Significant
52635	52636	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52636	40007	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52636	51391	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52636	52635	69	68	69	68	Negligible	Medium - High	Not Significant
52662	52332	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52663	50588	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52663	50589	71	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52663	52241	67	66	67	66	Negligible	Medium	Not Significant
52664	50751	69	68	69	69	Negligible	Medium - High	Not Significant
52665	50512	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52665	50960	68	67	69	69	Minor	Medium - High	Slight
52665	53281	69	68	69	69	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52668	53177	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52669	50682	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52669	53177	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52670	52671	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52670	53178	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52671	52670	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52671	52672	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52672	50754	70	69	70	70	Negligible	Medium - High	Not Significant
52672	52671	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52672	53286	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52673	52675	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52673	53178	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52674	50754	67	66	68	68	Minor	Medium - High	Slight
52674	50755	67	66	68	68	Minor	Medium - High	Slight
52675	50570	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52675	52673	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52676	52678	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52677	52682	63	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
52678	50504	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52679	52691	66	65	66	65	Negligible	Medium	Not Significant
52680	52567	70	70	70	70	Negligible	Medium - High	Not Significant
52680	52701	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52680	53307	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52681	52567	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52681	52683	70	70	70	70	Negligible	Medium - High	Not Significant
52682	52623	63	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
52683	50507	73	74	73	74	Negligible	High	Not Significant - Slight
52683	52681	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52683	52704	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
52684	52304	66	66	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52684	52685	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52684	53280	65	64	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52685	52367	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52685	52684	65	65	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52686	52820	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52687	50145	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52687	50147	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52688	48006	74	74	74	75	Negligible	High	Not Significant - Slight
52688	50767	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52688	50963	75	76	75	75	No change/Reduction	High	Imperceptible/ Positive
52690	51333	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52691	40008	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52691	50142	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52691	52679	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52694	52402	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
52695	50857	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
52695	53013	76	76	75	76	No change/Reduction	High	Imperceptible/ Positive
52695	53390	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52695	59004	76	77	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52696	50112	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52696	50592	72	72	72	72	Negligible	Medium - High	Not Significant
52697	52698	73	73	73	74	Negligible	High	Not Significant - Slight
52697	52700	74	75	73	74	No change/Reduction	High	Imperceptible/ Positive
52697	52701	72	72	72	72	Negligible	Medium - High	Not Significant
52697	53014	76	77	76	77	No change/Reduction	High	Imperceptible/ Positive
52698	52697	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
52698	52700	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52698	52703	73	73	73	74	Negligible	High	Not Significant - Slight
52700	52697	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
52700	52706	75	76	75	75	No change/Reduction	High	Imperceptible/ Positive
52701	52680	70	70	70	70	Negligible	Medium - High	Not Significant
52701	52697	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52701	52702	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52702	50851	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52702	52701	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52703	50112	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52703	50603	70	70	71	71	Minor	Medium - High	Slight
52703	52698	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
52704	52683	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
52704	52705	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
52705	52704	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
52705	52706	75	76	75	76	Negligible	High	Not Significant - Slight

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52705	52707	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52705	53403	73	73	73	73	Negligible	High	Not Significant - Slight
52706	52700	76	77	76	76	No change/Reduction	High	Imperceptible/ Positive
52706	52705	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
52706	52707	69	68	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52707	52248	74	74	73	73	No change/Reduction	High	Imperceptible/ Positive
52707	52705	72	72	72	72	Negligible	High	Not Significant - Slight
52708	50816	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52708	53067	70	70	70	70	Negligible	Medium - High	Not Significant
52742	52898	72	73	72	73	No change/Reduction	High	Imperceptible/ Positive
52766	50049	72	73	72	72	No change/Reduction	High	Imperceptible/ Positive
52769	52826	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52769	52827	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52770	50942	74	75	74	75	Negligible	High	Not Significant - Slight
52770	52769	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
52771	50753	73	73	72	72	No change/Reduction	High	Imperceptible/ Positive
52771	52772	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
52772	50752	72	73	73	73	Negligible	High	Not Significant - Slight
52772	50965	73	73	72	72	No change/Reduction	High	Imperceptible/ Positive
52773	50643	68	68	68	68	Negligible	Medium - High	Not Significant
52773	50679	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52778	50108	68	68	69	69	Negligible	Medium - High	Not Significant
52778	50118	65	65	65	65	No change/Reduction	Medium	Imperceptible/ Positive
52778	52766	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52779	50145	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
52779	52687	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52780	50146	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52780	52779	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52781	50783	69	69	70	70	Minor	Medium - High	Slight
52781	50923	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52804	52322	71	71	71	71	Negligible	Medium - High	Not Significant
52805	50725	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52805	52817	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52806	50533	69	68	69	69	Negligible	Medium - High	Not Significant
52806	52274	69	68	69	68	Negligible	Medium - High	Not Significant
52807	50553	71	71	71	71	Negligible	Medium - High	Not Significant
52808	52038	70	70	71	71	Negligible	Medium - High	Not Significant
52808	52807	64	63	65	64	Negligible	Medium	Not Significant
52811	53011	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52812	52940	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52813	50650	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52813	52812	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52814	52813	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52815	50677	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52816	50686	64	63	64	63	Negligible	Medium	Not Significant
52816	52604	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52817	50809	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52818	50730	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52819	50735	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52819	53272	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52820	50761	72	72	72	73	Negligible	High	Not Significant - Slight
52820	52664	70	70	70	70	Negligible	Medium - High	Not Significant
52825	50784	72	73	72	73	Negligible	High	Not Significant - Slight
52825	50943	65	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52826	52825	73	73	73	73	Negligible	High	Not Significant - Slight
52827	50773	68	68	71	71	Minor	Medium - High	Slight
52827	52826	65	64	68	67	Moderate	Medium - High	Moderate - Significant
52828	52949	66	65	62	61	No change/Reduction	Medium	Imperceptible/ Positive
52829	50545	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52829	50645	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52830	50821	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52830	52829	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52838	52840	68	68	68	68	Negligible	Medium - High	Not Significant
52839	52838	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52839	52841	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52840	50874	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52840	52519	62	61	63	61	Negligible	Medium	Not Significant
52841	52528	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52841	52838	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52842	52527	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52843	50888	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52843	52842	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52844	50702	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52844	52816	65	64	65	64	Negligible	Medium	Not Significant
52845	50547	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52846	50820	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52846	52847	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52847	50655	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52847	52830	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52848	52804	68	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52898	50045	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
52898	51347	67	66	67	66	Negligible	Medium	Not Significant
52940	50652	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52940	52846	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52941	50735	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52941	50737	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52941	50797	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52942	50737	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52942	52943	70	70	72	72	Minor	Medium - High	Slight
52942	53277	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52943	50746	70	70	72	72	Minor	Medium - High	Slight
52943	52942	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52946	50724	70	71	71	71	Negligible	Medium - High	Not Significant
52946	52258	Flow too low	Flow too low	66	66	Flow too low	Medium	Flow too low
52949	50805	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52949	53402	66	65	68	67	Minor	Medium - High	Slight

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
52951	52556	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52954	48006	72	72	72	72	Negligible	High	Not Significant - Slight
52954	52630	74	74	74	74	Negligible	High	Not Significant - Slight
52958	52960	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52959	50111	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52960	52427	70	70	70	70	Negligible	Medium - High	Not Significant
52960	52959	69	69	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52961	52392	65	65	65	65	No change/Reduction	Medium	Imperceptible/ Positive
52961	52958	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52962	52396	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52963	52397	68	67	68	67	Negligible	Medium - High	Not Significant
52963	52425	69	69	69	69	Negligible	Medium - High	Not Significant
52964	53012	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
53004	50963	75	75	75	76	Negligible	High	Not Significant - Slight
53004	59000	74	75	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53005	52450	74	75	74	75	Negligible	High	Not Significant - Slight
53005	52962	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
53011	50930	69	69	70	70	Negligible	Medium - High	Not Significant
53012	52958	70	70	70	70	Negligible	Medium - High	Not Significant
53012	52959	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53013	52392	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
53013	52393	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
53013	52695	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
53014	52623	76	77	76	77	No change/Reduction	High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53014	52697	75	75	74	75	No change/Reduction	High	Imperceptible/ Positive
53020	50118	65	64	65	64	Negligible	Medium	Not Significant
53020	51360	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53022	50150	67	66	67	66	Negligible	Medium	Not Significant
53046	50516	69	69	69	69	Negligible	Medium - High	Not Significant
53046	50517	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53046	50793	68	68	68	68	Negligible	Medium - High	Not Significant
53047	50523	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
53048	50707	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53048	50708	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53048	52307	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53049	50561	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53049	50613	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53050	50575	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53051	50577	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53052	50578	65	65	65	65	No change/Reduction	Medium	Imperceptible/ Positive
53053	50592	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
53053	50608	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53053	53302	62	61	62	61	Negligible	Medium	Not Significant
53054	50617	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53054	50621	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53055	50627	61	59	60	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
53055	50628	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53057	50642	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
53057	50816	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
53057	53210	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53059	50648	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
53059	50650	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53060	50665	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53061	50677	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53063	50647	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53063	50708	68	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53063	50710	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53064	50724	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53064	50808	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53065	50733	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53065	52828	66	65	62	61	No change/Reduction	Medium	Imperceptible/ Positive
53066	50800	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53066	50801	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53067	50814	65	64	65	64	Negligible	Medium	Not Significant
53067	50817	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
53067	52708	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
53070	50954	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53070	50955	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53096	51349	73	73	73	73	Negligible	High	Not Significant - Slight
53096	51352	73	73	73	73	Negligible	High	Not Significant - Slight
53096	53347	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
53097	50117	70	70	71	71	Negligible	Medium - High	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
53097	51361	74	75	74	75	Negligible	High	Not Significant - Slight
53098	51364	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53099	51370	61	60	62	61	Minor	Medium	Slight
53099	51371	61	60	62	60	Negligible	Low - Medium	Not Significant
53145	51400	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53145	52586	62	61	62	61	Negligible	Medium	Not Significant
53145	53350	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53149	52008	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53150	52012	66	66	66	66	Negligible	Medium	Not Significant
53160	50529	70	70	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53160	52231	71	71	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53160	52818	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53161	52558	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53161	52951	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53169	52467	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53169	52468	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53169	53305	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53170	52472	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53170	52473	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53174	52527	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
53176	52579	62	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53177	52668	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53177	52669	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53178	52670	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53178	52673	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53200	50669	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53201	50664	63	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
53202	50668	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53203	50822	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53205	50662	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53207	52311	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53208	50661	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53208	50689	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53209	50640	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53210	53057	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53211	50811	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53215	52520	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53216	52529	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53217	52544	58	56	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
53218	50635	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53219	50968	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53220	50550	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53221	52312	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53223	53224	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53224	50647	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53224	50704	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53224	53223	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53225	50695	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53225	52313	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
53225	53385	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53226	50716	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53227	50713	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
53228	52288	62	61	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive
53229	52290	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
53230	52611	64	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53231	50539	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53232	52256	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53233	50804	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53234	52250	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53235	50789	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53236	53399	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53240	52315	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
53242	50819	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53247	50543	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53248	52628	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53249	50907	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53250	50779	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53251	50773	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53252	50494	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53253	50524	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
53254	50522	60	58	60	58	Negligible	Low - Medium	Not Significant
53256	52553	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
53259	50940	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53263	50531	65	65	65	65	No change/Reduction	Medium	Imperceptible/ Positive
53264	52299	67	66	67	66	Negligible	Medium	Not Significant
53265	50808	62	61	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53266	52252	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53267	70004	67	67	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53268	50513	62	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53269	53270	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
53270	50794	67	66	68	68	Minor	Medium - High	Slight
53270	52293	67	66	67	67	Negligible	Medium - High	Not Significant
53270	53269	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53271	52233	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
53272	52819	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53273	50736	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53275	50508	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53276	52599	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53277	52942	63	61	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive
53278	50740	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
53280	52684	64	63	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53281	52665	68	67	69	68	Negligible	Medium - High	Not Significant
53283	50739	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53284	50755	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53285	50762	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53286	52672	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53287	50750	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53289	50619	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53290	50628	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53291	52039	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53292	50912	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53293	50625	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53296	52009	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53297	52563	65	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53298	50581	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53299	52560	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53301	50588	64	64	64	64	No change/Reduction	Medium	Imperceptible/ Positive
53302	53053	64	62	64	62	Negligible	Medium	Not Significant
53303	50607	65	65	65	65	Negligible	Medium	Not Significant
53305	53169	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53306	50596	64	63	64	63	Negligible	Medium	Not Significant
53307	52680	71	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
53308	52567	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53309	50600	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53310	52538	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53311	51333	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53312	52589	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53313	50770	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53314	53390	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53315	52472	66	66	66	66	Negligible	Medium	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
53319	51376	59	57	59	57	Negligible	Low - Medium	Not Significant
53322	51394	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53323	51379	58	56	58	56	Negligible	Low - Medium	Not Significant
53324	40000	58	56	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
53324	40001	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53324	51358	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
53325	50984	65	64	65	64	Negligible	Medium	Not Significant
53326	50157	65	64	65	65	Negligible	Medium	Not Significant
53333	52323	58	56	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
53334	51330	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53335	52586	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53344	50420	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53347	53096	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
53348	50870	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53350	53145	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53353	50515	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53354	53402	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
53357	50917	58	55	57	55	No change/Reduction	Low - Medium	Imperceptible/ Positive
53358	53398	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53360	50528	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53361	53403	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
53362	50836	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53364	50780	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53365	52634	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
53366	51335	66	66	66	66	Negligible	Medium	Not Significant
53367	52119	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53369	52272	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53370	70003	66	66	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53371	52548	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53374	53396	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53375	50561	61	59	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
53382	50753	64	63	64	64	Negligible	Medium	Not Significant
53383	50930	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
53383	53384	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53383	70007	72	73	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53384	53383	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
53385	53225	65	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53386	52557	69	69	71	71	Minor	Medium - High	Slight
53386	53387	63	61	63	61	No change/Reduction	Medium	Imperceptible/ Positive
53387	53386	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53388	52946	70	71	72	72	Minor	Medium - High	Slight
53388	53389	66	65	65	65	No change/Reduction	Medium	Imperceptible/ Positive
53389	53388	64	63	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53390	50894	69	69	69	69	Negligible	Medium - High	Not Significant
53390	52695	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
53390	53314	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53394	50044	74	74	74	74	Negligible	High	Not Significant - Slight
53394	50984	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
53394	53395	62	61	62	61	Negligible	Medium	Not Significant
53395	53394	62	61	62	61	Negligible	Medium	Not Significant
53396	50700	65	64	65	65	Negligible	Medium	Not Significant
53396	50928	67	67	66	66	No change/Reduction	Medium	Imperceptible/ Positive
53396	53374	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53398	50523	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
53398	50915	70	70	70	70	Negligible	Medium - High	Not Significant
53398	53358	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53399	52273	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53399	52318	68	68	69	69	Negligible	Medium - High	Not Significant
53399	53236	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53400	50984	73	73	73	74	Negligible	High	Not Significant - Slight
53400	52396	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
53400	53401	64	63	64	63	Negligible	Medium	Not Significant
53401	53400	65	65	66	65	Negligible	Medium	Not Significant
53402	50804	65	64	68	68	Moderate	Medium - High	Moderate - Significant
53402	52949	65	64	65	64	Negligible	Medium	Not Significant
53402	53354	63	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
53403	52630	73	74	73	74	Negligible	High	Not Significant - Slight
53403	52705	73	73	73	73	Negligible	High	Not Significant - Slight
53403	53361	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
55000	50514	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
55000	50922	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
55001	50636	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
55001	55002	72	73	72	73	Negligible	High	Not Significant - Slight
55002	55001	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
55002	55003	72	73	72	73	Negligible	High	Not Significant - Slight
55003	50551	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
55003	55002	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
55004	50665	74	74	74	74	Negligible	High	Not Significant - Slight
55004	50906	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
58001	50944	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
58002	50787	65	64	65	65	Negligible	Medium	Not Significant
59000	50487	75	76	75	76	No change/Reduction	High	Imperceptible/ Positive
59000	52566	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
59000	53004	74	75	74	75	Negligible	High	Not Significant - Slight
59001	52694	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
59002	98000	76	77	76	77	No change/Reduction	High	Imperceptible/ Positive
59003	52964	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
59004	52623	76	77	76	77	No change/Reduction	High	Imperceptible/ Positive
59004	52695	75	76	75	76	No change/Reduction	High	Imperceptible/ Positive
59005	53065	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
59005	59006	67	66	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
59005	59008	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
59006	50733	Flow too low	Flow too low	63	62	Flow too low	Medium	Flow too low
59006	59005	67	66	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
59006	59007	67	67	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
59007	59006	67	67	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
59008	50918	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
59008	59005	68	68	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
59010	50669	74	74	73	74	No change/Reduction	High	Imperceptible/ Positive
59010	50906	73	74	73	74	Negligible	High	Not Significant - Slight
59011	50938	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
59011	50940	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
59011	59012	64	63	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
59012	59011	68	67	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
59013	52634	66	66	66	66	Negligible	Medium	Not Significant
60001	50802	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
70000	50720	59	57	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
70001	50671	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
70003	52296	66	65	66	66	Negligible	Medium	Not Significant
70003	52297	65	64	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
70003	53370	64	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
70004	53161	65	64	64	64	No change/Reduction	Medium	Imperceptible/ Positive
70004	53267	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
70006	50545	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
70006	50654	70	70	70	71	Negligible	Medium - High	Not Significant
70007	50622	72	73	73	73	Negligible	High	Not Significant - Slight
70007	53383	73	74	74	74	Negligible	High	Not Significant - Slight
70008	50766	72	73	72	73	No change/Reduction	High	Imperceptible/ Positive
70008	52360	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
70009	50544	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	**B**	**dB L_{den}**	**dB $L_{A10,18hr}$**	**dB L_{den}**	**dB $L_{A10,18hr}$**			
70009	50660	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
98013	98017	76	77	76	77	No change/Reduction	High	Imperceptible/ Positive
98017	53005	76	77	76	77	No change/Reduction	High	Imperceptible/ Positive

Table 2: Operational Results Including Significance Ratings for Long Term Operational Phase Traffic Noise Impacts – Design Year 2037

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
40000	53324	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
40001	53324	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
40002	51358	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
40004	40005	64	63	64	63	Negligible	Medium	Not Significant
40004	50860	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
40004	51378	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
40005	40004	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
40006	50158	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
40007	52636	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
40008	52691	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
40009	40010	63	62	63	61	No change/Reduction	Medium	Imperceptible/ Positive
40009	50895	69	69	69	69	Negligible	Medium - High	Not Significant
40009	51363	67	66	67	67	Negligible	Medium - High	Not Significant
40010	40009	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
40018	40019	64	63	64	63	Negligible	Medium	Not Significant
40018	50871	72	72	72	72	Negligible	Medium - High	Not Significant
40018	51357	75	75	75	76	Negligible	High	Not Significant - Slight

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
40019	40018	63	61	63	61	Negligible	Medium	Not Significant
40020	40021	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
40020	50910	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
40020	51411	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
40021	40020	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
48006	50754	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
48006	50766	71	71	71	72	Negligible	Medium - High	Not Significant
48006	52688	74	75	74	74	No change/Reduction	High	Imperceptible/ Positive
48006	52954	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
48008	52360	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
48008	52563	73	73	73	73	Negligible	High	Not Significant - Slight
48008	52955	68	68	69	69	Negligible	Medium - High	Not Significant
48010	48041	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
48010	48913	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
48010	50504	69	69	69	69	Negligible	Medium - High	Not Significant
48016	50111	71	71	71	72	Negligible	Medium - High	Not Significant
48017	48020	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
48017	48025	68	68	68	68	Negligible	Medium - High	Not Significant
48018	48024	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
48018	48029	75	76	75	76	Negligible	High	Not Significant - Slight
48019	48204	74	75	74	75	Negligible	High	Not Significant - Slight
48020	48026	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
48020	48037	75	75	74	75	No change/Reduction	High	Imperceptible/ Positive
48022	48036	74	74	74	74	Negligible	High	Not Significant - Slight

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
48023	48028	67	67	67	67	Negligible	Medium - High	Not Significant
48024	48016	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
48024	48026	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
48024	48223	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
48025	48026	67	66	67	66	Negligible	Medium	Not Significant
48026	48016	70	70	71	71	Negligible	Medium - High	Not Significant
48026	48020	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
48026	48024	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
48026	48028	70	70	70	70	Negligible	Medium - High	Not Significant
48028	48022	68	68	69	68	Negligible	Medium - High	Not Significant
48028	48026	68	67	68	68	Negligible	Medium - High	Not Significant
48029	48022	74	74	74	74	Negligible	High	Not Significant - Slight
48030	48019	74	75	74	75	Negligible	High	Not Significant - Slight
48036	48038	74	74	74	74	Negligible	High	Not Significant - Slight
48037	48020	75	76	76	76	Negligible	High	Not Significant - Slight
48037	52695	74	74	73	74	No change/Reduction	High	Imperceptible/ Positive
48038	48043	74	74	74	74	Negligible	High	Not Significant - Slight
48039	48046	75	76	76	76	Negligible	High	Not Significant - Slight
48040	48041	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
48040	48045	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
48040	52679	67	67	68	67	Negligible	Medium - High	Not Significant
48041	48010	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
48041	48040	69	69	69	69	Negligible	Medium - High	Not Significant
48041	48044	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
48042	48039	75	76	76	76	Negligible	High	Not Significant - Slight
48043	48044	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
48043	48882	73	74	74	74	Negligible	High	Not Significant - Slight
48044	48041	68	68	69	68	Negligible	Medium - High	Not Significant
48044	48882	64	63	65	64	Negligible	Medium	Not Significant
48045	48040	65	64	65	64	Negligible	Medium	Not Significant
48045	48042	67	67	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
48046	48023	67	67	67	67	Negligible	Medium - High	Not Significant
48046	48030	76	76	76	77	Negligible	High	Not Significant - Slight
48151	48897	70	70	70	70	Negligible	Medium - High	Not Significant
48151	51330	71	71	71	72	Negligible	Medium - High	Not Significant
48151	51402	72	72	72	72	Negligible	High	Not Significant - Slight
48152	48892	73	74	73	74	Negligible	High	Not Significant - Slight
48152	48897	65	65	66	65	Negligible	Medium	Not Significant
48153	48154	73	74	74	74	Negligible	High	Not Significant - Slight
48154	48152	74	75	75	75	Negligible	High	Not Significant - Slight
48204	52694	77	78	77	78	No change/Reduction	High	Imperceptible/ Positive
48220	48221	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
48220	50890	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
48220	50902	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
48221	48220	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
48221	50900	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
48221	52549	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
48222	51401	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
48222	52007	71	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
48222	52579	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
48223	48204	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
48830	50625	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
48830	50629	70	70	70	70	Negligible	Medium - High	Not Significant
48830	50630	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
48830	52038	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
48880	48881	76	77	75	75	No change/Reduction	High	Imperceptible/ Positive
48880	50501	78	79	77	79	No change/Reduction	High	Imperceptible/ Positive
48881	48880	75	75	75	76	Negligible	High	Not Significant - Slight
48881	48885	70	70	71	71	Negligible	Medium - High	Not Significant
48881	48913	74	74	73	74	No change/Reduction	High	Imperceptible/ Positive
48882	48885	74	75	74	75	Negligible	High	Not Significant - Slight
48883	48042	74	75	74	75	Negligible	High	Not Significant - Slight
48883	48045	62	61	62	61	Negligible	Low - Medium	Not Significant
48884	48880	68	68	69	68	Negligible	Medium - High	Not Significant
48884	48883	75	75	73	74	No change/Reduction	High	Imperceptible/ Positive
48885	48887	76	77	76	77	Negligible	High	Not Significant - Slight
48886	48884	76	77	76	77	Negligible	High	Not Significant - Slight
48887	48890	75	75	75	76	Negligible	High	Not Significant - Slight
48887	52118	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
48888	48886	68	68	69	69	Negligible	Medium - High	Not Significant
48888	52118	74	74	74	74	Negligible	High	Not Significant - Slight
48888	52119	76	77	76	77	Negligible	High	Not Significant - Slight

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
48889	48886	73	74	73	74	Negligible	High	Not Significant - Slight
48889	48888	66	65	66	65	Negligible	Medium	Not Significant
48890	48891	76	77	76	76	No change/Reduction	High	Imperceptible/ Positive
48891	48153	73	73	73	74	Negligible	High	Not Significant - Slight
48891	48896	71	71	72	72	Negligible	Medium - High	Not Significant
48892	48889	74	75	74	75	Negligible	High	Not Significant - Slight
48896	48153	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
48896	48897	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
48896	51401	72	73	73	73	Negligible	High	Not Significant - Slight
48897	48151	70	70	71	71	Negligible	Medium - High	Not Significant
48897	48892	70	70	70	70	Negligible	Medium - High	Not Significant
48897	48896	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
48913	48010	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
48913	48881	78	79	78	79	Negligible	High	Not Significant - Slight
48913	50836	75	76	75	75	No change/Reduction	High	Imperceptible/ Positive
50035	50107	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50035	52081	72	72	72	72	Negligible	High	Not Significant - Slight
50043	50049	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50043	51372	73	73	73	74	Negligible	High	Not Significant - Slight
50044	52742	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50044	53394	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50048	51347	73	73	73	73	Negligible	High	Not Significant - Slight
50049	50050	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50050	50044	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50050	52742	72	72	72	72	Negligible	Medium - High	Not Significant
50107	50035	72	72	72	72	Negligible	High	Not Significant - Slight
50107	50353	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50107	50421	72	73	72	73	Negligible	High	Not Significant - Slight
50107	52395	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50108	50110	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50108	52614	72	72	72	72	No change/Reduction	High	Imperceptible/ Positive
50108	52778	70	70	70	70	Negligible	Medium - High	Not Significant
50110	48017	71	72	71	72	Negligible	Medium - High	Not Significant
50111	52778	70	70	70	70	Negligible	Medium - High	Not Significant
50112	50601	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50112	52696	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50112	52703	72	72	72	72	Negligible	High	Not Significant - Slight
50116	50118	67	67	67	67	Negligible	Medium - High	Not Significant
50116	52466	68	67	68	67	Negligible	Medium - High	Not Significant
50117	50896	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50117	50897	64	63	64	63	Negligible	Medium	Not Significant
50117	53097	72	72	72	72	Negligible	Medium - High	Not Significant
50118	50116	68	67	68	67	Negligible	Medium - High	Not Significant
50118	52778	66	66	67	66	Negligible	Medium	Not Significant
50118	53020	66	65	67	67	Negligible	Medium - High	Not Significant
50134	52570	64	62	64	62	No change/Reduction	Medium	Imperceptible/ Positive
50137	52119	73	74	77	78	Minor	High	Slight - Moderate
50138	51379	68	68	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50139	52780	68	68	68	68	Negligible	Medium - High	Not Significant
50140	50144	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50141	50140	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50141	50142	66	65	67	66	Negligible	Medium	Not Significant
50142	50140	65	65	65	65	No change/Reduction	Medium	Imperceptible/ Positive
50142	52691	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50143	50139	64	63	65	64	Negligible	Medium	Not Significant
50143	52635	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50144	50139	66	65	66	66	Negligible	Medium	Not Significant
50144	50143	68	68	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
50145	50141	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50146	52780	65	64	65	64	Negligible	Medium	Not Significant
50147	51377	71	71	71	72	Negligible	Medium - High	Not Significant
50147	52634	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50147	52687	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50148	50149	70	70	70	70	Negligible	Medium - High	Not Significant
50148	52622	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50149	50148	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50149	51374	69	69	69	69	Negligible	Medium - High	Not Significant
50150	52536	68	67	68	67	Negligible	Medium - High	Not Significant
50150	52597	70	70	70	70	Negligible	Medium - High	Not Significant
50150	53022	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50155	50043	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50155	50156	71	72	71	72	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50156	50155	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50156	50157	71	71	71	71	Negligible	Medium - High	Not Significant
50157	50156	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50157	52353	71	71	71	71	Negligible	Medium - High	Not Significant
50157	53326	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50158	40006	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50158	50165	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50158	51349	74	75	74	74	No change/Reduction	High	Imperceptible/ Positive
50164	52352	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50164	52515	68	68	69	68	Negligible	Medium - High	Not Significant
50165	50158	74	75	74	74	No change/Reduction	High	Imperceptible/ Positive
50165	50164	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50165	52515	71	71	71	71	Negligible	Medium - High	Not Significant
50353	50107	70	70	70	70	Negligible	Medium - High	Not Significant
50420	50421	74	74	74	75	Negligible	High	Not Significant - Slight
50420	51357	73	74	73	74	Negligible	High	Not Significant - Slight
50420	53344	67	67	67	67	Negligible	Medium - High	Not Significant
50421	50107	70	69	70	69	Negligible	Medium - High	Not Significant
50421	50420	70	70	70	70	Negligible	Medium - High	Not Significant
50486	50760	75	76	76	77	Negligible	High	Not Significant - Slight
50486	50942	74	74	75	76	Negligible	High	Not Significant - Slight
50487	50761	74	75	74	74	No change/Reduction	High	Imperceptible/ Positive
50487	59000	74	75	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50489	52256	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50489	52274	68	68	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50490	50691	61	59	61	59	Negligible	Low - Medium	Not Significant
50490	50696	63	61	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50491	50577	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50491	50578	73	73	72	72	No change/Reduction	High	Imperceptible/ Positive
50492	50657	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50492	50931	64	63	64	63	Negligible	Medium	Not Significant
50492	52312	65	64	65	64	Negligible	Medium	Not Significant
50493	50915	69	68	70	69	Negligible	Medium - High	Not Significant
50493	50916	Flow too low	Flow too low	59	57	Flow too low	Low - Medium	Flow too low
50493	50917	70	69	70	70	Negligible	Medium - High	Not Significant
50494	50521	70	70	70	70	Negligible	Medium - High	Not Significant
50494	50917	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50494	53252	58	56	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
50495	50497	73	74	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50495	50741	70	70	74	74	Minor	High	Slight - Moderate
50495	52333	75	75	74	74	No change/Reduction	High	Imperceptible/ Positive
50497	50495	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50497	50498	71	71	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50498	50497	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50498	50738	71	71	72	72	Negligible	High	Not Significant - Slight
50498	50741	Flow too low	Flow too low	72	72	Flow too low	Medium - High	Flow too low
50499	50558	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50499	50625	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50499	50626	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50500	51368	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50500	52471	67	67	67	67	Negligible	Medium - High	Not Significant
50501	48880	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
50501	52123	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
50502	51335	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50502	52592	69	69	69	69	Negligible	Medium - High	Not Significant
50503	50506	68	67	68	67	Negligible	Medium - High	Not Significant
50503	51333	66	65	66	65	Negligible	Medium	Not Significant
50503	52676	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50504	48010	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50504	52690	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50506	50503	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50506	50851	68	67	68	67	Negligible	Medium - High	Not Significant
50507	50835	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50507	50836	75	76	75	76	Negligible	High	Not Significant - Slight
50507	52683	74	75	74	74	No change/Reduction	High	Imperceptible/ Positive
50508	50796	61	59	64	63	Minor	Medium	Slight
50508	50802	62	61	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50508	53275	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50509	50510	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50510	50796	Flow too low	Flow too low	68	67	Flow too low	Medium - High	Flow too low
50509	50797	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50510	50509	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50510	50798	73	74	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50510	52280	71	71	73	74	Negligible	High	Not Significant - Slight
50510	60001	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50511	50512	72	73	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50511	50962	72	72	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50512	50511	72	72	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50512	50747	72	73	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50512	52665	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50513	50551	69	69	70	70	Negligible	Medium - High	Not Significant
50513	50921	70	70	70	70	Negligible	Medium - High	Not Significant
50513	53268	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50514	50515	68	68	69	69	Negligible	Medium - High	Not Significant
50514	50636	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50514	55000	71	71	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50515	50514	68	68	69	69	Negligible	Medium - High	Not Significant
50515	52318	67	67	69	69	Negligible	Medium - High	Not Significant
50515	53353	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50516	50785	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50516	52276	70	70	71	71	Negligible	Medium - High	Not Significant
50516	53046	70	70	71	71	Negligible	Medium - High	Not Significant
50517	50518	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50517	50785	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50517	50789	Flow too low	Flow too low	62	61	Flow too low	Medium	Flow too low
50517	53046	59	57	62	60	Minor	Low - Medium	Slight

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50518	50517	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50518	50519	61	59	62	60	Negligible	Low - Medium	Not Significant
50518	50936	63	62	63	62	Negligible	Medium	Not Significant
50519	50518	62	61	63	62	Negligible	Medium	Not Significant
50519	50788	61	59	62	61	Negligible	Medium	Not Significant
50519	52272	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50520	50524	69	69	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50520	50941	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50521	50494	68	68	68	68	Negligible	Medium - High	Not Significant
50521	50776	70	70	70	70	Negligible	Medium - High	Not Significant
50522	50775	68	68	69	68	Negligible	Medium - High	Not Significant
50522	50776	69	69	69	69	Negligible	Medium - High	Not Significant
50522	53254	60	59	60	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50523	50914	71	71	71	71	Negligible	Medium - High	Not Significant
50523	53047	60	58	59	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
50523	53398	70	69	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50524	50520	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50524	50771	69	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50524	53253	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
50525	50768	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50525	50770	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50525	50945	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50526	50729	68	68	68	68	Negligible	Medium - High	Not Significant
50526	50748	71	71	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50526	52232	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50527	50746	72	73	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50527	50958	73	73	73	73	Negligible	High	Not Significant - Slight
50527	52599	70	70	70	70	Negligible	Medium - High	Not Significant
50528	50743	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50528	50745	67	66	67	66	Negligible	Medium - High	Not Significant
50528	53360	66	65	66	65	Negligible	Medium	Not Significant
50529	50729	70	71	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50529	53160	71	71	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50530	52269	69	68	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50530	52804	69	68	70	70	Negligible	Medium - High	Not Significant
50531	50722	69	69	69	69	Negligible	Medium - High	Not Significant
50531	53263	66	65	66	65	Negligible	Medium	Not Significant
50532	50533	71	71	72	72	Negligible	Medium - High	Not Significant
50532	52246	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50533	50532	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50533	50534	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50533	50715	63	62	63	62	Negligible	Medium	Not Significant
50533	52806	69	68	70	70	Negligible	Medium - High	Not Significant
50534	50533	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50534	50717	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50536	50703	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50536	50704	67	66	67	67	Negligible	Medium - High	Not Significant
50536	52292	67	66	68	67	Negligible	Medium - High	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50537	50538	70	70	70	70	Negligible	Medium - High	Not Significant
50537	50540	67	67	68	68	Negligible	Medium - High	Not Significant
50537	50698	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50537	50719	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50538	50537	70	70	71	71	Negligible	Medium - High	Not Significant
50538	50699	71	71	71	71	Negligible	Medium - High	Not Significant
50539	50698	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50539	52285	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50539	53231	63	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50540	50537	67	67	68	67	Negligible	Medium - High	Not Significant
50540	50695	67	67	69	68	Negligible	Medium - High	Not Significant
50540	52601	Flow too low	Flow too low	59	57	Flow too low	Low - Medium	Flow too low
50541	50656	60	58	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50541	50689	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50541	52311	60	59	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50542	50667	70	70	70	70	Negligible	Medium - High	Not Significant
50542	52243	68	67	69	69	Negligible	Medium - High	Not Significant
50542	52319	69	69	69	69	Negligible	Medium - High	Not Significant
50543	50666	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50543	52579	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50543	53247	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50544	50658	61	60	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50544	50659	67	66	67	66	Negligible	Medium	Not Significant
50544	70009	63	61	63	62	Negligible	Medium	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50545	50641	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50545	50645	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50545	70006	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50546	50647	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50546	50648	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50546	50702	63	62	63	61	No change/Reduction	Medium	Imperceptible/ Positive
50547	50653	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50547	50927	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50548	50641	61	59	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50548	50644	61	60	60	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50549	50550	68	67	68	68	Negligible	Medium - High	Not Significant
50549	52253	66	66	67	66	Negligible	Medium	Not Significant
50549	52260	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
50550	50549	68	67	68	67	Negligible	Medium - High	Not Significant
50550	50632	68	68	69	68	Negligible	Medium - High	Not Significant
50550	53220	65	64	64	64	No change/Reduction	Medium	Imperceptible/ Positive
50551	50513	69	69	70	70	Negligible	Medium - High	Not Significant
50551	50665	72	72	72	72	Negligible	Medium - High	Not Significant
50551	55003	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50552	50631	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50552	52041	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50554	50615	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50554	50618	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50554	50628	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50555	50556	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50555	50558	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50555	50912	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50556	50555	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50556	50557	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50556	50627	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50557	50556	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50557	50976	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50558	50499	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50558	50555	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50558	52598	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50559	50616	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50559	50617	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50559	50618	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50560	50614	68	68	68	68	Negligible	Medium - High	Not Significant
50560	52041	67	66	67	66	Negligible	Medium	Not Significant
50561	50562	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50561	53049	64	63	64	63	Negligible	Medium	Not Significant
50561	53375	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50562	50561	65	64	65	64	Negligible	Medium	Not Significant
50562	50563	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50563	50562	65	64	65	64	Negligible	Medium	Not Significant
50563	50612	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50563	50614	67	66	67	67	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50564	50595	67	66	67	66	Negligible	Medium	Not Significant
50564	50597	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50565	50620	68	68	68	68	Negligible	Medium - High	Not Significant
50565	50912	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50565	52039	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50566	50584	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50566	52242	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50567	50583	69	69	69	69	Negligible	Medium - High	Not Significant
50567	52259	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50568	50569	71	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50568	50582	71	71	71	72	Negligible	Medium - High	Not Significant
50568	50957	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50569	50568	71	71	71	71	Negligible	Medium - High	Not Significant
50569	50570	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50570	50569	71	71	71	71	Negligible	Medium - High	Not Significant
50570	50753	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50570	52675	71	71	71	71	Negligible	Medium - High	Not Significant
50571	50572	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50571	52248	70	70	71	71	Negligible	Medium - High	Not Significant
50572	50571	71	71	71	71	Negligible	Medium - High	Not Significant
50572	50581	68	68	68	68	Negligible	Medium - High	Not Significant
50572	50582	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50575	50624	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50575	53050	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50576	50579	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50576	50604	71	71	71	72	Negligible	Medium - High	Not Significant
50576	50605	68	68	68	68	Negligible	Medium - High	Not Significant
50576	52248	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50577	50491	73	73	72	72	No change/Reduction	High	Imperceptible/ Positive
50577	52561	72	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50577	53051	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50578	50491	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50578	50579	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50578	53052	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50579	50576	73	73	72	72	No change/Reduction	High	Imperceptible/ Positive
50579	50578	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50579	50580	61	59	63	61	Negligible	Medium	Not Significant
50580	50579	63	62	63	62	Negligible	Medium	Not Significant
50580	50581	61	59	63	61	Negligible	Medium	Not Significant
50581	50572	68	67	68	68	Negligible	Medium - High	Not Significant
50581	50580	63	62	63	62	Negligible	Medium	Not Significant
50581	53298	68	68	68	68	Negligible	Medium - High	Not Significant
50582	50568	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50582	50572	71	71	71	72	Negligible	Medium - High	Not Significant
50583	50567	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50583	51375	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50583	52538	69	69	69	69	Negligible	Medium - High	Not Significant
50584	50566	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50584	50593	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50588	50629	71	71	71	71	Negligible	Medium - High	Not Significant
50588	52612	65	65	65	65	No change/Reduction	Medium	Imperceptible/ Positive
50588	52663	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50588	53301	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50589	50590	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50589	50613	64	63	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50589	52663	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50590	50589	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50590	50591	72	72	72	72	Negligible	Medium - High	Not Significant
50590	52275	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50591	50590	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50591	50592	72	72	72	72	Negligible	High	Not Significant - Slight
50591	50974	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50592	50591	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50592	52696	73	73	73	73	Negligible	High	Not Significant - Slight
50592	53053	63	61	63	62	Negligible	Medium	Not Significant
50593	50584	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50593	50594	59	58	59	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
50593	52470	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50594	50593	60	59	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
50594	50596	59	58	59	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
50595	50564	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50595	50596	64	63	64	63	Negligible	Medium	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50595	50885	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50596	50594	60	59	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
50596	50595	62	60	62	60	Negligible	Low - Medium	Not Significant
50596	53306	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50597	50564	67	66	67	66	Negligible	Medium	Not Significant
50597	50598	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50598	50597	67	66	67	66	Negligible	Medium	Not Significant
50598	50599	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50599	50598	67	66	67	66	Negligible	Medium	Not Significant
50599	52259	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50600	50601	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50600	52259	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50600	53309	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50601	50112	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50601	50600	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50603	50909	71	71	71	72	Negligible	Medium - High	Not Significant
50603	52703	71	71	71	71	Negligible	Medium - High	Not Significant
50604	50576	71	71	71	71	Negligible	Medium - High	Not Significant
50604	50606	65	64	65	64	Negligible	Medium	Not Significant
50604	50909	71	72	72	72	Negligible	Medium - High	Not Significant
50605	50576	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50605	52249	68	68	68	68	Negligible	Medium - High	Not Significant
50606	50604	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50606	50607	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50606	50810	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50607	50606	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50607	50608	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50607	53303	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50608	50607	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50608	53053	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50609	50610	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50609	50810	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50610	50609	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50610	50611	68	68	69	68	Negligible	Medium - High	Not Significant
50610	52249	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50611	50610	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50611	50612	68	68	68	68	Negligible	Medium - High	Not Significant
50612	50563	68	68	68	68	Negligible	Medium - High	Not Significant
50612	50611	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50612	52275	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50613	50589	64	63	64	63	Negligible	Medium	Not Significant
50613	53049	64	63	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50614	50560	67	66	67	67	Negligible	Medium - High	Not Significant
50614	50563	68	68	68	68	Negligible	Medium - High	Not Significant
50615	50554	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50615	50616	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50616	50559	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50616	50615	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50617	50559	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50617	53054	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50618	50554	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50618	50559	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50618	50619	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50619	50618	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50619	50620	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50619	53289	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50620	50565	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50620	50619	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50621	50620	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50621	50623	61	60	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50621	53054	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50622	50623	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50622	50932	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50622	70007	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50623	50621	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50623	50622	61	60	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50624	50575	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50624	50626	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50624	50976	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50625	48830	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50625	50499	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50625	53293	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50626	50499	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50626	50624	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50627	50556	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50627	53055	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50628	50554	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50628	53055	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50628	53290	65	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50629	48830	70	70	70	70	Negligible	Medium - High	Not Significant
50629	50588	70	70	70	70	Negligible	Medium - High	Not Significant
50630	48830	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50630	50631	72	73	72	72	No change/Reduction	High	Imperceptible/ Positive
50631	50552	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50631	50630	72	72	72	72	No change/Reduction	High	Imperceptible/ Positive
50631	52598	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50632	50550	68	68	69	68	Negligible	Medium - High	Not Significant
50632	50634	69	69	69	69	Negligible	Medium - High	Not Significant
50632	50643	69	69	70	70	Negligible	Medium - High	Not Significant
50632	50664	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50633	50639	67	67	67	67	Negligible	Medium - High	Not Significant
50633	50660	66	65	66	66	Negligible	Medium	Not Significant
50634	50632	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50634	50822	69	69	69	69	Negligible	Medium - High	Not Significant
50635	50901	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50635	52549	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50635	53218	66	66	66	66	Negligible	Medium	Not Significant
50636	50514	69	69	70	70	Negligible	Medium - High	Not Significant
50636	52628	67	66	67	67	Negligible	Medium - High	Not Significant
50636	55001	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50637	50668	69	68	69	69	Negligible	Medium - High	Not Significant
50637	50903	69	69	69	69	Negligible	Medium - High	Not Significant
50639	50633	66	66	67	66	Negligible	Medium	Not Significant
50639	52253	67	66	67	66	Negligible	Medium	Not Significant
50640	50641	61	60	60	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50640	52548	63	61	63	62	Negligible	Medium	Not Significant
50640	53209	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50641	50545	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50641	50548	61	60	60	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50641	50640	61	59	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50642	50654	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50642	52260	64	64	65	64	Negligible	Medium	Not Significant
50642	53057	70	70	70	70	Negligible	Medium - High	Not Significant
50643	50632	69	69	69	69	Negligible	Medium - High	Not Significant
50643	50673	69	69	70	70	Negligible	Medium - High	Not Significant
50643	53061	Flow too low	Flow too low	63	61	Flow too low	Medium	Flow too low
50644	50548	61	59	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50644	50657	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50644	50660	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50645	50821	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50645	50931	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
50645	52829	61	59	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50646	50926	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50646	52311	59	57	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50646	52604	65	64	65	64	Negligible	Medium	Not Significant
50647	50546	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50647	53063	68	68	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50647	53224	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50648	50546	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50648	53059	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50650	52812	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50650	53059	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50653	50547	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50653	52812	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50654	50642	69	69	69	69	Negligible	Medium - High	Not Significant
50654	52548	66	65	66	65	Negligible	Medium	Not Significant
50654	70006	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50655	50820	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50655	52847	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50656	50541	60	59	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50656	50689	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50656	52312	60	58	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50657	50492	65	64	65	64	Negligible	Medium	Not Significant
50657	50644	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50657	52320	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50658	50544	62	61	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50658	50662	61	60	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50659	50544	67	67	67	67	Negligible	Medium - High	Not Significant
50659	50661	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50659	52320	65	65	66	65	Negligible	Medium	Not Significant
50660	50633	67	67	67	67	Negligible	Medium - High	Not Significant
50660	50644	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50660	70009	64	63	64	63	Negligible	Medium	Not Significant
50661	50659	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50661	50690	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50661	53208	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50662	50658	62	61	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50662	50663	Flow too low	Flow too low	58	56	Flow too low	Low - Medium	Flow too low
50662	53205	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50663	50662	Flow too low	Flow too low	61	59	Flow too low	Low - Medium	Flow too low
50663	52253	Flow too low	Flow too low	58	56	Flow too low	Low - Medium	Flow too low
50664	50632	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50664	50697	68	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50664	53201	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50665	50551	71	72	72	72	Negligible	High	Not Significant - Slight
50665	52243	69	68	70	70	Negligible	Medium - High	Not Significant
50665	53060	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50665	55004	71	71	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50666	50543	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50666	50667	69	68	70	70	Negligible	Medium - High	Not Significant
50666	52006	68	67	68	68	Negligible	Medium - High	Not Significant
50667	50542	69	69	70	70	Negligible	Medium - High	Not Significant
50667	50666	69	69	70	69	Negligible	Medium - High	Not Significant
50667	50907	66	65	66	65	Negligible	Medium	Not Significant
50668	50637	69	69	69	69	Negligible	Medium - High	Not Significant
50668	50905	68	68	69	69	Negligible	Medium - High	Not Significant
50668	53202	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50669	50670	70	70	70	70	Negligible	Medium - High	Not Significant
50669	50905	69	69	69	69	Negligible	Medium - High	Not Significant
50669	53200	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50669	59010	68	68	69	69	Negligible	Medium - High	Not Significant
50670	50669	71	71	72	72	Negligible	Medium - High	Not Significant
50670	50678	70	70	70	70	Negligible	Medium - High	Not Significant
50671	50680	69	69	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50671	50904	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50671	70001	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50673	50643	69	69	70	69	Negligible	Medium - High	Not Significant
50673	50678	70	70	71	71	Negligible	Medium - High	Not Significant
50673	50680	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50678	50670	70	70	71	71	Negligible	Medium - High	Not Significant
50678	50673	71	71	71	71	Negligible	Medium - High	Not Significant
50680	50671	68	68	68	68	Negligible	Medium - High	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50680	50673	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50681	50683	72	72	74	74	Negligible	High	Not Significant - Slight
50681	50741	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50681	52325	67	67	72	73	Moderate	High	Significant
50682	50683	72	72	74	75	Negligible	High	Not Significant - Slight
50682	52252	70	71	73	74	Minor	High	Slight - Moderate
50682	52669	70	69	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50683	50681	73	73	75	76	Negligible	High	Not Significant - Slight
50683	50682	71	72	74	74	Negligible	High	Not Significant - Slight
50683	50985	67	67	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50684	50772	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50684	50937	71	71	72	73	Negligible	High	Not Significant - Slight
50684	50938	71	71	71	71	Negligible	Medium - High	Not Significant
50685	50687	66	65	66	65	Negligible	Medium	Not Significant
50685	50688	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50685	52844	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50686	50685	66	66	66	66	Negligible	Medium	Not Significant
50687	50701	68	67	68	68	Negligible	Medium - High	Not Significant
50687	52844	66	65	66	65	Negligible	Medium	Not Significant
50688	50685	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50689	50541	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50689	50656	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50689	53208	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50690	50661	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50690	50691	63	61	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50690	50692	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50691	50490	63	61	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50691	50690	61	59	61	59	Negligible	Low - Medium	Not Significant
50691	50692	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50692	50690	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50692	50691	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50692	50693	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50693	50692	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50693	50694	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50694	50693	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50694	50696	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50694	50701	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50695	50540	68	67	68	68	Negligible	Medium - High	Not Significant
50695	52315	68	68	69	69	Negligible	Medium - High	Not Significant
50695	53225	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50696	50490	61	59	61	59	Negligible	Low - Medium	Not Significant
50696	50694	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50696	52550	63	62	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive
50697	50664	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50697	52313	68	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50698	50537	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50698	50539	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50698	52290	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50699	50538	71	71	71	71	Negligible	Medium - High	Not Significant
50699	50700	71	71	71	71	Negligible	Medium - High	Not Significant
50700	50699	71	71	71	71	Negligible	Medium - High	Not Significant
50700	52292	66	66	67	66	Negligible	Medium	Not Significant
50700	52601	70	70	70	70	Negligible	Medium - High	Not Significant
50700	53396	64	62	65	64	Negligible	Medium	Not Significant
50701	50687	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50701	50694	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50701	52600	69	69	69	69	Negligible	Medium - High	Not Significant
50702	50546	63	62	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50702	52816	61	59	60	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50703	50536	63	62	63	62	Negligible	Medium	Not Significant
50703	50928	64	63	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50704	50536	68	68	68	68	Negligible	Medium - High	Not Significant
50704	50710	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50704	53224	67	66	67	67	Negligible	Medium - High	Not Significant
50706	50708	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50707	50711	68	67	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50707	52308	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50707	53048	68	68	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50708	50706	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50708	53048	68	67	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50708	53063	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50709	50717	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50709	50929	69	69	69	69	Negligible	Medium - High	Not Significant
50709	52288	63	62	63	61	No change/Reduction	Medium	Imperceptible/ Positive
50710	50704	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50710	53063	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50711	50707	68	68	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50711	50712	67	67	65	65	No change/Reduction	Medium	Imperceptible/ Positive
50711	50713	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50712	50711	68	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50712	52246	67	67	65	65	No change/Reduction	Medium	Imperceptible/ Positive
50713	50711	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50713	50715	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50713	53227	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50714	50715	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50714	52307	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50714	52308	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50715	50533	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50715	50713	63	62	63	62	Negligible	Medium	Not Significant
50715	50714	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50716	50717	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50716	52307	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50716	53226	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50717	50534	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50717	50709	69	69	69	69	Negligible	Medium - High	Not Significant
50717	50716	65	64	65	64	Negligible	Medium	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50718	50933	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50718	52257	67	66	67	66	Negligible	Medium	Not Significant
50718	52289	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50719	50537	66	65	66	65	Negligible	Medium	Not Significant
50719	50538	63	62	63	61	No change/Reduction	Medium	Imperceptible/ Positive
50719	50935	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50720	52301	65	65	66	66	Negligible	Medium	Not Significant
50721	52556	65	64	68	67	Negligible	Medium - High	Not Significant
50721	52805	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50722	50721	70	70	71	71	Negligible	Medium - High	Not Significant
50723	50722	65	64	67	66	Negligible	Medium	Not Significant
50723	50726	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50724	50809	71	71	71	71	Negligible	Medium - High	Not Significant
50724	53064	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50725	53386	69	69	70	70	Negligible	Medium - High	Not Significant
50726	50531	60	58	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50726	50925	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50727	50933	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50728	52329	Flow too low	Flow too low	64	63	Flow too low	Medium	Flow too low
50729	50526	65	64	68	68	Minor	Medium - High	Slight
50729	50529	71	71	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50729	50748	68	67	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50730	52329	65	64	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50731	50734	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50731	52233	71	71	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50731	52270	70	70	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50732	50733	Flow too low	Flow too low	70	70	Flow too low	Medium - High	Flow too low
50732	50918	72	73	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50732	50920	73	73	72	72	No change/Reduction	High	Imperceptible/ Positive
50733	50732	Flow too low	Flow too low	70	69	Flow too low	Medium - High	Flow too low
50733	59006	Flow too low	Flow too low	68	67	Flow too low	Medium - High	Flow too low
50734	50529	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50735	50737	Flow too low	Flow too low	69	69	Flow too low	Medium - High	Flow too low
50735	52232	72	73	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50735	52233	71	71	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50736	50737	67	67	72	73	Moderate	High	Significant
50736	52326	71	71	72	73	Negligible	High	Not Significant - Slight
50736	53273	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50737	50735	Flow too low	Flow too low	69	69	Flow too low	Medium - High	Flow too low
50737	50736	68	68	72	72	Minor	High	Slight - Moderate
50737	50740	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50737	52941	72	72	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50737	52942	70	70	73	73	Minor	High	Slight - Moderate
50738	50498	71	71	72	72	Negligible	Medium - High	Not Significant
50738	50739	71	71	72	72	Negligible	High	Not Significant - Slight
50739	50738	71	71	72	72	Negligible	Medium - High	Not Significant
50739	50740	71	71	71	71	Negligible	Medium - High	Not Significant
50739	53283	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50740	50737	71	71	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50740	50739	70	70	71	71	Negligible	Medium - High	Not Significant
50740	50797	Flow too low	Flow too low	70	69	Flow too low	Medium - High	Flow too low
50740	53278	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50741	50495	69	69	74	74	Minor	High	Slight - Moderate
50741	50497	69	69	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50741	50498	Flow too low	Flow too low	72	72	Flow too low	High	Flow too low
50741	50681	72	72	72	72	Negligible	High	Not Significant - Slight
50742	50743	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50742	50744	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50743	50528	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50743	50742	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50744	50742	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50744	50745	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50744	52603	73	74	73	74	Negligible	High	Not Significant - Slight
50745	50528	66	65	66	65	Negligible	Medium	Not Significant
50745	50744	73	73	73	73	Negligible	High	Not Significant - Slight
50745	50959	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50746	50527	73	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50746	50749	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50746	52943	71	72	72	72	Negligible	Medium - High	Not Significant
50747	50512	72	72	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50747	52284	72	73	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50747	52304	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50747	52599	71	71	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50748	50749	72	73	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50749	50746	73	73	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50749	52305	67	67	70	70	Negligible	Medium - High	Not Significant
50750	50755	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50750	53287	61	59	61	60	Negligible	Low - Medium	Not Significant
50752	50964	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
50752	52332	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
50753	50570	72	72	72	72	Negligible	Medium - High	Not Significant
50753	50964	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50753	53382	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50754	48006	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50754	52672	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50754	52674	70	70	70	70	Negligible	Medium - High	Not Significant
50755	50750	61	59	61	60	Negligible	Low - Medium	Not Significant
50755	52674	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50755	53284	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50760	50486	75	75	76	77	Negligible	High	Not Significant - Slight
50760	50761	74	74	75	76	Negligible	High	Not Significant - Slight
50761	50487	75	75	75	75	No change/Reduction	High	Imperceptible/ Positive
50761	50760	75	75	76	77	Negligible	High	Not Significant - Slight
50761	50961	74	74	72	73	No change/Reduction	High	Imperceptible/ Positive
50761	52820	73	73	73	74	Negligible	High	Not Significant - Slight
50762	50763	68	68	68	68	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50762	50767	69	69	70	69	Negligible	Medium - High	Not Significant
50762	53285	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50763	50762	67	66	67	67	Negligible	Medium - High	Not Significant
50763	50945	67	67	67	67	Negligible	Medium - High	Not Significant
50763	50954	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50766	48006	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50766	50767	69	69	69	69	Negligible	Medium - High	Not Significant
50766	70008	70	69	70	70	Negligible	Medium - High	Not Significant
50767	50762	70	70	70	70	Negligible	Medium - High	Not Significant
50767	50766	69	68	69	69	Negligible	Medium - High	Not Significant
50768	50525	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50768	50947	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50769	52367	67	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50769	52584	66	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50770	50525	65	64	65	64	Negligible	Medium	Not Significant
50770	51400	64	63	64	63	Negligible	Medium	Not Significant
50770	53313	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
50771	50524	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50771	50775	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50771	52553	67	67	68	67	Negligible	Medium - High	Not Significant
50772	50684	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50772	50773	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50773	50772	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50773	53251	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50774	50916	Flow too low	Flow too low	63	62	Flow too low	Medium	Flow too low
50774	50941	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50774	50942	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50775	50522	68	68	69	68	Negligible	Medium - High	Not Significant
50775	50771	71	71	71	71	Negligible	Medium - High	Not Significant
50775	52245	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50776	50521	69	69	69	69	Negligible	Medium - High	Not Significant
50776	50522	69	69	70	70	Negligible	Medium - High	Not Significant
50777	50779	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50777	50915	70	70	70	70	Negligible	Medium - High	Not Significant
50778	50779	70	69	70	70	Negligible	Medium - High	Not Significant
50778	52319	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50778	52628	67	66	68	67	Negligible	Medium - High	Not Significant
50779	50777	70	70	70	70	Negligible	Medium - High	Not Significant
50779	50778	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50779	53250	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50780	50940	65	64	67	67	Negligible	Medium - High	Not Significant
50780	52568	67	66	68	68	Negligible	Medium - High	Not Significant
50780	53364	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50781	50914	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50781	52785	70	70	70	70	Negligible	Medium - High	Not Significant
50783	52785	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50785	50516	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50785	50517	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50785	52272	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50786	50789	64	63	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50786	50790	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50786	50793	64	63	65	65	Negligible	Medium	Not Significant
50787	50790	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50787	50936	61	60	62	61	Negligible	Low - Medium	Not Significant
50787	58002	66	66	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50788	50519	62	61	63	62	Negligible	Medium	Not Significant
50788	52318	61	59	62	61	Negligible	Medium	Not Significant
50789	50517	Flow too low	Flow too low	62	61	Flow too low	Low - Medium	Flow too low
50789	50786	64	63	63	61	No change/Reduction	Medium	Imperceptible/ Positive
50789	53235	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50790	50786	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50790	50787	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50790	50791	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50791	50790	66	65	66	65	Negligible	Medium	Not Significant
50791	52250	71	72	72	72	Negligible	High	Not Significant - Slight
50791	52251	71	71	72	72	Negligible	Medium - High	Not Significant
50792	52285	69	69	70	70	Negligible	Medium - High	Not Significant
50792	52309	62	61	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
50792	52611	67	67	69	69	Negligible	Medium - High	Not Significant
50793	50786	66	65	67	66	Negligible	Medium	Not Significant
50793	52285	69	69	70	69	Negligible	Medium - High	Not Significant
50793	53046	70	70	71	71	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50794	52305	67	67	70	70	Minor	Medium - High	Slight
50794	53270	67	66	69	69	Negligible	Medium - High	Not Significant
50795	50796	72	73	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50795	50800	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50795	52284	72	73	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
50796	50508	62	60	64	63	Negligible	Medium	Not Significant
50796	50510	Flow too low	Flow too low	72	72	Flow too low	High	Flow too low
50796	50795	72	73	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
50796	50797	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50796	50800	Flow too low	Flow too low	65	65	Flow too low	Medium	Flow too low
50797	50509	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50797	50740	Flow too low	Flow too low	70	69	Flow too low	Medium - High	Flow too low
50797	50796	72	73	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50797	50802	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50797	50967	Flow too low	#DIV/0!	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50797	52941	Flow too low	Flow too low	70	69	Flow too low	Medium - High	Flow too low
50798	50510	74	74	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50798	50799	59	58	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50798	50918	74	74	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50798	52297	65	65	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50799	50798	62	60	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50799	50802	59	58	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50800	52052	Flow too low	Flow too low	65	65	Flow too low	Medium	Flow too low
50801	52294	Flow too low	Flow too low	65	65	Flow too low	Medium	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50802	50508	61	60	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50802	50797	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50802	50799	62	60	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50803	50804	65	64	67	67	Negligible	Medium - High	Not Significant
50803	50919	63	62	67	66	Minor	Medium	Slight
50803	52309	64	62	63	61	No change/Reduction	Medium	Imperceptible/ Positive
50804	50803	66	65	68	67	Negligible	Medium - High	Not Significant
50804	53233	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50804	53402	65	65	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50805	52256	68	68	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50805	52310	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50805	52949	67	67	68	67	Negligible	Medium - High	Not Significant
50806	50807	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
50806	51362	70	70	70	70	Negligible	Medium - High	Not Significant
50806	51363	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50807	50806	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50807	51371	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50808	50809	62	61	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive
50808	53064	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50808	53265	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50809	50723	71	71	71	71	Negligible	Medium - High	Not Significant
50809	50808	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
50810	50606	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50810	50609	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50811	50814	65	64	65	64	Negligible	Medium	Not Significant
50811	50815	66	65	66	65	Negligible	Medium	Not Significant
50811	53211	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50812	50813	66	65	66	65	Negligible	Medium	Not Significant
50812	50815	64	63	64	63	Negligible	Medium	Not Significant
50813	50812	64	63	64	63	Negligible	Medium	Not Significant
50813	50823	68	68	68	68	Negligible	Medium - High	Not Significant
50813	50824	68	68	69	68	Negligible	Medium - High	Not Significant
50814	50811	65	64	65	65	Negligible	Medium	Not Significant
50814	53067	65	64	65	64	Negligible	Medium	Not Significant
50815	50811	64	63	64	63	Negligible	Medium	Not Significant
50815	50812	66	65	66	65	Negligible	Medium	Not Significant
50816	52708	71	71	71	71	Negligible	Medium - High	Not Significant
50816	53057	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50817	50819	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50817	53067	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50818	50819	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50818	50841	71	71	71	71	Negligible	Medium - High	Not Significant
50818	52255	68	67	68	68	Negligible	Medium - High	Not Significant
50819	50817	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50819	50818	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50819	53242	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50820	52812	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50821	50655	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50821	52830	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50822	50634	70	70	70	70	Negligible	Medium - High	Not Significant
50822	50823	68	68	68	68	Negligible	Medium - High	Not Significant
50822	53203	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50823	50813	68	68	68	68	Negligible	Medium - High	Not Significant
50823	50822	68	68	68	68	Negligible	Medium - High	Not Significant
50824	50813	69	69	69	69	Negligible	Medium - High	Not Significant
50824	50825	68	68	69	68	Negligible	Medium - High	Not Significant
50824	52255	67	67	68	67	Negligible	Medium - High	Not Significant
50825	50824	68	68	69	68	Negligible	Medium - High	Not Significant
50825	50877	68	68	69	68	Negligible	Medium - High	Not Significant
50829	50876	66	66	66	66	Negligible	Medium	Not Significant
50835	50507	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50835	51331	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50835	51332	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50836	48913	74	75	74	75	Negligible	High	Not Significant - Slight
50836	50507	74	75	74	74	No change/Reduction	High	Imperceptible/ Positive
50836	53362	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50841	50818	70	70	70	70	Negligible	Medium - High	Not Significant
50851	50506	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50851	52677	66	66	67	66	Negligible	Medium	Not Significant
50851	52702	67	66	67	66	Negligible	Medium	Not Significant
50857	50860	73	74	74	74	Negligible	High	Not Significant - Slight
50857	52695	73	74	73	74	Negligible	High	Not Significant - Slight

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50858	50859	71	71	71	72	Negligible	Medium - High	Not Significant
50858	51376	72	72	72	72	Negligible	High	Not Significant - Slight
50859	50858	73	73	73	73	Negligible	High	Not Significant - Slight
50859	50860	71	71	72	72	Negligible	Medium - High	Not Significant
50860	40004	74	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50860	50857	74	75	74	75	Negligible	High	Not Significant - Slight
50860	50859	73	73	73	73	Negligible	High	Not Significant - Slight
50861	50863	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50863	50861	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50863	50864	67	67	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
50863	53214	Flow too low	#DIV/0!	Flow too low	#DIV/0!	Flow too low	Flow too low	Flow too low
50864	50863	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50864	50865	67	67	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
50865	50864	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50865	53454	66	65	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50868	50872	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50868	53454	66	65	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50869	52529	67	66	67	66	Negligible	Medium	Not Significant
50869	52569	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50870	50871	72	73	72	72	No change/Reduction	High	Imperceptible/ Positive
50870	51378	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
50870	53348	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50871	40018	73	74	74	74	Negligible	High	Not Significant - Slight
50871	50870	72	73	72	72	No change/Reduction	High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50871	52452	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50872	50868	66	65	66	65	Negligible	Medium	Not Significant
50872	52529	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50875	52518	67	67	68	67	Negligible	Medium - High	Not Significant
50875	52520	67	66	68	67	Negligible	Medium - High	Not Significant
50876	50829	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50876	50877	66	66	66	66	Negligible	Medium	Not Significant
50877	50825	68	68	69	68	Negligible	Medium - High	Not Significant
50877	50876	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50877	52518	66	65	67	66	Negligible	Medium	Not Significant
50885	50595	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50885	52467	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50885	52469	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50887	50892	68	68	68	68	Negligible	Medium - High	Not Significant
50887	52528	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50888	50889	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50888	50892	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50889	50888	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50889	50890	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50890	48220	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50890	50889	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50892	50887	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50892	50888	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50892	51325	66	66	67	66	Negligible	Medium	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50892	53174	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50894	51374	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50894	52534	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50894	53390	71	71	71	71	Negligible	Medium - High	Not Significant
50895	40009	67	66	67	67	Negligible	Medium - High	Not Significant
50895	52474	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50895	52533	69	69	69	69	Negligible	Medium - High	Not Significant
50896	50117	73	73	73	73	Negligible	High	Not Significant - Slight
50896	51364	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50896	52613	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50897	50117	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50897	52348	64	63	64	63	Negligible	Medium	Not Significant
50900	48221	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50900	52545	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50901	50635	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50901	50900	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50902	48220	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50902	50904	69	69	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50903	50637	69	69	70	69	Negligible	Medium - High	Not Significant
50903	51329	68	68	69	68	Negligible	Medium - High	Not Significant
50904	50671	69	69	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50904	50902	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50905	50668	68	68	69	68	Negligible	Medium - High	Not Significant
50905	50669	68	68	69	69	Negligible	Medium - High	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50906	55004	71	71	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50906	59010	69	68	69	68	Negligible	Medium - High	Not Significant
50907	50667	65	65	66	65	Negligible	Medium	Not Significant
50907	52609	65	64	65	64	Negligible	Medium	Not Significant
50907	53249	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
50909	50603	71	72	72	72	Negligible	Medium - High	Not Significant
50909	50604	71	71	71	72	Negligible	Medium - High	Not Significant
50910	40020	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50910	50911	75	75	75	75	No change/Reduction	High	Imperceptible/ Positive
50910	51403	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
50911	50910	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
50911	51402	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50912	50555	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50912	50565	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50912	53292	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50914	50523	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50914	50781	71	71	71	71	Negligible	Medium - High	Not Significant
50915	50493	70	70	70	70	Negligible	Medium - High	Not Significant
50915	50777	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50915	53398	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50916	50493	Flow too low	Flow too low	63	62	Flow too low	Medium	Flow too low
50916	50774	Flow too low	Flow too low	59	57	Flow too low	Low - Medium	Flow too low
50917	50493	69	68	69	68	Negligible	Medium - High	Not Significant
50917	50494	69	69	70	70	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50917	53357	58	56	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
50918	50732	73	73	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50918	50798	74	74	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50918	59008	69	69	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50919	50803	65	64	66	66	Negligible	Medium	Not Significant
50919	52251	63	62	67	66	Minor	Medium	Slight
50920	50732	73	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50920	50944	73	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50921	50513	70	70	71	71	Negligible	Medium - High	Not Significant
50921	52273	69	69	70	70	Negligible	Medium - High	Not Significant
50922	50923	71	71	72	72	Negligible	Medium - High	Not Significant
50922	55000	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50923	50783	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50923	50922	70	70	70	70	Negligible	Medium - High	Not Significant
50923	52785	71	71	72	72	Negligible	Medium - High	Not Significant
50924	52299	67	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50925	50531	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
50925	52246	72	73	72	73	Negligible	High	Not Significant - Slight
50926	50646	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50926	52845	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50927	50926	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50928	50703	63	62	63	62	Negligible	Medium	Not Significant
50928	50929	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50928	53396	67	67	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50929	50709	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50929	50928	68	67	68	67	Negligible	Medium - High	Not Significant
50929	52254	65	64	65	64	Negligible	Medium	Not Significant
50930	52583	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
50930	53383	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
50931	50492	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
50931	50645	64	63	64	63	Negligible	Medium	Not Significant
50932	50622	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
50932	52039	72	72	72	72	No change/Reduction	High	Imperceptible/ Positive
50932	52041	72	72	72	72	No change/Reduction	High	Imperceptible/ Positive
50933	50718	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50933	50934	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50934	50933	66	65	67	66	Negligible	Medium	Not Significant
50934	50935	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50935	50719	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50935	50934	66	65	67	66	Negligible	Medium	Not Significant
50935	52254	63	62	63	62	Negligible	Medium	Not Significant
50936	50518	61	60	62	61	Negligible	Low - Medium	Not Significant
50936	50787	63	62	63	62	Negligible	Medium	Not Significant
50937	50684	71	71	71	71	Negligible	Medium - High	Not Significant
50937	52234	71	71	72	73	Negligible	High	Not Significant - Slight
50938	50684	71	72	73	73	Negligible	High	Not Significant - Slight
50938	50939	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50938	59011	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50939	50938	70	70	71	72	Negligible	Medium - High	Not Significant
50939	52235	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50940	50780	66	65	67	67	Negligible	Medium - High	Not Significant
50940	53259	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
50940	59011	61	60	61	60	Negligible	Low - Medium	Not Significant
50941	50520	70	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50941	50774	69	69	70	70	Negligible	Medium - High	Not Significant
50941	52568	66	66	67	67	Negligible	Medium - High	Not Significant
50942	50486	75	76	76	77	Negligible	High	Not Significant - Slight
50942	50774	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50942	52235	70	70	71	72	Negligible	Medium - High	Not Significant
50942	52770	73	74	74	74	Negligible	High	Not Significant - Slight
50943	52032	70	70	70	70	Negligible	Medium - High	Not Significant
50943	52785	68	68	70	70	Negligible	Medium - High	Not Significant
50944	50920	73	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50944	52230	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50944	58001	69	69	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50945	50525	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50945	50763	66	65	67	66	Negligible	Medium	Not Significant
50945	52585	67	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50946	50948	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50946	50949	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50946	52011	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50947	50768	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50947	52011	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50948	50946	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50948	52009	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50949	50946	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50949	50950	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50950	50949	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50950	50953	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50951	50953	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50951	50955	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50952	50955	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50952	52360	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50953	50950	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50953	50951	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50954	50763	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50954	52011	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50954	53070	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50955	50951	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50955	50952	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50955	53070	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50956	52120	74	74	74	74	Negligible	High	Not Significant - Slight
50956	52564	73	74	73	74	Negligible	High	Not Significant - Slight
50957	50568	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
50958	50527	72	73	72	72	No change/Reduction	High	Imperceptible/ Positive
50958	50959	73	73	73	73	Negligible	High	Not Significant - Slight

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50959	50745	72	72	72	73	Negligible	High	Not Significant - Slight
50959	50958	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
50960	50961	73	74	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50960	50962	72	73	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50960	52665	69	69	70	70	Negligible	Medium - High	Not Significant
50961	50761	73	74	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
50961	50960	74	74	72	73	No change/Reduction	High	Imperceptible/ Positive
50962	50511	72	73	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
50962	50960	72	72	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
50963	52688	74	75	74	75	Negligible	High	Not Significant - Slight
50963	53004	74	75	74	74	No change/Reduction	High	Imperceptible/ Positive
50964	50752	74	74	73	74	No change/Reduction	High	Imperceptible/ Positive
50964	50753	71	72	72	72	Negligible	Medium - High	Not Significant
50964	52603	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
50964	52686	70	69	71	71	Negligible	Medium - High	Not Significant
50967	50797	65	65	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50967	50800	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50968	51327	66	65	66	66	Negligible	Medium	Not Significant
50968	52546	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
50968	53219	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50969	51332	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50969	51397	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50974	50591	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
50976	50557	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
50976	50624	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
50984	53325	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
50984	53394	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
50984	53400	74	75	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
50985	50683	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
51325	50892	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
51325	52544	63	61	63	61	Negligible	Medium	Not Significant
51325	52546	65	64	66	65	Negligible	Medium	Not Significant
51326	52570	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
51326	52602	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
51327	50968	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
51327	51328	66	65	66	66	Negligible	Medium	Not Significant
51328	51327	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
51328	51415	70	70	70	70	Negligible	Medium - High	Not Significant
51328	52007	70	70	70	70	Negligible	Medium - High	Not Significant
51329	50903	69	69	70	69	Negligible	Medium - High	Not Significant
51329	52007	68	68	69	68	Negligible	Medium - High	Not Significant
51330	48151	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
51330	52245	71	72	71	72	Negligible	Medium - High	Not Significant
51330	53334	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51331	50835	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51331	52605	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51332	50835	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51332	50969	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
51333	50503	67	67	67	67	Negligible	Medium - High	Not Significant
51333	53311	70	69	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
51334	51335	70	70	70	70	Negligible	Medium - High	Not Significant
51334	52539	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
51335	50502	69	69	69	69	Negligible	Medium - High	Not Significant
51335	51334	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
51335	53366	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
51336	52471	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
51336	52472	67	67	67	67	Negligible	Medium - High	Not Significant
51337	51368	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
51337	51369	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
51344	52515	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
51347	50155	73	73	73	74	Negligible	High	Not Significant - Slight
51349	50158	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
51349	51351	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
51349	53096	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
51350	51351	64	63	66	65	Negligible	Medium	Not Significant
51350	51360	66	65	66	65	Negligible	Medium	Not Significant
51351	51349	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
51351	51350	66	65	66	65	Negligible	Medium	Not Significant
51351	51358	68	67	68	68	Negligible	Medium - High	Not Significant
51352	51361	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
51352	53096	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
51357	40018	73	74	73	74	Negligible	High	Not Significant - Slight

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
51357	50420	73	74	73	74	Negligible	High	Not Significant - Slight
51358	40002	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
51358	51351	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
51358	51359	67	66	68	67	Negligible	Medium - High	Not Significant
51358	53324	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
51359	51358	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
51359	52451	67	66	68	67	Negligible	Medium - High	Not Significant
51360	51350	66	65	67	67	Negligible	Medium - High	Not Significant
51360	53020	66	65	66	65	Negligible	Medium	Not Significant
51361	51352	73	74	75	75	Negligible	High	Not Significant - Slight
51361	53097	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
51362	50806	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
51362	52613	70	70	70	70	Negligible	Medium - High	Not Significant
51363	40009	69	69	69	69	Negligible	Medium - High	Not Significant
51363	50806	69	69	69	69	Negligible	Medium - High	Not Significant
51363	52348	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
51363	52614	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
51364	50896	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
51364	51370	64	63	63	62	No change/Reduction	Medium	Imperceptible/ Positive
51364	53098	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51367	51368	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
51367	52038	75	76	75	75	No change/Reduction	High	Imperceptible/ Positive
51368	50500	67	67	67	67	Negligible	Medium - High	Not Significant
51368	51337	75	76	75	76	No change/Reduction	High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
51368	51367	75	76	75	76	No change/Reduction	High	Imperceptible/ Positive
51369	51337	75	75	75	75	No change/Reduction	High	Imperceptible/ Positive
51369	51371	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
51370	51364	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
51370	53099	64	63	63	62	No change/Reduction	Medium	Imperceptible/ Positive
51371	50807	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
51371	51369	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
51371	53099	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
51372	50108	71	71	71	71	Negligible	Medium - High	Not Significant
51374	50149	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
51374	50894	69	69	69	69	Negligible	Medium - High	Not Significant
51374	51375	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51375	50583	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51375	51374	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51376	50858	71	71	71	72	Negligible	Medium - High	Not Significant
51376	51377	72	73	72	73	Negligible	High	Not Significant - Slight
51376	53319	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
51377	50147	72	72	72	72	Negligible	Medium - High	Not Significant
51377	51376	70	70	71	71	Negligible	Medium - High	Not Significant
51378	40004	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
51378	50870	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
51378	51379	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
51379	50138	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
51379	51378	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
51379	53323	59	57	59	57	Negligible	Low - Medium	Not Significant
51389	51391	74	74	74	74	Negligible	High	Not Significant - Slight
51391	51389	76	76	76	77	Negligible	High	Not Significant - Slight
51391	52123	74	75	74	75	Negligible	High	Not Significant - Slight
51391	52636	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
51392	51394	66	66	67	66	Negligible	Medium	Not Significant
51394	51392	69	69	70	70	Negligible	Medium - High	Not Significant
51394	52123	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
51394	53322	70	70	71	71	Negligible	Medium - High	Not Significant
51397	50969	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51400	50770	64	62	64	63	Negligible	Medium	Not Significant
51400	53145	64	63	64	63	Negligible	Medium	Not Significant
51401	48222	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
51401	48896	71	71	71	71	Negligible	Medium - High	Not Significant
51401	51414	63	62	62	61	No change/Reduction	Medium	Imperceptible/ Positive
51401	52006	68	68	69	69	Negligible	Medium - High	Not Significant
51402	48151	71	71	71	71	Negligible	Medium - High	Not Significant
51402	50911	75	76	75	76	No change/Reduction	High	Imperceptible/ Positive
51402	52324	60	58	61	59	Negligible	Low - Medium	Not Significant
51403	50910	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
51410	51413	64	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
51411	40020	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
51411	51413	60	58	61	60	Negligible	Low - Medium	Not Significant
51411	52323	59	58	61	60	Negligible	Low - Medium	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
51412	51413	63	62	62	61	No change/Reduction	Medium	Imperceptible/ Positive
51412	51414	61	60	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
51413	51410	65	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
51413	51411	61	59	63	62	Negligible	Medium	Not Significant
51413	51412	61	60	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
51413	51415	64	63	64	63	Negligible	Medium	Not Significant
51414	51401	61	60	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
51414	51412	63	62	62	61	No change/Reduction	Medium	Imperceptible/ Positive
51415	51328	69	69	70	70	Negligible	Medium - High	Not Significant
51415	51413	62	61	64	63	Negligible	Medium	Not Significant
51415	51416	69	68	69	68	Negligible	Medium - High	Not Significant
51415	52602	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
51416	51415	67	66	67	67	Negligible	Medium - High	Not Significant
52006	50666	68	68	69	69	Negligible	Medium - High	Not Significant
52006	51401	68	67	68	68	Negligible	Medium - High	Not Significant
52007	48222	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52007	51328	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52007	51329	69	68	69	69	Negligible	Medium - High	Not Significant
52007	52549	67	67	67	67	Negligible	Medium - High	Not Significant
52008	52579	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
52008	53149	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52009	50948	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52009	52010	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52009	53296	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52010	52009	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52010	52564	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52011	50946	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52011	50947	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52011	50954	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52012	52537	67	67	67	67	Negligible	Medium - High	Not Significant
52012	52541	69	69	70	69	Negligible	Medium - High	Not Significant
52012	53150	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52031	52032	68	68	70	70	Negligible	Medium - High	Not Significant
52031	52037	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52031	52234	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52032	50943	68	68	70	70	Negligible	Medium - High	Not Significant
52032	52031	70	70	70	70	Negligible	Medium - High	Not Significant
52034	52230	65	64	64	64	No change/Reduction	Medium	Imperceptible/ Positive
52037	52031	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52038	48830	72	73	72	73	No change/Reduction	High	Imperceptible/ Positive
52038	51367	75	76	75	76	No change/Reduction	High	Imperceptible/ Positive
52039	50565	68	68	68	68	Negligible	Medium - High	Not Significant
52039	50932	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52039	53291	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52041	50552	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52041	50560	68	68	68	68	Negligible	Medium - High	Not Significant
52041	50932	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52052	50967	65	65	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52052	52306	63	62	65	65	Negligible	Medium	Not Significant
52081	50035	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52118	48888	72	73	72	73	No change/Reduction	High	Imperceptible/ Positive
52118	48890	70	70	70	70	Negligible	Medium - High	Not Significant
52118	52363	74	75	74	75	Negligible	High	Not Significant - Slight
52119	48888	73	74	73	74	Negligible	High	Not Significant - Slight
52119	50137	76	77	76	77	Negligible	High	Not Significant - Slight
52119	53367	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
52120	50956	74	74	74	75	Negligible	High	Not Significant - Slight
52120	52565	74	74	74	74	Negligible	High	Not Significant - Slight
52123	50501	76	77	76	77	No change/Reduction	High	Imperceptible/ Positive
52123	51391	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
52123	51394	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52230	50944	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
52230	52034	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52230	52234	72	72	73	73	Negligible	High	Not Significant - Slight
52230	52250	71	72	72	72	Negligible	High	Not Significant - Slight
52231	52278	69	69	70	69	Negligible	Medium - High	Not Significant
52231	52306	65	64	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52231	53160	70	70	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52232	50526	72	73	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52232	50735	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52233	50731	70	70	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52233	50735	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52233	53271	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52234	50937	71	71	71	71	Negligible	Medium - High	Not Significant
52234	52031	68	68	69	69	Negligible	Medium - High	Not Significant
52234	52230	73	73	74	74	Negligible	High	Not Significant - Slight
52235	50939	70	70	71	72	Negligible	Medium - High	Not Significant
52235	50942	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52241	52242	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52241	52663	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52242	50566	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52242	52241	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52243	50542	69	68	70	70	Negligible	Medium - High	Not Significant
52243	50665	68	67	69	69	Negligible	Medium - High	Not Significant
52244	52245	65	64	65	64	Negligible	Medium	Not Significant
52244	52609	64	63	65	64	Negligible	Medium	Not Significant
52245	50775	71	71	71	71	Negligible	Medium - High	Not Significant
52245	51330	71	71	72	72	Negligible	Medium - High	Not Significant
52245	52244	64	63	65	64	Negligible	Medium	Not Significant
52246	50532	71	71	72	72	Negligible	Medium - High	Not Significant
52246	50712	68	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52246	50925	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52248	50571	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52248	50576	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52248	52707	73	73	72	72	No change/Reduction	High	Imperceptible/ Positive
52249	50605	69	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52249	50610	68	67	68	67	Negligible	Medium - High	Not Significant
52250	50791	72	72	72	73	Negligible	High	Not Significant - Slight
52250	52230	72	72	72	72	Negligible	High	Not Significant - Slight
52250	53234	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52251	50791	71	71	72	72	Negligible	Medium - High	Not Significant
52251	50919	65	64	66	66	Negligible	Medium	Not Significant
52251	52285	71	71	71	71	Negligible	Medium - High	Not Significant
52252	50682	71	71	74	75	Minor	High	Slight - Moderate
52252	52322	72	72	74	75	Negligible	High	Not Significant - Slight
52252	53266	64	63	64	63	Negligible	Medium	Not Significant
52253	50549	67	66	67	67	Negligible	Medium - High	Not Significant
52253	50639	66	66	67	66	Negligible	Medium	Not Significant
52253	50663	Flow too low	Flow too low	61	59	Flow too low	Low - Medium	Flow too low
52254	50929	63	62	63	62	Negligible	Medium	Not Significant
52254	50935	65	64	65	64	Negligible	Medium	Not Significant
52255	50818	68	68	68	68	Negligible	Medium - High	Not Significant
52255	50824	68	68	69	68	Negligible	Medium - High	Not Significant
52256	50489	68	68	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52256	50805	65	64	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52256	53232	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52257	50718	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52257	52274	69	69	70	69	Negligible	Medium - High	Not Significant
52257	52611	69	69	70	70	Negligible	Medium - High	Not Significant
52258	50725	Flow too low	Flow too low	65	64	Flow too low	Medium	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52259	50567	69	69	69	69	Negligible	Medium - High	Not Significant
52259	50599	67	66	67	66	Negligible	Medium	Not Significant
52259	50600	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52260	50549	64	63	64	63	Negligible	Medium	Not Significant
52260	50642	63	61	63	61	Negligible	Medium	Not Significant
52269	52270	69	68	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52270	50731	71	71	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52270	52848	67	67	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52272	50519	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52272	50785	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52272	53369	61	59	60	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
52273	50921	70	70	71	71	Negligible	Medium - High	Not Significant
52273	52277	70	70	72	72	Negligible	Medium - High	Not Significant
52273	53399	67	67	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52274	50489	66	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52274	52257	70	69	70	70	Negligible	Medium - High	Not Significant
52274	52806	69	69	70	70	Negligible	Medium - High	Not Significant
52275	50590	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52275	50612	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52276	50516	70	70	71	71	Negligible	Medium - High	Not Significant
52276	52277	70	70	71	71	Negligible	Medium - High	Not Significant
52277	52273	71	71	72	72	Negligible	High	Not Significant - Slight
52277	52276	70	70	71	71	Negligible	Medium - High	Not Significant
52277	52314	68	67	68	68	Negligible	Medium - High	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52278	52231	71	71	73	74	Negligible	High	Not Significant - Slight
52278	52279	69	69	70	69	Negligible	Medium - High	Not Significant
52279	52278	71	71	73	74	Negligible	High	Not Significant - Slight
52279	52280	69	69	70	69	Negligible	Medium - High	Not Significant
52280	50510	69	69	70	69	Negligible	Medium - High	Not Significant
52280	52279	71	71	73	74	Negligible	High	Not Significant - Slight
52284	50747	72	73	73	74	Negligible	High	Not Significant - Slight
52284	50795	72	73	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52284	52293	66	65	67	67	Negligible	Medium - High	Not Significant
52284	52303	67	66	67	67	Negligible	Medium - High	Not Significant
52285	50539	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52285	50792	68	68	69	69	Negligible	Medium - High	Not Significant
52285	50793	70	70	70	70	Negligible	Medium - High	Not Significant
52285	52251	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52288	50709	62	61	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive
52288	52289	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52288	53228	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
52289	50718	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52289	52288	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52290	52291	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
52290	53229	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52291	50727	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
52292	50536	66	65	66	65	Negligible	Medium	Not Significant
52292	50700	67	66	67	67	Negligible	Medium - High	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52293	52284	66	66	68	68	Negligible	Medium - High	Not Significant
52293	53066	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52293	53270	66	65	67	67	Negligible	Medium - High	Not Significant
52294	50794	Flow too low	Flow too low	65	65	Flow too low	Medium	Flow too low
52296	52231	68	67	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
52296	70003	61	59	61	60	Negligible	Low - Medium	Not Significant
52297	50798	65	64	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52297	70003	63	62	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52299	52300	68	67	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52299	53264	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52300	50730	62	61	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52300	52296	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52301	50924	67	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52301	52310	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52302	50720	64	63	66	65	Negligible	Medium	Not Significant
52302	50728	Flow too low	Flow too low	64	63	Flow too low	Medium	Flow too low
52303	52284	65	64	68	67	Minor	Medium - High	Slight
52303	52304	67	66	67	67	Negligible	Medium - High	Not Significant
52304	50747	64	63	65	64	Negligible	Medium	Not Significant
52304	52303	65	64	68	67	Minor	Medium - High	Slight
52304	52684	69	69	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52305	50749	67	67	70	70	Minor	Medium - High	Slight
52305	50794	67	67	70	70	Negligible	Medium - High	Not Significant
52306	50801	Flow too low	Flow too low	65	65	Flow too low	Medium	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52306	52052	65	64	62	61	No change/Reduction	Medium	Imperceptible/ Positive
52306	52231	66	65	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52307	50714	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52307	50716	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52307	53048	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52308	50707	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52308	50714	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52309	50792	64	62	63	61	No change/Reduction	Medium	Imperceptible/ Positive
52309	50803	62	61	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
52310	50805	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52310	52301	67	66	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52311	50541	60	58	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52311	50646	60	58	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52311	53207	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52312	50492	66	65	66	65	Negligible	Medium	Not Significant
52312	50656	60	59	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52312	53221	65	65	65	65	No change/Reduction	Medium	Imperceptible/ Positive
52313	50697	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52313	52550	61	60	62	60	Negligible	Low - Medium	Not Significant
52313	53225	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52314	52277	68	68	69	68	Negligible	Medium - High	Not Significant
52314	52316	68	67	68	68	Negligible	Medium - High	Not Significant
52315	50695	67	67	68	68	Negligible	Medium - High	Not Significant
52315	52316	68	68	69	68	Negligible	Medium - High	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52315	53240	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52316	52314	68	68	69	68	Negligible	Medium - High	Not Significant
52316	52315	68	67	68	68	Negligible	Medium - High	Not Significant
52318	50515	68	68	70	70	Negligible	Medium - High	Not Significant
52318	50788	62	61	63	62	Negligible	Medium	Not Significant
52318	53399	67	66	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52319	50542	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52319	50778	69	69	69	69	Negligible	Medium - High	Not Significant
52320	50657	65	65	66	65	Negligible	Medium	Not Significant
52320	50659	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52322	52252	72	72	74	75	Negligible	High	Not Significant - Slight
52322	53388	72	72	72	72	Negligible	High	Not Significant - Slight
52323	51411	58	56	60	58	Negligible	Low - Medium	Not Significant
52323	52324	60	59	62	60	Negligible	Low - Medium	Not Significant
52323	53333	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
52324	51402	60	59	62	60	Negligible	Low - Medium	Not Significant
52324	52323	60	58	61	59	Negligible	Low - Medium	Not Significant
52325	50681	70	70	72	72	Negligible	Medium - High	Not Significant
52325	52326	67	67	72	73	Moderate	High	Significant
52326	50736	66	66	72	73	Moderate	High	Significant
52326	52325	70	70	72	72	Negligible	Medium - High	Not Significant
52326	52819	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52329	70004	66	65	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52331	52332	73	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52331	52560	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
52332	50752	74	74	73	74	No change/Reduction	High	Imperceptible/ Positive
52332	52331	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
52332	52333	74	74	74	74	Negligible	High	Not Significant - Slight
52332	52811	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52333	50495	74	74	74	74	Negligible	High	Not Significant - Slight
52333	52332	75	75	74	75	No change/Reduction	High	Imperceptible/ Positive
52348	50897	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52348	51363	67	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52348	52350	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52349	52351	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52350	52348	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52350	52351	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52351	52349	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52351	52350	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52352	50164	71	71	71	71	Negligible	Medium - High	Not Significant
52352	52353	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52353	50157	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52353	52352	71	71	71	71	Negligible	Medium - High	Not Significant
52360	48008	72	72	72	72	Negligible	High	Not Significant - Slight
52360	50952	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52360	70008	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52363	52118	73	74	73	74	Negligible	High	Not Significant - Slight
52363	52565	74	75	74	75	Negligible	High	Not Significant - Slight

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52367	50769	66	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52367	52685	67	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52395	50107	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52395	52399	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
52396	52400	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52396	53400	73	73	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52397	52398	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52397	52401	71	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52398	52399	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52399	52395	74	74	73	74	No change/Reduction	High	Imperceptible/ Positive
52399	52963	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52400	52401	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52400	52450	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52401	52397	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52401	52962	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52402	52398	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52402	52425	77	79	77	79	Negligible	High	Not Significant - Slight
52425	59002	79	80	79	80	No change/Reduction	High	Imperceptible/ Positive
52450	59003	72	73	75	75	Negligible	High	Not Significant - Slight
52451	51359	67	67	68	67	Negligible	Medium - High	Not Significant
52451	52452	67	66	68	67	Negligible	Medium - High	Not Significant
52452	50871	65	64	66	66	Negligible	Medium	Not Significant
52452	52451	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52466	50116	67	67	67	67	Negligible	Medium - High	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52467	50885	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52467	53169	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52468	52469	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52468	53169	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52469	50885	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52469	52468	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52469	52470	63	62	63	62	Negligible	Medium	Not Significant
52470	50593	63	62	63	62	Negligible	Medium	Not Significant
52470	52469	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52471	50500	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52471	51336	67	67	67	67	Negligible	Medium - High	Not Significant
52472	51336	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52472	53170	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52472	53315	68	67	68	67	Negligible	Medium - High	Not Significant
52473	52474	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52473	53170	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52474	50895	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52474	52473	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52515	50164	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52515	50165	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52515	51344	72	72	72	72	Negligible	Medium - High	Not Significant
52518	50875	67	66	68	67	Negligible	Medium - High	Not Significant
52518	50877	66	65	67	66	Negligible	Medium	Not Significant
52519	52520	67	66	67	67	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52519	53454	68	67	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52520	50875	67	67	68	67	Negligible	Medium - High	Not Significant
52520	52519	68	67	68	68	Negligible	Medium - High	Not Significant
52520	53215	61	60	62	60	Negligible	Low - Medium	Not Significant
52528	50887	70	70	70	70	Negligible	Medium - High	Not Significant
52528	52841	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52529	50869	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52529	50872	66	65	66	65	Negligible	Medium	Not Significant
52529	53216	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52533	50895	67	67	67	67	Negligible	Medium - High	Not Significant
52533	52537	69	69	69	69	Negligible	Medium - High	Not Significant
52534	50894	69	69	69	69	Negligible	Medium - High	Not Significant
52534	52592	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52535	52536	69	69	70	69	Negligible	Medium - High	Not Significant
52535	52541	68	67	68	67	Negligible	Medium - High	Not Significant
52536	50150	69	69	70	69	Negligible	Medium - High	Not Significant
52536	52535	68	67	68	67	Negligible	Medium - High	Not Significant
52537	52012	69	69	69	69	Negligible	Medium - High	Not Significant
52537	52533	67	67	67	67	Negligible	Medium - High	Not Significant
52538	50583	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52538	52539	70	70	70	70	Negligible	Medium - High	Not Significant
52538	53310	61	60	61	60	Negligible	Low - Medium	Not Significant
52539	51334	70	70	70	70	Negligible	Medium - High	Not Significant
52539	52538	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52541	52012	68	67	68	67	Negligible	Medium - High	Not Significant
52541	52535	69	69	70	69	Negligible	Medium - High	Not Significant
52544	51325	61	59	61	59	Negligible	Low - Medium	Not Significant
52544	52545	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52544	53217	63	61	63	61	Negligible	Medium	Not Significant
52545	50901	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52545	52544	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52546	50968	65	64	66	65	Negligible	Medium	Not Significant
52546	51325	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52548	50640	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
52548	50654	69	69	69	69	Negligible	Medium - High	Not Significant
52548	53371	65	65	65	65	No change/Reduction	Medium	Imperceptible/ Positive
52549	48221	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52549	50635	66	66	66	66	Negligible	Medium	Not Significant
52549	52007	65	64	65	64	Negligible	Medium	Not Significant
52550	50696	61	60	62	60	Negligible	Low - Medium	Not Significant
52550	52313	63	62	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive
52551	52552	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52551	52568	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52552	52551	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52552	52553	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52553	50771	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52553	52552	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52553	53256	67	67	67	67	Negligible	Medium - High	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52556	52302	66	65	68	67	Negligible	Medium - High	Not Significant
52557	52558	70	70	71	71	Negligible	Medium - High	Not Significant
52558	50530	71	71	71	72	Negligible	Medium - High	Not Significant
52560	52331	72	73	72	73	No change/Reduction	High	Imperceptible/ Positive
52560	52561	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
52560	53299	Flow too low	Flow too low	59	57	Flow too low	Low - Medium	Flow too low
52561	50577	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
52561	52560	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52563	48008	74	74	74	74	Negligible	High	Not Significant - Slight
52563	52564	73	74	73	74	Negligible	High	Not Significant - Slight
52563	53297	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52564	50956	74	74	74	74	Negligible	High	Not Significant - Slight
52564	52010	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52564	52563	73	74	73	74	Negligible	High	Not Significant - Slight
52565	52120	74	74	74	75	Negligible	High	Not Significant - Slight
52565	52363	74	75	74	75	Negligible	High	Not Significant - Slight
52565	52576	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52566	59000	68	68	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52567	52680	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52567	52681	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52567	53308	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52568	50780	66	66	68	67	Negligible	Medium - High	Not Significant
52568	50941	67	66	68	68	Negligible	Medium - High	Not Significant
52568	52551	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52569	50869	67	66	67	66	Negligible	Medium	Not Significant
52569	52580	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52570	50134	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52570	51326	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52570	52580	67	66	67	66	Negligible	Medium	Not Significant
52576	52565	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52576	52577	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52576	52588	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52577	52588	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52577	52605	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52579	48222	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52579	50543	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52579	52008	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52579	53176	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52580	52569	67	66	67	66	Negligible	Medium	Not Significant
52580	52570	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52583	52662	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52584	50769	67	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52584	52585	66	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52585	50945	66	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52585	52584	67	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52586	52587	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52586	53145	61	60	61	60	Negligible	Low - Medium	Not Significant
52586	53335	63	61	63	61	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52587	52586	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52588	52576	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52588	52589	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52589	52588	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52589	53312	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52592	50502	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52592	52534	69	69	69	69	Negligible	Medium - High	Not Significant
52597	50150	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52597	52622	70	70	70	70	Negligible	Medium - High	Not Significant
52598	50558	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52598	50631	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52599	50527	68	68	69	68	Negligible	Medium - High	Not Significant
52599	50747	69	69	64	62	No change/Reduction	Medium	Imperceptible/ Positive
52599	53276	71	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52600	50701	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52600	52601	69	69	69	69	Negligible	Medium - High	Not Significant
52601	50540	Flow too low	Flow too low	61	59	Flow too low	Low - Medium	Flow too low
52601	50700	69	69	70	70	Negligible	Medium - High	Not Significant
52601	52600	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52602	51326	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52602	51415	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
52603	50744	73	73	73	73	No change/Reduction	High	Imperceptible/ Positive
52603	50964	73	73	73	73	Negligible	High	Not Significant - Slight
52604	50646	65	65	65	65	Negligible	Medium	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52604	50686	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52605	51331	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52605	52577	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52609	50907	64	63	65	64	Negligible	Medium	Not Significant
52609	52244	65	64	65	64	Negligible	Medium	Not Significant
52611	50792	68	68	69	69	Negligible	Medium - High	Not Significant
52611	52257	68	67	69	69	Negligible	Medium - High	Not Significant
52611	53230	66	65	65	65	No change/Reduction	Medium	Imperceptible/ Positive
52612	50588	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52613	50896	70	70	70	70	Negligible	Medium - High	Not Significant
52613	51362	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52614	50108	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52614	51363	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52622	50148	70	70	70	70	Negligible	Medium - High	Not Significant
52622	52597	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52623	52682	63	62	63	62	Negligible	Medium	Not Significant
52623	52695	75	76	75	76	No change/Reduction	High	Imperceptible/ Positive
52623	53014	75	76	75	76	No change/Reduction	High	Imperceptible/ Positive
52628	50636	66	66	67	67	Negligible	Medium - High	Not Significant
52628	50778	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52628	53248	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52630	52955	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52630	53403	74	74	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52634	50147	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52634	53365	68	68	68	68	Negligible	Medium - High	Not Significant
52634	59013	64	63	64	63	Negligible	Medium	Not Significant
52635	50143	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52635	52636	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52636	40007	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52636	51391	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52636	52635	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52662	52332	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52663	50588	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52663	50589	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52663	52241	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52664	50964	69	69	70	70	Negligible	Medium - High	Not Significant
52665	50512	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52665	50960	70	70	70	70	Negligible	Medium - High	Not Significant
52665	53281	69	69	70	70	Negligible	Medium - High	Not Significant
52668	53177	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52669	50682	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52669	53177	70	69	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52670	52671	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52670	53178	67	66	68	67	Negligible	Medium - High	Not Significant
52671	52670	67	66	68	67	Negligible	Medium - High	Not Significant
52671	52672	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52672	50754	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52672	52671	67	66	68	67	Negligible	Medium - High	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52672	53286	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52673	52675	71	71	71	71	Negligible	Medium - High	Not Significant
52673	52955	68	68	69	69	Negligible	Medium - High	Not Significant
52673	53178	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52674	50754	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52674	50755	70	70	70	70	Negligible	Medium - High	Not Significant
52675	50570	71	71	71	71	Negligible	Medium - High	Not Significant
52675	52673	71	71	71	71	Negligible	Medium - High	Not Significant
52676	52678	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52677	50851	63	62	63	62	Negligible	Medium	Not Significant
52677	52682	66	66	67	66	Negligible	Medium	Not Significant
52678	50504	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52679	48040	68	67	68	67	Negligible	Medium - High	Not Significant
52679	52691	67	67	68	67	Negligible	Medium - High	Not Significant
52680	52567	70	70	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52680	52701	73	73	73	73	Negligible	High	Not Significant - Slight
52680	53307	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
52681	52567	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52681	52683	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52682	52623	66	66	67	66	Negligible	Medium	Not Significant
52682	52677	63	62	63	62	Negligible	Medium	Not Significant
52683	50507	74	75	75	75	Negligible	High	Not Significant - Slight
52683	52681	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52683	52704	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52684	52304	67	67	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52684	52685	66	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52684	53280	68	67	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52685	52367	66	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52685	52684	67	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52686	52820	70	69	71	71	Negligible	Medium - High	Not Significant
52687	50145	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52687	50147	70	69	70	70	Negligible	Medium - High	Not Significant
52688	48006	74	75	74	75	Negligible	High	Not Significant - Slight
52688	50767	63	62	64	63	Negligible	Medium	Not Significant
52688	50963	75	75	74	75	No change/Reduction	High	Imperceptible/ Positive
52690	51333	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52691	40008	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52691	50142	69	69	70	70	Negligible	Medium - High	Not Significant
52691	52679	67	67	67	67	Negligible	Medium - High	Not Significant
52694	52402	75	76	75	76	No change/Reduction	High	Imperceptible/ Positive
52695	48037	75	76	76	76	Negligible	High	Not Significant - Slight
52695	50857	74	75	75	75	Negligible	High	Not Significant - Slight
52695	52623	75	75	75	75	No change/Reduction	High	Imperceptible/ Positive
52695	53390	71	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52696	50112	72	73	72	73	Negligible	High	Not Significant - Slight
52696	50592	72	72	72	72	No change/Reduction	High	Imperceptible/ Positive
52697	52698	73	74	73	74	Negligible	High	Not Significant - Slight
52697	52700	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52697	52701	72	72	72	72	Negligible	High	Not Significant - Slight
52697	53014	76	76	75	76	No change/Reduction	High	Imperceptible/ Positive
52698	52697	73	74	73	74	Negligible	High	Not Significant - Slight
52698	52700	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52698	52703	74	74	74	74	Negligible	High	Not Significant - Slight
52700	52697	72	73	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52700	52706	74	74	73	74	No change/Reduction	High	Imperceptible/ Positive
52701	52680	72	72	72	72	Negligible	High	Not Significant - Slight
52701	52697	72	73	72	73	Negligible	High	Not Significant - Slight
52701	52702	69	69	69	69	Negligible	Medium - High	Not Significant
52702	50851	69	69	69	69	Negligible	Medium - High	Not Significant
52702	52701	67	66	67	66	Negligible	Medium	Not Significant
52703	50112	72	72	72	72	No change/Reduction	High	Imperceptible/ Positive
52703	50603	71	71	71	72	Negligible	Medium - High	Not Significant
52703	52698	74	74	74	74	Negligible	High	Not Significant - Slight
52704	52683	74	75	74	75	Negligible	High	Not Significant - Slight
52704	52705	74	74	73	74	No change/Reduction	High	Imperceptible/ Positive
52705	52704	74	75	75	75	Negligible	High	Not Significant - Slight
52705	52706	74	74	73	74	No change/Reduction	High	Imperceptible/ Positive
52705	52707	71	71	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52705	53403	73	74	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52706	52700	74	75	74	74	No change/Reduction	High	Imperceptible/ Positive
52706	52705	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52706	52707	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52707	52248	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52707	52705	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52708	50816	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52708	53067	70	70	70	70	Negligible	Medium - High	Not Significant
52742	52898	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
52766	50049	72	72	72	72	Negligible	Medium - High	Not Significant
52770	50942	72	73	74	74	Negligible	High	Not Significant - Slight
52770	52785	72	72	72	73	Negligible	High	Not Significant - Slight
52778	50108	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52778	50118	67	67	68	67	Negligible	Medium - High	Not Significant
52778	52766	71	71	71	71	Negligible	Medium - High	Not Significant
52779	50145	61	60	62	60	Negligible	Low - Medium	Not Significant
52779	52687	67	66	67	67	Negligible	Medium - High	Not Significant
52780	50146	65	64	65	64	Negligible	Medium	Not Significant
52780	52779	68	68	68	68	Negligible	Medium - High	Not Significant
52785	50781	70	70	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52785	50923	71	71	71	71	Negligible	Medium - High	Not Significant
52785	50943	70	70	70	70	Negligible	Medium - High	Not Significant
52785	52770	73	74	75	76	Negligible	High	Not Significant - Slight
52804	52322	71	71	71	72	Negligible	Medium - High	Not Significant
52805	50725	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52805	52817	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52806	50533	69	69	70	70	Negligible	Medium - High	Not Significant
52806	52274	69	68	70	70	Negligible	Medium - High	Not Significant

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52811	53011	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52812	50650	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
52812	50653	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52812	52846	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52816	50686	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
52816	52604	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52817	50809	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52818	50730	62	61	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52819	50735	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52819	53272	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52820	50761	72	72	72	73	Negligible	High	Not Significant - Slight
52820	52664	70	70	71	71	Negligible	Medium - High	Not Significant
52828	52949	66	65	63	62	No change/Reduction	Medium	Imperceptible/ Positive
52829	50545	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52829	50645	Flow too low	#DIV/0!	Flow too low	#DIV/0!	Flow too low	Flow too low	Flow too low
52830	50821	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52830	52829	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52841	52528	70	70	70	70	Negligible	Medium - High	Not Significant
52841	53454	68	68	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52844	50702	60	58	59	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
52844	52816	65	64	65	64	Negligible	Medium	Not Significant
52845	50547	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52846	52847	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52847	50655	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52847	52830	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
52848	52804	67	67	66	65	No change/Reduction	Medium	Imperceptible/ Positive
52898	50045	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
52898	51347	68	67	68	67	Negligible	Medium - High	Not Significant
52941	50735	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52941	50737	71	71	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
52941	50797	Flow too low	Flow too low	70	69	Flow too low	Medium - High	Flow too low
52942	50737	71	71	72	72	Negligible	High	Not Significant - Slight
52942	52943	70	70	72	73	Minor	High	Slight - Moderate
52942	53277	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
52943	50746	70	70	72	73	Minor	High	Slight - Moderate
52943	52942	71	72	72	72	Negligible	Medium - High	Not Significant
52946	50724	71	71	71	71	Negligible	Medium - High	Not Significant
52946	52258	Flow too low	Flow too low	65	64	Flow too low	Medium	Flow too low
52949	50805	68	67	68	68	Negligible	Medium - High	Not Significant
52949	53402	67	67	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52951	52556	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
52954	48006	72	72	71	72	No change/Reduction	Medium - High	Imperceptible/ Positive
52954	52955	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
52955	48008	68	68	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52955	52630	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
52955	52673	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
52955	52954	73	73	72	73	No change/Reduction	High	Imperceptible/ Positive
52962	52396	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
52963	52397	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
52963	52425	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
52964	48018	76	77	76	77	No change/Reduction	High	Imperceptible/ Positive
53004	50963	75	75	75	75	Negligible	High	Not Significant - Slight
53004	59000	74	75	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53005	52450	77	78	77	78	No change/Reduction	High	Imperceptible/ Positive
53005	52962	70	70	70	70	Negligible	Medium - High	Not Significant
53011	50930	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
53014	52623	75	76	75	76	No change/Reduction	High	Imperceptible/ Positive
53014	52697	74	75	74	74	No change/Reduction	High	Imperceptible/ Positive
53020	50118	65	64	65	64	Negligible	Medium	Not Significant
53020	51360	66	65	67	67	Negligible	Medium - High	Not Significant
53022	50150	67	67	67	66	No change/Reduction	Medium - High	Imperceptible/ Positive
53046	50516	70	70	71	71	Negligible	Medium - High	Not Significant
53046	50517	61	60	63	62	Negligible	Medium	Not Significant
53046	50793	69	69	70	70	Negligible	Medium - High	Not Significant
53047	50523	60	58	59	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53048	50707	68	67	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53048	50708	68	68	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53048	52307	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53049	50561	64	63	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53049	50613	64	63	64	63	Negligible	Medium	Not Significant
53050	50575	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53051	50577	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53052	50578	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53053	50592	64	63	64	63	Negligible	Medium	Not Significant
53053	50608	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53053	53302	63	61	63	61	No change/Reduction	Medium	Imperceptible/ Positive
53054	50617	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53054	50621	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53055	50627	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53055	50628	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53057	50642	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53057	50816	71	71	71	71	Negligible	Medium - High	Not Significant
53057	53210	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53059	50648	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
53059	50650	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
53060	50665	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53061	50643	Flow too low	Flow too low	61	60	Flow too low	Low - Medium	Flow too low
53063	50647	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53063	50708	68	68	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53063	50710	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53064	50724	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53064	50808	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53065	50733	Flow too low	Flow too low	66	66	Flow too low	Medium	Flow too low
53065	52828	66	65	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53066	50800	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53066	50801	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53067	50814	65	64	65	65	Negligible	Medium	Not Significant
53067	50817	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
53067	52708	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
53070	50954	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53070	50955	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53096	51349	73	74	73	74	No change/Reduction	High	Imperceptible/ Positive
53096	51352	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
53096	53347	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53097	50117	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
53097	51361	73	74	75	75	Negligible	High	Not Significant - Slight
53098	51364	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53099	51370	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53099	51371	64	63	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53145	51400	64	62	64	63	Negligible	Medium	Not Significant
53145	52586	62	61	62	61	Negligible	Medium	Not Significant
53145	53350	62	61	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive
53149	52008	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53150	52012	66	66	66	66	No change/Reduction	Medium	Imperceptible/ Positive
53160	50529	71	71	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53160	52231	71	72	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53160	52818	62	61	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53161	52558	66	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53161	52951	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53169	52467	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53169	52468	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53169	53305	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53170	52472	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53170	52473	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53174	50892	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53176	52579	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53177	52668	70	69	70	69	No change/Reduction	Medium - High	Imperceptible/ Positive
53177	52669	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
53178	52670	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53178	52673	67	66	68	67	Negligible	Medium - High	Not Significant
53200	50669	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53201	50664	63	62	62	61	No change/Reduction	Medium	Imperceptible/ Positive
53202	50668	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53203	50822	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53205	50662	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53207	52311	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53208	50661	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53208	50689	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53209	50640	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53210	53057	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53211	50811	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53214	50863	59	57	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
53215	52520	62	61	62	61	Negligible	Low - Medium	Not Significant
53216	52529	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53217	52544	61	59	61	60	Negligible	Low - Medium	Not Significant
53218	50635	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53219	50968	61	60	61	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53220	50550	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53221	52312	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53223	53224	65	65	65	65	No change/Reduction	Medium	Imperceptible/ Positive
53224	50647	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53224	50704	68	68	68	68	Negligible	Medium - High	Not Significant
53224	53223	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53225	50695	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53225	52313	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53225	53385	65	65	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53226	50716	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53227	50713	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53228	52288	63	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
53229	52290	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53230	52611	64	63	64	62	No change/Reduction	Medium	Imperceptible/ Positive
53231	50539	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53232	52256	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53233	50804	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53234	52250	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53235	50789	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53236	53399	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53240	52315	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53242	50819	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53247	50543	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53248	52628	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53249	50907	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53250	50779	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53251	50773	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53252	50494	58	56	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
53253	50524	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
53254	50522	60	59	60	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
53256	52553	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53259	50940	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53263	50531	66	65	66	65	Negligible	Medium	Not Significant
53264	52299	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53265	50808	62	61	62	61	No change/Reduction	Low - Medium	Imperceptible/ Positive
53266	52252	68	68	69	68	Negligible	Medium - High	Not Significant
53267	70004	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53268	50513	62	61	62	61	No change/Reduction	Medium	Imperceptible/ Positive
53269	53270	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
53270	50794	68	67	69	69	Negligible	Medium - High	Not Significant
53270	52293	67	66	68	68	Negligible	Medium - High	Not Significant
53270	53269	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53271	52233	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53272	52819	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53273	50736	68	68	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53275	50508	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53276	52599	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
53277	52942	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53278	50740	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53280	52684	66	65	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53281	52665	70	70	70	70	Negligible	Medium - High	Not Significant
53283	50739	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53284	50755	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
53285	50762	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53286	52672	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
53287	50750	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53289	50619	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53290	50628	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53291	52039	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
53292	50912	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53293	50625	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
53296	52009	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53297	52563	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53298	50581	68	68	68	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53299	52560	Flow too low	Flow too low	61	59	Flow too low	Low - Medium	Flow too low
53301	50588	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53302	53053	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53303	50607	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53305	53169	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		Do Minimum		Do Something		Magnitude of Change	Noise Level Category	Overall Significance
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53306	50596	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53307	52680	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
53308	52567	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53309	50600	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53310	52538	61	59	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
53311	51333	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53312	52589	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53313	50770	61	59	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
53314	53390	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53315	52472	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53319	51376	61	59	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
53322	51394	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
53323	51379	59	57	59	57	Negligible	Low - Medium	Not Significant
53324	40000	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53324	40001	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53324	51358	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53325	50984	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53326	50157	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53333	52323	59	57	59	57	No change/Reduction	Low - Medium	Imperceptible/ Positive
53334	51330	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53335	52586	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53344	50420	68	68	68	68	Negligible	Medium - High	Not Significant
53347	53096	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53348	50870	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

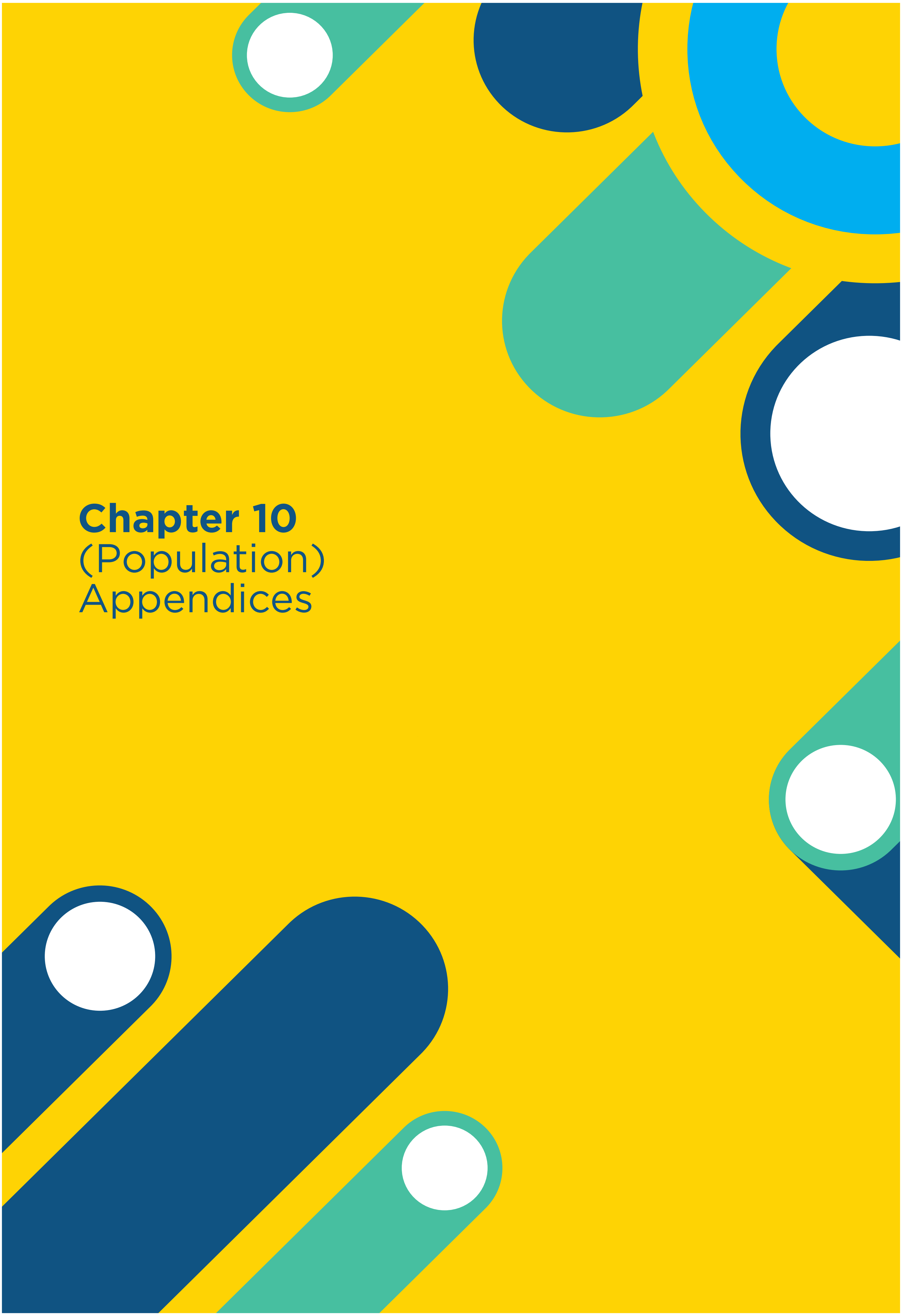
Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53350	53145	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53353	50515	66	65	65	65	No change/Reduction	Medium	Imperceptible/ Positive
53354	53402	63	62	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53357	50917	58	57	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
53358	53398	58	56	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53360	50528	67	66	67	66	Negligible	Medium - High	Not Significant
53361	53403	69	68	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53362	50836	61	60	61	59	No change/Reduction	Low - Medium	Imperceptible/ Positive
53364	50780	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53365	52634	69	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
53366	51335	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53367	52119	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53369	52272	60	58	60	58	No change/Reduction	Low - Medium	Imperceptible/ Positive
53370	70003	64	63	64	63	Negligible	Medium	Not Significant
53371	52548	69	68	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53374	53396	65	64	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53375	50561	62	60	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53382	50753	65	64	65	64	Negligible	Medium	Not Significant
53383	50930	74	75	73	73	No change/Reduction	High	Imperceptible/ Positive
53383	53384	62	61	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53383	70007	71	71	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
53384	53383	62	61	62	60	No change/Reduction	Low - Medium	Imperceptible/ Positive
53385	53225	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53386	52557	70	70	71	71	Negligible	Medium - High	Not Significant

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53386	53387	65	64	65	64	No change/Reduction	Medium	Imperceptible/ Positive
53387	53386	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53388	52946	71	71	72	72	Negligible	Medium - High	Not Significant
53388	53389	68	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53389	53388	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53390	50894	71	71	71	71	Negligible	Medium - High	Not Significant
53390	52695	72	72	72	72	Negligible	Medium - High	Not Significant
53390	53314	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
53394	50044	74	75	74	75	No change/Reduction	High	Imperceptible/ Positive
53394	50984	72	72	72	72	No change/Reduction	Medium - High	Imperceptible/ Positive
53394	53395	63	62	63	62	No change/Reduction	Medium	Imperceptible/ Positive
53395	53394	63	62	63	62	Negligible	Medium	Not Significant
53396	50700	64	63	65	64	Negligible	Medium	Not Significant
53396	50928	65	64	64	63	No change/Reduction	Medium	Imperceptible/ Positive
53396	53374	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53398	50523	71	71	71	71	Negligible	Medium - High	Not Significant
53398	50915	69	69	69	68	No change/Reduction	Medium - High	Imperceptible/ Positive
53398	53358	58	56	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
53399	52273	66	66	69	68	Negligible	Medium - High	Not Significant
53399	52318	68	67	69	69	Negligible	Medium - High	Not Significant
53399	53236	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53400	50984	73	73	74	75	Negligible	High	Not Significant - Slight
53400	52396	75	75	75	75	No change/Reduction	High	Imperceptible/ Positive
53400	53401	66	65	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
53401	53400	67	66	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
53402	50804	67	66	68	68	Negligible	Medium - High	Not Significant
53402	52949	66	65	66	66	Negligible	Medium	Not Significant
53402	53354	63	62	63	61	No change/Reduction	Medium	Imperceptible/ Positive
53403	52630	73	74	73	73	No change/Reduction	High	Imperceptible/ Positive
53403	52705	73	74	74	74	Negligible	High	Not Significant - Slight
53403	53361	68	68	68	68	Negligible	Medium - High	Not Significant
53454	50865	67	67	67	66	No change/Reduction	Medium	Imperceptible/ Positive
53454	50868	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
53454	52519	67	66	67	67	Negligible	Medium - High	Not Significant
53454	52841	70	70	70	70	Negligible	Medium - High	Not Significant
55000	50514	71	71	71	71	Negligible	Medium - High	Not Significant
55000	50922	71	71	72	72	Negligible	Medium - High	Not Significant
55001	50636	71	71	71	71	Negligible	Medium - High	Not Significant
55001	55002	69	68	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
55002	55001	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
55002	55003	69	68	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
55003	50551	70	69	69	69	No change/Reduction	Medium - High	Imperceptible/ Positive
55003	55002	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
55004	50665	72	72	72	73	Negligible	High	Not Significant - Slight
55004	50906	71	71	71	71	Negligible	Medium - High	Not Significant
58001	50944	66	65	66	65	No change/Reduction	Medium	Imperceptible/ Positive
58002	50787	66	65	66	65	Negligible	Medium	Not Significant
59000	50487	75	75	74	75	No change/Reduction	High	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
59000	52566	67	67	67	67	No change/Reduction	Medium - High	Imperceptible/ Positive
59000	53004	74	75	74	75	Negligible	High	Not Significant - Slight
59002	98000	79	80	79	80	Negligible	High	Not Significant - Slight
59003	52964	75	75	75	75	No change/Reduction	High	Imperceptible/ Positive
59005	53065	66	65	68	67	Negligible	Medium - High	Not Significant
59005	59006	68	67	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
59005	59008	66	66	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
59006	50733	Flow too low	Flow too low	64	63	Flow too low	Medium	Flow too low
59006	59005	70	70	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
59006	59007	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
59007	59006	68	67	68	67	No change/Reduction	Medium - High	Imperceptible/ Positive
59008	50918	72	72	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
59008	59005	69	69	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
59010	50669	72	72	72	72	Negligible	Medium - High	Not Significant
59010	50906	71	71	72	72	Negligible	Medium - High	Not Significant
59011	50938	70	70	70	70	No change/Reduction	Medium - High	Imperceptible/ Positive
59011	50940	67	67	67	67	Negligible	Medium - High	Not Significant
59011	59012	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
59012	59011	67	67	67	67	Negligible	Medium - High	Not Significant
59013	52634	67	66	67	66	Negligible	Medium	Not Significant
60001	50802	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
70000	50720	60	58	58	56	No change/Reduction	Low - Medium	Imperceptible/ Positive
70001	50671	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
70003	52296	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive

Road Link		**Do Minimum**		**Do Something**		**Magnitude of Change**	**Noise Level Category**	**Overall Significance**
A	B	dB L_{den}	dB $L_{A10,18hr}$	dB L_{den}	dB $L_{A10,18hr}$			
70003	52297	65	64	Flow too low	Flow too low	Flow too low	Flow too low	Flow too low
70003	53370	64	63	64	63	No change/Reduction	Medium	Imperceptible/ Positive
70004	53161	66	66	65	64	No change/Reduction	Medium	Imperceptible/ Positive
70004	53267	67	66	67	66	No change/Reduction	Medium	Imperceptible/ Positive
70006	50545	72	72	71	71	No change/Reduction	Medium - High	Imperceptible/ Positive
70006	50654	70	70	70	70	Negligible	Medium - High	Not Significant
70007	50622	74	74	74	74	No change/Reduction	High	Imperceptible/ Positive
70007	53383	74	74	73	73	No change/Reduction	High	Imperceptible/ Positive
70008	50766	72	73	72	72	No change/Reduction	High	Imperceptible/ Positive
70008	52360	72	72	72	72	Negligible	Medium - High	Not Significant
70009	50544	65	65	66	65	Negligible	Medium	Not Significant
70009	50660	66	66	67	66	Negligible	Medium	Not Significant
98013	98017	78	80	78	79	No change/Reduction	High	Imperceptible/ Positive
98017	53005	77	78	77	78	No change/Reduction	High	Imperceptible/ Positive



Chapter 10

(Population) Appendices

ID	NAME	ADDRESS	BUSINESS TYPE
1	A COPPER BEECH HOUSE	26 COLLEGE ROAD, GALWAY, H91TX37	OTHER ACCOMMODATION
2	A. HARTMANN AND SON	29 WILLIAM STREET, GALWAY, H91RP04	RETAIL SALE OF WATCHES AND JEWELLERY IN SPECIALISED STORES
3	AARON HOUSE	25 COLLEGE ROAD, GALWAY, H91P688	OTHER ACCOMMODATION
4	ABBEY LODGE	1 THE STABLES, COLLEGE ROAD, GALWAY, H91K3H4	OTHER ACCOMMODATION
5	ACCORD	GALWAY DIOCESAN PASTORAL CENTRE, ÁRUS DE BRÚN, NEWTOWNSMITH, GALWAY, H91XKF4	OTHER SOCIAL WORK ACTIVITIES WITHOUT ACCOMMODATION
6	ACE	19 COLLEGE ROAD, GALWAY, H91YK72	OTHER ACCOMMODATION
7	AIB	18 EYRE SQUARE, GALWAY, H91TWE0	OTHER MONETARY INTERMEDIATION
8	ALASTAIR PURDY & CO. SOLICITORS	CORRIB CASTLE, 1 WATERSIDE, WOODQUAY, GALWAY, H91DK58	LEGAL ACTIVITIES
9	ALI'S BARBERS	39 EYRE SQUARE, GALWAY, H91T9FC	HAIRDRESSING AND OTHER BEAUTY TREATMENT
10	AMBER	18 MARY STREET, GALWAY, H91F7K4	RETAIL SALE OF OTHER GOODS IN SPECIALISED STORES
11	AN POST	GALWAY POST OFFICE, 3 EGLINTON STREET, GALWAY, H91E2X2	RETAIL SALE OF OTHER GOODS IN SPECIALISED STORES
12	AN POST	LETTERPOST AREA OFFICE, FORSTER STREET, GALWAY, H91W312	OFFICE ADMINISTRATION AND SUPPORT ACTIVITIES
13	AN POST	78 PROSPECT HILL, GALWAY, H91WR6P	RETAIL SALE OF OTHER GOODS IN SPECIALISED STORES
14	AN PÚCÁN	11 FORSTER STREET, GALWAY, H91P65D	BEVERAGE SERVING ACTIVITIES
15	ANAM AIRE	7A SAINT FRANCIS STREET, GALWAY, H91W6X4	OTHER HUMAN HEALTH ACTIVITIES
16	ANGELA'S RED GATE HOUSE	12 COLLEGE ROAD, GALWAY, H91H263	OTHER ACCOMMODATION
17	ARAN FERRIES	1 VICTORIA PLACE, GALWAY, H91FD72	SEA AND COASTAL PASSENGER WATER TRANSPORT
18	ARDAWN	31 COLLEGE ROAD, GALWAY, H91P2N2	OTHER ACCOMMODATION
19	ARMAZÉM BRAZIL	34 PROSPECT HILL, GALWAY, H91NP93	RETAIL SALE IN NON-SPECIALIZED STORES WITH FOOD, BEVERAGES OR TOBACCO PREDOMINATING
20	AROMATHERAPY HEALTH & BEAUTY CLINIC	EYRE HOUSE, 21 EYRE SQUARE, GALWAY, H91A07D	HAIRDRESSING AND OTHER BEAUTY TREATMENT
21	ASGARD	21 COLLEGE ROAD, GALWAY, H91Y048	OTHER ACCOMMODATION
22	ASHFORD MANOR	7 COLLEGE ROAD, GALWAY, H91NH79	OTHER ACCOMMODATION
23	ASIAN TEA HOUSE	15 MARY STREET, GALWAY, H91AP80	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
24	ASPECT DESIGN TO FINISH LTD.	ISLAND HOUSE, GAOL ROAD, GALWAY, H91CDW7	DEVELOPMENT OF BUILDING PROJECTS
25	AVALON	AVALON HOUSE, 11 COLLEGE ROAD, GALWAY, H91K335	OTHER ACCOMMODATION

ID	NAME	ADDRESS	BUSINESS TYPE
26	BALCONY HOUSE	27 COLLEGE ROAD, GALWAY, H91KN56	OTHER ACCOMMODATION
27	BANK OF IRELAND	43 EYRE SQUARE, GALWAY, H91D6X9	OTHER MONETARY INTERMEDIATION
28	BAR ITALIA CAFFE	7 DALYS PLACE, WOODQUAY, GALWAY, H91K37W	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
29	BARR AN CHALADH	3 DALYS PLACE, WOODQUAY, GALWAY, H91Y90F	BEVERAGE SERVING ACTIVITIES
30	BARTLEY LYDON INSURANCES LTD.	33/34 WOODQUAY, GALWAY, H91A2PP	INSURANCE, REINSURANCE AND PENSION FUNDING, EXCEPT COMPULSORY SOCIAL SECURITY INSURANCE
31	BAY VIEW HOUSE	COLLEGE ROAD, GALWAY, H91T2H4	OTHER ACCOMMODATION
32	BERWICK SOLICITORS	16 EYRE SQUARE, GALWAY, H91Y735	LEGAL ACTIVITIES
33	BLACK SHEEP SURF COMPANY	GALWAY OCEAN SPORTS CENTRE, GALWAY HARBOUR ENTERPRISE PARK, NEW DOCKS, THE DOCKS, GALWAY , H91V25X	MANUFACTURE OF SPORTS GOODS
34	BLAKE & KENNY SOLICITORS	2 SAINT FRANCIS STREET, GALWAY, H91CA37	LEGAL ACTIVITIES
35	BLAKE'S BAR	EGLINTON STREET, GALWAY, H91VY1F	BEVERAGE SERVING ACTIVITIES
36	BORD IASCAIGH MHARA	DOCK ROAD, THE DOCKS, GALWAY, H91HD92	REGULATION OF AND CONTRIBUTION TO MORE EFFICIENT OPERATION OF BUSINESSES
37	BOYLESPORTS	2 AMERICAN HOUSE, EYRE SQUARE, GALWAY, H91F6P1	GAMBLING AND BETTING ACTIVITIES
38	BRANDO SCREEN PRINTING	17 CORRIB TERRACE, WOODQUAY, GALWAY, H91FT85	OTHER PRINTING
39	BRIAN LYNCH AND ASSOCIATES	4 COURTHOUSE SQUARE, GALWAY, H91R7W7	LEGAL ACTIVITIES
40	BRITE	15 EYRE STREET, GALWAY, H91C6X9	N/A - UNKNOWN
41	BROTHERS OF CHARITY SERVICES IRELAND	THE WOODLANDS CENTRE, WOODLANDS, DUBLIN ROAD, GALWAY, H91KN20	OTHER HUMAN HEALTH ACTIVITIES
42	BROWN THOMAS	1/2 EGLINTON STREET, GALWAY, H91KD70	RETAIL SALE OF OTHER GOODS IN SPECIALISED STORES
43	BRYAN EGAN	12 SAINT FRANCIS STREET, GALWAY, H91A215	ENGINEERING ACTIVITIES AND RELATED TECHNICAL CONSULTANCY
44	BUDDHA BAR	14 MARY STREET, GALWAY, H91P7D6	BEVERAGE SERVING ACTIVITIES
45	BUDGET CAR RENTAL IRELAND	12 EYRE SQUARE, GALWAY, H91TW2K	RENTING AND LEASING OF CARS AND LIGHT MOTOR VEHICLES
46	BURKE INSURANCES LTD.	6 SAINT BRENDAN'S ROAD, WOODQUAY, GALWAY, H91HTT2	INSURANCE, REINSURANCE AND PENSION FUNDING, EXCEPT COMPULSORY SOCIAL SECURITY INSURANCE
47	BUS ÉIREANN	GALWAY HARBOUR ENTERPRISE PARK, NEW DOCKS, THE DOCKS, GALWAY, H91A304	OFFICE ADMINISTRATION AND SUPPORT ACTIVITIES
48	CAFFE NERO	30 EYRE SQUARE, GALWAY, H91E3W9	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES

ID	NAME	ADDRESS	BUSINESS TYPE
49	CALL OF THE WILD	EGLINTON STREET, GALWAY, H91YK63	RETAIL SALE OF OTHER GOODS IN SPECIALISED STORES
50	CALLINAN COACHES LIMITED	GALWAY HARBOUR ENTERPRISE PARK, NEW DOCKS, THE DOCKS, GALWAY, H91C9X2	OTHER PASSENGER LAND TRANSPORT N.E.C.
51	CARE PLUS PHARMACY	WHELAN'S, 11 WILLIAMSGATE STREET, GALWAY, H91HT21	DISPENSING CHEMIST IN SPECIALISED STORES
52	CARIBOU	31 WOODQUAY, GALWAY, H91P5K8	BEVERAGE SERVING ACTIVITIES
53	CARRAIG DONN	CORRIB SHOPPING CENTRE, EYRE STREET, GALWAY, H91C67A	RETAIL SALE OF OTHER GOODS IN SPECIALISED STORES
54	CASH CREATORS	EGLINTON STREET, GALWAY, H91AP99	RETAIL SALE OF SECOND-HAND GOODS IN STORES
55	CELTIC TOURIST HOSTEL	QUEEN STREET, GALWAY, H91TNP4	HOTELS AND SIMILAR ACCOMMODATION
56	CENTRA	DAVIS & MAHON, 7/9 FORSTER STREET, GALWAY, H91TX67	RETAIL SALE IN NON-SPECIALIZED STORES WITH FOOD, BEVERAGES OR TOBACCO PREDOMINATING
57	CEX ENTERTAINMENT EXCHANGE	1 WILLIAMSGATE STREET, GALWAY, H91R9N4	RETAIL SALE OF GAMES AND TOYS IN SPECIALISED STORES
58	CHANGE	5 EGLINTON STREET, GALWAY, H91YP70	RETAIL SALE OF CLOTHING IN SPECIALISED STORES
59	CHAT & NET	2 EYRE STREET, GALWAY, H91R9K6	OTHER INFORMATION TECHNOLOGY AND COMPUTER RELATED ACTIVITIES
60	CHIME	9A SAINT FRANCIS STREET, GALWAY, H91EV2F	OTHER SOCIAL WORK ACTIVITIES WITHOUT ACCOMMODATION
61	CIARAN'S ACCOMMODATION	50 PROSPECT HILL, GALWAY, H91RK03	OTHER ACCOMMODATION
62	CIRCLE K	GALWAY HARBOUR ENTERPRISE PARK, NEW DOCKS, THE DOCKS, GALWAY, H91X030	RETAIL SALE OF AUTOMOTIVE FUEL IN SPECIALISED STORES
63	CIRCLE K	COLLEGE ROAD, GALWAY, H91E3TW	RETAIL SALE OF AUTOMOTIVE FUEL IN SPECIALISED STORES
65	CITYLINK	17 FORSTER STREET, GALWAY, H91AC67	OTHER PASSENGER LAND TRANSPORT N.E.C.
66	COLETTE LATCHFORD	APARTMENT 19, LYDON COURT, BÓTHAR IRWIN, GALWAY, H91A263	RETAIL SALE OF CLOTHING IN SPECIALISED STORES
67	COLLEGE CREST	5 COLLEGE ROAD, GALWAY, H91P7Y2	OTHER ACCOMMODATION
68	COLLEGE ROAD FLORIST	78 COLLEGE ROAD, GALWAY, H91W2K7	RETAIL SALE OF FLOWERS, PLANTS, SEEDS, FERTILISERS, PET ANIMALS AND PET FOOD IN SPECIALISED STORES
69	COMMERCIAL BOAT CLUB	RIVERSIDE, WOODQUAY, GALWAY, H91FH61	ACTIVITIES OF SPORT CLUBS
70	CONNACHT GYMNASIUM	COLLEGE ROAD, GALWAY, H91PK1W	FITNESS FACILITIES
71	CONNACHT RUGBY	THE SPORTSGROUND, COLLEGE ROAD, GALWAY, H91H340	ACTIVITIES OF SPORT CLUBS
72	COPE GALWAY	FAIRGREEN HOSTEL, FAIRGREEN ROAD, GALWAY, H91D6F2	OTHER SOCIAL WORK ACTIVITIES WITHOUT ACCOMMODATION

ID	NAME	ADDRESS	BUSINESS TYPE
73	COPE GALWAY	WATERSIDE HOUSE, COURTHOUSE SQUARE, GALWAY, H91X6RP	OTHER SOCIAL WORK ACTIVITIES WITHOUT ACCOMMODATION
74	CORRIB HOUSE	3 WATERSIDE, WOODQUAY, GALWAY, H91NXV1	BEVERAGE SERVING ACTIVITIES
75	COURTS SERVICE	CIRCUIT COURT OFFICE, THE COURTHOUSE, COURTHOUSE SQUARE, GALWAY, H91CDT6	JUSTICE AND JUDICIAL ACTIVITIES
76	CRYSTAL VALET	14A WALSH'S TERRACE, WOODQUAY, GALWAY, H91XW96	OTHER CLEANING ACTIVITIES
77	CUCINA DESIGN	26 DOCK ROAD, THE DOCKS, GALWAY, H91ET3C	RETAIL SALE OF OTHER GOODS IN SPECIALISED STORES
78	CURRAN FINANCIAL SERVICES	21 MARY STREET, GALWAY, H91CC65	OTHER ACTIVITIES AUXILIARY TO FINANCIAL SERVICES, EXCEPT INSURANCE AND PENSION FUNDING
79	D'ARCY'S BAR	2 FORSTER STREET, GALWAY, H91W862	BEVERAGE SERVING ACTIVITIES
80	DAYBREAK	HENCHY'S, 38 EYRE SQUARE, GALWAY, H91PH98	RETAIL SALE IN NON-SPECIALIZED STORES WITH FOOD, BEVERAGES OR TOBACCO PREDOMINATING
81	DEALZ	HIBERNIAN HOUSE, 45 EYRE SQUARE, GALWAY, H91XYE0	RETAIL SALE OF OTHER GOODS IN SPECIALISED STORES
82	DENNIS CUNNINGHAM B.A. B.DENT. SC. (T.C.D.)	6 SAINT FRANCIS STREET, GALWAY, H91CVK0	DENTAL PRACTICE ACTIVITIES
83	DEPARTMENT OF EDUCATION AND SKILLS	14 UNIVERSITY ROAD, GALWAY, H91ED81	TERTIARY EDUCATION
84	DEPARTMENT OF EDUCATION AND SKILLS	NATIONAL EDUCATIONAL PSYCHOLOGICAL SERVICE, VICTORIA PLACE, GALWAY, H91N7X6	OTHER SOCIAL WORK ACTIVITIES WITHOUT ACCOMMODATION
85	DEPARTMENT OF EDUCATION AND SKILLS	SCOIL AN LINBH ÍOSA, SAINT FRANCIS STREET, GALWAY, H91RX32	PRIMARY EDUCATION
86	DEPARTMENT OF EMPLOYMENT AFFAIRS AND SOCIAL PROTECTION	INTREO CENTRE GALWAY, SÉAN DUGGAN CENTRE, FAIRGREEN ROAD, GALWAY, H91XT91	GENERAL PUBLIC ADMINISTRATION ACTIVITIES
87	DNA	BALLALLEY LANE, GALWAY, H91X3P8	BEVERAGE SERVING ACTIVITIES
88	DNG MAXWELL HEASLIP & LEONARD	BARTON HOUSE, 5 SAINT FRANCIS STREET, GALWAY, H91RHP5	REAL ESTATE AGENCIES
89	DOCTOR M. COLBERT B.DEN.SC. (T.C.D.)	ARUS GUAIRE, BÓTHAR BHREANDAIN UÍ EITHIR, GALWAY, H91FD3H	DENTAL PRACTICE ACTIVITIES
90	DOMINO'S	16 PROSPECT HILL, GALWAY, H91RP20	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
91	DR. PETER KEENAN B.D.S MS ORTH (U. IOWA)	41 FORSTER STREET, GALWAY, H91VXE6	DENTAL PRACTICE ACTIVITIES
92	DR. V. M. O'CONNOR B.D.S., N.U.I.	14 EGLINTON STREET, GALWAY, H91N223	DENTAL PRACTICE ACTIVITIES
93	DUNNES STORES	EYRE SQUARE, GALWAY, H91P6C1	RETAIL SALE OF OTHER GOODS IN SPECIALISED STORES
94	DUNNES STORES PAUL COSTELLOE LIVING	EYRE SQUARE, GALWAY, H91F6R2	RETAIL SALE OF CLOTHING IN SPECIALISED STORES
95	EGLINGTON SNOOKER CLUB	EGLINTON COURT, EGLINTON STREET, GALWAY, H91XF3X	ACTIVITIES OF SPORT CLUBS

ID	NAME	ADDRESS	BUSINESS TYPE
96	EGLINTON ST. PHARMACY	17 EGLINTON STREET, GALWAY, H91K319	DISPENSING CHEMIST IN SPECIALISED STORES
97	ELITE HAIR STUDIO	66 PROSPECT HILL, GALWAY, H91A5W7	HAIRDRESSING AND OTHER BEAUTY TREATMENT
98	EMER MEENEGHAN BARRISTER	13 EGLINTON STREET, GALWAY, H91A5NV	LEGAL ACTIVITIES
99	EMERSON & CONWAY SOLICITORS	1 SAINT FRANCIS STREET, GALWAY, H91K036	LEGAL ACTIVITIES
100	ENGAGE ART STUDIOS	7 SAINT FRANCIS STREET, GALWAY, H91W8CV	ARTISTIC CREATION
101	EOGHAN O'SULLIVAN INSURANCES (GALWAY) LTD.	17 EYRE SQUARE, GALWAY, H91AV6P	INSURANCE, REINSURANCE AND PENSION FUNDING, EXCEPT COMPULSORY SOCIAL SECURITY INSURANCE
102	ESQUIRES COFFEE	11 EYRE SQUARE, GALWAY, H91FW42	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
103	EVERGREEN FLORIST	11 SAINT FRANCIS STREET, GALWAY, H91X5D2	RETAIL SALE OF FLOWERS, PLANTS, SEEDS, FERTILISERS, PET ANIMALS AND PET FOOD IN SPECIALISED STORES
104	EVE'S MASSAGE THERAPY	UNIT 8, KILTARTAN HOUSE, FORSTER STREET, GALWAY, H91HFH2	PHYSICAL WELL-BEING ACTIVITIES
105	EXPRESS FRAMES	136 COLLEGE ROAD, GALWAY, H91HP70	RETAIL SALE OF OTHER GOODS IN SPECIALISED STORES
106	EYE CINEMA	WELLPARK RETAIL CENTRE, WELLPARK ROAD, GALWAY, H91X4AV	RETAIL SALE OF FLOWERS, PLANTS, SEEDS, FERTILISERS, PET ANIMALS AND PET FOOD IN SPECIALISED STORES
107	EYRE SQUARE DENTAL	3RD FLOOR EYRE SQUARE CENTRE, EYRE SQUARE, GALWAY, H91T275	DENTAL PRACTICE ACTIVITIES
108	EZ LIVING FURNITURE	GALWAY HARBOUR ENTERPRISE PARK, NEW DOCKS, THE DOCKS, GALWAY, H91KA48	RETAIL SALE OF FURNITURE, LIGHTING EQUIPMENT AND OTHER HOUSEHOLD ARTICLES IN SPECIALISED STORES
109	F.X. O'BRIEN B.DENT.SC. MA. U.DUBL.	35 FORSTER STREET, GALWAY, H91V023	DENTAL PRACTICE ACTIVITIES
110	FAHERTY'S	29 WOODQUAY, GALWAY, H91KF7V	RETAIL SALE OF HARDWARE, PAINTS AND GLASS IN SPECIALISED STORES
111	FAHY MONUMENTAL WORKS	12 HEADFORD ROAD, GALWAY, H91D6X6	ARTISTIC CREATION
112	FALLERS	10/12 WILLIAMSGATE STREET, GALWAY, H91V3WC	RETAIL SALE OF WATCHES AND JEWELLERY IN SPECIALISED STORES
113	FIBBER MAGEES	3 EYRE SQUARE, GALWAY, H91D328	BEVERAGE SERVING ACTIVITIES
114	FORSTER COURT HOTEL	FORSTER STREET, GALWAY, H91PY7E	HOTELS AND SIMILAR ACCOMMODATION
115	FOUR SEASONS	23 COLLEGE ROAD, GALWAY, H91W8H7	OTHER ACCOMMODATION
116	FROM HERE STUDENT LIVING	UNIT 62, FAIRGREEN ROAD, GALWAY, H91A0FY	OTHER ACCOMMODATION
117	G. CONBOY ELECTRICAL	1/2 DALYS PLACE, WOODQUAY, GALWAY, H91HE09	RETAIL SALE OF ELECTRICAL HOUSEHOLD APPLIANCES IN SPECIALISED STORES
118	G.B.C.	BALLALLEY LANE, GALWAY, H91YH31	OFFICE ADMINISTRATION AND SUPPORT ACTIVITIES

ID	NAME	ADDRESS	BUSINESS TYPE
119	G.B.C. RESTAURANT AND COFFEE SHOP	9 WILLIAMSGATE STREET, GALWAY, H91X5D4	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
120	GALA	6 PROSPECT HILL, GALWAY, H91C920	RETAIL SALE IN NON-SPECIALIZED STORES WITH FOOD, BEVERAGES OR TOBACCO PREDOMINATING
121	GALWAY ADVERTISER	41/42 EYRE SQUARE, GALWAY, H91YV30	PUBLISHING OF NEWSPAPERS
122	GALWAY BAY SEAFOODS LTD.	DOCK ROAD, THE DOCKS, GALWAY, H91NFH6	WHOLESALE OF OTHER FOOD, INCLUDING FISH, CRUSTACEANS AND MOLLUSCS
123	GALWAY CAMERA SHOP	1 WILLIAM STREET, GALWAY, H91V128	OTHER RETAIL SALE OF NEW GOODS IN SPECIALISED STORES
124	GALWAY CITY COUNCIL	CITY HALL, COLLEGE ROAD, GALWAY, H91X4K8	GENERAL PUBLIC ADMINISTRATION ACTIVITIES
125	GALWAY CITY HOSTEL	FRENCHVILLE LANE, GALWAY, H91TF62	OTHER ACCOMMODATION
126	GALWAY CITY INNOVATION DISTRICT	PORTERSHED, EYRE SQUARE, GALWAY, H91HY51	BUSINESS AND OTHER MANAGEMENT CONSULTANCY ACTIVITIES
127	GALWAY GREYHOUND RACING CO.	GALWAY GREYHOUND STADIUM, COLLEGE ROAD, GALWAY, H91F880	OPERATION OF SPORTS FACILITIES
128	GALWAY RAPE CRISIS CENTRE	FORSTER LODGE, FORSTER COURT, GALWAY, H91EA03	OTHER SOCIAL WORK ACTIVITIES WITHOUT ACCOMMODATION
129	GALWAY REGIONAL MARRIAGE TRIBUNAL	7 WATERSIDE, WOODQUAY, GALWAY, H91PF61	OTHER SOCIAL WORK ACTIVITIES WITHOUT ACCOMMODATION
130	GALWAY ROWING CLUB	RIVERSIDE, WOODQUAY, GALWAY, H91K072	ACTIVITIES OF SPORT CLUBS
131	GALWAY ROWING CLUB	RIVERSIDE, WOODQUAY, GALWAY, H91N9WH	ACTIVITIES OF SPORT CLUBS
132	GALWAY SALMON AND EEL FISHERY	GAOL ROAD, GALWAY, H91N1W5	FISHING
133	GALWAY SIMON COMMUNITY	3 THE STABLES, COLLEGE ROAD, GALWAY, H91K138	OTHER RESIDENTIAL CARE ACTIVITIES
134	GATSBY	16/17 WOODQUAY, GALWAY, H91AE67	RETAIL SALE OF CLOTHING IN SPECIALISED STORES
135	GERAGHTY & CO.	1 ROSEMARY AVENUE, GALWAY, H91PD39	LEGAL ACTIVITIES
136	GINO'S GELATO	24 WILLIAM STREET, GALWAY, H91F970	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
137	GO BUS.IE	FORSTER COURT, GALWAY, H91N527	OTHER PASSENGER LAND TRANSPORT N.E.C.
138	GREAT GAS	WOODQUAY SERVICE STATION, 9 HEADFORD ROAD, GALWAY, H91R791	RETAIL SALE OF AUTOMOTIVE FUEL IN SPECIALISED STORES
139	GREAT WESTERN HOUSE	FRENCHVILLE LANE, GALWAY, H91Y5XV	OTHER ACCOMMODATION
140	GREEN WAY PROPERTIES LTD.	9 EYRE SQUARE, GALWAY, H91EP30	DEVELOPMENT OF BUILDING PROJECTS
141	HAIR AT 74	74 PROSPECT HILL, GALWAY, H91D2R7	HAIRDRESSING AND OTHER BEAUTY TREATMENT
142	HANLEY & CO.	8 WILLIAMSGATE STREET, GALWAY, H91XC93	RETAIL SALE OF CLOTHING IN SPECIALISED STORES
144	HARDIMAN HOUSE	5 EYRE SQUARE, GALWAY, H91FPK2	N/A - UNKNOWN

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145	HARPER	12 EGLINTON STREET, GALWAY, H91F2D0	RETAIL SALE OF CLOTHING IN SPECIALISED STORES
146	HOLLAND'S	4/6 WILLIAMSGATE STREET, GALWAY, H91WK76	RETAIL SALE OF NEWSPAPERS AND STATIONERY IN SPECIALISED STORES
147	HOME PHARMACY	13 FORSTER STREET, GALWAY, H91XT0A	DISPENSING CHEMIST IN SPECIALISED STORES
148	HOME STORE & MORE	UNIT 3/4, WELLPARK RETAIL CENTRE, WELLPARK ROAD, GALWAY, H91N2P3	RETAIL SALE OF FURNITURE, LIGHTING EQUIPMENT AND OTHER HOUSEHOLD ARTICLES IN SPECIALISED STORES
149	HORAN & SON	CONSTITUENCY OFFICE, WOODQUAY COURT, WOODQUAY, GALWAY, H91WR6D	LEGAL ACTIVITIES
150	HSE	UNIVERSITY HOSPITAL GALWAY, NEWCASTLE ROAD, GALWAY, H91YR71	OTHER HUMAN HEALTH ACTIVITIES
151	HUGHES BAR	14 WOODQUAY, GALWAY, H91C2Y7	BEVERAGE SERVING ACTIVITIES
152	IARNROD TIREANN	CEANNT STATION, STATION ROAD, GALWAY, H91T9CE	LAND TRANSPORT AND TRANSPORT VIA PIPELINES
153	IGGY MADDEN TRANSPORT	GALWAY HARBOUR ENTERPRISE PARK, NEW DOCKS, THE DOCKS, GALWAY, H91TV76	FREIGHT TRANSPORT BY ROAD
154	IGNITE COACHING	ROSS HOUSE, MERCHANTS ROAD, GALWAY, H91FPK5	OTHER SOCIAL WORK ACTIVITIES WITHOUT ACCOMMODATION
155	IMPERIAL HOTEL	35 EYRE SQUARE, GALWAY, H91X529	HOTELS AND SIMILAR ACCOMMODATION
156	INLAND FISHERIES IRELAND	TEACH BREAC, EARLS ISLAND, GALWAY, H91E2A2	REGULATION OF AND CONTRIBUTION TO MORE EFFICIENT OPERATION OF BUSINESSES
157	INTERNATIONAL HOUSE	19A EYRE SQUARE, GALWAY, H91E516	OTHER EDUCATION
158	IRELAND ASSIST LTD.	CNOC RUA, 22_26 PROSPECT HILL, GALWAY, H91ADX2	NON-LIFE INSURANCE
159	IRWINS FUNERAL HOME	BÓTHAR IRWIN, GALWAY, H91CK84	FUNERAL AND RELATED ACTIVITIES
160	IT MUSIC	BÓTHAR BHREANDAIN UÍ EITHIR, GALWAY, H91C8X7	RETAIL SALE OF FURNITURE, LIGHTING EQUIPMENT AND OTHER HOUSEHOLD ARTICLES IN SPECIALISED STORES
161	IVY HOUSE	116 COLLEGE ROAD, GALWAY, H91W082	OTHER ACCOMMODATION
162	JAMES A. ROCHE B.E.	16 FORSTER STREET, GALWAY, H91YY31	ENGINEERING ACTIVITIES AND RELATED TECHNICAL CONSULTANCY
163	JIGSAW	VICTORIA HOUSE, VICTORIA PLACE, GALWAY, H91R9CH	OTHER SOCIAL WORK ACTIVITIES WITHOUT ACCOMMODATION
164	JOHN F. KIELY	10 MCDONAGH TERRACE, WOODQUAY, GALWAY, H91R8X6	LEGAL ACTIVITIES
165	JOYCE, MACKIE & LOUGHEED	8 SAINT ANTHONY'S PLACE, WOODQUAY, GALWAY, H91K753	REAL ESTATE AGENCIES
166	JULIE'S HAIR DESIGN	13 SAINT FRANCIS STREET, GALWAY, H91XP21	HAIRDRESSING AND OTHER BEAUTY TREATMENT

ID	NAME	ADDRESS	BUSINESS TYPE
167	JUNGLE	29 FORSTER STREET, GALWAY, H91EK71	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
168	JUNGLE FLORIST	29 FORSTER STREET, GALWAY, H91X7D6	RETAIL SALE OF FLOWERS, PLANTS, SEEDS, FERTILISERS, PET ANIMALS AND PET FOOD IN SPECIALISED STORES
169	KAYANNE HORGAN SOLICITORS	ODEON HOUSE, 7 EYRE SQUARE, GALWAY, H91CP5T	LEGAL ACTIVITIES
170	KBC	EYRE SQUARE, GALWAY, H91Y1X2	OTHER MONETARY INTERMEDIATION
171	KEANE MAHONY SMITH	37 PROSPECT HILL, GALWAY, H91K271	REAL ESTATE AGENCIES
172	KENNEDY'S	47 EYRE SQUARE, GALWAY, H91C1HW	BEVERAGE SERVING ACTIVITIES
173	KINLAY HOSTEL	MERCHANTS ROAD, GALWAY, H91F2KT	OTHER ACCOMMODATION
174	LA FEMME	10 EGLINTON STREET, GALWAY, H91XP77	RETAIL SALE OF CLOTHING IN SPECIALISED STORES
175	LADBROKES	35 WOODQUAY, GALWAY, H91RX56	GAMBLING AND BETTING ACTIVITIES
176	LADIES HAIR DRESSING SALON	15 WOODQUAY, GALWAY, H91XV83	HAIRDRESSING AND OTHER BEAUTY TREATMENT
177	LAKEVIEW SCHOOL	WOODLANDS, DUBLIN ROAD, GALWAY, H91YF88	PRIMARY EDUCATION
178	LALLY TOURS	4 FORSTER STREET, GALWAY, H91A317	OTHER RESERVATION SERVICE AND RELATED ACTIVITIES
179	LAPTECK	11 EYRE STREET, GALWAY, H91E308	RETAIL SALE OF COMPUTERS, PERIPHERAL UNITS AND SOFTWARE IN SPECIALISED STORES
180	LASTA MARA	DOCK ROAD, THE DOCKS, GALWAY, H91YTK2	SEA AND COASTAL FREIGHT WATER TRANSPORT
181	LAZLO JEWELLERS	20 WILLIAM STREET, GALWAY, H91F8D9	RETAIL SALE OF WATCHES AND JEWELLERY IN SPECIALISED STORES
182	LE PETIT POIS	VICTORIA PLACE, GALWAY, H91TY40	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
183	LEGAL AID BOARD	9A SAINT FRANCIS STREET, GALWAY, H91EV2F	LEGAL ACTIVITIES
184	L'OCCITANE	12 EGLINTON STREET, GALWAY, H91D278	RETAIL SALE OF COSMETIC AND TOILET ARTICLES IN SPECIALISED STORES
185	LOGUES	5/7 WILLIAMSGATE STREET, GALWAY, H91W6W7	RETAIL SALE OF FOOTWEAR AND LEATHER GOODS IN SPECIALISED STORES
186	LOHAN'S PHARMACY	60 PROSPECT HILL, GALWAY, H91VX40	DISPENSING CHEMIST IN SPECIALISED STORES
187	LYNCH AUCTIONEERS	EYRE STREET, GALWAY, H91P295	REAL ESTATE AGENCIES
188	LYNFIELD	9 COLLEGE ROAD, GALWAY, H91EE37	OTHER ACCOMMODATION
189	MACDERMOTT AND ALLEN	10 SAINT FRANCIS STREET, GALWAY, H91A0D1	LEGAL ACTIVITIES
190	MACE	RETAIL UNIT 2 GROUND FLOOR, 37/39 FORSTER STREET, GALWAY, H91FXA6	RETAIL SALE IN NON-SPECIALIZED STORES WITH FOOD, BEVERAGES OR TOBACCO PREDOMINATING
191	MACNAS	EARLS ISLAND, GALWAY, H91D9CV	SUPPORT ACTIVITIES TO PERFORMING ARTS

ID	NAME	ADDRESS	BUSINESS TYPE
192	MACSWEENEY & COMPANY	22 EYRE SQUARE, GALWAY, H91XP3Y	LEGAL ACTIVITIES
193	MANDATE	UNIT 2, MARY STREET, GALWAY, H91ARX3	ACTIVITIES OF TRADE UNIONS
194	MATT O'FLAHERTY CHEMISTS	37 EYRE SQUARE, GALWAY, H91W63A	DISPENSING CHEMIST IN SPECIALISED STORES
195	MCCARTHY AND ASSOCIATES FINANCIAL CONSULTANTS LTD.	WATERVILLE HOUSE, 7 WALSH'S TERRACE, WOODQUAY, GALWAY, H91A257	OTHER ACTIVITIES AUXILIARY TO FINANCIAL SERVICES, EXCEPT INSURANCE AND PENSION FUNDING
196	MCGETTIGAN'S	9/11 PROSPECT HILL, GALWAY, H91VK27	BEVERAGE SERVING ACTIVITIES
197	MCGINN'S HOP HOUSE	18/19 WOODQUAY, GALWAY, H91AW2P	BEVERAGE SERVING ACTIVITIES
198	MCINERNEY SOLICITORS	CLEGGAN HOUSE, 46 EYRE SQUARE, GALWAY, H91Y3X6	LEGAL ACTIVITIES
199	MCMAHON & CO. SOLICITORS	1ST FLOOR, 27 WOODQUAY, GALWAY, H91DT98	LEGAL ACTIVITIES
200	MCSWIGGANS	3/5 EYRE STREET, GALWAY, H91X0KX	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
201	MERCHANT CAFÉ	6 FORSTER STREET, GALWAY, H91KD99	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
202	METHODIST SCHOOL	SCHOOL HOUSE, QUEEN STREET, GALWAY, H91HH66	ACTIVITIES OF RELIGIOUS ORGANIZATIONS
203	MIZZONI'S PIZZA	40 EYRE SQUARE, GALWAY, H91F882	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
204	MOTOR TAX	GALWAY COUNTY COUNCIL, COUNTY HALL, PROSPECT HILL, GALWAY, H91H6KX	GENERAL PUBLIC ADMINISTRATION ACTIVITIES
205	MRHC	5 DALYS PLACE, WOODQUAY, GALWAY, H91P0K1	HAIRDRESSING AND OTHER BEAUTY TREATMENT
206	MULROY & CO.	SAINT ANN'S, 4 UNIVERSITY ROAD, GALWAY, H91D3H4	LEGAL ACTIVITIES
207	MURTY RABBITTS	23/25 FORSTER STREET, GALWAY, H91W1WK	BEVERAGE SERVING ACTIVITIES
208	NATIONAL UNIVERSITY OF IRELAND GALWAY	UNIVERSITY ROAD, GALWAY, H91TK33	TERTIARY EDUCATION
209	NILAND HOLDINGS LTD.	2 VICTORIA PLACE, GALWAY, H91DDR6	ACTIVITIES OF HOLDING COMPANIES
210	NOEL J. FARRELL AND ASSOCIATES	12 UNIVERSITY ROAD, GALWAY, H91E7EP	ENGINEERING ACTIVITIES AND RELATED TECHNICAL CONSULTANCY
211	O'BRIEN	22 WILLIAM STREET, GALWAY, H91RWK1	RETAIL SALE OF NEWSPAPERS AND STATIONERY IN SPECIALISED STORES
212	O'CONNELLS	8 EYRE SQUARE, GALWAY, H91FT22	BEVERAGE SERVING ACTIVITIES
213	O'CONNORS	FLAT 3, 3/4 SAINT FRANCIS STREET, GALWAY, H91KV90	BEVERAGE SERVING ACTIVITIES
214	O'HEHIRS	BUSÁRAS NA GAILLIMHE, ÁRAS CÓISTÍ, FAIRGREEN ROAD, GALWAY, H91CX90	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
215	ON YER BIKE	42 PROSPECT HILL, GALWAY, H91N5F6	RETAIL SALE OF SPORTING EQUIPMENT IN SPECIALISED STORES

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216	ORLA MURRAY FINANCIAL SERVICES	1 FORTHILL STREET, GALWAY, H91Y542	OTHER ACTIVITIES AUXILIARY TO FINANCIAL SERVICES, EXCEPT INSURANCE AND PENSION FUNDING
217	O'TOOLE'S TOOLS	5 ROSEMARY AVENUE, GALWAY, H91K7F3	RETAIL SALE OF HARDWARE, PAINTS AND GLASS IN SPECIALISED STORES
218	P. & O. MARITIME	GALWAY HARBOUR ENTERPRISE PARK, NEW DOCKS, THE DOCKS, GALWAY, H91XVR3	SERVICE ACTIVITIES INCIDENTAL TO WATER TRANSPORTATION
219	PADDY POWER	PROSPECT HOUSE, 8 PROSPECT HILL, GALWAY, H91T2D3	GAMBLING AND BETTING ACTIVITIES
220	PADDY POWER	162 COLLEGE ROAD, GALWAY, H91WF60	GAMBLING AND BETTING ACTIVITIES
221	PADDY POWER	13 WOODQUAY, GALWAY, H91D290	GAMBLING AND BETTING ACTIVITIES
222	PADDYS	12/14 PROSPECT HILL, GALWAY, H91C6C0	BEVERAGE SERVING ACTIVITIES
223	PADRAIC J. REGAN F.R.SC. (PLAST.)	15 UNIVERSITY ROAD, GALWAY, H91K5RE	SPECIALIST MEDICAL PRACTICE ACTIVITIES
224	PARK HOUSE HOTEL	18 FORSTER STREET, GALWAY, H91PCF8	HOTELS AND SIMILAR ACCOMMODATION
225	PASCAL COFFEE HOUSE	EDWARD SQUARE, BARRACK LANE, GALWAY, H91N4N2	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
226	PASTA FACTORY	13 MARY STREET, GALWAY, H91K4X2	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
227	PAT RYNN ENGINEERING	GALWAY HARBOUR ENTERPRISE PARK, NEW DOCKS, THE DOCKS, GALWAY, H91W5T8	ENGINEERING ACTIVITIES AND RELATED TECHNICAL CONSULTANCY
228	PERMANENT TSB	31 EYRE SQUARE, GALWAY, H91P5Y8	OTHER MONETARY INTERMEDIATION
229	PETITE BEAUTÉ	UNIT 2, BÓTHAR BHREANDAIN UÍ EITHIR, GALWAY, H91X781	HAIRDRESSING AND OTHER BEAUTY TREATMENT
230	PETRA	29 COLLEGE ROAD, GALWAY, H91PV40	OTHER ACCOMMODATION
231	PODIATRY CLINIC SEAMUS O'HAGAN & ASSOCIATES	7 EGLINTON STREET, GALWAY, H91NYD6	OTHER HUMAN HEALTH ACTIVITIES
232	PREMOLI	WILLIAM STREET, GALWAY, H91E009	RETAIL SALE OF FOOTWEAR AND LEATHER GOODS IN SPECIALISED STORES
233	PRO CABS	7 PROSPECT HILL, GALWAY, H91XNV9	TAXI OPERATION
234	PROMETRIC	43 FORSTER STREET, GALWAY, H91R68N	OTHER EDUCATION
235	PROSPECT HILL LAUNDRETTE	44 PROSPECT HILL, GALWAY, H91X002	WASHING AND (DRY-)CLEANING OF TEXTILE AND FUR PRODUCTS
236	Q23 MENSWEAR	2 ROSEMARY AVENUE, GALWAY, H91D1FN	RETAIL SALE OF CLOTHING IN SPECIALISED STORES
237	QUAY DENTAL	12 WALSH'S TERRACE, WOODQUAY, GALWAY, H91H6FH	DENTAL PRACTICE ACTIVITIES
238	RED SQUARE	EYRE SQUARE HOTEL, 8/10 FORSTER STREET, GALWAY, H91TCP0	BEVERAGE SERVING ACTIVITIES
239	REVIVE CAFE	EYRE SQUARE TOWNHOUSE, 35 EYRE STREET, GALWAY, H91K5CE	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES

ID	NAME	ADDRESS	BUSINESS TYPE
240	RICHARD HUGHES F.A.O.I. OPTICIANS	CORNER HOUSE, 37 WOODQUAY, GALWAY, H91FW10	SPECIALIST MEDICAL PRACTICE ACTIVITIES
241	RICHARD WALSH CYCLES	11 HEADFORD ROAD, GALWAY, H91YFF9	RETAIL SALE OF SPORTING EQUIPMENT IN SPECIALISED STORES
242	RICHARDSONS	1 EYRE SQUARE, GALWAY, H91ED70	BEVERAGE SERVING ACTIVITIES
243	ROMAN CATHOLIC CHURCH	SAINT PATRICK'S CHURCH, FORSTER STREET, GALWAY, H91FP84	ACTIVITIES OF RELIGIOUS ORGANIZATIONS
244	ROMAN CATHOLIC CHURCH	THE CATHEDRAL, GAOL ROAD, GALWAY, H91A780	ACTIVITIES OF RELIGIOUS ORGANIZATIONS
245	ROMAN CATHOLIC CHURCH	SAINT FRANCIS ABBEY, 8 SAINT FRANCIS STREET, GALWAY, H91C53K	ACTIVITIES OF RELIGIOUS ORGANIZATIONS
246	ROSSA	21 SAINT BRENDAN'S AVENUE, WOODQUAY, GALWAY, H91EY16	OTHER ACCOMMODATION
247	SAINT COLUMBA'S CREDIT UNION	24 EYRE SQUARE, GALWAY, H91XP84	OTHER MONETARY INTERMEDIATION
248	SAINT JOSEPH'S PATRICIAN COLLEGE THE BISH ROWING CLUB	RIVERSIDE, WOODQUAY, GALWAY, H91N1Y9	ACTIVITIES OF SPORT CLUBS
249	SAINT JUDE'S LODGE	24 COLLEGE ROAD, GALWAY, H91N560	OTHER ACCOMMODATION
250	SAINT NICHOLAS PAROCHIAL SCHOOL	WATERSIDE, WOODQUAY, GALWAY, H91W2V0	PRIMARY EDUCATION
251	SAINT PATRICK'S BAND SOCIETY	FAIRGREEN ROAD, GALWAY, H91KT68	PERFORMING ARTS
252	SAINT PATRICK'S HALL	FORSTER STREET, GALWAY, H91F722	ACTIVITIES OF OTHER MEMBERSHIP ORGANISATIONS
253	SALMON WEIR HOSTEL	3 SAINT VINCENTS AVENUE, WOODQUAY, GALWAY, H91NR77	OTHER ACCOMMODATION
254	SAN ANTONIO	5/6 HEADFORD ROAD, GALWAY, H91K8E8	OTHER ACCOMMODATION
255	SARA MASON PROFESSIONAL	UNIT 3, BÓTHAR BHREANDAIN UÍ EITHIR, GALWAY, H91P0E0	HAIRDRESSING AND OTHER BEAUTY TREATMENT
256	SAVOY HOSTEL	EGLINTON STREET, GALWAY, H91VW14	OTHER ACCOMMODATION
257	SHAKE DOG	32 PROSPECT HILL, GALWAY, H91K2K0	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
258	SHERRY FITZGERALD	ONE GALWAY CENTRAL, FORSTER STREET, GALWAY, H91E3FW	REAL ESTATE AGENCIES
259	SKECHERS	3/5 WILLIAM STREET, GALWAY, H91Y9H3	RETAIL SALE OF FOOTWEAR AND LEATHER GOODS IN SPECIALISED STORES
260	SKEFFINGTON ARMS HOTEL	EYRE SQUARE, GALWAY, H91CFX5	HOTELS AND SIMILAR ACCOMMODATION
261	SLEEP ZONE HOSTEL	BÓTHAR NA MBAN, GALWAY, H91TD66	OTHER ACCOMMODATION
262	SNOOZLES	FORSTER STREET, GALWAY, H91D378	OTHER ACCOMMODATION
263	STITCHES	4 EYRE STREET, GALWAY, H91VY81	MANUFACTURE OF WEARING APPAREL
264	STUDIO102	TOWNHOUSE 27, EYRE SQUARE CENTRE, EYRE SQUARE, GALWAY, H91A0V2	HAIRDRESSING AND OTHER BEAUTY TREATMENT
265	STYLE	EGLINTON STREET, GALWAY, H91NW66	HAIRDRESSING AND OTHER BEAUTY TREATMENT

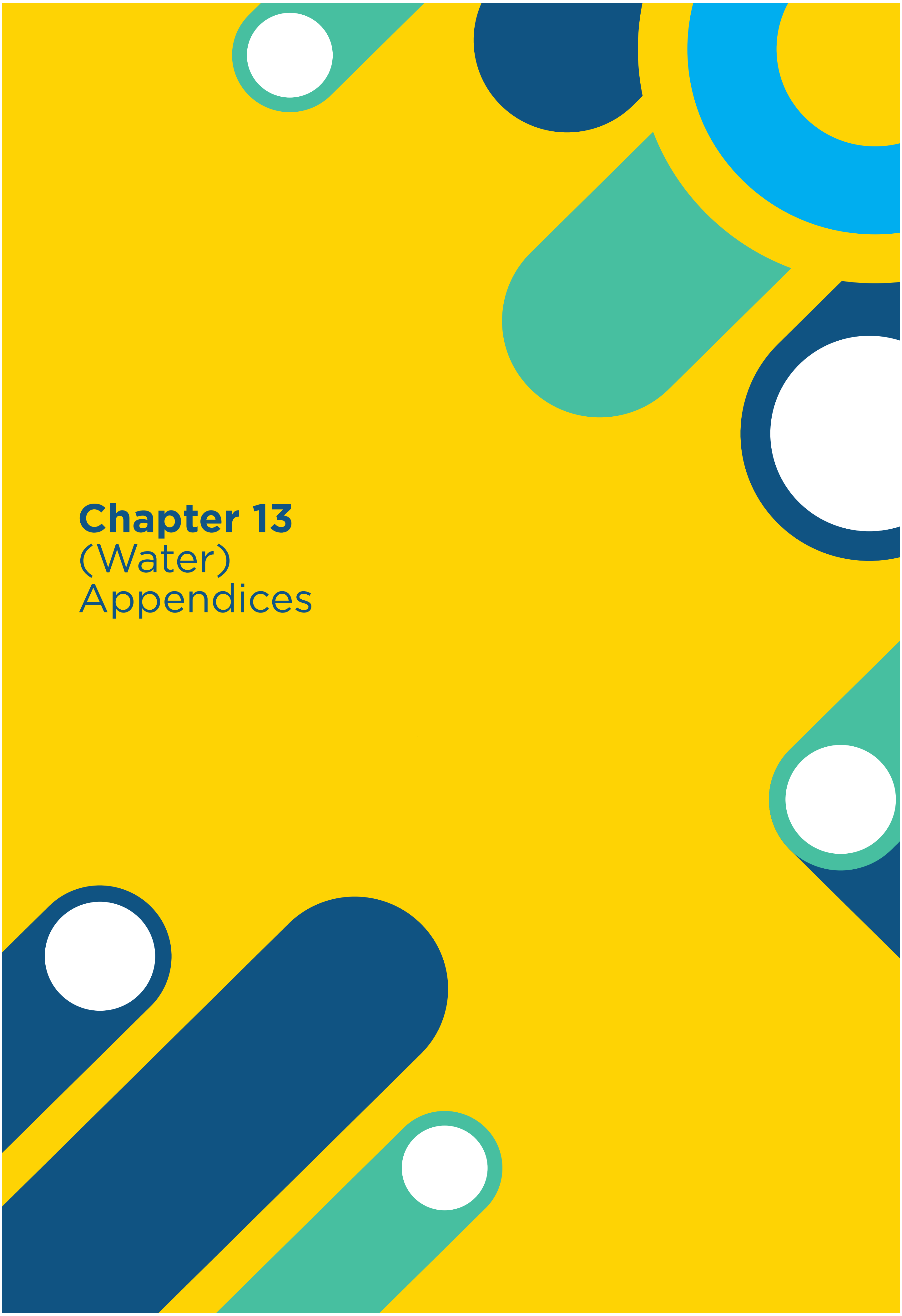
ID	NAME	ADDRESS	BUSINESS TYPE
266	SUB-CITY COMICS	CORBETT COURT, WILLIAMSGATE STREET, GALWAY, H91A2HA	RETAIL SALE OF CLOTHING IN SPECIALISED STORES
267	SUNNY CAR VALETING CENTRE	HEADFORD ROAD, GALWAY, H91TV7R	OTHER PERSONAL SERVICE ACTIVITIES
268	SUPER KETONES	76 PROSPECT HILL, GALWAY, H91N24E	RETAIL SALE IN NON-SPECIALIZED STORES WITH FOOD, BEVERAGES OR TOBACCO PREDOMINATING
269	SUPERMAC'S	36 EYRE SQUARE, GALWAY, H91T2CX	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
270	T.K. MAXX	CITYPOINT, 13-27 PROSPECT HILL, GALWAY, H91CK28	RETAIL SALE OF OTHER GOODS IN SPECIALISED STORES
271	TEXACO	CENTRA, LOUGH ATALIA ROAD, GALWAY, H91KN7F	RETAIL SALE OF AUTOMOTIVE FUEL IN SPECIALISED STORES
272	TEXACO (IRELAND) LIMITED	LOUGH ATALIA ROAD, GALWAY, H91PX2R	WHOLESALE OF SOLID, LIQUID AND GASEOUS FUELS AND RELATED PRODUCTS
273	THE ANCHOR LODGE	ANCHOR LODGE, 13 COLLEGE ROAD, GALWAY, H91D2XK	OTHER ACCOMMODATION
274	THE ANTIQUES ROOM	11 WOODQUAY, GALWAY, H91AX50	RETAIL SALE OF SECOND-HAND GOODS IN STORES
275	THE BLACK GATE CULTURAL CENTRE	14 SAINT FRANCIS STREET, GALWAY, H91R6P3	CREATIVE, ARTS AND ENTERTAINMENT ACTIVITIES
276	THE CHARCOAL GRILL	3 PROSPECT HILL, GALWAY, H91T291	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
277	THE ECIG STORE	EGLINTON STREET, GALWAY, H91WYF3	RETAIL SALE OF TOBACCO PRODUCTS IN SPECIALISED STORES
278	THE G HOTEL & SPA	DUBLIN ROAD, GALWAY, H91V0HR	HOTELS AND SIMILAR ACCOMMODATION
279	THE GALMONT HOTEL & SPA	FAIRGREEN ROAD, GALWAY, H91CYN3	HOTELS AND SIMILAR ACCOMMODATION
280	THE GALWAY COUNTY CLUB	GAOL ROAD, GALWAY, H91W257	ACTIVITIES OF OTHER MEMBERSHIP ORGANISATIONS
281	THE GRAFTON BARBER	1 EYRE STREET, GALWAY, H91EY17	HAIRDRESSING AND OTHER BEAUTY TREATMENT
282	THE HARDIMAN	14/15 EYRE SQUARE, GALWAY, H91NFD2	HOTELS AND SIMILAR ACCOMMODATION
283	THE HUNTSMAN INN	THE HUNSTMAN, 164 COLLEGE ROAD, GALWAY, H91D5DW	BEVERAGE SERVING ACTIVITIES
284	THE LOUGH INN	32 WOODQUAY, GALWAY, H91FK81	BEVERAGE SERVING ACTIVITIES
285	THE OL'55 BAR	30 PROSPECT HILL, GALWAY, H91YD86	BEVERAGE SERVING ACTIVITIES
286	THE PHYSIO COMPANY	ATLANTIC HOUSE, 39 PROSPECT HILL, GALWAY, H91DD5X	PHYSICAL WELL-BEING ACTIVITIES
287	THE POSTGRADUATE APPLICATIONS CENTRE LTD.	1 COURTHOUSE SQUARE, GALWAY, H91VF21	TERTIARY EDUCATION
288	THE SITTING DUCK	37 EYRE STREET, GALWAY, H91EWH7	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES

ID	NAME	ADDRESS	BUSINESS TYPE
289	THE WESTERN HOTEL	33 PROSPECT HILL, GALWAY, H91Y3FA	HOTELS AND SIMILAR ACCOMMODATION
290	THE WINE BUFF	15 EGLINTON STREET, GALWAY, H91VA40	RETAIL SALE OF BEVERAGES IN SPECIALISED STORES
291	THÉRESE MOYLAN SKINCARE CENTRE	10 WOODQUAY, GALWAY, H91AY90	PHYSICAL WELL-BEING ACTIVITIES
292	THIRTEEN ON THE GREEN	13 EYRE SQUARE, GALWAY, H91N6PF	HOTELS AND SIMILAR ACCOMMODATION
293	THRESHOLD	5 PROSPECT HILL, GALWAY, H91HC1H	OTHER SOCIAL WORK ACTIVITIES WITHOUT ACCOMMODATION
294	TOMODACHI SUSHI BAR	COLONIAL BUILDINGS, EGLINTON STREET, GALWAY, H91XWH3	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
295	TOP NOTCH	20 EGLINTON STREET, GALWAY, H91F958	RETAIL SALE OF CLOTHING IN SPECIALISED STORES
296	TOWN HALL THEATRE	TOWN HALL, COURTHOUSE SQUARE, GALWAY, H91H3C2	OPERATION OF ARTS FACILITIES
297	TREASURE CHEST	31/33 WILLIAM STREET, GALWAY, H91CY64	RETAIL SALE OF OTHER GOODS IN SPECIALISED STORES
298	TRESPASS	TOWER HOUSE, EGLINTON STREET, GALWAY, H91X25V	RETAIL SALE OF CLOTHING IN SPECIALISED STORES
299	TRIBESMEN ROWING CLUB	EARLS ISLAND, GALWAY, H91EP9N	ACTIVITIES OF SPORT CLUBS
300	TRIBETON	1-3 MERCHANTS ROAD, GALWAY, H91AT0V	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
301	TUSLA	FAIRGREEN HOUSE, FAIRGREEN ROAD, GALWAY, H91AXK8	REGULATION OF THE ACTIVITIES OF PROVIDING HEALTH CARE, EDUCATION, CULTURAL SERVICES AND OTHER SOCIAL SERVICES, EXCLUDING SOCIAL SECURITY
302	ULSTER BANK	EXCHANGE HOUSE, FAIRGREEN ROAD, GALWAY, H91D767	OTHER MONETARY INTERMEDIATION
303	ULSTER BANK	33 EYRE SQUARE, GALWAY, H91HY96	OTHER MONETARY INTERMEDIATION
304	UNBOUND MEDIA	UNIT 4, BÓTHAR BHREANDAIN UÍ EITHIR, GALWAY, H91A407	OTHER INFORMATION TECHNOLOGY AND COMPUTER RELATED ACTIVITIES
305	UNITED METHODIST AND PRESBYTERIAN CHURCH	QUEEN STREET, GALWAY, H91TW21	ACTIVITIES OF RELIGIOUS ORGANIZATIONS
306	V.P. MOTORS GALWAY LTD.	QUEEN STREET, GALWAY, H91NR7F	SALE OF CARS AND LIGHT MOTOR VEHICLES
307	VICTORIA HOTEL	VICTORIA PLACE, GALWAY, H91KVW0	HOTELS AND SIMILAR ACCOMMODATION
308	VOCHO	19 FORSTER STREET, GALWAY, H91CR9T	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
309	WARD'S CORNER STORE	1 UNIVERSITY ROAD, GALWAY, H91Y234	RETAIL SALE OF NEWSPAPERS AND STATIONERY IN SPECIALISED STORES
310	WILLIAM F. SEMPLE AND CO.	LOUGH CORRIB HOUSE, 5 WATERSIDE, WOODQUAY, GALWAY, H91PT0C	LEGAL ACTIVITIES
311	WONDER PHOTO SHOP	2 WILLIAMSGATE STREET, GALWAY, H91TF60	PHOTOGRAPHIC ACTIVITIES

ID	NAME	ADDRESS	BUSINESS TYPE
312	WOODIE'S DIY	WELLPARK RETAIL CENTRE, WELLPARK ROAD, GALWAY, H91YEY2	RETAIL SALE OF HARDWARE, PAINTS AND GLASS IN SPECIALISED STORES
313	WOODQUAY HOSTEL	24 WOODQUAY, GALWAY, H91YX71	OTHER ACCOMMODATION
314	WOODQUAY STORES	DAY-TODAY, 21 WOODQUAY, GALWAY, H91CK72	RETAIL SALE IN NON-SPECIALIZED STORES WITH FOOD, BEVERAGES OR TOBACCO PREDOMINATING
315	YEATS COLLEGE	COLLEGE ROAD, GALWAY, H91PW50	SECONDARY EDUCATION
316	YES FLOWERS	9 EGLINTON STREET, GALWAY, H91E6E5	RETAIL SALE OF FLOWERS, PLANTS, SEEDS, FERTILISERS, PET ANIMALS AND PET FOOD IN SPECIALISED STORES
317	YOUTH WORK IRELAND GALWAY	41/43 PROSPECT HILL, GALWAY, H91E4W5	OTHER SOCIAL WORK ACTIVITIES WITHOUT ACCOMMODATION
318	YUMMY WOK	10 HEADFORD ROAD, GALWAY, H91XT22	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES
319	ZAPPI'S	16/18 EGLINTON STREET, GALWAY, H91YX62	RESTAURANTS AND MOBILE FOOD SERVICE ACTIVITIES

Businesses located on routes that will be negatively affected by traffic as a result of the proposed development.

ID	NAME	ADDRESS	BUSINESS TYPE
64	CITY DIRECT	LOUGH ATALIA ROAD, GALWAY, H91CDD8	OTHER PASSENGER LAND TRANSPORT N.E.C.
143	HARBOUR HOTEL	BÓTHAR NA LONG, THE DOCKS, GALWAY, H91E9PR	HOTELS AND SIMILAR ACCOMMODATION
271	TEXACO	CENTRA, LOUGH ATALIA ROAD, GALWAY, H91KN7F	RETAIL SALE OF AUTOMOTIVE FUEL IN SPECIALISED STORES
272	TEXACO (IRELAND) LIMITED	LOUGH ATALIA ROAD, GALWAY, H91PX2R	WHOLESALE OF SOLID, LIQUID AND GASEOUS FUELS AND RELATED PRODUCTS



Chapter 13
(Water) Appendices

Galway City Council

BusConnects Galway: Cross-City Link (University Road to Dublin Road)

Flood Risk Assessment

253352-00

Issue | August 2022

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Contents

Figures

Executive Summary

Arup was commissioned by Galway City Council to prepare a site-specific Flood Risk Assessment (FRA) to support a planning application for the proposed Bus Connects Galway: Cross-City Link (University Road to Dublin Road) transport infrastructure development within Galway City Centre.

This FRA is undertaken in accordance with “The Planning System and Flood Risk Management Guidelines for Planning Authorities” published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DoEHLG) and Circular PL 2/2014 (here after known as the Guidelines).

Galway City has historically been prone to fluvial and/or tidal flooding with some significant events occurring in recent years. Parts of the site are at risk of flooding from the River Corrib and surrounding canals and waterways. The risk of pluvial and groundwater flooding to the site is considered moderate and is limited to the construction period.

The Proposed Scheme has an overall length of approximately 6.7km of road infrastructure, cycle lane and pedestrian walkway upgrades and therefore interfaces with many watercourses. The site ground levels vary significantly throughout.

As sections of the Study Area are located within Flood Zones A and B and are deemed vulnerable, a Justification Test for the development was completed as part of the site-specific Flood Risk Assessment (FRA) and it was determined that the development proposal satisfied all the requirements.

The scope of the Proposed Scheme is in keeping with the existing road profile and does not increase the risk of flooding elsewhere. Moreover, surface water management measures including upgraded surface water drainage system, additional green area, SUDs features such as tree pits, bioretention areas and catchpits, oversized pipes, and an attenuation tank are incorporated in the design.

To minimise the risk further, the design for this area ensured access and egress to emergency vehicles is not restricted at all times. Site staff employed during the construction of the Proposed Scheme will maintain awareness of flood and weather forecasts on an ongoing basis as well as receiving warnings from Galway City Council and Met Eireann as appropriate. During operation, motorist, cyclist, and pedestrian users will have sufficient notice through social media and news reports as part of weather warnings to avoid affected areas in advance of a possible flood.

This FRA demonstrated that the risks relating to flooding can be managed to acceptable levels and therefore comply with the Guidelines.

1 Introduction

1.1 Background

Arup was commissioned by Galway City Council (GCC) to prepare a site-specific Flood Risk Assessment (FRA) to support a planning application for the proposed Cross City Link.

This FRA was undertaken in accordance with the ‘The Planning System and Flood Risk Management Guidelines for Planning Authorities’ published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DoEHLG), and Circular PL 2/2014, herein referred to as “the Guidelines”. Reference is also made to the Strategic Flood Risk Assessment completed for the Galway City Development Plan 2017 – 2023.

1.2 Proposed Scheme

Galway City Council proposes to develop the BusConnects Galway: Cross-City Link (R863 University Road to R338 Dublin Road) (herein referred to as ‘the Proposed Scheme') as part of the Galway Transport Strategy.

The Proposed Scheme is a public transport priority corridor encompassing pedestrian crossings, upgraded footpaths, enhanced cycle facilities and additional bus priority measures, from University Road to Dublin Road. The Proposed Scheme is being progressed to enable more sustainable and effective movement in the transport networks in Galway City, and the wider region.

The Cross City Link route covers a total length of approximately 6.7km of road infrastructure, cycle lane and pedestrian walkway upgrades from University Road to Dublin Road. The route is shown in Figure 1.

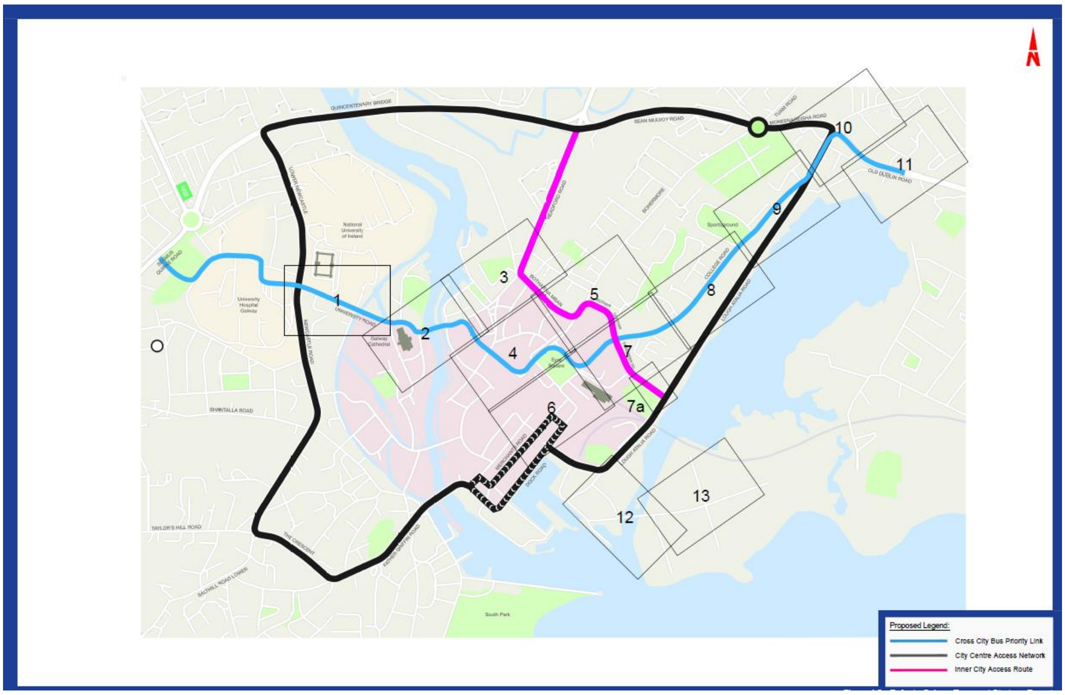


Figure 1: Cross-City Link (blue) of the Proposed Scheme layout

The Proposed Scheme commences at the junction of the University Road and Newcastle Road and moves eastwards along University Road and across the Salmon Weir Bridge. It continues to St Vincent’s Avenue, St Francis Street, Eglinton Street and into Eyre Square, routing along the northern and eastern sides of Eyre Square, on to Forster Street and through College Road. The Scheme continues to Dublin Road and terminates approximately 370m east of the junction at Moneenageisha.

Primary access to the Proposed Scheme will be from Lower Newcastle and the N6 from the University Roadside and via the Dublin Road and Well Park Road for the Moneenageisha junction. Emergency access/egress for all emergency services will be provided from all access routes.

A site plan and typical sections of the Proposed Scheme are included in the planning application.

1.3 Site Location

The Proposed Scheme is located within the Galway city centre, extending on the west from the University Road and R864 junction at the University Hospital Galway, travelling along University Road to the Galway Cathedral and city centre and extending east to College Road along Lough Atalia. Approximate points of eastern and western bounds are Irish Transverse Mercator (ITM) reference E: 530541, N: 725639 and E: 529071, N: 725716, respectively. The location of the Proposed Scheme including Site Compounds is shown in Figure 2.

Figure 2: Site location (© Open Street Map (and) contributors)

The site route crosses, from west to east, the Eglington Canal, Gaol River, Distillery River, the River Corrib, and Friars River. Additionally, sections of the site terminate on waterfronts at the Commercial Docks and Lough Atalia. The development is located along the major road infrastructure from University Road to Dublin Road. The proposed main Site Compounds are situated south of the site at Galway Harbour.

The River Corrib flows in a southerly direction through the development site.

The site slopes from north to south, falling from its highest point of +19.07mOD at Prospect Hill to the lowest points of +3.61mOD at Dock Road and +3.80mOD on Lough Atalia Road.

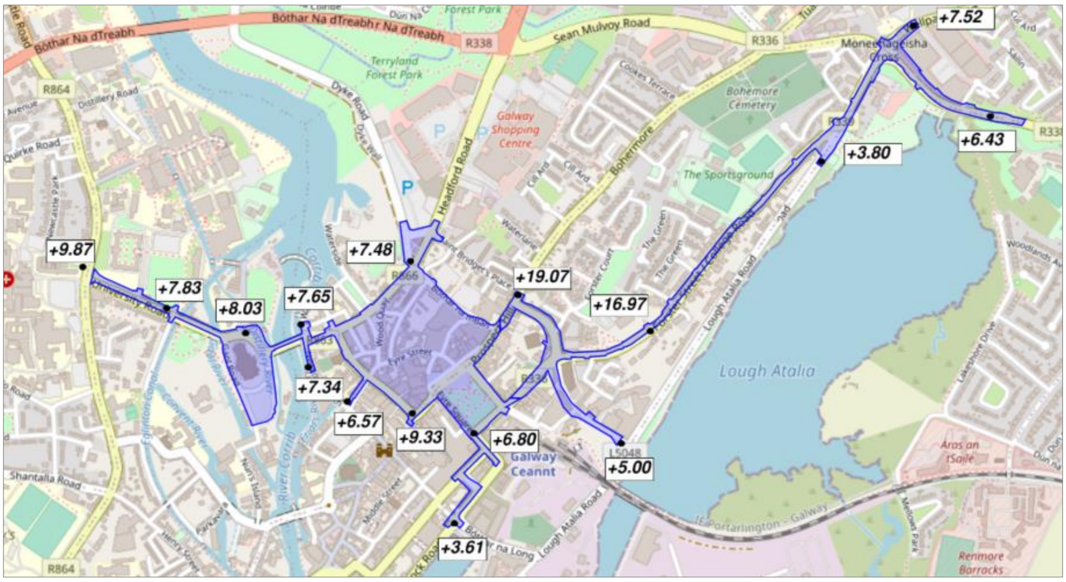


Figure 3: Site topographic levels (Information: APEX Surveys, 28th April 2017, Background: © Open Street Map (and) contributors)

1.4 Scope of the Report

This FRA report contains the following information:

- Identification and confirmation of the sources of flooding which may affect the site,
- A qualitative assessment of the risk of flooding from the various sources to the site and to adjacent areas because of construction of the Proposed Scheme,
- Justification Test for Development Management,
- Identification of possible measures which could mitigate the flood risk to acceptable levels, and
- Statement of residual flood risk.

1.5 Summary of Data Sources

Data relating to flood risk relevant to the Proposed Scheme and surrounding area has been obtained from the following sources:

- Galway City Development Plan 2017 – 2023 including its Strategic Flood Risk Assessment,
- Western CFRAM Hydrology and Hydraulics Reports and predictive flood mapping (https://www.floodinfo.ie/publications/),
- Western CFRAM Catchment Flood Risk Management Plan (https://www.floodinfo.ie/publications/),
- OPW National Flood Hazard Mapping Website (www.floodinfo.ie),
- Preliminary Flood Risk Assessment (PFRA) mapping produced by the OPW (https://www.floodinfo.ie/publications/),
- Topographical survey of the site,
- Proposed scheme planning application drawings.

2 Stage 1 – Flood Risk Identification

2.1 Historic Flooding Maps

The OSI Historic 6" map marks out flooding vulnerability along College Road and Dublin Road with incidents noted to occur at spring tide. Directly south of the Moneenageisha Road junction historic floods are outlined. This indicates a historic tendency for flooding at this low point of the road.

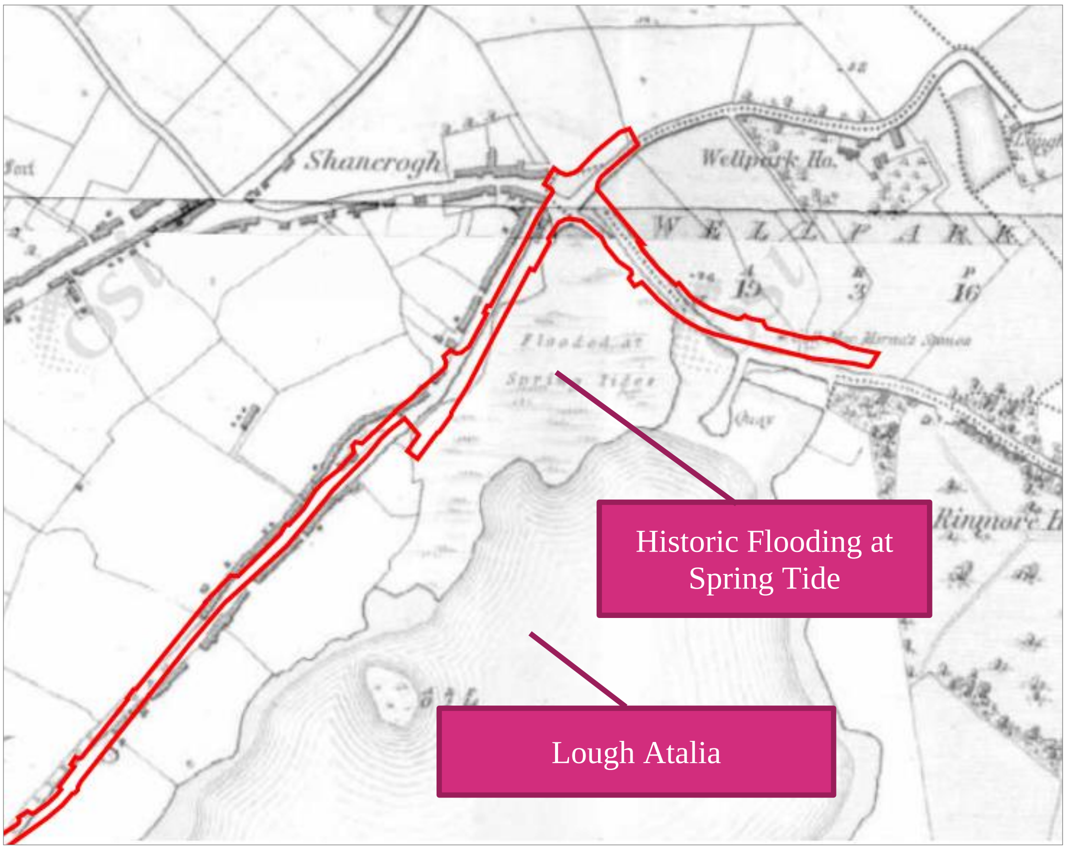


Figure 4: OSI Historic 6'' Mapping from Beehive

2.2 Past Flood Events

Records of past fluvial and tidal floods were obtained from the OPW National Flood Hazard Mapping website (www.floodmaps.ie) and reports produced as part of the Western Catchment Flood Risk Assessment Management Study (Western CFRAMS). There are no records for pluvial or groundwater flooding available from the above sources.

An extract from the National Flood Hazard Mapping website report summary, indicating the locations of recorded flood events, is shown in Figure 5. The area approximately 400m south of the Proposed Scheme is indicated to have flooded in the past.

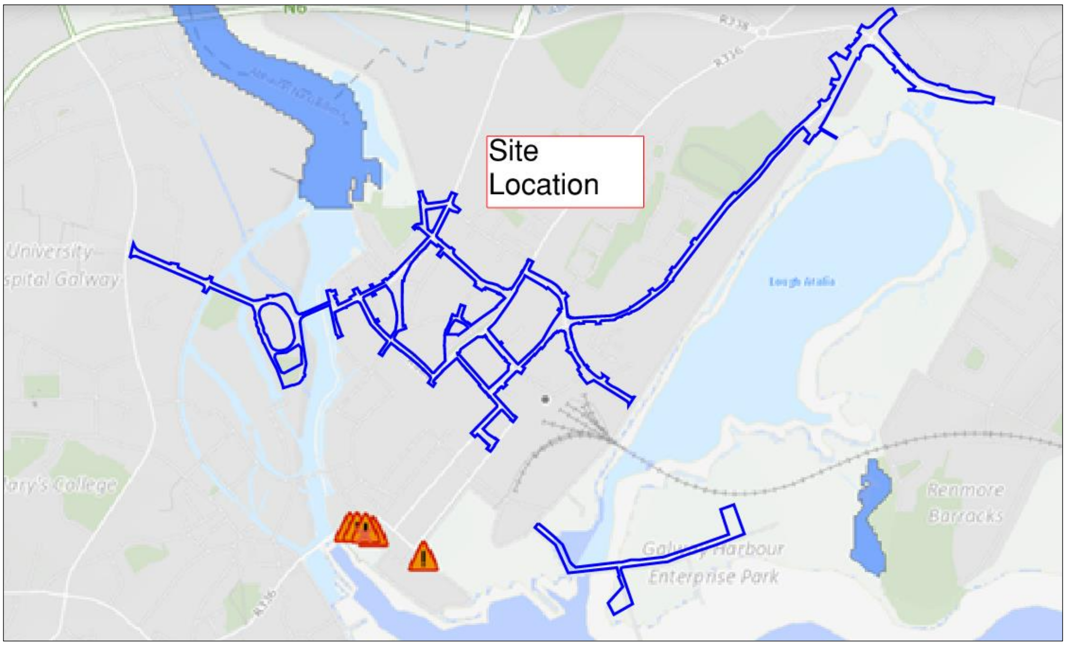


Figure 5: Past Flood Events - Extract from the National Flood Hazard Mapping Website

Galway City has historically been prone to fluvial and/or tidal flooding with significant events occurring in recent years. A summary of the flood events that have occurred near the subject site are listed in Table 1. However, none of the above recorded flood events have occurred within the boundary of the Proposed Scheme site.

Table 1: Summary of recorded flood events near the subject site (Source: OPW National Flood Hazard Mapping website).

Date of flood event	Location	Flooding mechanism
17 – 20 January 1995	Docks, Flood Street & Quay Street	Pluvial / Tidal
28 January 2013	Galway City	Pluvial
18 December 2013	Salthill & Galway	Tidal
3 January 2014	Salthill & Galway	Tidal
1 February 2014	Salthill & Galway	Tidal

2.3 Fluvial Flood Risk Map

The Western CFRAM was completed in recent years and provided predicted fluvial and tidal flood maps in Galway City for a range of return periods.

An extract from the Western CFRAMS fluvial flood extent map is presented in Figure 6. The predicted extents for the 1 in 10-, 100- and 1000-year fluvial flood events are shown.

The flood map indicates that the southern portion of Gaol Road south of the Galway Cathedral lies within the 1 in 1000-year fluvial flood extent (Flood Zone B), with the rest of the site is located outside of the 1 in 1000-year fluvial flood extent.

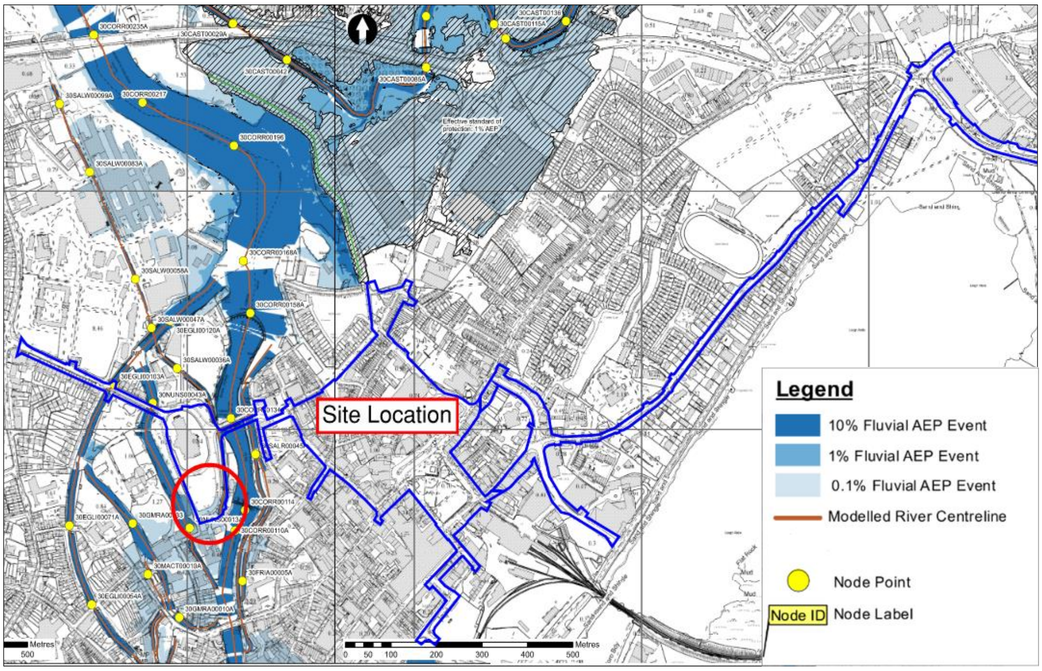


Figure 6: Flood Extents - Extract from Western CFRAMS fluvial flood extent map, current scenario

2.4 Tidal Flood Risk Map

An extract from the Western CFRAMS tidal flood extent map is displayed in Figure 7. The predicted extents for three separate return period events of the 1 in 10-, 200- and 1000-year tidal flood events are shown. Nodal points detailing the water level have not been included within the Western CFRAM Coastal study.

The flood map indicates that most of the site is in areas outside the 1 in 1000-year tidal flood extent, categorised as Flood Zone C. However, three sections of the work within the Lough Atalia/College Road region (no. 1 in figure 7) were categorised as Flood Zone B and an additional area along Dock Road was categorised as Flood Zone A (no.2 in Figure 7) and small encroachment at Dyke Road.

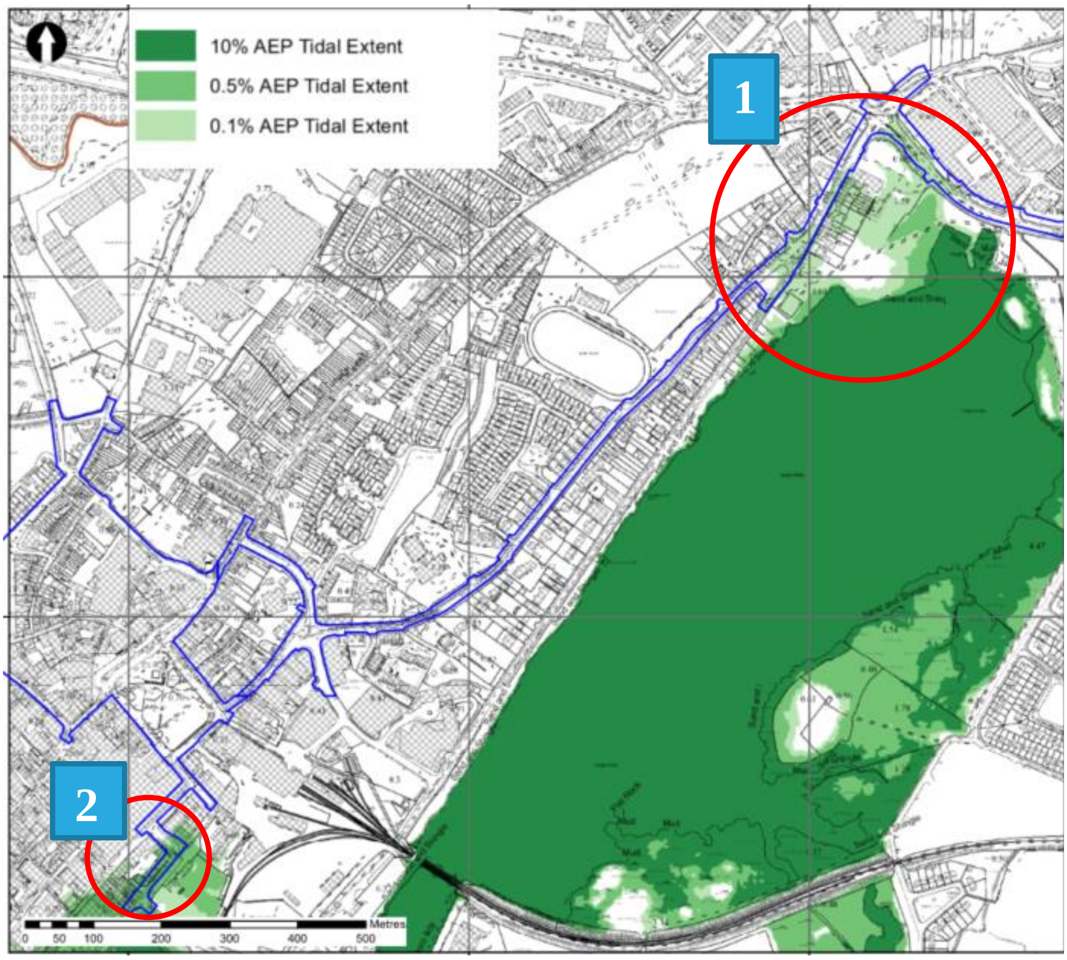


Figure 7: Extract from the Western CFRAM tidal flood extent map

2.5 Pluvial Flooding

Pluvial flooding occurs when extreme rainfall overwhelms drainage systems or soil infiltration capacity, causing excess rainwater to pond above ground at low points in the topography. To assess the risk of pluvial flooding to the development, the PFRA mapping undertaken by the OPW was reviewed. An extract of the OPW PFRA map is presented in Figure 8.

The PFRA map indicates that the site and many of the roads in the vicinity of the site are not within areas at high risk of pluvial flooding (orange). Therefore, the risk of pluvial flooding at the site is considered low.

It should be noted that the PFRA maps are only indicative. Pluvial flooding to the site may still exist and hence should be mitigated with appropriate landscaping and adequately designed drainage system where required if the development proposal goes ahead as planned.

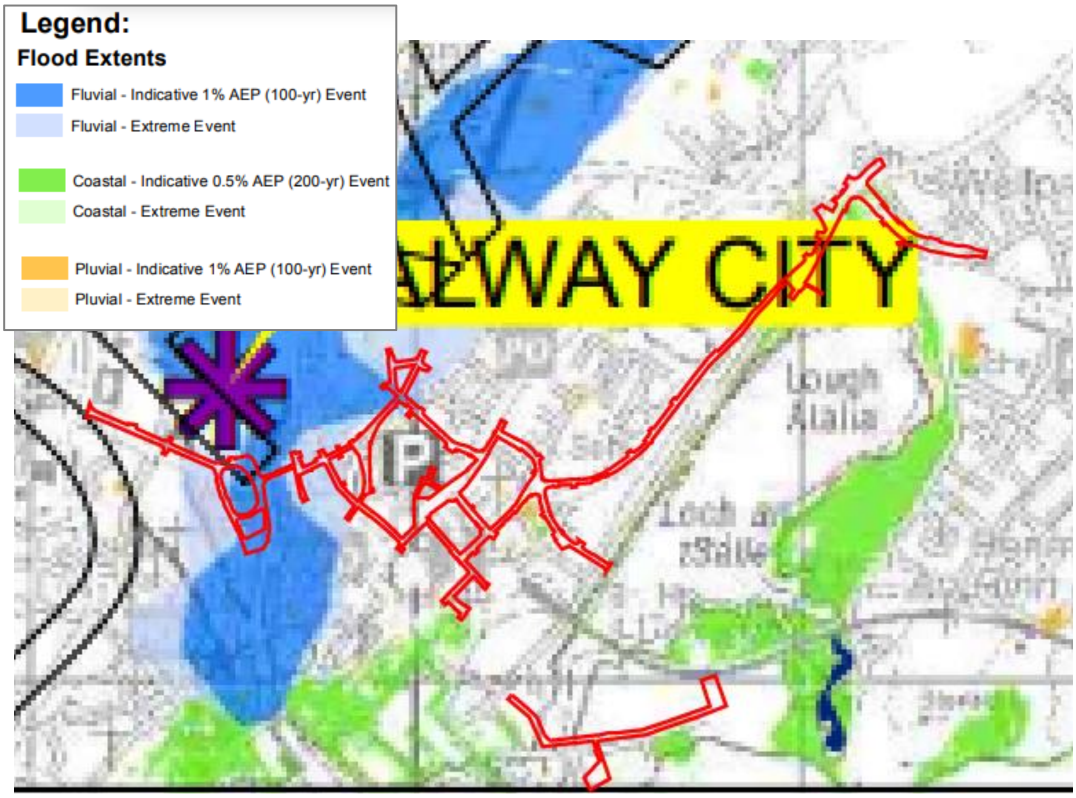


Figure 8: Extract from OPW PFRA pluvial flood map (www.myplan.ie)

2.6 Groundwater Flooding

Groundwater flooding can occur during lengthy periods of heavy rainfall, typically during late winter/early spring when the groundwater table is already high. If the groundwater level rises above ground level, it can pond at local low points and cause periods of flooding.

To assess the risk of groundwater flooding to the site, the Geological Society Ireland (GSI) Groundwater Flooding Data maps were obtained from floodinfo.ie.

An extract of the map is presented in Figure 9. It should be noted that the groundwater flooding data maps are only indicative. These maps are developed to indicate areas of high groundwater likelihood given the karst limestone rock formation found in this western area of the country.

The map suggests that the site and areas in the vicinity are not identified at risk of groundwater flooding.

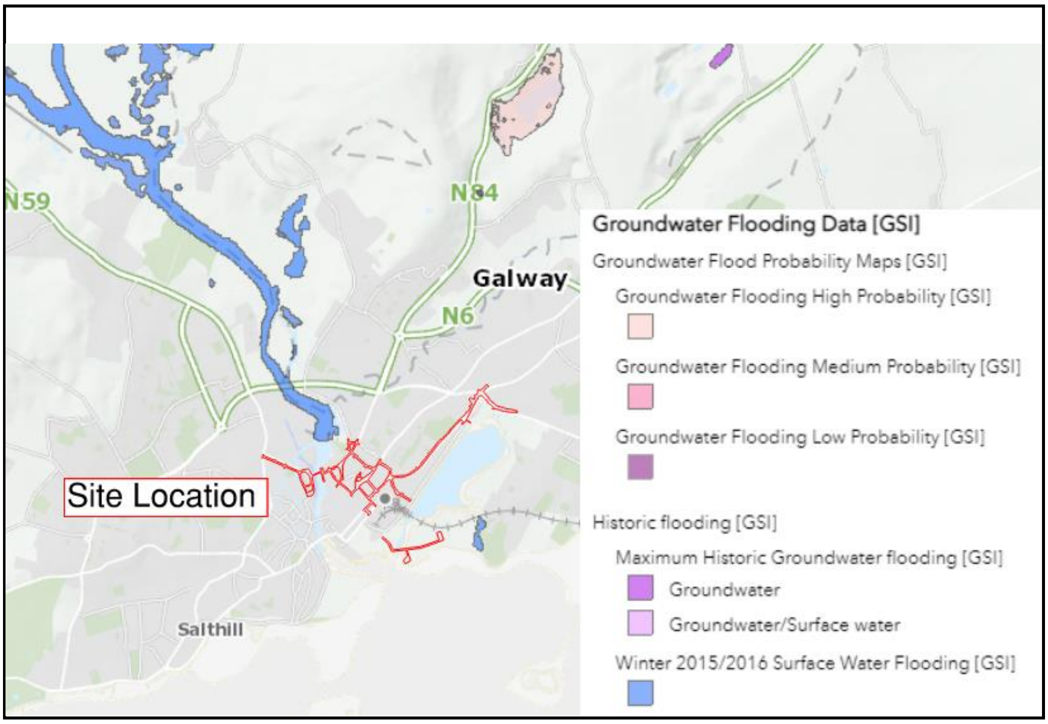


Figure 9: Extract from GSI Groundwater Flood Map (floodinfo.ie)

Figure 10 presents information on the Geological Survey of Ireland (GSI) groundwater vulnerability at the Proposed Scheme. It can be seen from the figure that the groundwater vulnerability is indicated as high for a large portion of the site, with moderate vulnerability along Lough Atalia and a small area of extreme vulnerability in the southern section of Nuns Island at Gaol Road. This suggests that groundwater levels at the site may be relatively shallow. Additionally, it is known that highly permeable rock is present in these locations.

Therefore, it is likely that the vulnerability rating is indicative of a relatively shallow water table due to the site’s proximity to the River Corrib and surrounding canals and waterways. Coupled with a permeable rock, this represents a moderate risk of groundwater flooding which is limited to the construction stage.

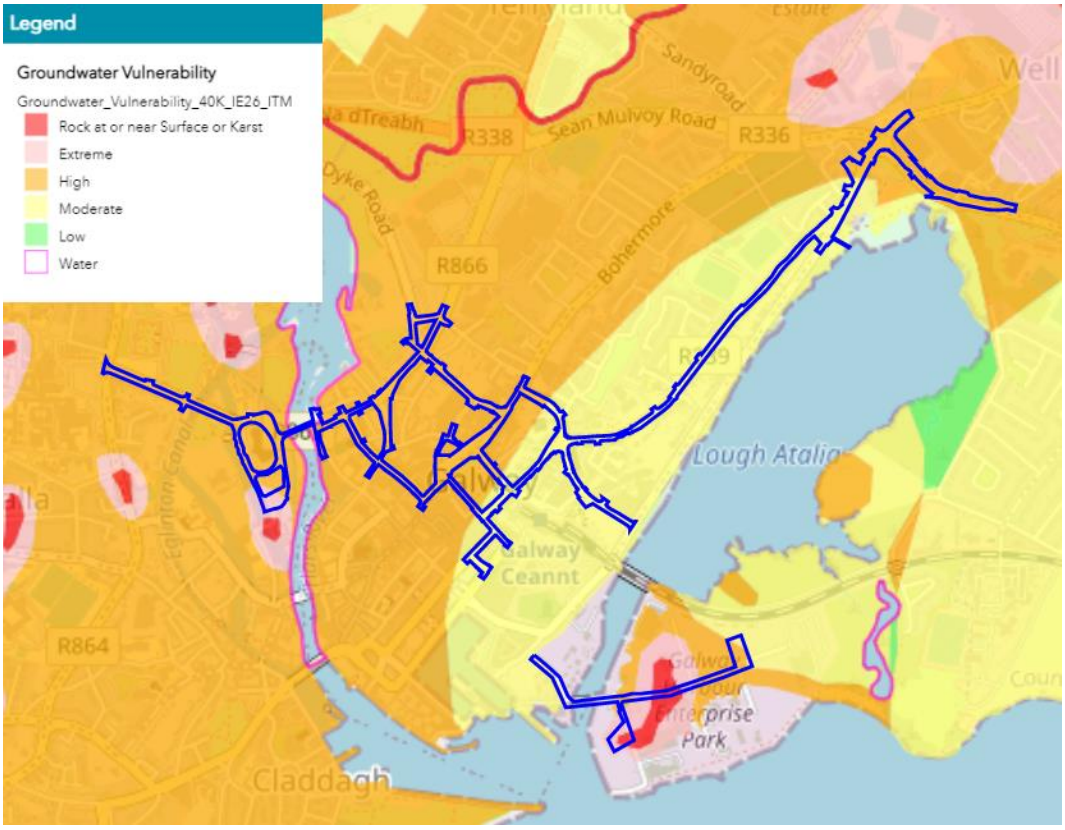


Figure 10: Extract from GSI spatial resources Groundwater Vulnerability Mapping

2.7 Mechanical/Operational Failure

There are several bridges and locks on River Corrib and other waterways which may fail or block due to mechanical error, deterioration, and operational problems. Of these, the Salmon Weir Barrage and the lock at Eglington Canal constitute a significant source of flooding to the Study Area. The OPW regulate the flow of the River Corrib and level of Lough Corrib via the Salmon Weir Barrage. The Barrage is open almost always open during winter and as required depending on existing and forecasted rainfall. The flow in Eglington Canal is controlled by lock gates which may cause flooding if the lock gate fails for any reason. The canal is known to have burst its banks in the past under extreme tide and/or storm surge. The Eastern CFRAM maps also showed that the canal the Nuns Island area for the 0.1% AEP event.

2.8 Summary of Existing Flood Risk

The risk of flooding to the existing site from fluvial, tidal, pluvial and groundwater sources was assessed and is summarised as follows:

- Parts of the site at Gaol Road have a moderate risk of fluvial flooding from Gaol River. The remainder of the site have a low probability of fluvial flooding.

- Part of the site at Dock Road have a high probability of tidal flooding. Areas around Lough Atalia have a moderate risk of tidal flooding. Most of the Proposed Scheme site has a low probability of flooding.
- The site is partially located within Flood Zones A and B.
- The risk of pluvial flooding to the site is considered low with the site identified as being outside the pluvial flood extents in the draft OPW PFRA mapping. As this risk may not be eliminated, appropriate drainage system design will be required to reduce the risk from pluvial flooding to acceptable level during construction.
- The risk of groundwater flooding to the site is considered moderate and limited to construction stage.
- The Salmon Weir and the Eglington Canal lock have been identified as the main sources of flooding due to mechanical or operational failure.

2.9 Conclusion of Stage 1 - FRA

The various sources of flooding were assessed and was determined that the site, at least in part, is at risk of flooding from fluvial, tidal and groundwater sources. Therefore, the flood risk assessment is progressed to Stage 2: Initial Flood Risk Assessment.

3 Stage 2 – Initial Flood Risk Assessment

3.1 General

For Stage 2: Initial Flood Risk Assessment, the Proposed Scheme is divided into 21no. distinct areas of works to better understand the risk of flooding from all sources and identify management options for each area. Flood risk to each of these sections is detailed below.

3.2 University Road

Along University Road (from the junction with Newcastle Road to the Salmon Weir Bridge), the proposed Scheme Works will involve creating grassed area, provision of an entry treatment at the National University of Ireland, Galway (NUIG), provision of two raised tables along the route at Canal Road Upper and Fisheries Field, and the provision of two new signalised pedestrian crossings.

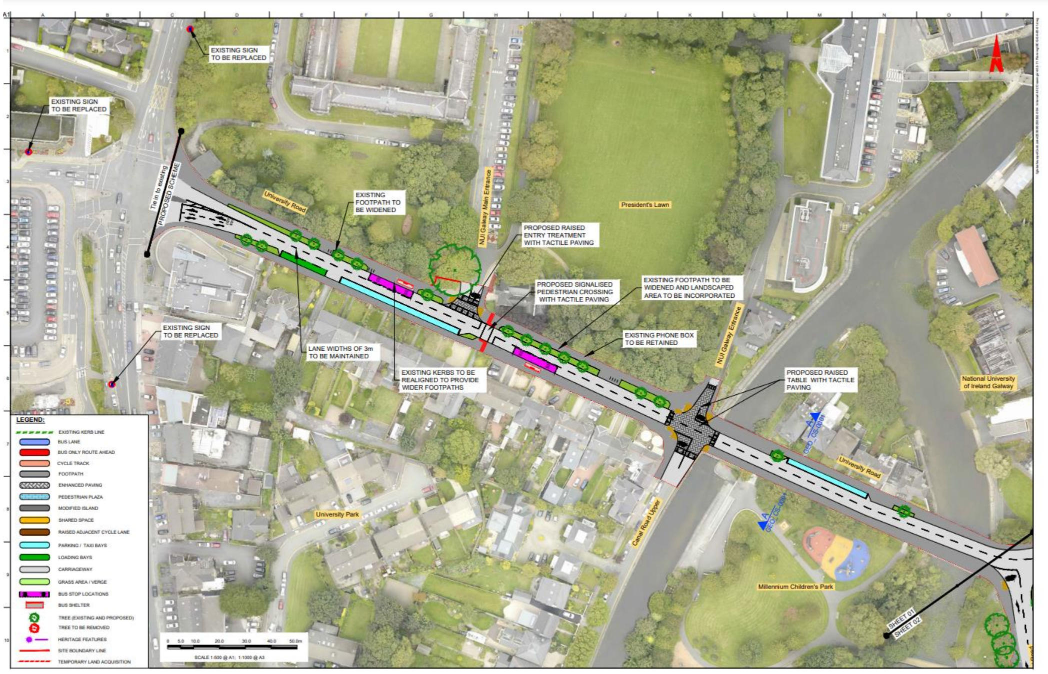


Figure 11: University Road Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is outside of the 0.5%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater was not indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site's proximity to the River Corrib and surrounding canals and waterways. Management of the groundwater may be required during construction.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.3 Gaol Road and Galway Cathedral

To the west of Galway Cathedral, on Gaol Road the Works involve creating grassed area at the junction with University Road and to the south on Gaol Road the works involve re-development of the car and coach parking area to the south of Galway Cathedral. To the east of Galway Cathedral, the works involve the closure of the existing carriageway to vehicles and creation of a paved pedestrianised plaza area.

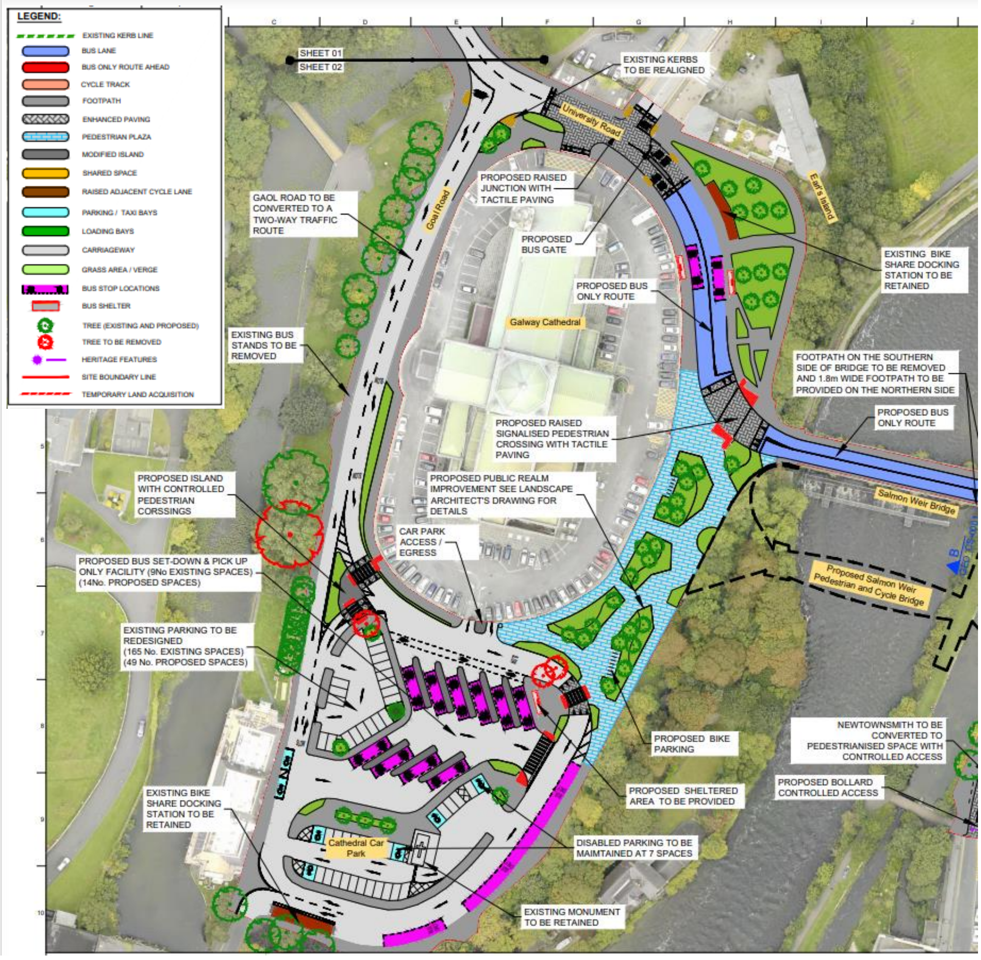


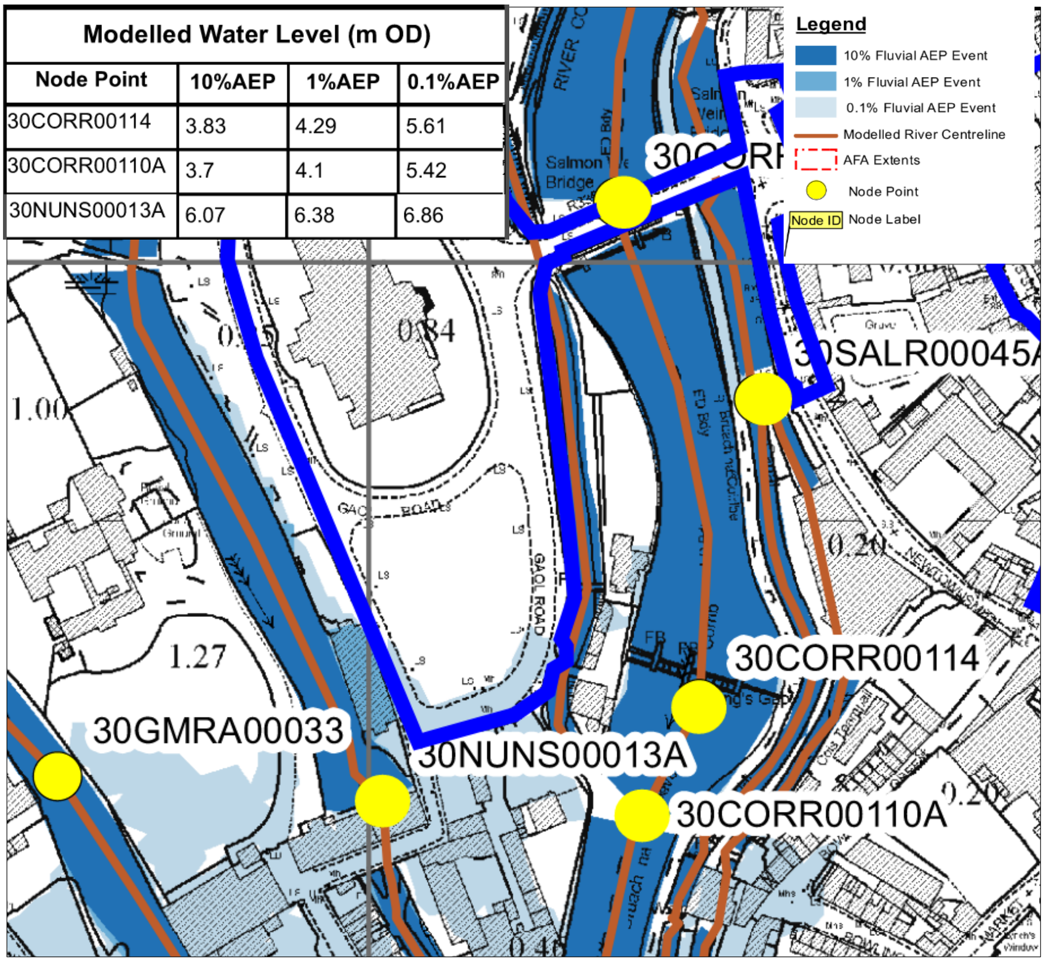
Figure 12: Gaol Road and Galway Cathedral Section of Works

Fluvial Flooding

The area of development is within the 0.1% AEP extent and is therefore classified as Flood Zone B. Figure 13 includes the modelled 10%, 1% and 0.1% AEP return period water levels for the displayed nodes. The node closest to Gaol Road along Gaol River is 30NUNS00013A. The 1 in 100-year fluvial water level at the node is 6.38mOD and the 1 in 1000-year fluvial water level is 6.86m OD.

The node closest to the site on the River Corrib is 30CORR00110A. The 1% AEP fluvial water level at the node is 4.1mOD and the 0.1% AEP fluvial flood levels is 5.42m OD.

At the location at risk of flooding, Gaol Road lies at 6.51m OD. The flood risk to the road is from overtopping of the Gaol River during the 0.1% AEP fluvial flood event.



Modelled Water Level (m OD)

Node Point	10%AEP	1%AEP	0.1%AEP
30CORR00114	3.83	4.29	5.61
30CORR00110A	3.7	4.1	5.42
30NUNS00013A	6.07	6.38	6.86

Figure 13:Gaol Road and Galway Cathedral Fluvial Flooding

Tidal Flooding

The area of development is outside of the 0.5%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site’s proximity to the River Corrib and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.4 Salmon Weir Bridge

There are some kerb realignment works proposed on the existing Salmon Weir Bridge. To improve the safety of the pedestrian environment, the existing kerb lines will be reconstructed to provide a single 1.8m wide footpath along the northern side, in place of the two existing footpaths which are approximately 1.1m to 1.2m wide.

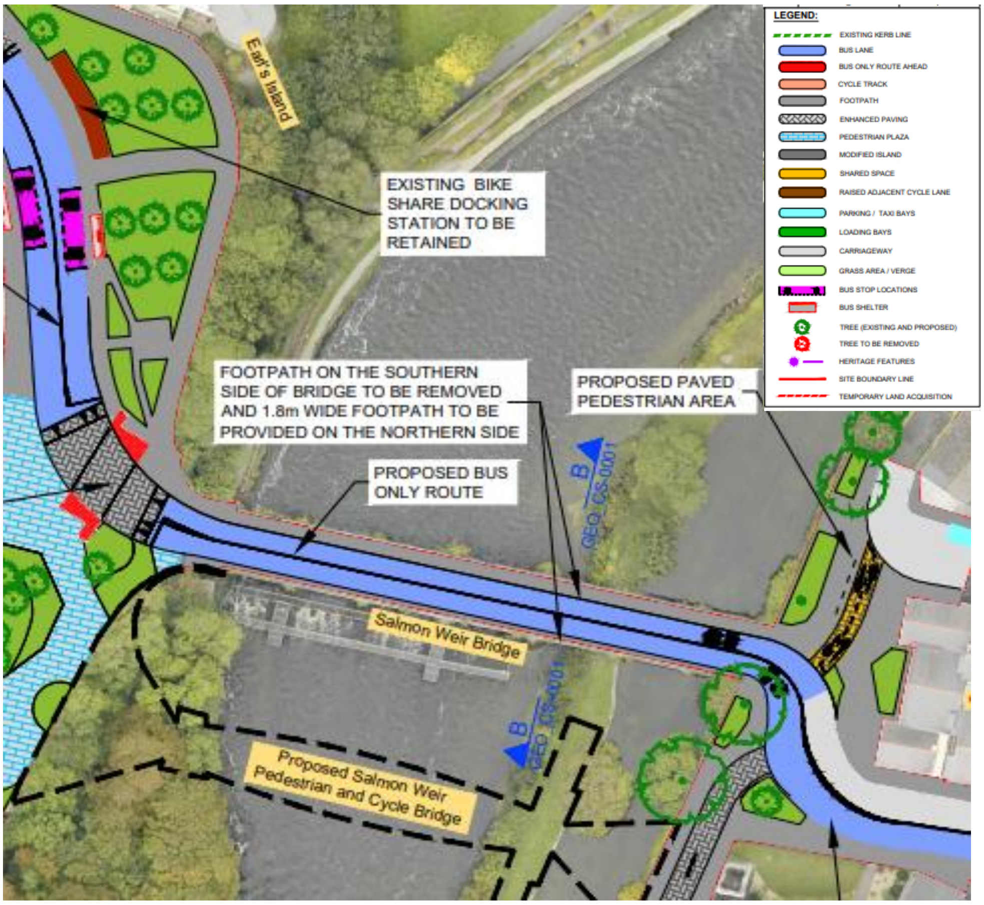


Figure 14: Salmon Weir Bridge Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is outside of the 0.5%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

As this section of the Proposed Scheme is a bridge, it is not affected by groundwater and therefore is not at risk.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.5 Newtownsmith/Waterside

The works at this location will involve the permanent closure of Waterside (west of the Court House) as it approaches St. Vincent's Avenue from the north (with the resultant space used to create a public space), and the narrowing of Newtownsmith as it approaches St. Vincent's Avenue from the south (reduced to a single northbound traffic lane, with resultant wider footpaths).

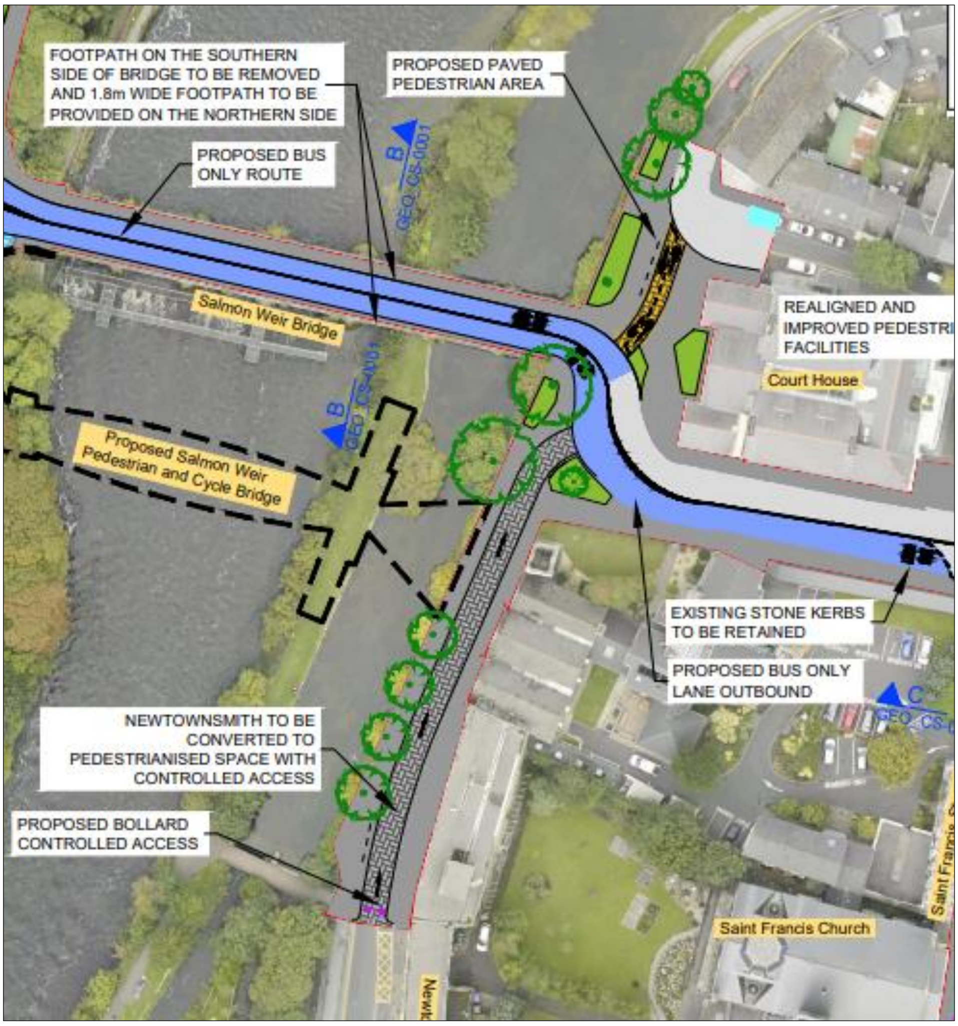


Figure 15: Newtownsmith Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is outside of the 0.5%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site's proximity to the River Corrib and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.6 St. Vincent's Avenue/Walsh's Terrace

Localised works along St. Vincent's Avenue and Walsh's Terrace (between the Salmon Weir Bridge and Dyke Road) involve the redesign of the junction at Woodquay which is to be tightened up and replaced with a single, in-only southbound road from St. Vincent's Avenue. A new entry treatment is to be provided at the junctions of Corrib Terrace and Riverside on St. Vincent's Avenue to improve pedestrian safety while retaining access. Landscaping interventions are proposed at this location on St. Vincent's Avenue to improve pedestrian connectivity between Wood Quay and the park area to the north.

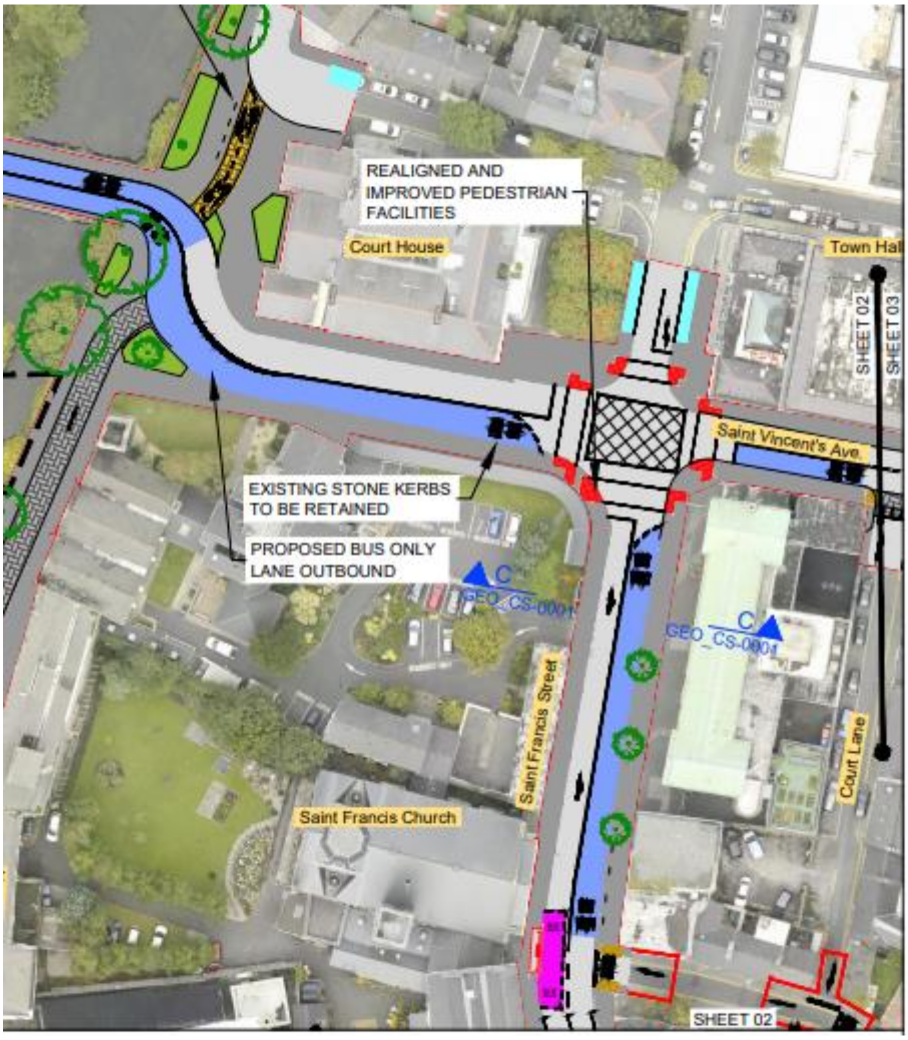


Figure 16: St. Vincent's Avenue/Walsh's Terrace Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is outside of the 0.5%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site's proximity to the River Corrib and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.7 Woodquay/Daly's Place/Mary Street

The works within Woodquay involve the removal of a substantial portion of the carriageway space and conversion of same to a pedestrian public space through creation of grassed area, the rationalisation of the junctions with St. Vincent's Avenue to the north into a single junction only, and the provision of a southbound traffic lane linking Woodquay to Daly's Place/Eyre Street. Entry treatments are also proposed at the junction with St. Brendan's Avenue and the junction with St. Anthony's Place.

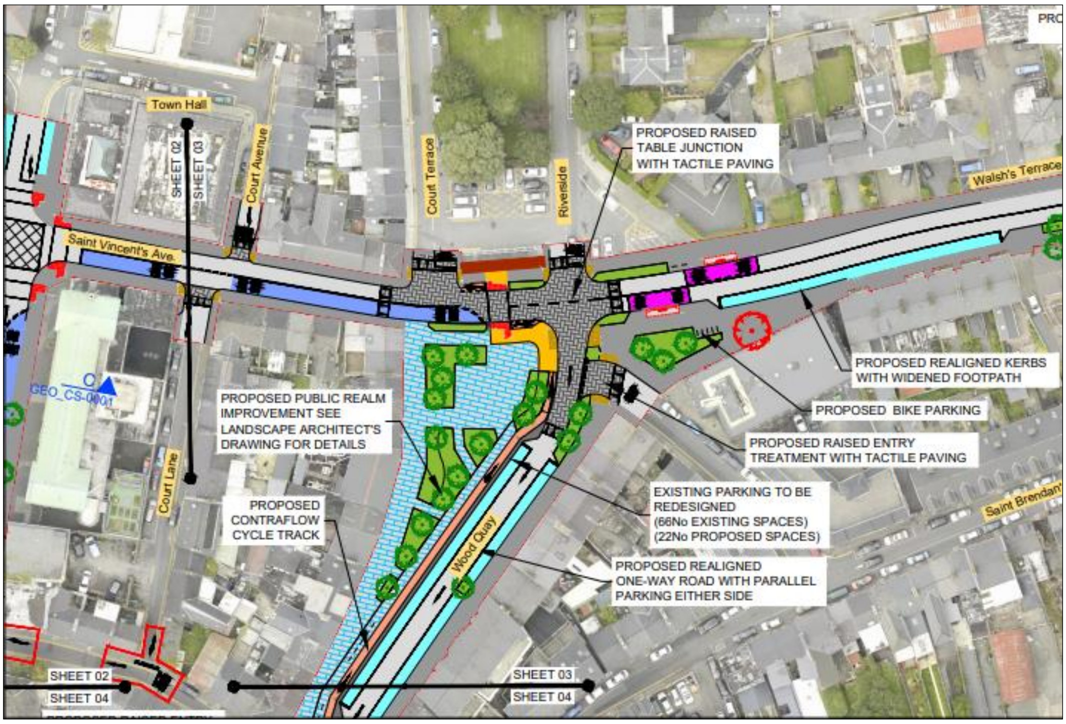


Figure 17: Woodquay/Daly's Place/Mary Street Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is outside of the 0.5%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site's proximity to the River Corrib and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.8 Dyke Road/Headford Road

Works on Dyke Road and the Headford Road include footpath widening and the signalisation of the junction of Dyke Road (heading north) and Dyke Road (heading east) and the signalisation of the junction of Dyke Road/Headford Road/St. Bridget's Place junction.

A short section of Dyke Road is also to have the carriageway widened, approaching the signalised junction of Dyke Road northbound/Dyke Road eastbound. Junctions to be signalised will have pedestrian crossings incorporated.

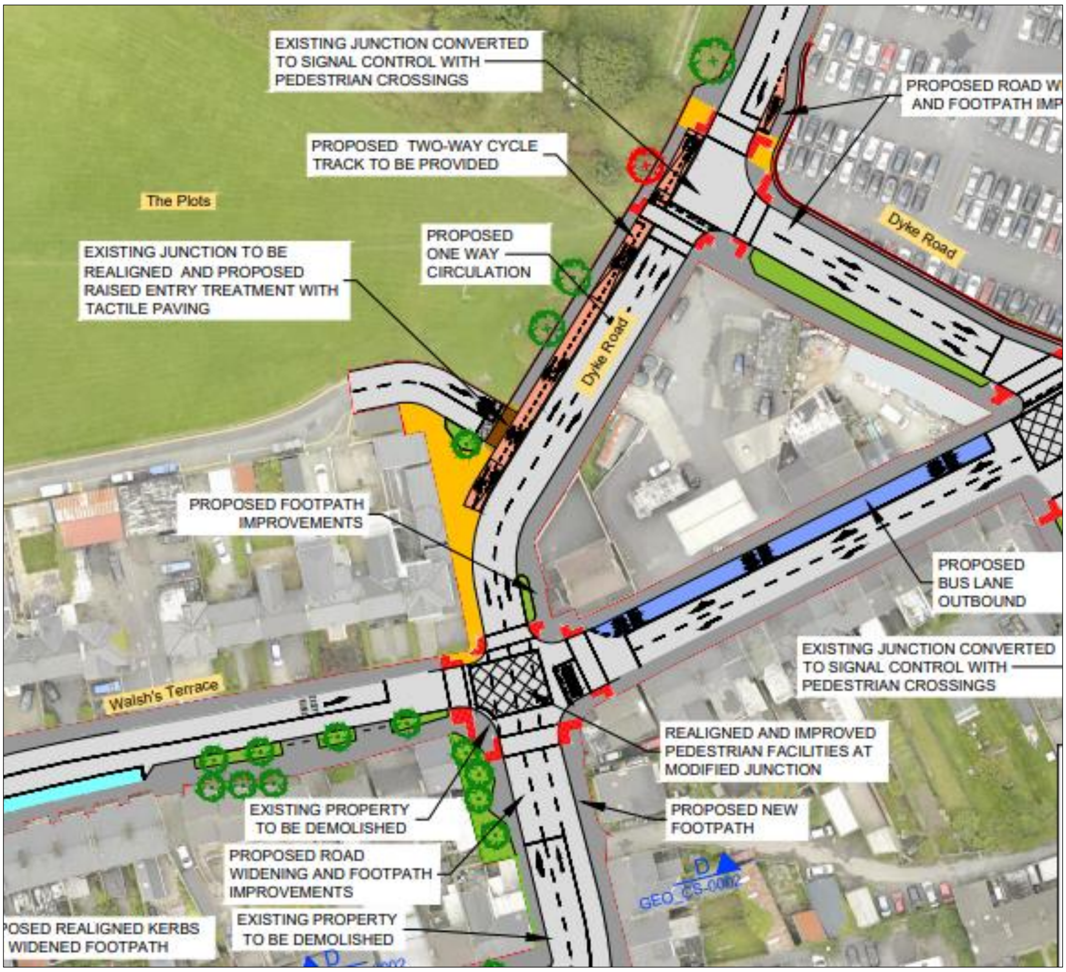
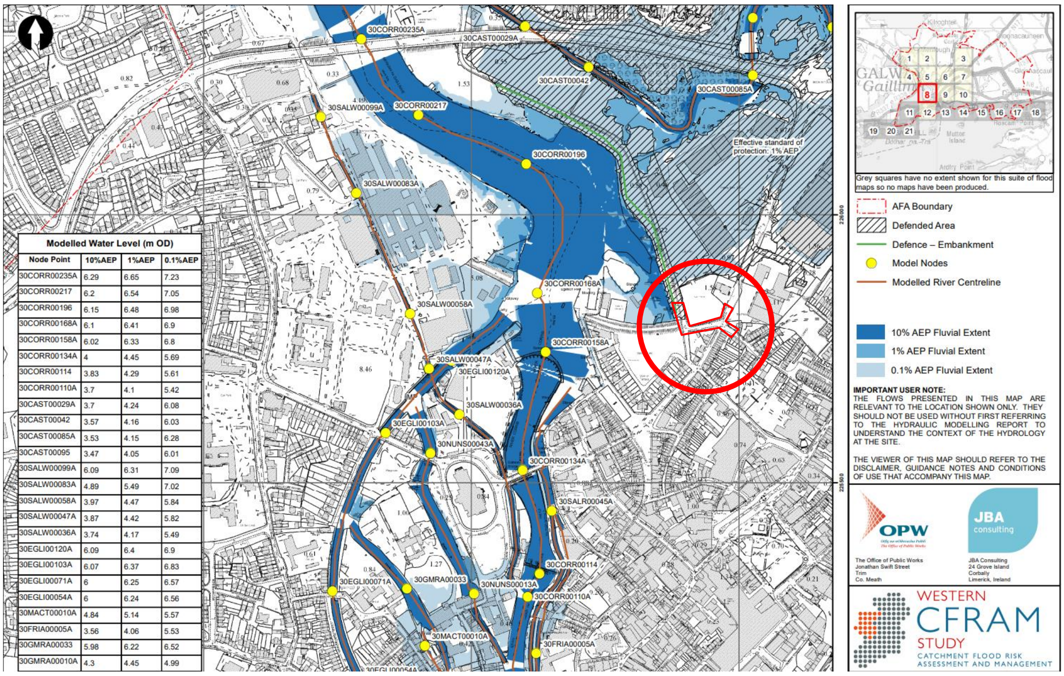


Figure 18: Dyke Road/Headford Road Section of Works

Fluvial Flooding

The area of development is outside the 1% AEP but not from the 0.1%AEP and is therefore classified as Flood Zone B. However, this is because of the protection provided by the Dyke Road embankment (see Figure 19 – note that the cross hatch represents a defended area). It is noted that this embankment provides a flood defence of up to the 1% AEP (with no allowance for freeboard) and hence may overtop under the 0.1% AEP event. The Western CFRAM Preliminary Options Report (JBA, 2016) documented that this embankment was damaged and repaired in 2007. The condition of the embankment is described as “fair” and there is a possibility that a breach may occur in the future and hence this FRA assumes that this defence will be maintained on ongoing basis to sustain the existing level of protection.



Modelled Water Level (m OD)			
Node Point	10%AEP	1%AEP	0.1%AEP
30CORR00235A	6.29	6.65	7.23
30CORR00217	6.2	6.54	7.05
30CORR00196	6.15	6.48	6.98
30CORR00168A	6.1	6.41	6.9
30CORR00158A	6.02	6.33	6.8
30CORR00134A	4	4.45	5.69
30CORR00114	3.83	4.29	5.61
30CORR00110A	3.7	4.1	5.42
30CAST00029A	3.7	4.24	6.08
30CAST00042	3.57	4.16	6.03
30CAST00085A	3.53	4.15	6.28
30CAST00095	3.47	4.05	6.01
30SALW00099A	6.09	6.31	7.09
30SALW00083A	4.89	5.49	7.02
30SALW00058A	3.97	4.47	5.84
30SALW00047A	3.87	4.42	5.82
30SALW00036A	3.74	4.17	5.49
30EGLI00120A	6.09	6.4	6.9
30EGLI00103A	6.07	6.37	6.83
30EGLI00071A	6	6.25	6.57
30EGLI00054A	6	6.24	6.56
30MACT00010A	4.84	5.14	5.57
30FRIA00005A	3.56	4.06	5.53
30GMRA00033	5.98	6.22	6.52
30GMRA00010A	4.3	4.45	4.99

Grey squares have no extent shown for this suite of flood maps so no maps have been produced.

IMPORTANT USER NOTE:
THE FLOWS PRESENTED IN THIS MAP ARE RELEVANT TO THE LOCATION SHOWN ONLY. THEY SHOULD NOT BE USED WITHOUT FIRST REFERRING TO THE HYDRAULIC MODELLING REPORT TO UNDERSTAND THE CONTEXT OF THE HYDROLOGY AT THE SITE.

THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath

JBA Consulting
24 Grove Island
Corbally
Limerick, Ireland

Figure 19 Dyke Road Flood Defence

Tidal Flooding

The area of development is outside of the 0.5%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site's proximity to the River Corrib and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.9 St. Francis Street/Eglinton Street/Williamsgate Street

The works on St. Francis Street/Eglinton Street will involve provision of a new signalised crossing on St. Francis Street and the signalisation of the junction with Mary Street/Daly's Place.

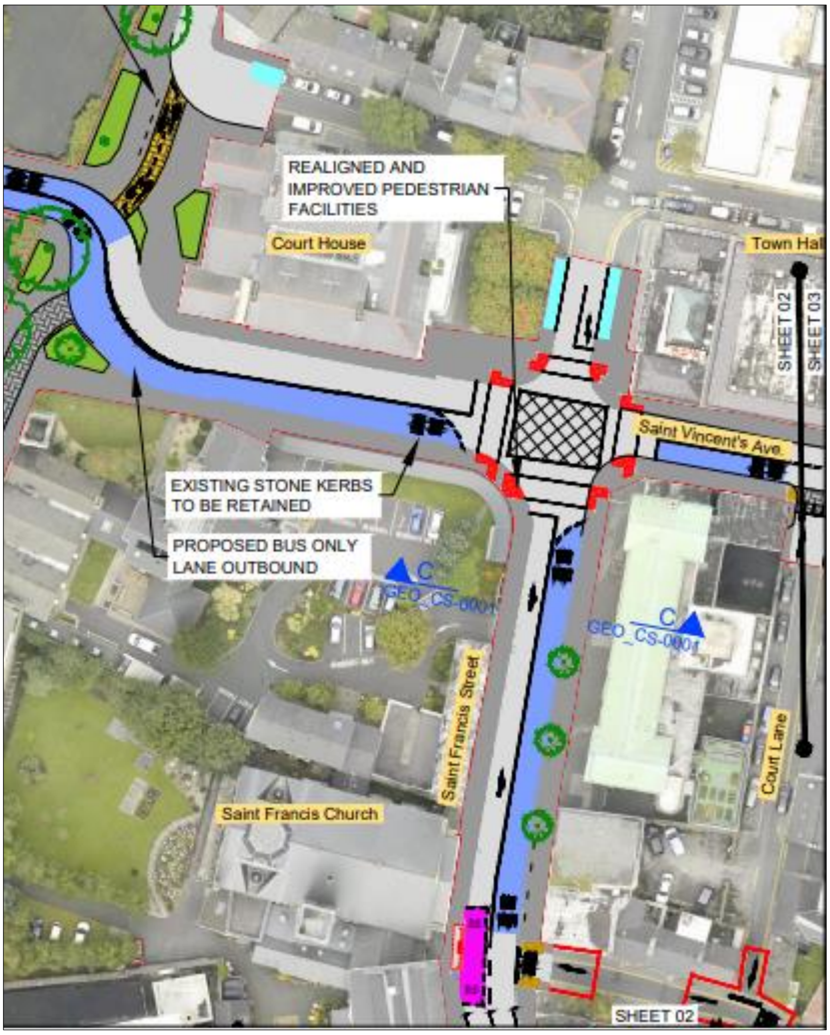


Figure 20: St. Francis Street/Eglinton Street/Williamsgate Street Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is outside of the 0.5%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site’s proximity to the River Corrib and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.10 Bóthar na mBan/St. Brendan's Avenue

At Bóthar na mBan/St. Brendan's Avenue the proposed works include realigned and improved pedestrian facilities at modified Bóthar na mBan/St. Brendan's Avenue junction and entry treatments to St. Brendan's Avenue west of Bóthar na mBan and to the overflow car park for County Hall.

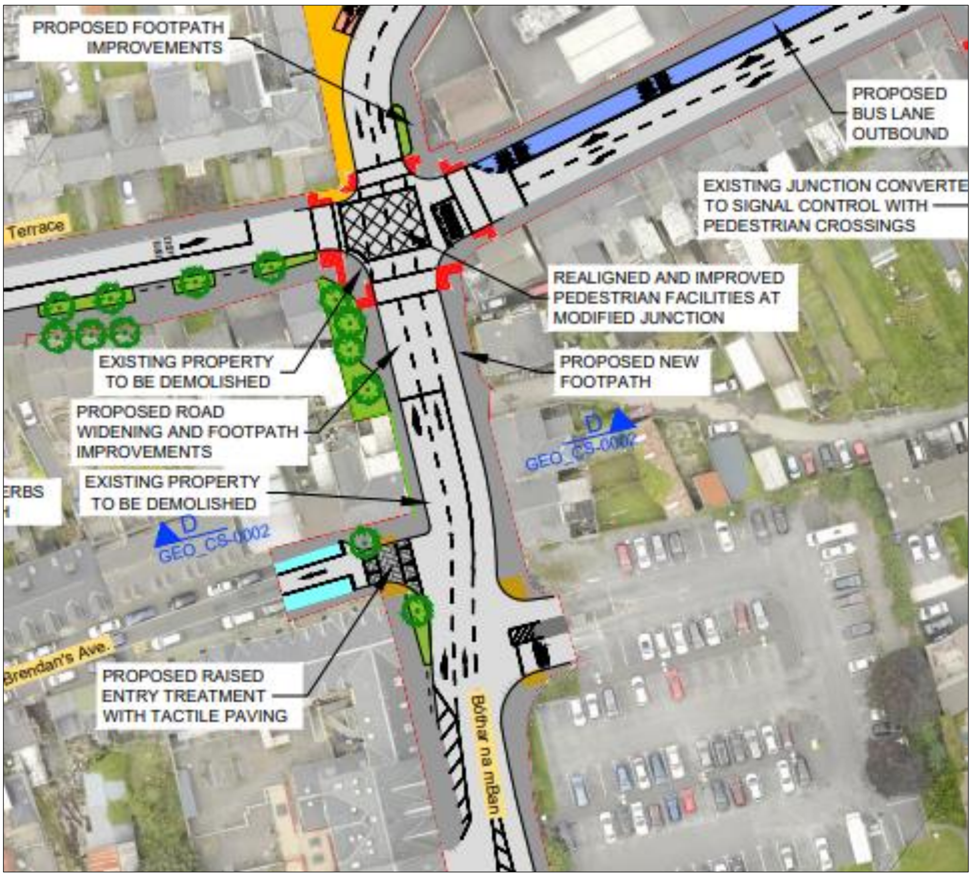


Figure 21: Bóthar na mBan/St. Brendan's Avenue Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is outside of the 0.5%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site’s proximity to the River Corrib and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.11 Prospect Hill

The works on Prospect Hill will comprise of the signalisation of the junction with Bohermore/Bóthar Uí hEithir and the realignment of the junction with Bóthar na mBan (to re-designate Prospect Hill to the south-west as the minor arm of a T-junction with a proposed entry treatment).

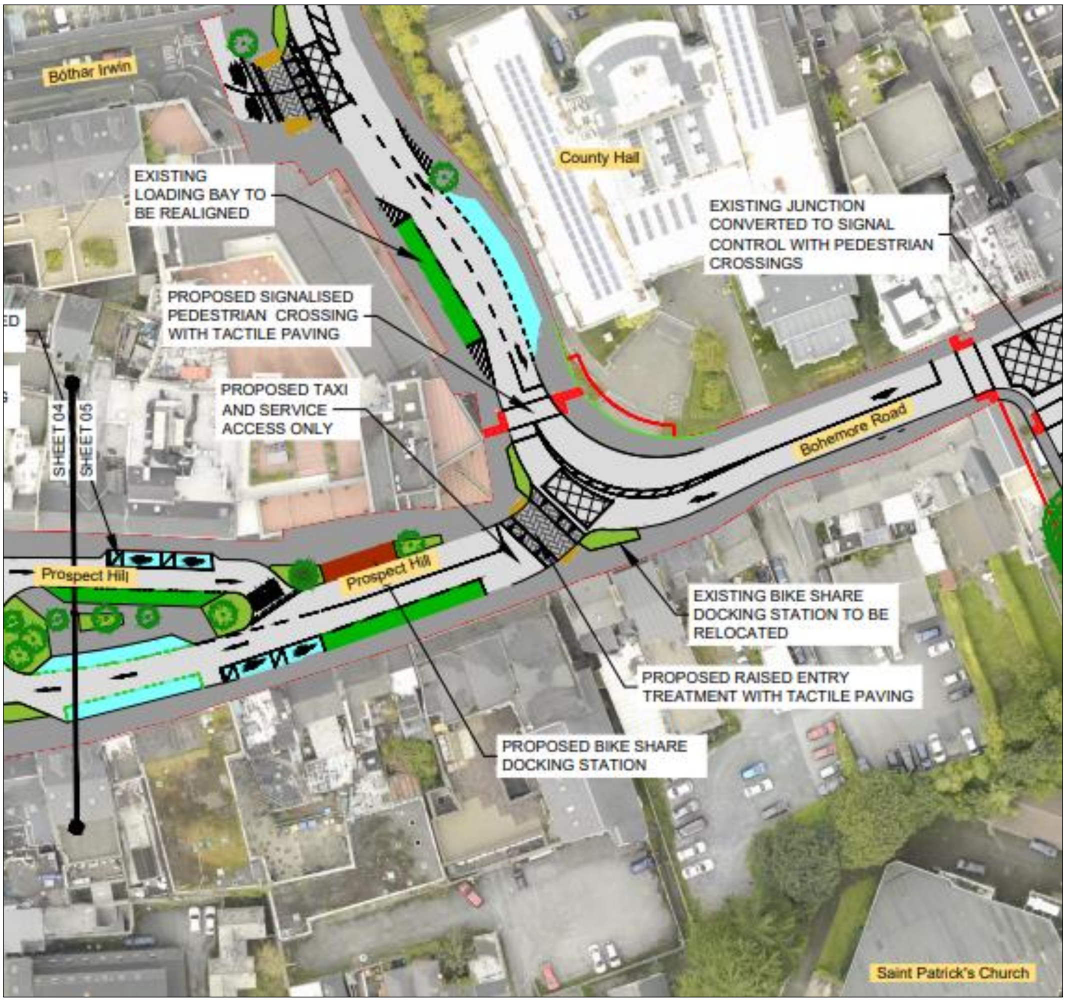


Figure 22: Prospect Hill

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is outside of the 0.5%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site’s proximity to the River Corrib and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.12 Eyre Square North/Eyre Square East/Eyre Square South

The works on Eyre Square North involve the removal of the carriageway space running parallel to Eyre Square North (to the north of the Liam Mellows Statue) and conversion of this area to a pedestrianised public space.

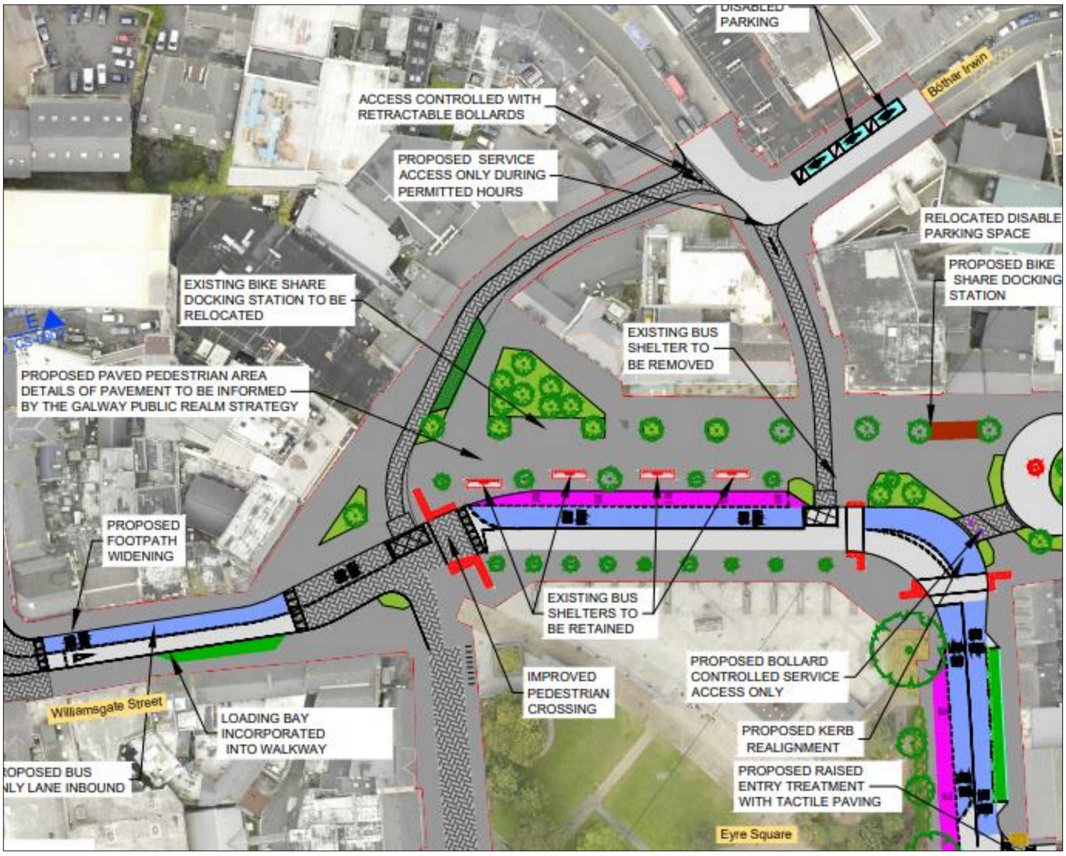


Figure 23 : Eyre Square North/Eyre Square East/Eyre Square South

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is outside of the 0.5%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site's proximity to the River Corrib and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.13 Victoria Place/Merchant's Road/Queen Street

Localised works on Victoria Place, Merchant's Road and Queen Street primarily involve footpath widening, provision of new raised uncontrolled pedestrian crossings and two new signalised pedestrian crossings on Forthill Road. An entry treatment is proposed at the junction of Forthill Road and Queen Street, and a new footpath is proposed on the south-eastern side of Dock Road, between Queen Street and Bóthar na Long.

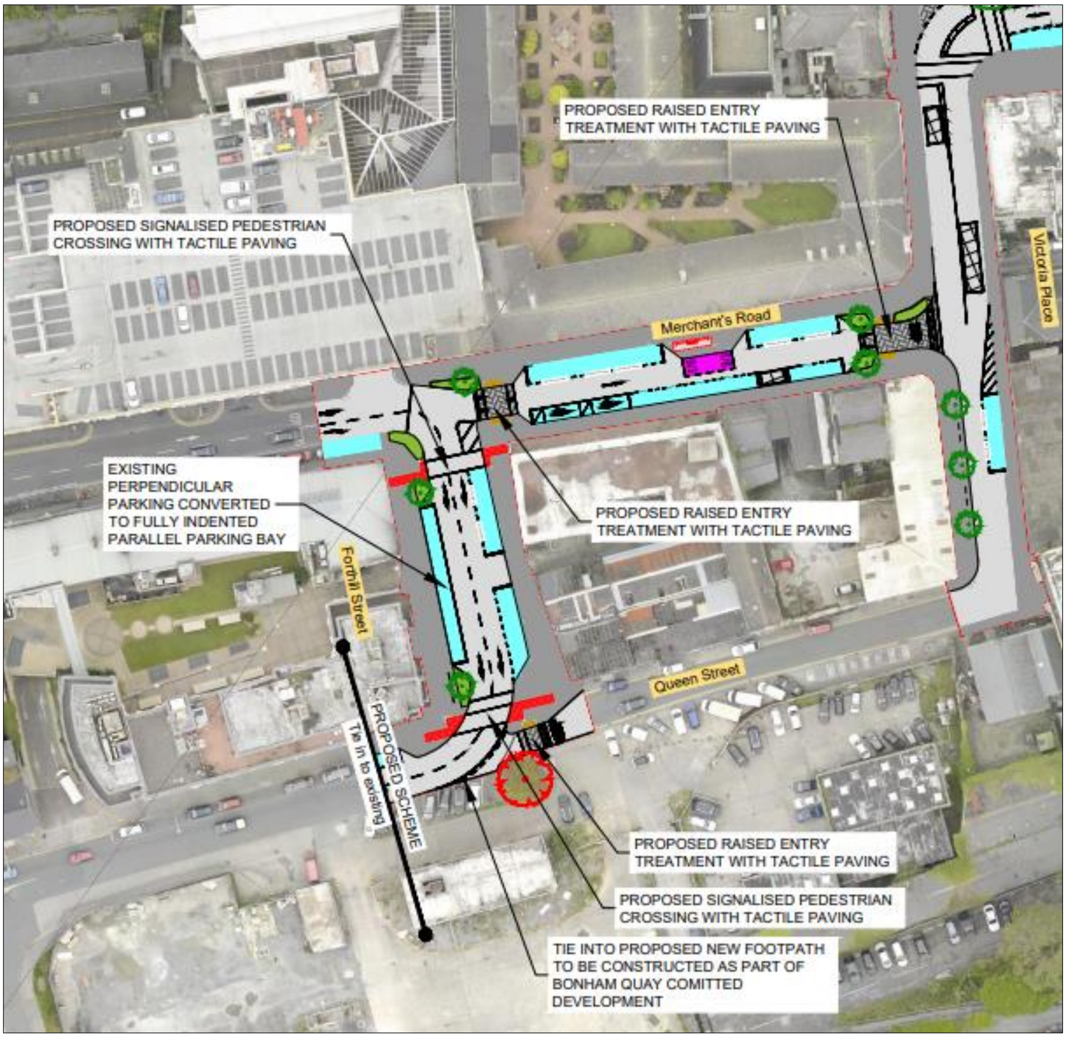


Figure 24:Victoria Place/Merchant’s Road/Queen Street

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is predominantly within the 0.5% AEP extent and is therefore classified as Flood Zone A (Figure 25).

Ground levels in this area are noted to be between 3.4 and 3.7m OD. Flood depths during tidal flooding events can be approximated to be between 0.25m and 1.0m for the 0.5% AEP flood event as shown in Figure 26.

Figure 25: Victoria Place/ Merchants Road/Queen Street Flood Zone Identification

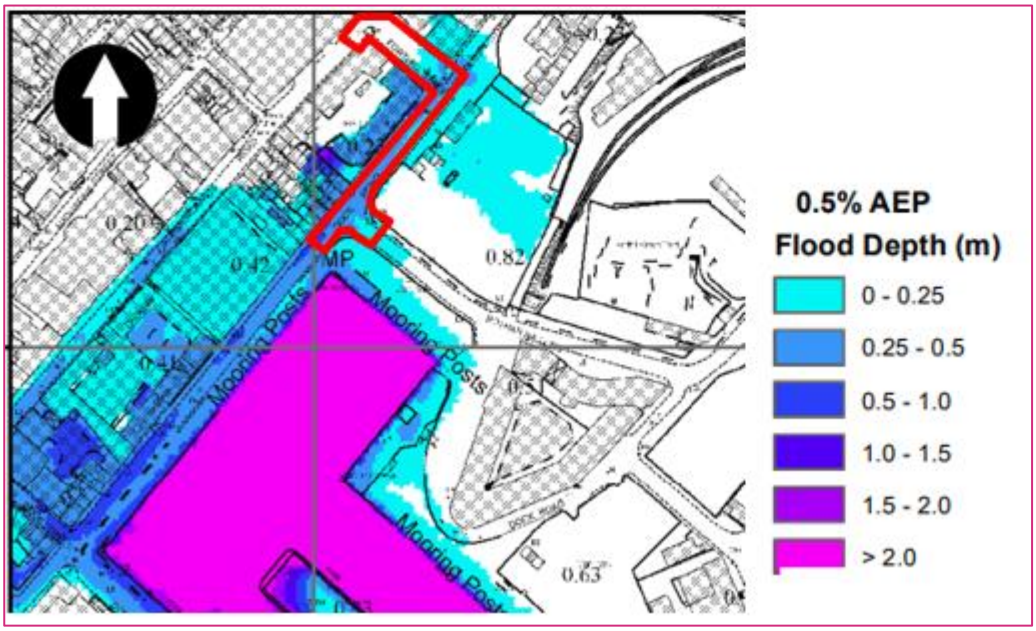


Figure 26 Victoria Place/Merchants Road/ Queen Street Tidal Flood Depth

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map as shown in Figure 9. The area is noted as moderate groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site’s proximity to the River Corrib and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map. However, historic records show that pluvial floods occurred near the site along Dock and Flood Street.

3.14 Forster Street

The works on Forster Street are localised to the eastern end of the street, in the vicinity of the junction with Bóthar Uí hEithir/College Road/Fairgreen Road.

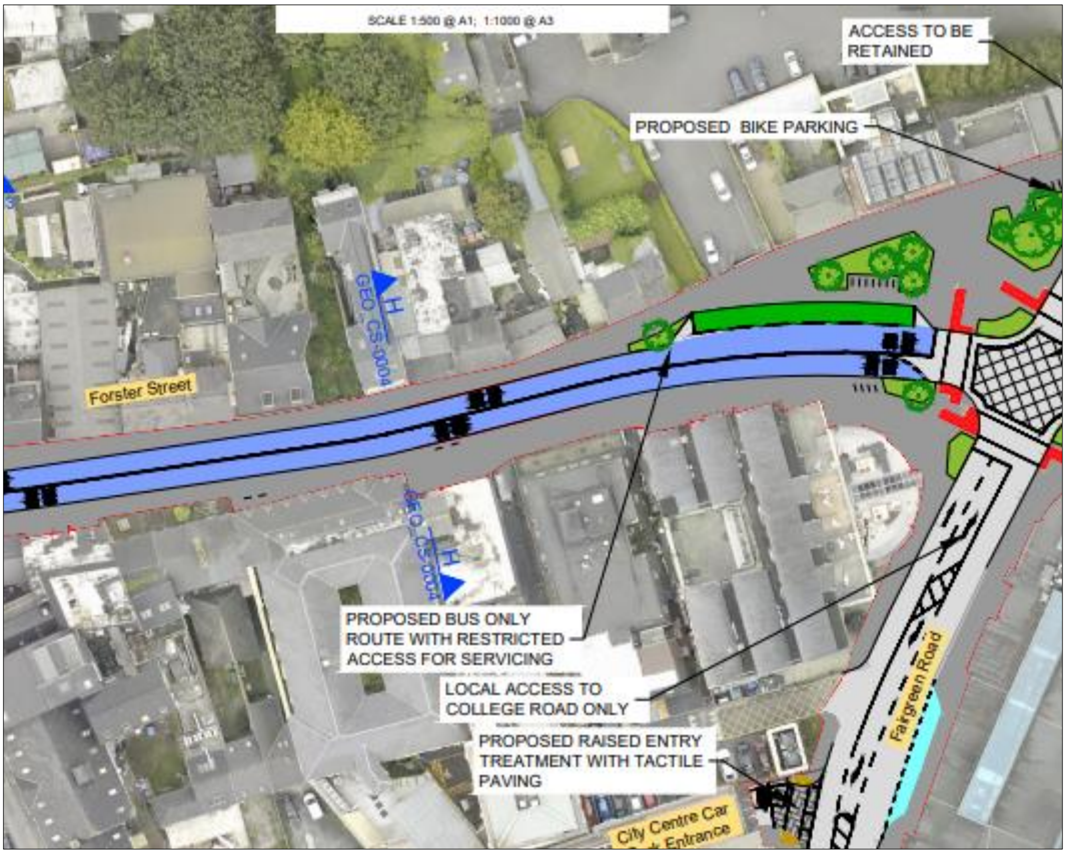


Figure 27:Forster Street Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is outside of the 0.5%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map as shown in Figure 9. The area is noted as moderate groundwater vulnerability as per Figure 10. However, it is likely that the vulnerability rating is indicative of a moderate water table due to the site's proximity to the River Corrib and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.15 College Road/Forster Street/Fairgreen Road/Bóthar Uí hEithir Junction

The works at this junction will comprise of junction upgrade works to reduce the overall size and provide wider footpaths and shorter crossing distances. Therefore, the works will primarily comprise of footpath widening and the removal of islands within the main carriageway and the installation of replacement traffic signals.

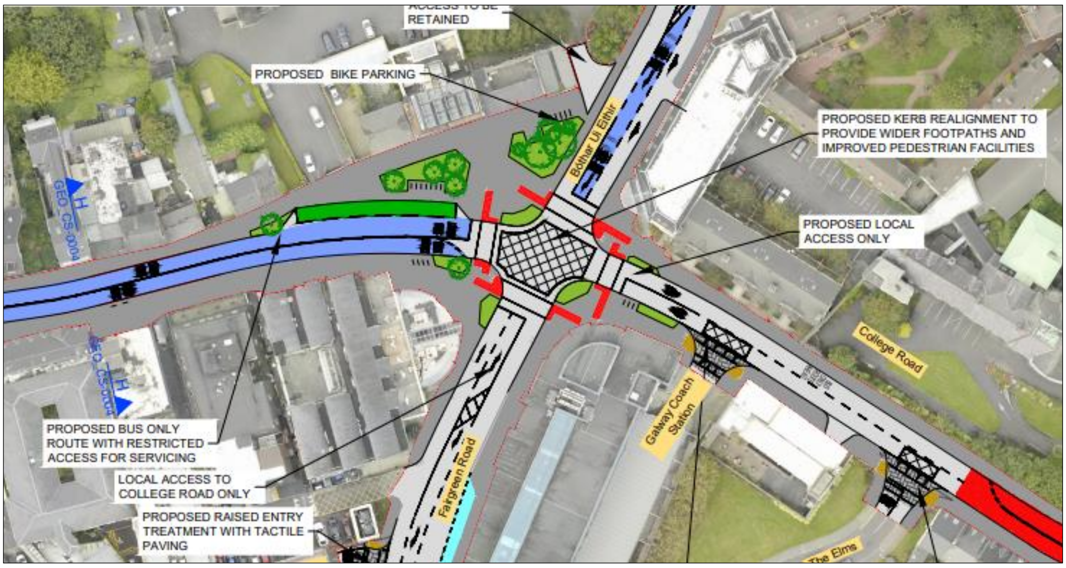


Figure 28: College Road/Forster Street/Fairgreen Road/Bóthar Uí hEithir Junction

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is outside of the 0.1%, 0.5% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as moderate groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site’s proximity to the sea and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.16 Bóthar Uí hEithir

Works on Bóthar Uí hEithir are localised in nature and will primarily comprise of localised footpath widening at the junction to the south (with Forster Street/College Road) and the junction to the north (with Prospect Hill/Bohermore).

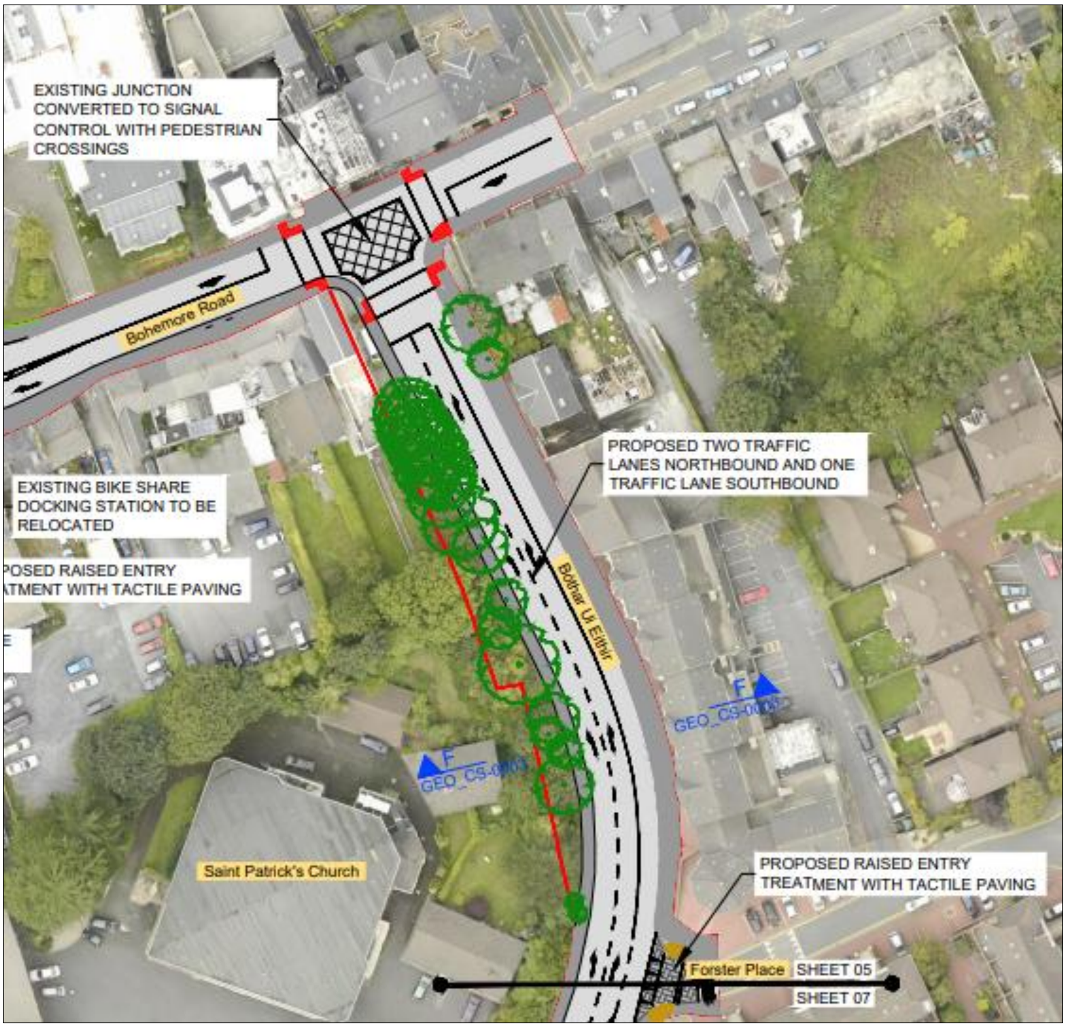


Figure 29: Bóthar Uí hEithir Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is outside of the 0.1%, 0.5% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as moderate to high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a moderate water table due to the site's proximity to the River Corrib and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.17 Fairgreen Road

The works at Fairgreen Road will primarily comprise of the upgrade at the signalised junction with College Road/Forster Street, the provision of new entry treatments and some localised footpath widening in the vicinity of the entrance to the Radisson Blu Hotel.

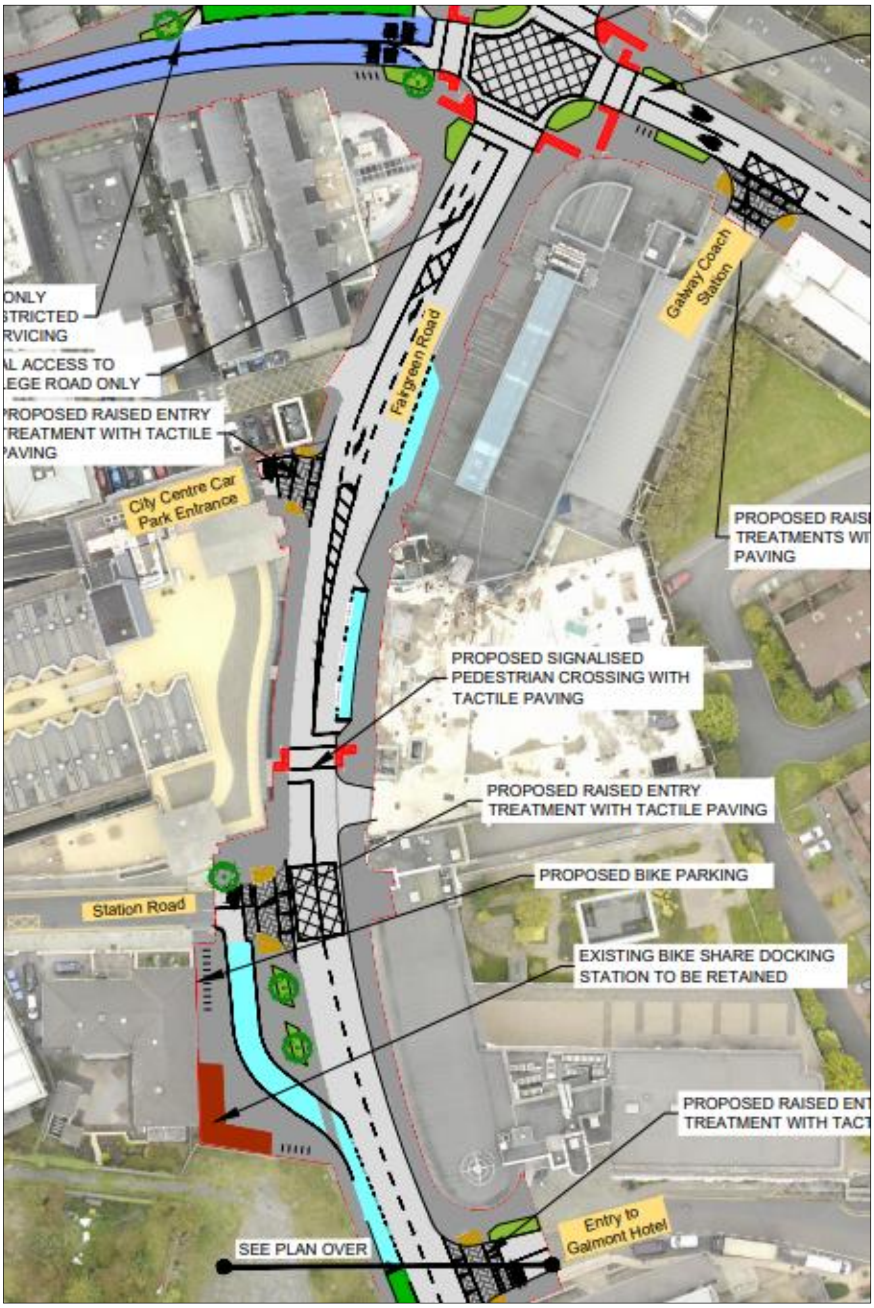


Figure 30: Fairgreen Road Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is outside of the 0.1%, 0.5% and 10% AEP and is therefore classified as Flood Zone C.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as moderate groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a moderate water table due to the site's proximity to the River Corrib and surrounding canals and waterways.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.18 College Road (to junction with Lough Atalia Road)

The works along College Road between the junction with Forster Street and the junction with Lough Atalia Road will primarily comprise of localised footpath widening works, the provision of entry treatments at several junctions, new priority pedestrian crossings and the installation of a bus gate on College Road, west of the entrance to Galway City Hall.

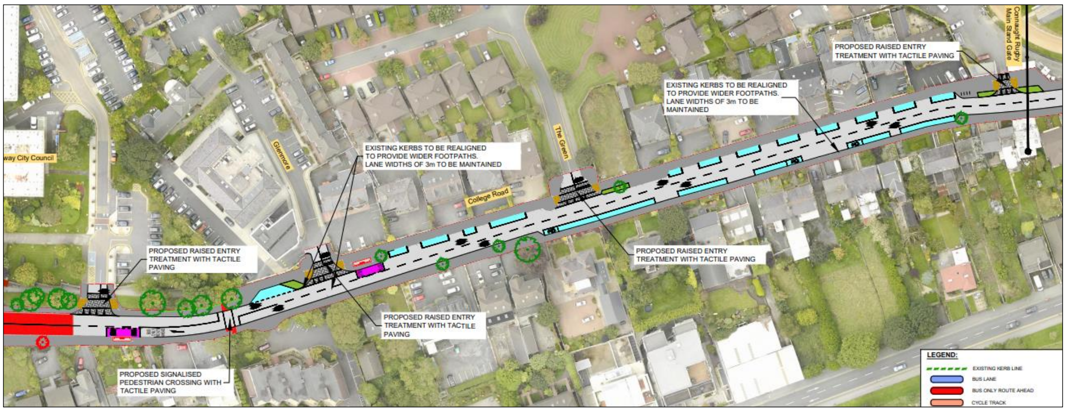


Figure 31: College Road (to junction with Lough Atalia Road) Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

Most of the area of development is outside of the 0.5% but a small portion of it is within the 0.1% AEP and is therefore classified as Flood Zone B.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as moderate groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a moderate water table due to the site’s proximity to the sea.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.19 College Road/Lough Atalia Road Junction

The development proposes to realign the junction of College Road and Lough Atalia Road, to a formal T-junction (with College Road forming the minor arm and Lough Atalia Road forming the major arm). This junction will be signalised, with pedestrian crossings provided on two of the three arms.

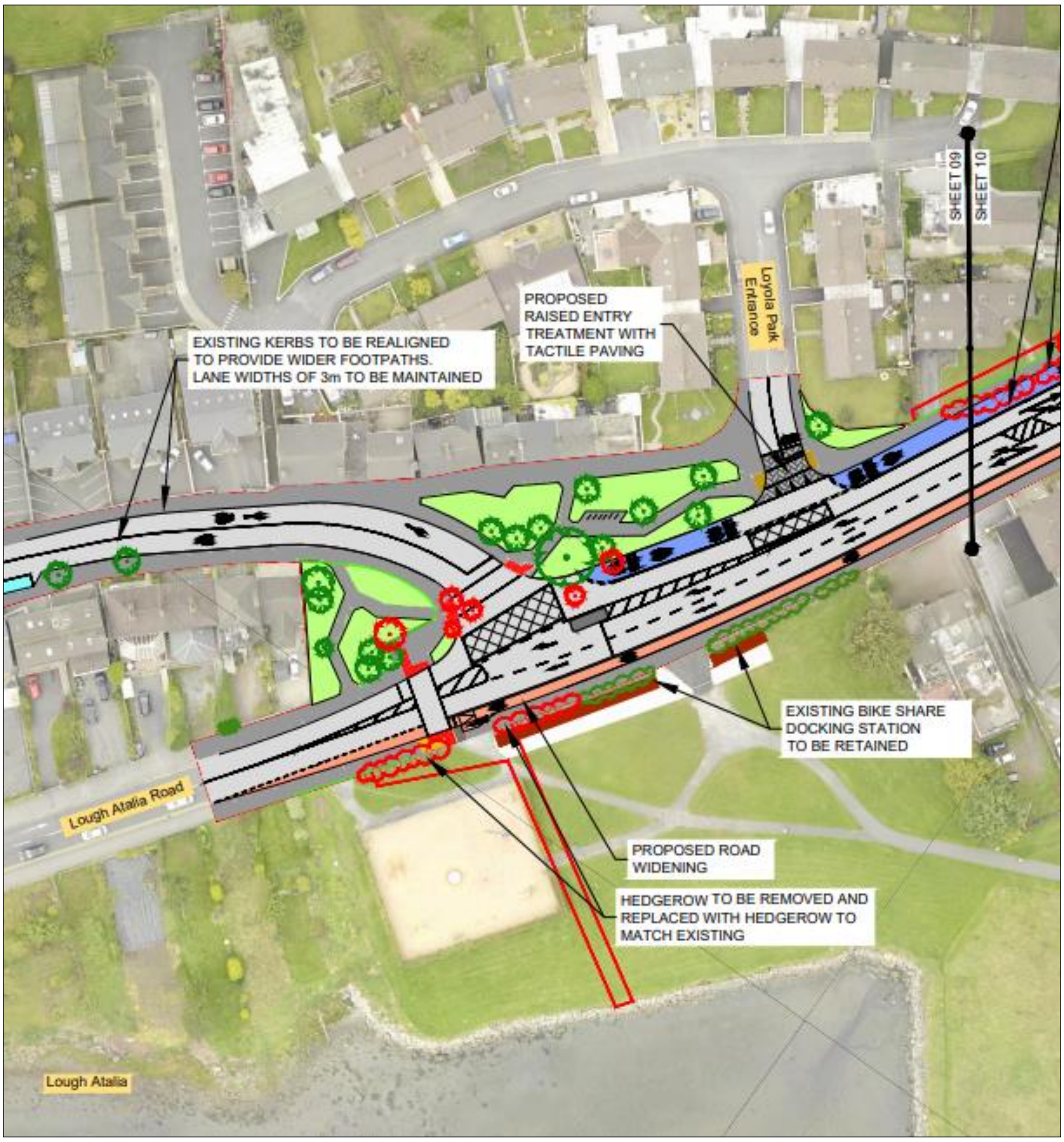


Figure 32: College Road/Lough Atalia Road Junction Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is predominantly within the 0.1% AEP extent and is therefore classified as Flood Zone B.

Ground levels in this area are noted to be 3.80m OD at the lowest point. Nodal water depths during tidal flooding events have not been made available through the CFRAMs study but can be assumed to reach a maximum of 1m for the 0.1% AEP flood event as shown in Figure 33.

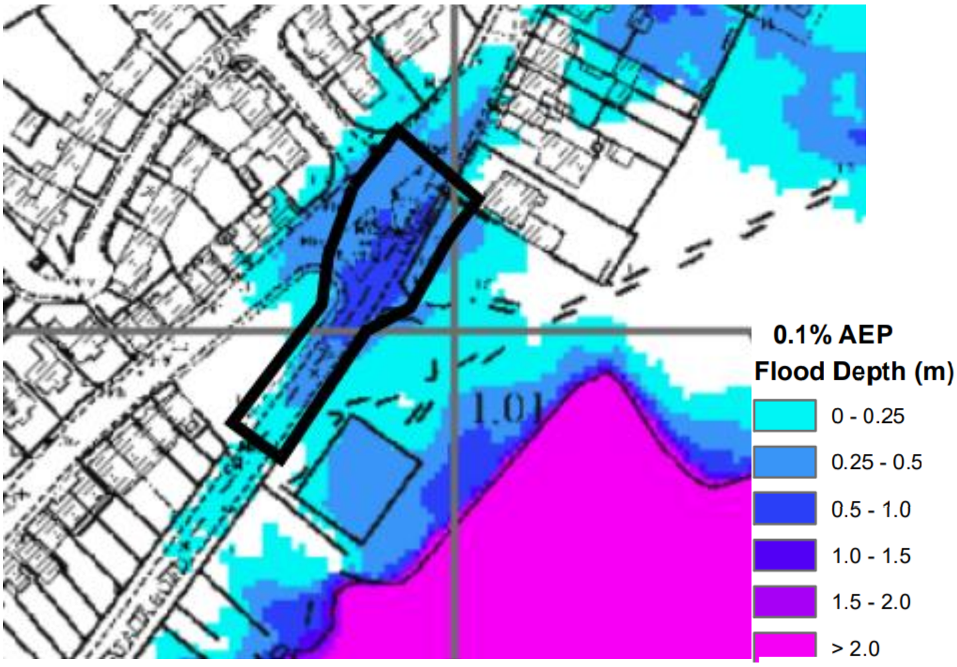


Figure 33: College Road/Lough Atalia Road Junction Tidal Flooding

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as moderate groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site's proximity to the sea.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.20 College Road/Lough Atalia Road to Moneenageisha Junction

The works proposed on College Road (between Lough Atalia Road and Moneenageisha) will comprise of significant carriageway widening on the north-western side of College Road to facilitate the construction of an additional outbound bus lane.

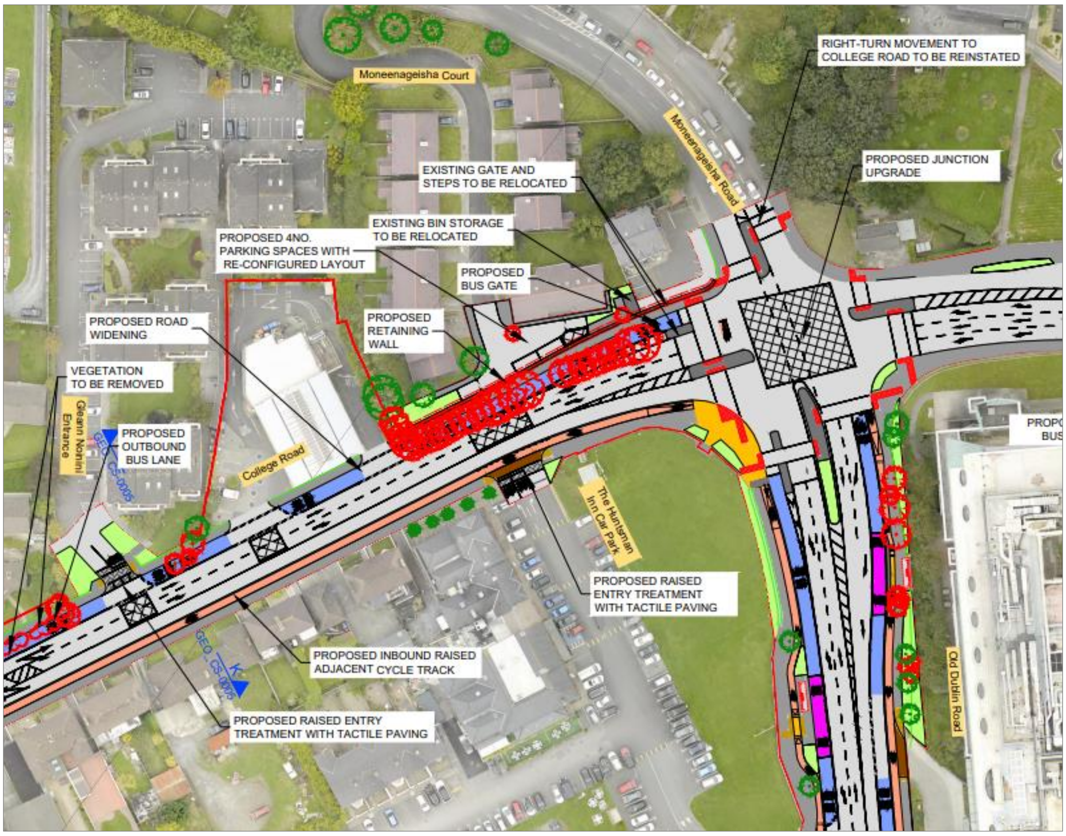


Figure 34: College Road/Lough Atalia Road to Moneenageisha Junction Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is predominantly within the 1:1,000 year or 0.1% AEP extent and is therefore classified as Flood Zone B.

Ground levels in this area are noted to be 3.73m OD at the lowest point. Water levels during tidal flooding events have not been made available through this CFRAMs study but can be assumed to be greater than 3.73m OD for 0.1% AEP flood event. Flood extents are predicted to reach a depth of between 0-0.25m along a section of the road as per Figure 35.

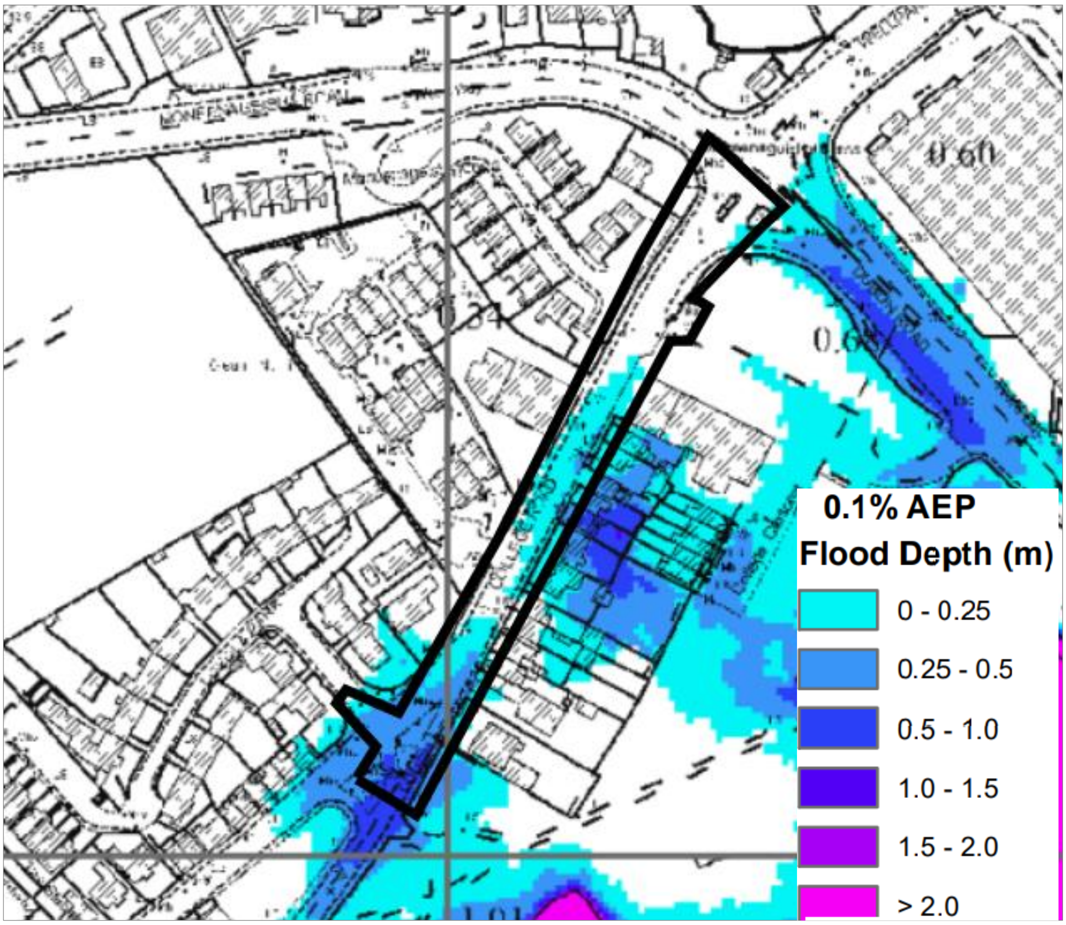


Figure 35: College Road/Lough Atalia Road to Moneenageisha Junction Tidal Flooding

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as moderate to high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site's proximity to the sea.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.21 Moneenageisha Junction

The works at the junction at Moneenageisha involve the upgrade of the junction to reduce the junction footprint by removal of the existing left-slip islands on the College Road and the Dublin Road arms, and the relocation of several splitter islands at the junction.

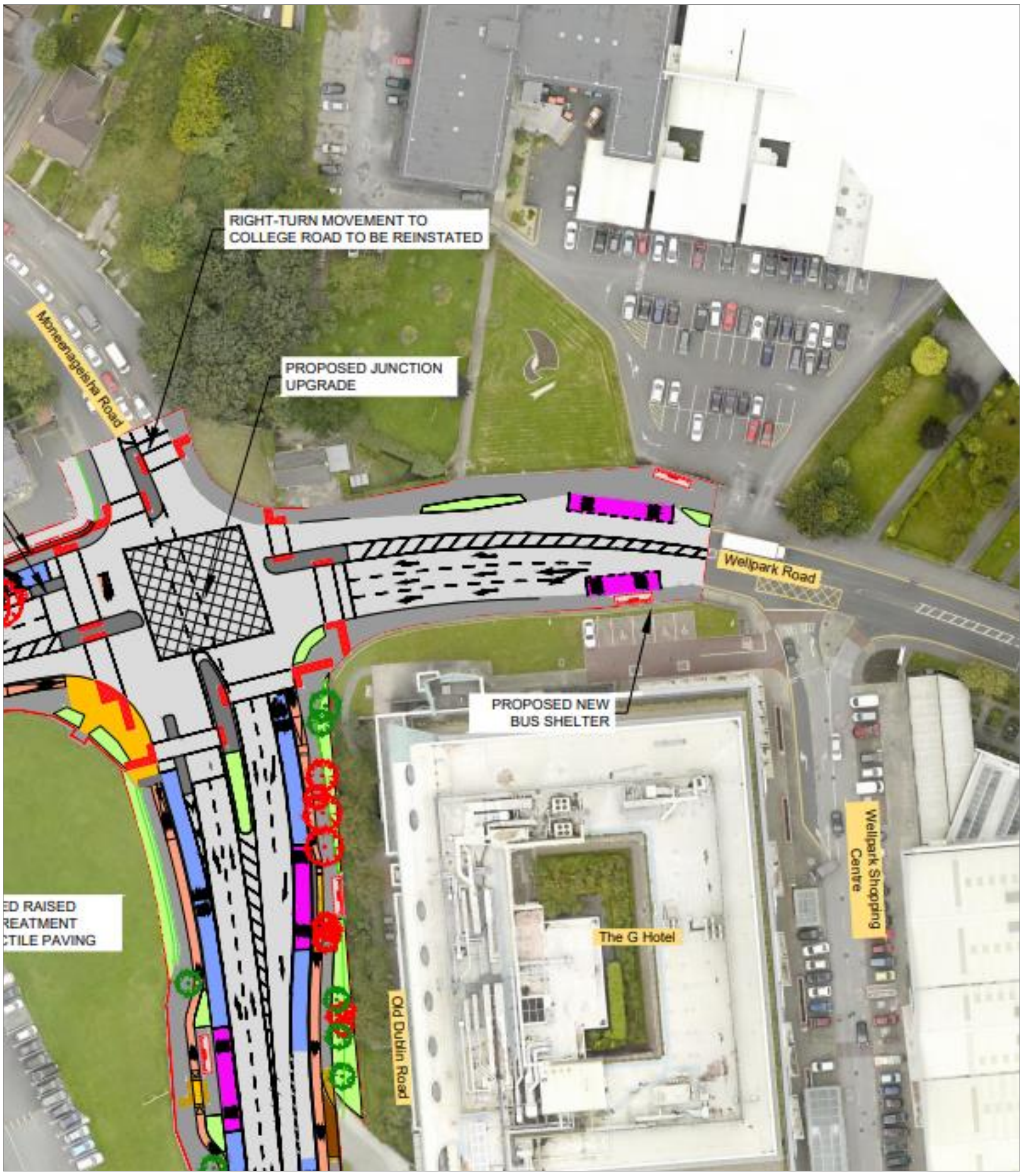


Figure 36: Moneenageisha Junction Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is predominantly outside the flood extents with a small portion at the Dublin Road tie-in falling within the 1:1000 year or 0.1% AEP extent and is therefore classified as Flood Zone B.

Ground levels in this area are noted to be 3.9m OD at the lowest point.

Water levels during tidal flooding events have not been made available through this CFRAMs study but can be assumed to be greater than 3.9m OD for 0.1% AEP flood event. Flood extents are predicted to reach a depth of between 0-0.25m along the portion of road as per Figure 37.

Figure 37 Moneenageisha Junction - Tidal Flooding

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site’s proximity to the sea.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.22 R338 Dublin Road

The works on the R338 Dublin Road will comprise of the installation of inbound and outbound bus lanes, raised adjacent cycle lanes and footpaths on both sides of the road. This is to be achieved via a combination of carriageway widening, re-purposing of existing traffic lanes and setting back the existing footpath.

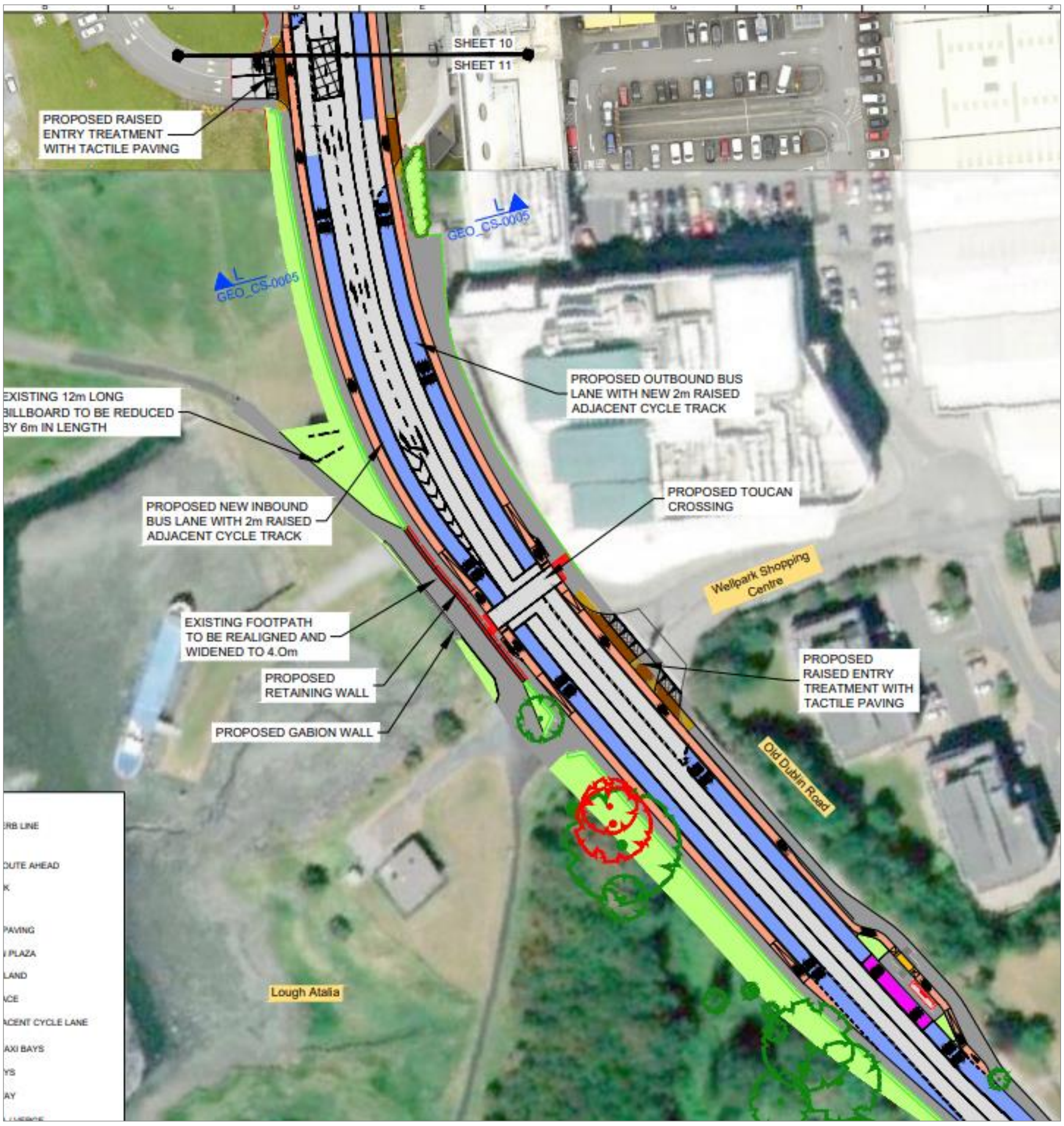


Figure 38:R338 Dublin Road Section of Works

Fluvial Flooding

The area of development is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The area of development is predominantly outside the flood extents with a small portion at the Dublin Road tie-in falling within the 1:1000 year or 0.1% AEP extent and is therefore classified as Flood Zone B.

Ground levels in this area are noted to be 3.9m OD at the lowest point. Water levels during tidal flooding events have not been made available through this CFRAMs study but can be assumed as greater than 3.9m OD for 1% AEP flood event. Flood extents are predicted to reach a depth of between 0-1 m along the portion of road as per.

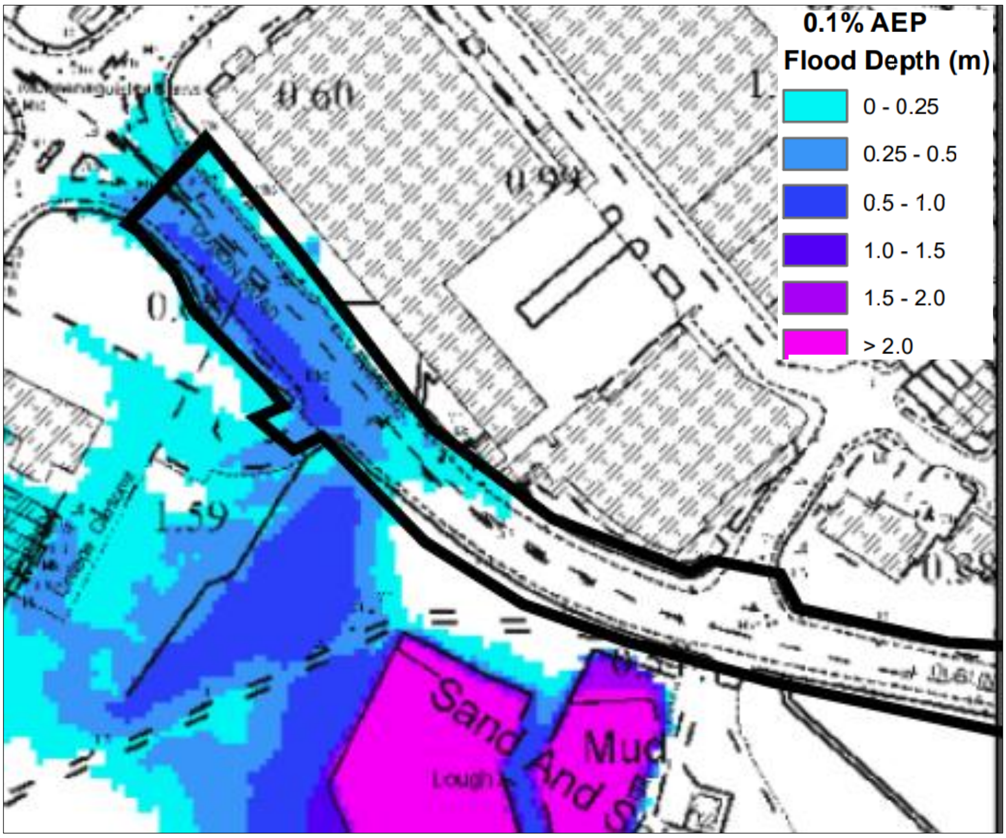


Figure 39:R338 Dublin Road Tidal Flooding

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map, Figure 9. The area is noted as high groundwater vulnerability as per Figure 10. It is likely that the vulnerability rating is indicative of a shallow water table due to the site's proximity to the sea.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.23 Site Compounds

It is anticipated that three construction compounds will be utilised during the construction of the Proposed Scheme, two main compounds located at Galway Harbour Enterprise Park and a satellite compound at Galway Cathedral Car-Park. The Satellite Site Compound is assessed as part of the Scheme Works and will not be assessed any further. The main Site Compounds will be actively used during construction period which may well last longer than one hydrologic year and hence was assessed for any risk of flooding from the following known sources.

Fluvial Flooding

The main Site Compounds is outside the 0.1%, 1% and 10% AEP and is therefore classified as Flood Zone C.

Tidal Flooding

The compound is predominantly outside the flood extents except for the bridge over Lough Atalia (New Docks) falling within the 1:200 year or 0.5% AEP extent and is therefore partially within Flood Zone A as shown in Figure 40.

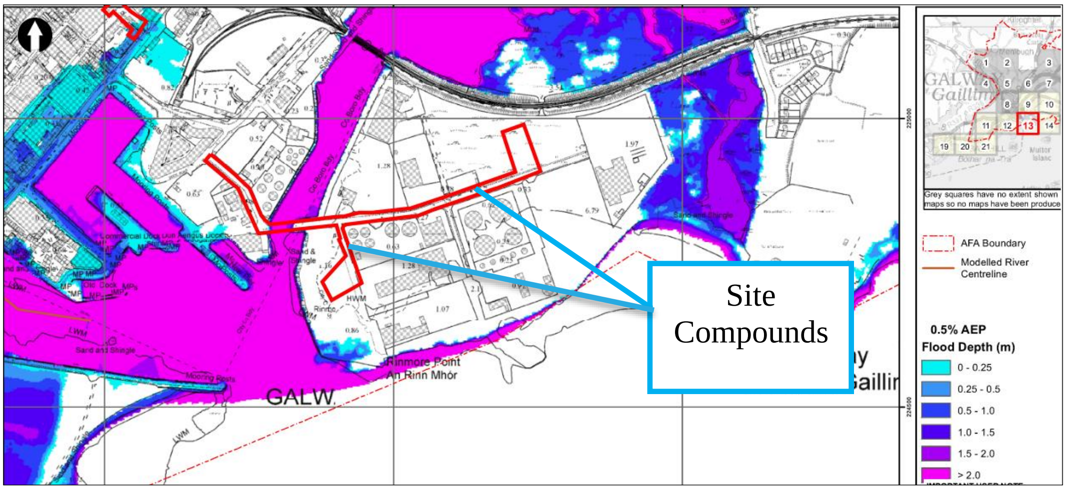


Figure 40 Site Compounds Tidal Flood Extents (0.5% AEP)

As it can be seen in the flood map, the bridge across the Lough Atalia will be submerged by a flood depth of greater than 2.0m during the 0.5% AEP tidal event in which case the entire Galway Harbour will be cut-off.

Groundwater Flooding

Groundwater has not been indicated in this area by the GSI Groundwater Flood Map. The area is noted as high groundwater vulnerability. It is likely that the vulnerability rating is indicative of absence of soil cover rather than a highwater table. However, the groundwater table is likely to be shallow due its proximity to the bay.

Pluvial Flooding

Pluvial Flooding in this area is not indicated in the PFRA map and therefore the risk is deemed to be low.

3.24 Summary of Flood Risk

Table 2: Summary of flood risk to the Work Areas

Location	Source of Flooding				
	Fluvial	**Tidal**	**Groundwater**	**Pluvial**	**Mechanical**
University Road	Low	Low	Moderate	Low	Low
Gaol Road and Galway Cathedral	Moderate	Low	Moderate	Low	Medium
Salmon Weir Bridge	Low	Low	Moderate	Low	Low
Newtownsmith/Waterside	Low	Low	Moderate	Low	Low
St. Vincent’s Avenue/Walsh’s Terrace	Low	Low	Moderate	Low	Low
Woodquay/Daly’s Place/Mary Street	Low	Low	Moderate	Low	Low
Dyke Road/Headford Road	Moderate	Low	Moderate	Low	Low
St. Francis Street/Eglinton Street/Williamsgate Street	Low	Low	Moderate	Low	Low
Bóthar na mBan/St. Brendan’s Avenue	Low	Low	Moderate	Low	Low
Prospect Hill	Low	Low	Low	Low	Low
Eyre Square North/Eyre Square East/Eyre Square South	Low	Low	Low	Low	Low
Victoria Place/Merchant’s Road/Queen Street	Low	High	Low	Moderate	Low
Forster Street	Low	Low	Low	Low	Low
College Road/Forster Street/Fairgreen Road/Bóthar Uí hEithir Junction	Low	Low	Low	Low	Low
Bóthar Uí hEithir	Low	Low	Low	Low	Low
Fairgreen Road	Low	Low	Low	Low	Low
College Road (to junction with Lough Atalia Road)	Low	Moderate	Low	Low	Low
College Road/Lough Atalia Road Junction	Low	Moderate	Moderate	Low	Low
College Road/Lough Atalia Road to Moneenageisha Junction	Low	Moderate	Moderate	Low	Low
Moneenageisha Junction	Low	Moderate	Moderate	Low	Low
R338 Dublin Road	Low	Moderate	Moderate	Low	Low
Site Compounds (Harbour)	Low	High	Moderate	Low	Low

3.25 Conclusion of Stage 2 - FRA

As summarised in Table 2, there is two locations at high risk of flooding (Flood Zone A) from tidal sources and further seven areas at moderate risk of flooding (Flood Zone B) from fluvial sources in the Proposed Scheme area. Areas at moderate risk from groundwater sources are likely due to the site's proximity to the sea as opposed to a shallow water table and this may require dewatering during construction, as required. The pluvial flood risk at Victoria Place is only a historic and is probably due to undersized drainage pipe or blockage of the system.

The risk of flooding does not suggest progressing to Stage-3 Flood Risk Assessment. However, as outlined in in the preceding sections, some of the work areas are within Flood Zone A or B and the development being classed a "Highly Vulnerable", a Justification Test is required to be passed for the development proposal to go ahead[1].

3.26 Justification Test

A Development Management Justification Test is completed in accordance with the guidelines. This was to ensure the development proposal is not at risk of flooding to itself or does not increase the risk elsewhere. Although not all parts of the development are considered at risk as they are outside of Flood Zone A or B, the Justification Test was applied for the whole development area.

The Proposed Scheme has been determined to have satisfied all requirements of the justification test as demonstrated in Table 3.

As flood risks are present is some areas, measures included in the Proposed Scheme design measures are used are outlined in the Section 4 which were used to complete the Justification Test. Some of the measures included:

- Upgraded road drainage system including SUDs,
- Routine maintenance plan of the drainage system,
- Flood risk warning and flood risk awareness system.

Section 4 provides more details of these proposed design measures applied at the areas identified.

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[1] Note that flood risk assessments do not take into account the presence of flood defence structures or design measures in place as a residual risk always remains and flood risk is never zero.

Table 3: Justification Test Table for the Proposed scheme

No.	Criteria	Response	Criteria Satisfied?
1	The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.	The subject road corridor is an existing development. The Galway City Development Plan 2017-2023 plans to, " *Implement traffic management and infrastructural changes to facilitate the development of a public bus network in accordance with the Galway Transport Strategy (GTS).*" This development achieves this purpose by providing enhanced public transport network to Galway City.	Yes
2	The proposal has been subject to an appropriate flood risk assessment that demonstrates:		
2(i)	The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;	The FRA completed demonstrated that the Proposed Scheme does not increase the existing risk of flooding to itself or elsewhere. Standard SUDs measures in the form tree pits, oversized pipes and attenuation tanks) are also provided to improve on the existing situation outlined in Section 4.	Yes
2(ii)	The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;	The development proposal includes upgraded drainage system and additional green area where available to reduce the existing risk of flooding. The development proposal consisted of SUDs in the form of tree pits, bioretention areas and catchpits to reduce the risk further and improve the discharge quality. Any net increase in impermeable area was compensated by creating additional green area. Therefore, no overall increase in flooding to the site or elsewhere is expected.	Yes
2(iii)	The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and	The existing flood warning system and routine drainage inspection maintenance plan will be in place to reduce the residual risk to acceptable level. For fluvial sources, the development proposal is designed to include upgraded drainage system with additional gullies to collect surface water from foot paths and carriageway to connect to new surface water network. The development proposal will also contain flood resilient construction methods and materials.	Yes

No.	Criteria	Response	Criteria Satisfied?
2(iv)	The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.	The Proposed Scheme will facilitate good urban growth through a provision of high-quality pedestrian, cycle, and public transport corridor. This is in line with the Galway City Development Plan objectives which states, "Support the improvement of access for public transport, pedestrian and cyclists to and within major employment areas and institutions." The development is in keeping with the landscape and visuals of Galway city.	Yes

4 Proposed Scheme Design Measures

4.1 Flood Risk Areas

There were nine flood risk areas identified along the proposed routes sections of work that spanned from University Road to College Road.

- Area 1: Gaol Road and Galway Cathedral Car Park (Satellite Compound) lie within Flood Zone B (between 1 in 100 and 1 in 1000-year fluvial flood extents,
- Area 2: Dyke Road/Headford Road (1 in 1000 fluvial extent)/Defended Area
- Area 3: Victoria Place/Merchant’s Road/Queen Street lies within Flood Zone A (1 in 200-year tidal flood extents),
- Area 4: College Road (to junction with Lough Atalia Road) within Flood Zone B (between 1 in 200 and 1 in 1000-year tidal flood extents),
- Area 5: College Road/Lough Atalia Road Junction within Flood Zone B (between 1 in 200 and 1 in 1000-year tidal flood extents),
- Area 6: College Road/Lough Atalia Road to Moneenageisha Junction within Flood Zone B (between 1 in 200 and 1 in 1,000-year tidal flood extents),
- Area 7: Moneenageisha Junction within Flood Zone B (between 1 in 200 and 1 in 1000-year tidal flood extents),
- Area 8: Dublin Road within Flood Zone B (between 1 in 200 and 1 in 1000-year tidal flood extents),
- Area 9: Main Site Compounds (Galway Harbour) in part is in Flood Zone A from tidal sources

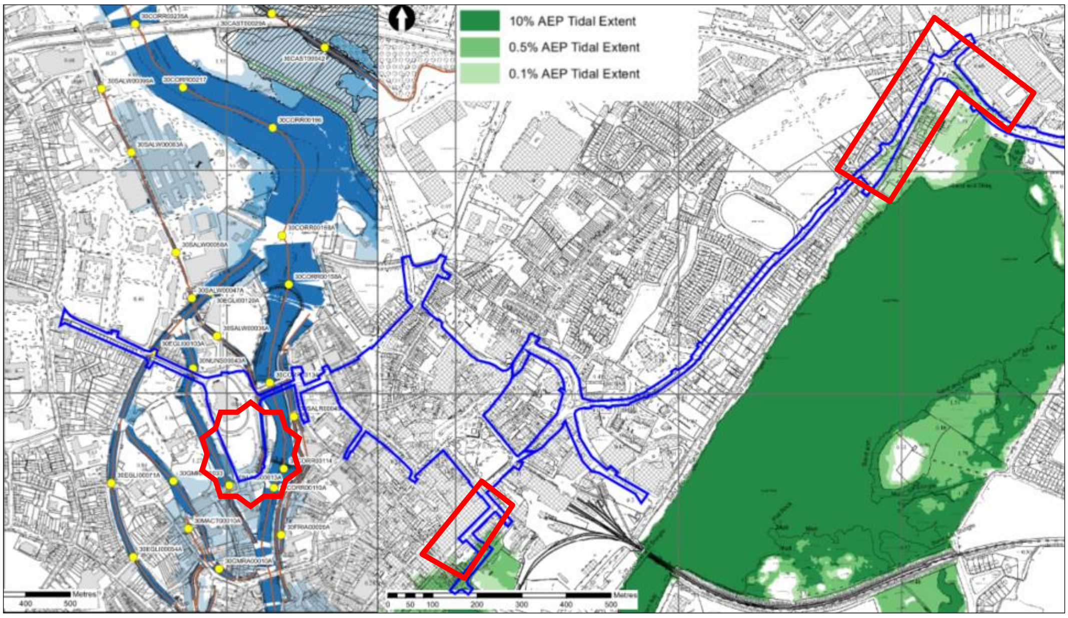


Figure 41: Full fluvial and tidal flood risk sites (shown in red)

Design measures applied to each of these areas is outlined below:

4.2 Area 1: Gaol Road and Galway Cathedral

The flood depth for the Gaol Road/Cathedral work area varies from 0.0 to 0.25m for the 0.1% AEP as shown in Figure 42.

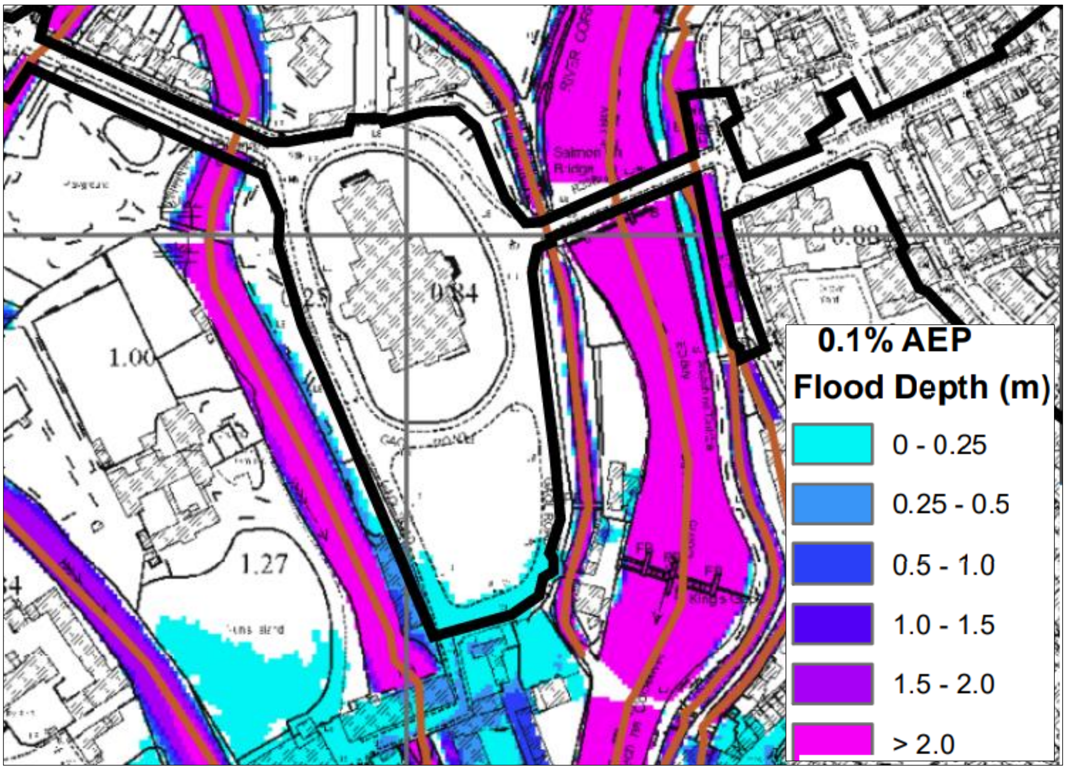


Figure 42 Gaol Road/Galway Cathedral Area

No material change is proposed to the existing road to mitigate against fluvial flood risk. However, the following design solutions are included to mitigate the risk from surface water drainage:

- Upgraded the surface water drainage system with additional gullies and relocated existing ones for efficiency,
- Provided additional green area,
- Provided adequate space for post flood draining and cleaning.

4.3 Area 2: Dyke Road/Headford Road

This is a defended area by means of the Dyke Road embankment. This embankment provides a flood protection of up to the 1% AEP from the River Corrib. The condition of the embankment is described as “fair”. The risk of flooding in this area dependent on this defence being maintained on an ongoing basis.

To mitigate against pluvial flooding, the following design solutions are included:

- Upgraded surface water drainage system, additional gullies provided and relocated existing ones as required,
- New gullies provided to collect surface water from footpaths, cycle tracks and carriageway and connected to oversized pipe and a flow control structure (a hydrobrake) to attenuate flows form any impermeable area.
- Surface water outfall to the Corrib River in the vicinity of the Dyke Road embankment avoided,
- Provided additional green area.

4.4 Area 3: Victoria Place/Merchant's Road/Queen Street

The flood depth on these areas varies from 0.5m to 1.0m during the 0.1% AEP tidal event as shown in

Figure **43**. A maximum flood depth of 1.0m is inaccessible for passenger cars, but emergency vehicles can ford through if their exhaust is at higher level. There is no physical flood protection scheme in place yet. Until such scheme is in place, this area will continue to be at high risk of flooding from tidal sources from 0.5%AEP event.

The strategy to mitigate the impact of flooding in this section of the works is by avoiding construction during high tide. Galway City Council's tidal warning system will be used to warn construction personnel and other road users.

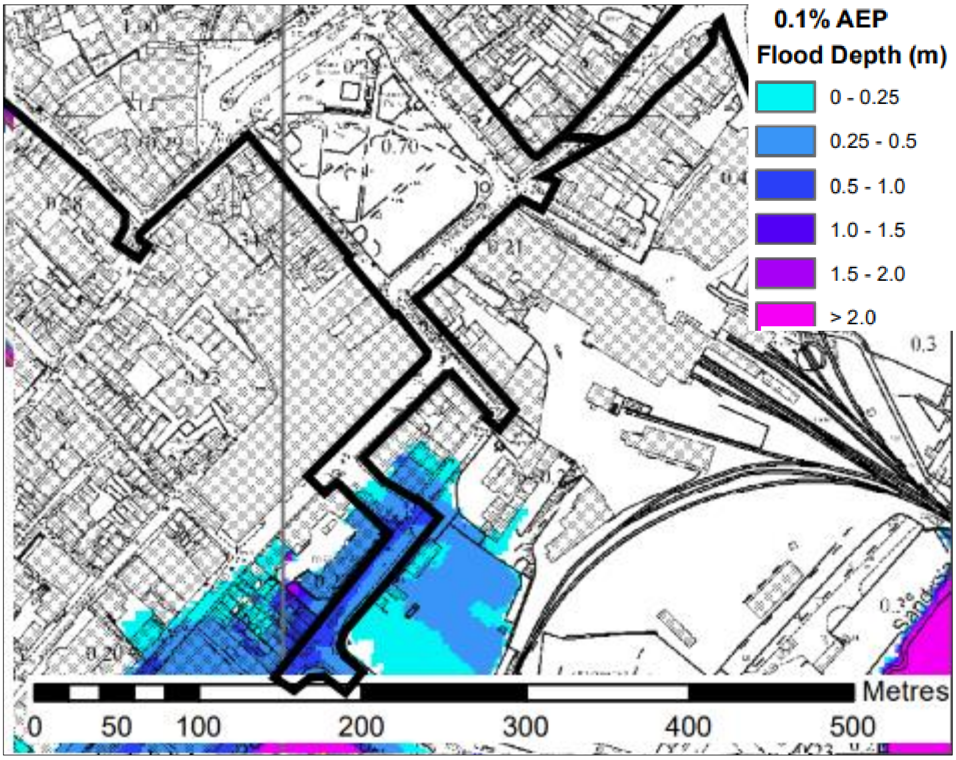


Figure 43 Tidal Flood Depth – Victoria Place/Merchant's Road/Queen Street

4.5 Area 4: College Road/Lough Atalia Road Junction

The flood depth on these areas varies from 0.5m to 1.0m during the 0.1% AEP tidal event as shown in Figure 44.

Measures for surface water management included in the design are:

- Upgraded drainage system with additional gullies,
- No net increase in impermeable surface,
- Provided attenuation tank: Volume = 279m^3
- Provided adequate space for post flood draining and cleaning

Additional measures that will be in place to mitigate the impacts of tidal flooding is the tidal warning issued by Galway City Council in advance of high tides so that construction during such periods is avoided.

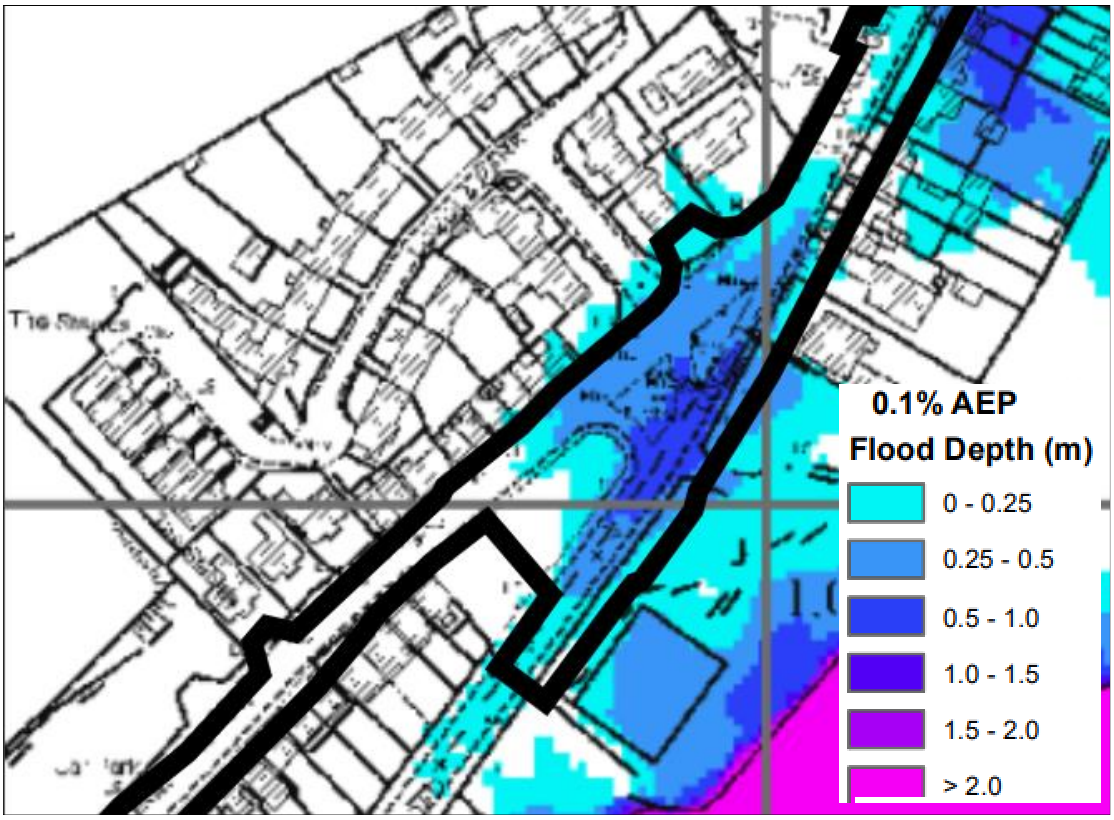


Figure 44 Tidal Flood Depth - College Road/Lough Atalia Road Junction

4.6 Area 5: College Road/Lough Atalia Road to Moneenageisha Junction

The flood depth on these areas is less than 0.5m during the 0.1% AEP tidal event as shown in Figure 45.

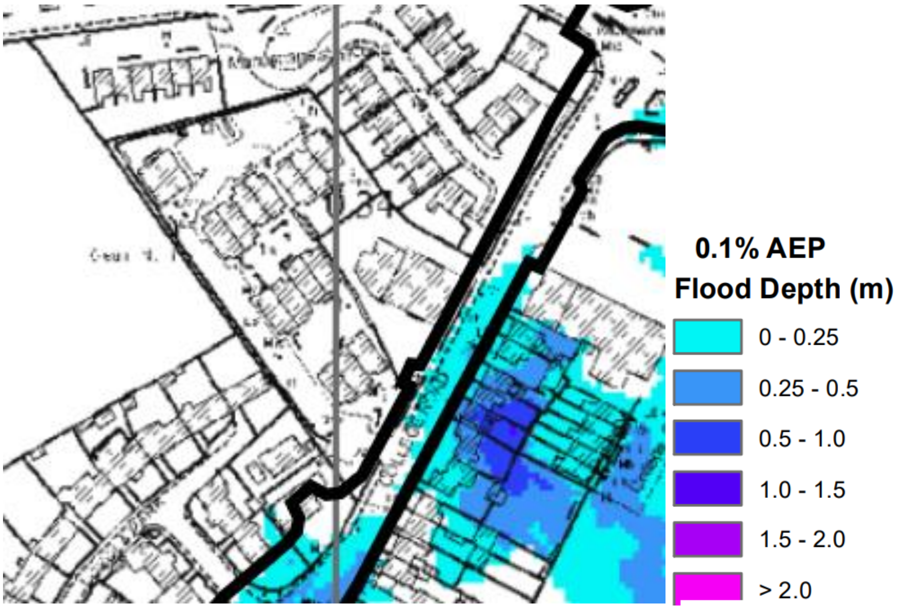


Figure 45 Tidal flooding College Road/Lough Atalia Road to Moneenageisha Junction

Design measures for surface water management included in the design are:

- Upgraded drainage system to speed up drainage,
- New gullies to collect surface water from footpaths, cycle tracks and carriageway and connected to oversized pipes and a flow control structure (hydrobrake) to attenuate flows form any increase in impervious area.

Additional measures that will be in place to mitigate the impacts of tidal flooding is the tidal warning issued by Galway City Council in advance of high tides so that construction during such periods is avoided.

4.7 Areas 6, 7 and 8: Moneenageisha Junction/Dublin Road

The flood depth on these areas is between 0.0 to 1.0m during the 0.1% AEP tidal event as shown in Figure 46.

Design measures for surface water management applied in this area include:

- Upgraded drainage system including additional gullies to speed up drainage
- New gullies to collect surface water from footpaths, cycle tracks and carriageway and piped via a flow control structure (hydrobrake) to attenuate flows before discharge to the sea,
- Provided adequate space for post flood draining and cleaning.

Additional measures that will be in place to mitigate the impacts of tidal flooding is the tidal warning issued by Galway City Council in advance of high tides so that construction during such periods is avoided.

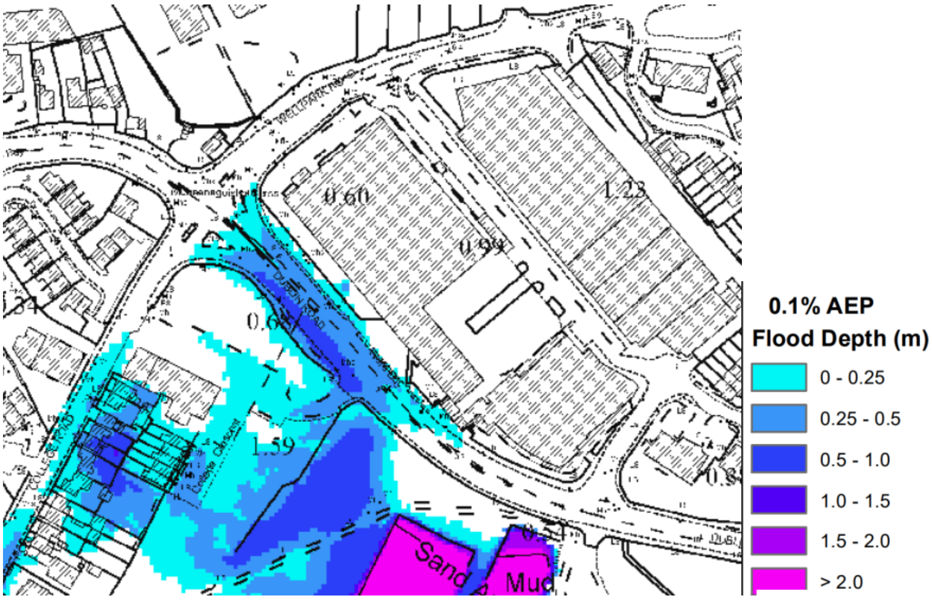


Figure 46 Tidal flooding at Moneenageisha Junction

4.8 Areas 9: Main Site Compound

The flood depth across the bridge over Lough Atalia reaches to a maximum 2m for the 0.5% AEP tidal event. The site is only for a temporary use during construction and design measures may not be justified. The main Site Compounds will be cut off until the high tide subsides which will result in the disruption of the works. The road will be allowed to flood with advance warning given to the road user by Galway City Council.

5 Conclusion

This FRA was carried out as part of the Planning Application for the proposed Bus Connects Galway: Cross-City Link (University Road to Dublin Road.

While most areas at low risk of flooding (i.e., Flood Zone C), sections of the Proposed Scheme site are at moderate to high risk of fluvial or tidal flooding. Work areas of the Scheme at moderate/high risk (Flood Zone B or A) of flooding include:

- Area near Goal Road, Galway Cathedral and Dyke Road are within Flood Zone B from fluvial source.
- Sections of Victoria Place/Merchant’s Road/Queen Street are identified as being in Flood Zone A, at risk from tidal source. This section is also at moderate risk from pluvial flooding.
- Sections of the works from College Road/Lough Atalia Road to the Moneenageisha Junction and work areas on Dublin Road are within Flood Zone B from tidal source.

- The risk of flooding from groundwater source was determined as moderate. However, this is likely indicative of a shallow water table due to the site's proximity to the sea and hence dewatering may be required during construction.

Therefore, some of the sections of the development are either in Flood Zone A or B. With the type of development being "essential infrastructure" (i.e., highly vulnerable), a justification test was completed and determined that the proposal satisfied all the requirements.

The scope of the Proposed Scheme is in keeping with the existing road profile and does not increase the risk of flooding elsewhere. However, as sections of the area are situated in flood risk zones, the proposal includes drainage design measures including upgrade of the surface water drainage system with additional (or relocated) gullies, additional green area where there is a net increase in impervious area, and attenuation systems via SUDs including tree pits, bioretention areas and catchpits, oversized pipes, and an attenuation tank at College Road/Lough Atalia Road.

There remains a residual risk to sections of the Study Area from tidal sources. The worst impacted area are at Victoria Place and at the junction of College Road/Lough Atalia Road form the 0.5% AEP tidal event reaching a maximum depth of 0.5m to 1.0m OD. Access to the main Site Compounds, located at Galway Harbour Enterprise Park, may also be hampered as the bridge over Lough Atalia will be submerged for the 0.5% AEP tidal event. However, the interruption is expected to be brief until the high tide subsides. The Contractor will maintain awareness of tidal event and weather forecasts from Galway City Council and Met Eireann as appropriate during construction, as is standard practice.

In conclusion, this FRA has demonstrated that the risks relating to flooding to the Proposed Scheme are moderate and can be managed for during construction and operation of the Proposed Scheme and therefore comply with DoEHLG / OPW.

Chapter 14

(Land, Soils, Geology & Hydrogeology) Appendices

Appendix

14.1 Scheme Walkover Summary

A1 Contents

A2 Scheme Walkover Summary

A2.1 Introduction

The following is a summary of the observations by the Land, Soils, Geology and Hydrogeology Environmental Impact Assessment Team following physical walkovers of the scheme. The walkover occurred on the 11th October 2021. The drawings used to determine the type and extent of proposed works and in turn to inform the site walkover were the General Arrangement Key Plan Drawings No. BCG-0100-00-001 to BCG-100-00-05 (Version P01).

Not all observations have been included in this summary for conciseness. Typically, only observations that could not have been determined from the desk study and that are relevant to the Land, Soils, Geology and Hydrogeology chapter have been included. The omission of an observation or a feature does not negate the feature’s importance in terms of the Land, Soils, Geology and Hydrogeology environmental impact assessment.

The observations are summarized in Table 1 and the corresponding photos in A2.3 of this appendix. The sheet locations are in reference to Sheets 01 to 05 of the General Arrangement Key Plan Drawings No. BCG-0100-00-001 to BCG-100-00-05.

A2.2 Summary

Table 1 : Scheme Walkover Summary

Site Notes				
Name	**Category**	**Importance/Activity**	**Location**	**Photo ID**
River Corrib	Waterbody	Extremely High Importance	Sheet 01	Galway_Image01
	Comments: The Proposed Development traverses the River Corrib along the existing Salmon Weir Bridge. The River Corrib is part of 'The Lough Corrib SAC and pNHA'.			
The Lough Corrib SAC	SAC and pNHA	Extremely High Importance	Sheet 01 and North of all sheets	Galway_Image01
	Comments: This area includes Lough Corrib north of the study area and the River Corrib which flows south from Lough Corrib and into the Galway Bay Complex SAC. It must be considered due to its proximity.			
The Galway Bay Complex	SAC and pNHA	Extremely High Importance	Sheet 05 and South of all sheets	Galway_Image02
	Comments: This area includes the coastal waters of inner Galway Bay and Lough Atalia. It must be considered due to its proximity.			
Surface water discharge – Lough Atalia	Waterbodies	Refer to conceptual site model	Sheet 05	Galway_Image03
	Comments: There were to surface water discharges observed entering the eastern end of Lough Atalia. One discharge was clear and entering the Lough at approximately 1L/Sec. The other was milky white to grey and was entering the Lough at approximately <.1L/Sec.			
Inner Galway Bay	SPA	Extremely High Importance	South of all sheets	N/A
	Comments: This area includes the coastal waters of the Corrib Estuary and Inner Galway Bay. It must be considered due to its proximity.			
Demolition site St. Brendan's Avenue	Earthworks/Demolition	Earthworks/Levelling	Sheet 03	Galway_Image04 and 05
	Comments: The junction is proposed to be updated. For the junction to be updated in line with the current plans the corner house on St. Brendan's Avenue is proposed to be demolished. This will result in the demolition of the building and existing walls, there may be minor level changes to accommodate the works.			
Former Petrol Station Headford Road	Earthworks	Earthworks/Levelling	Sheet 03	Galway_Image06
	Comments: The Proposed Development is adjacent to a former Petrol Station on Headford Road. Due to the nature of the works and existing infrastructure already at the location, consideration of this impact is important and mitigation measures may be required if a localised contamination source is identified.			
Road updates	Earthworks	Earthworks/Levelling	Sheet 05	Galway_Image07

College Road and Lough Atalia Junction	Comments: The junction is proposed to be updated. A level change between Lough Atalia Road and College Road of approximately 3m was noted. Earthworks may be required to accommodate the works			
Circle K-College Road	Earthworks	Earthworks/Levelling	Sheet 05	Galway_Image08
	Comments: The Proposed Development is to interact with the Circle K garage on College Road. Due to the nature of the works and existing infrastructure already at the location, consideration of this impact is important and mitigation measures may be required if a localised contamination source is identified. The petrol station is on a reduced level, there were retaining walls surrounding the petrol station separating it from the higher ground level. The forecourt of the petrol station was in good order and appeared clean.			
Road widening College Road	Earthworks	Earthworks/Levelling	Sheet 05	Galway_Image09
	Comments: College Road is proposed to be widened; this occurs along a housing estate (Accessed from Moneengeisha Road). Minor level changes were noted at this location. There is a small retaining wall here, which allows for a level change between the road and the housing estate carpark. Earthworks will be required to accommodate the works			
Road widening at College Road – Dublin Road Junction	Earthworks	Earthworks/Levelling	Sheet 05	Galway_Image10
	Comments: The College Road-Dublin Road Junction is proposed to be updated and widened. This may result in the removal of walls and minor level changes to accommodate the works.			
Road widening Dublin Road	Earthworks	Earthworks/Levelling	Sheet 05	Galway_Image11
	Comments: The Dublin Road is proposed to be widened. This may result in the removal of walls and minor level changes to accommodate the works.			

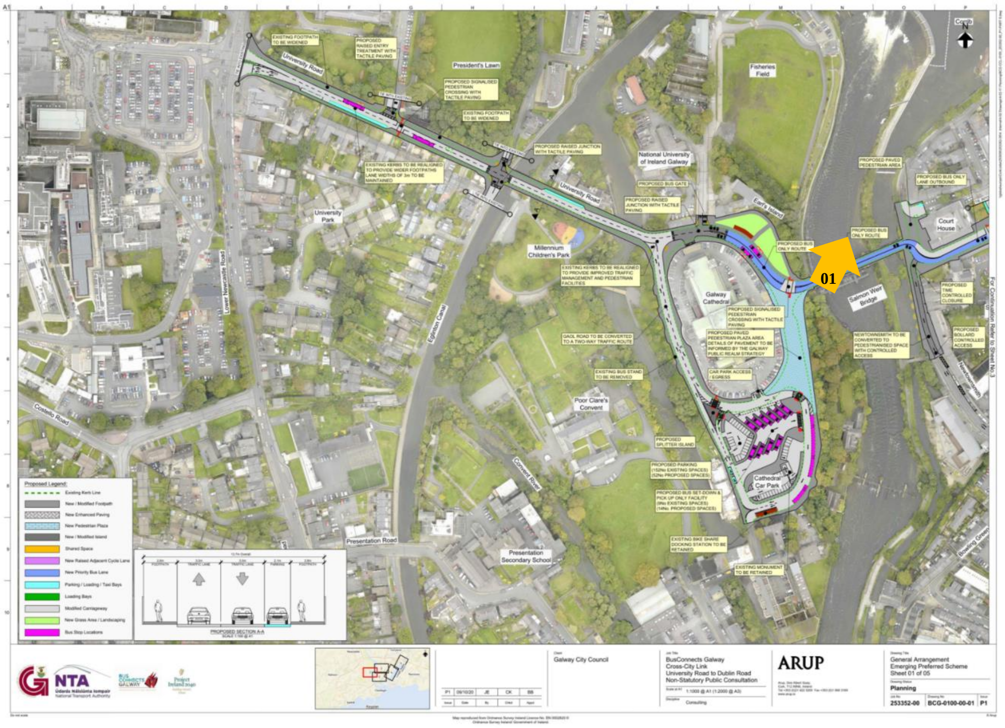
A2.3 Photos

Photos

Caption: River Corrib / Lough Corrib SAC

ID:	Galway_Image01	Date	11/10/2021	Co-ordinates	Easting: 529536 Northing: 725538

Keplan:



Caption: Galway Bay Complex SAC – Lough Atalia

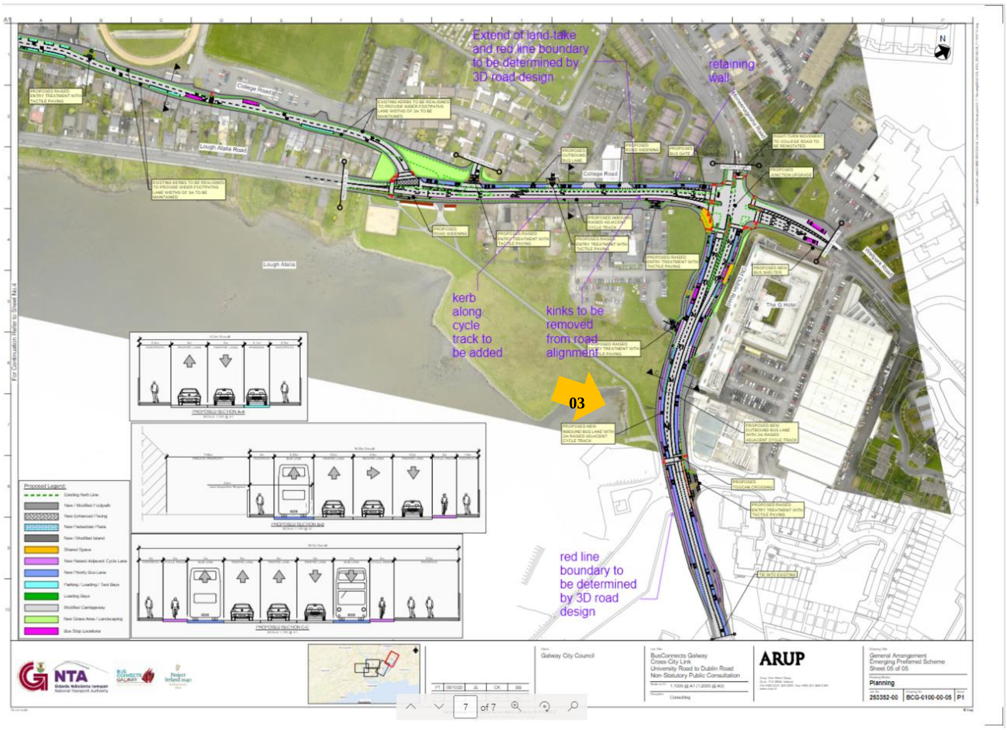
ID	Galway_Image02	Date	11/10/2021	Co-ordinates	Easting: 530445 Northing: 725292

Keyplan:

Caption: Surface water discharge – Lough Atalia

ID	Galway_Image03	Date	11/10/2021	Co-ordinates	Easting: 531159 Northing: 726095

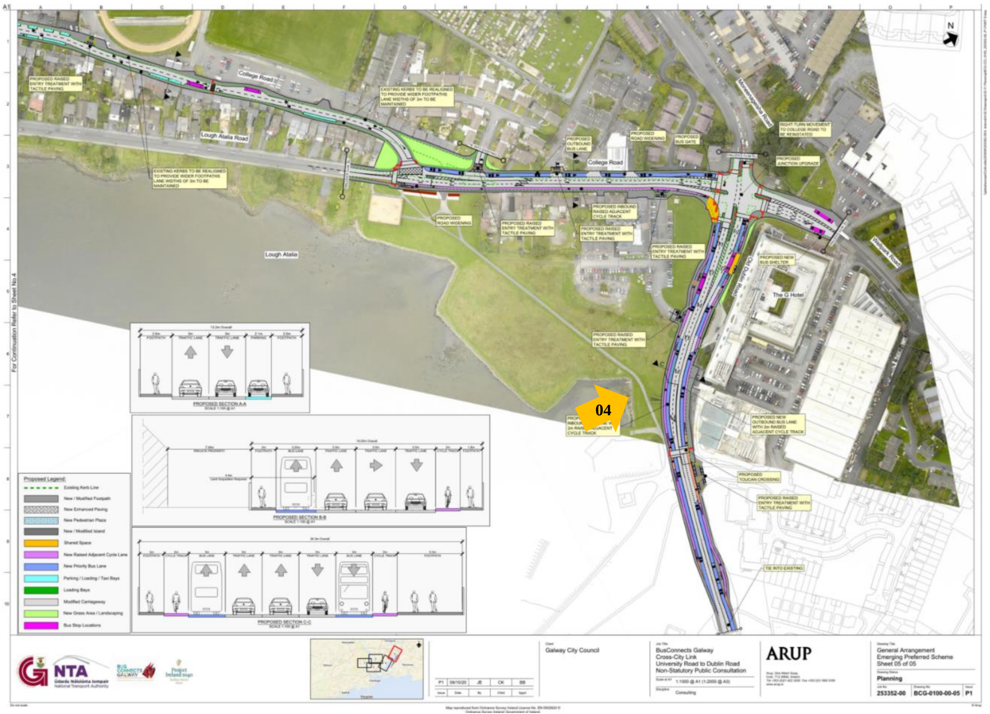
Keyplan:



Caption: Surface water discharge – Lough Atalia

ID	Galway_Image04	Date	11/10/2021	Co-ordinates	Easting: 531159 Northing: 726093

Keyplan:



Caption: Demolition site at 5/6 Headford Road property. Building to be demolished highlighted in red. Extent of the demolition site is not included in the photo. Demolition site also includes property at the rear 20 Saint Brendans Avenue

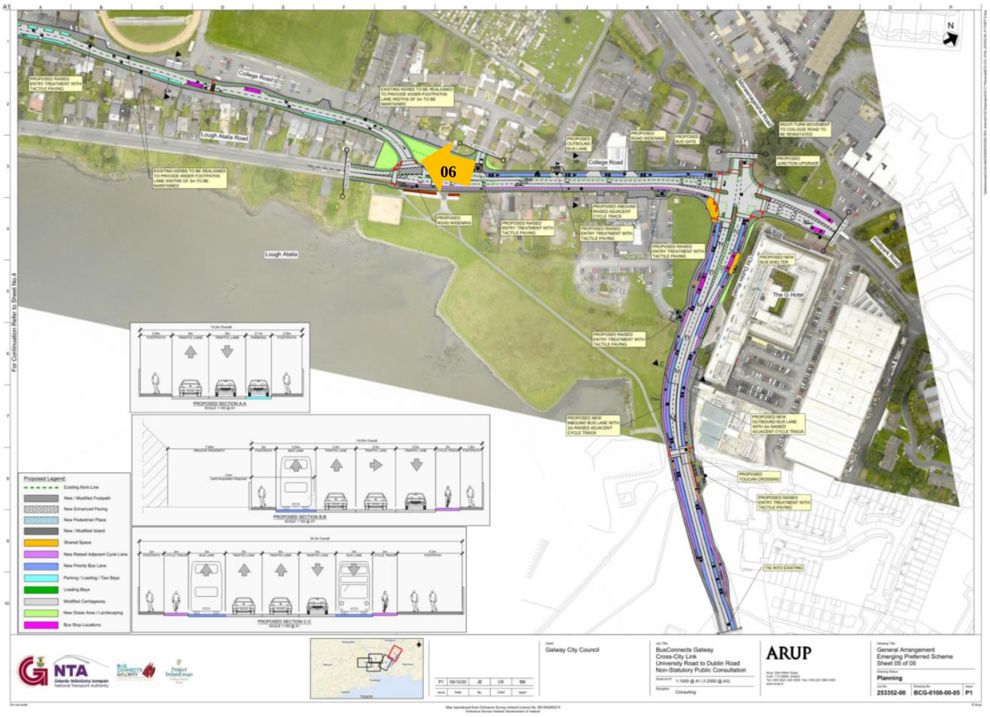
ID	Galway_Image05	Date	11/10/2021	Co-ordinates	Easting: 529876 Northing: 725737

Keyplan

Caption: Lough Atalia Road and College Road Level difference

ID	Galway_Image06	Date	11/10/2021	Co-Ordinates:	Easting: 530927 Northing: 726042

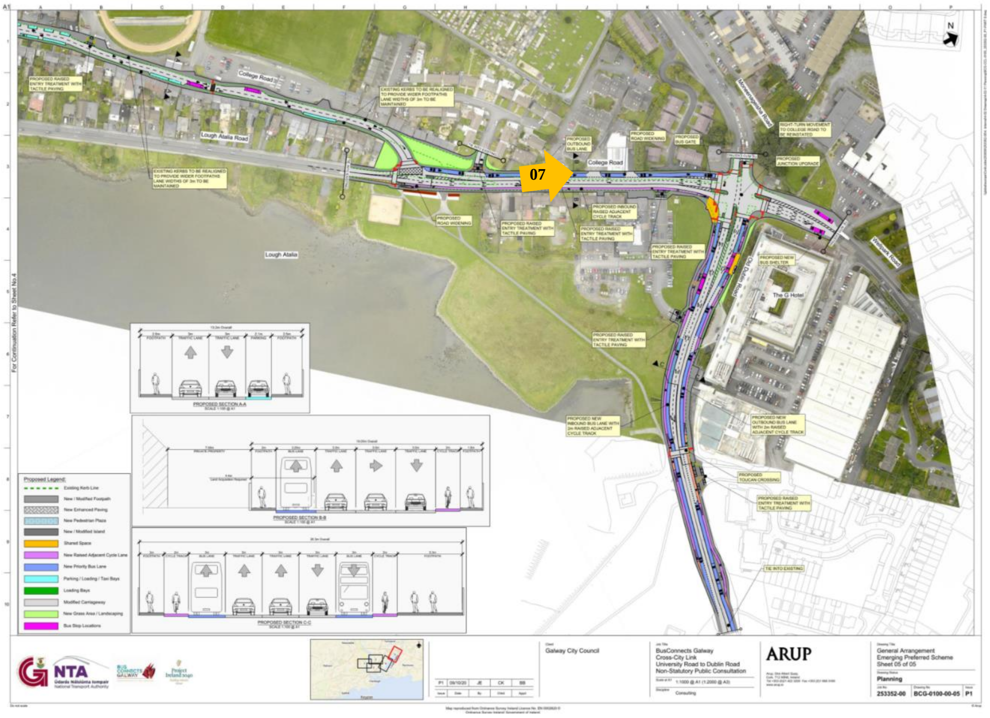
Keyplan:



Caption: Circle K College Road

ID	Galway_Image07	DATE:	11/10/2021	Co-Ordinates:	Easting: 530993 Northing:726151

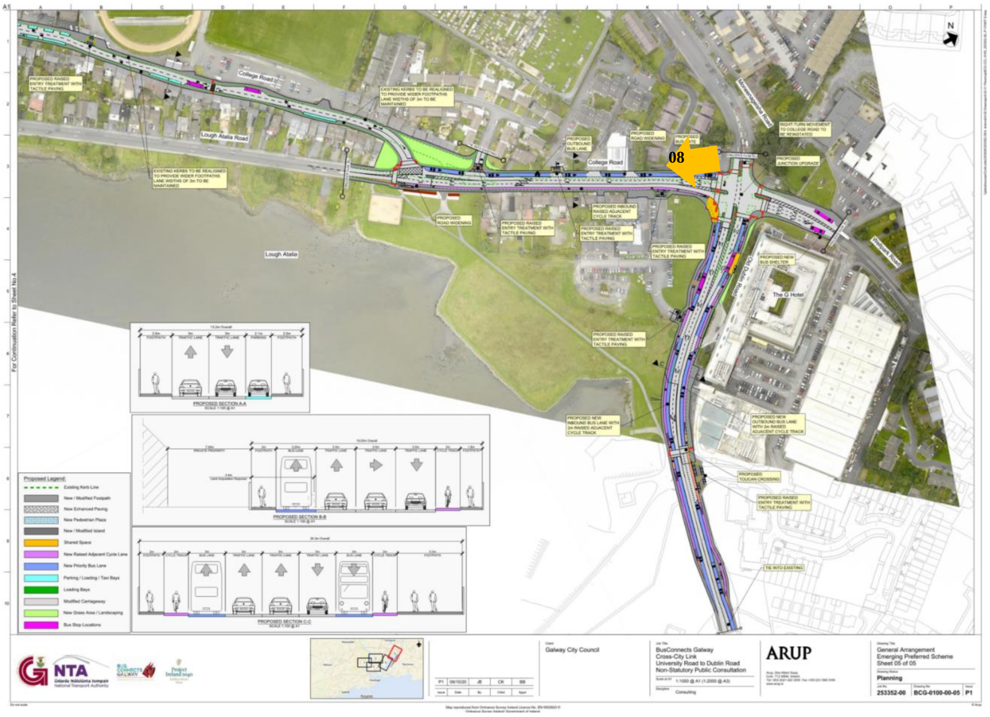
Keyplan:



Caption: Housing estate carpark adjacent to College Road ***note difference in level change between road and carpark with reference to circle K signpost***

ID:	Galway_Image08	Date:	11/10/2021	Co-Ordinates:	Easting: 531026 Northing: 726218

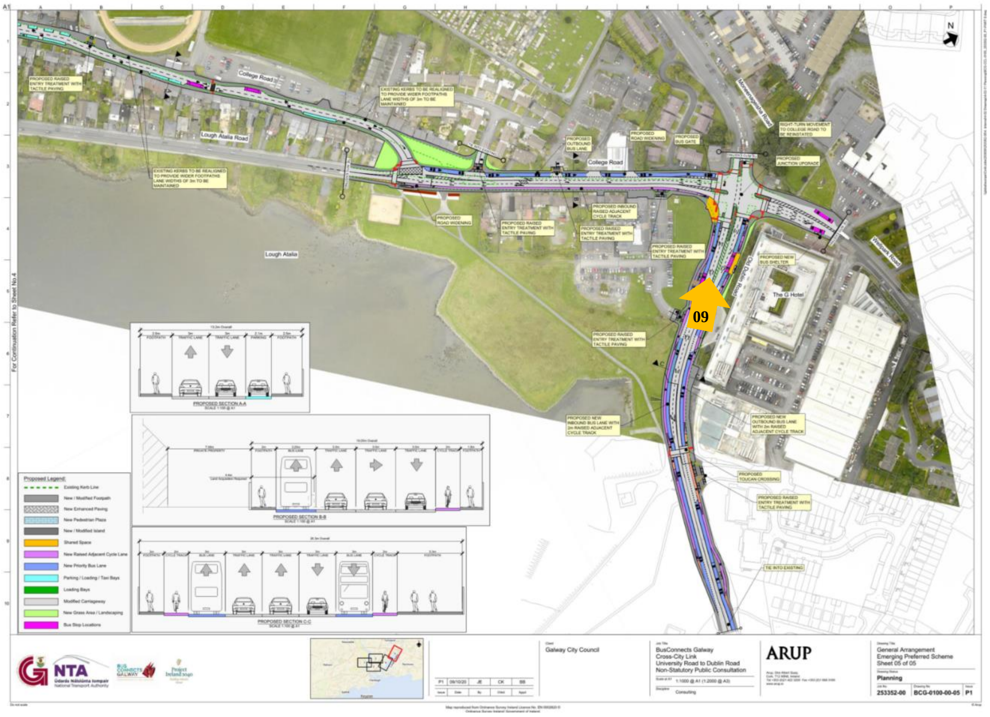
Keyplan:



Caption: Junction of College Road and the Dublin Road

ID:	Galway_Image09	Date:	11/10/2021	Co-Ordinates:	Easting: 531108 Northing: 726204

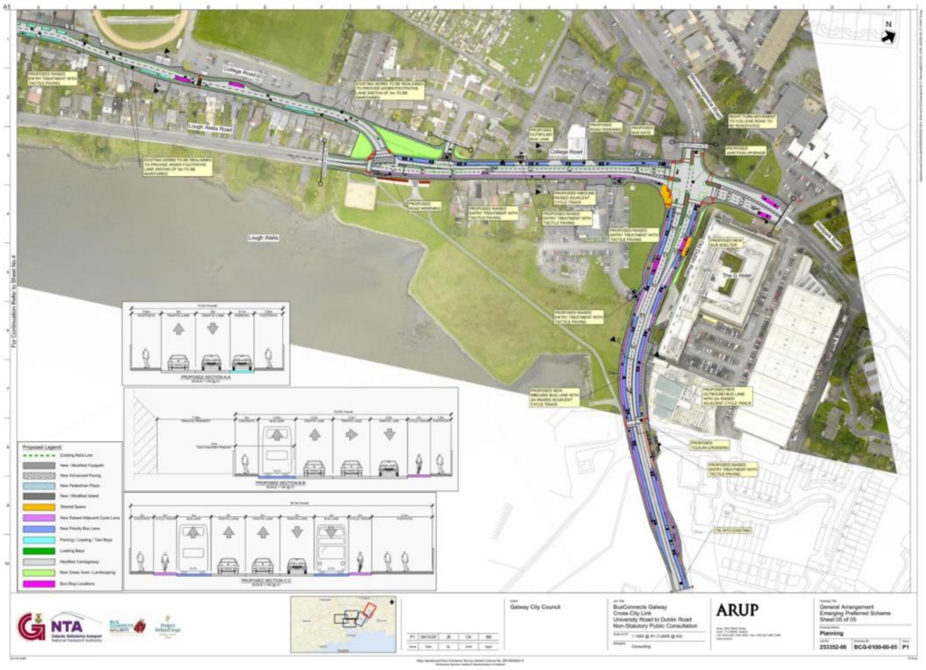
Keyplan:



Caption: Dublin Road

ID:	Galway_Image10	Date:	11/10/2021	Co-Ordinates:	Easting: 531236 Northing: 726106

Keyplan:



BusConnects Galway – Ground Investigation

Client:	Galway City Council
Client's Representative:	Arup
Report No.:	21-1298
Date:	March 2022
Status:	Draft Report

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Document Control Sheet

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APPENDICES

Appendix A	Site and exploratory hole location plans
Appendix B	Borehole logs
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Appendix D	Groundwater monitoring
Appendix E	Geotechnical laboratory test results
Appendix F	Environmental laboratory test results
Appendix G	SPT hammer energy measurement report

Document Control Sheet

Report No.:	21-1298
Project Title:	BusConnects Galway
Client:	Galway City Council
Client's Representative:	Arup

Revision:	A00	**Status:**	Draft Report	**Issue Date:**	10th March 2022

Prepared by:	**Reviewed by:**	**Approved by:**
Gabriella Horan Gabriella Horan BSc	Sean Ross. Sean Ross BSc MSc PGeo MIEI	Darren O'Mahony BSc MSc MIEI EurGeol PGeo

The works were conducted in accordance with:

British Standards Institute (2015) BS 5930:2015+A1:2020, Code of practice for site investigations.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

Laboratory testing was conducted in accordance with:

British Standards Institute BS 1377:1990 parts 2, 4, 5, 7 and 9

METHODS OF DESCRIBING SOILS AND ROCKS

Soil and rock descriptions are based on the guidance in BS5930:2015+A1:2020, The Code of Practice for Site Investigation.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample (thick walled sampler).
UT	Nominal 100mm diameter undisturbed open tube sample (thin walled sampler).
P	Nominal 100mm diameter undisturbed piston sample.
B	Bulk disturbed sample.
LB	Large bulk disturbed sample.
D	Small disturbed sample.
C	Core sub-sample (displayed in the Field Records column on the logs).
L	Liner sample from dynamic sampled borehole.
W	Water sample.
ES / EW	Soil sample for environmental testing / Water sample for environmental testing.
SPT (s)	Standard penetration test using a split spoon sampler (small disturbed sample obtained).
SPT (c)	Standard penetration test using 60 degree solid cone.
(x,x/x,x,x,x)	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length.
(Y for Z/ Y for Z)	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given seating or test length 'Z' (mm).
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm).
HVP / HVR	In situ hand vane test result (HVP) and vane test residual result (HVR). Results presented in kPa.
V VR	Shear vane test (borehole). Shear strength stated in kPa. V: undisturbed vane shear strength VR: remoulded vane shear strength
Soil consistency description	In cohesive soils, where samples are disturbed and there are no suitable laboratory tests, N values may be used to indicate consistency on borehole logs – a median relationship of Nx5=Cu is used (as set out in Stroud & Butler 1975).
dd-mm-yyyy	Date at the end and start of shifts, shown at the relevant borehole depth. Corresponding casing and water depths shown in the adjacent columns.
▽	Water strike: initial depth of strike.
▼	Water strike: depth water rose to.
Abbreviations relating to rock core – reference Clause 36.4.4 of BS 5930: 2015+A1:2020	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.
(xxx/xxx/xxx)	Spacing between discontinuities (minimum/average/maximum) measured in millimetres.

BusConnects Galway

1 AUTHORITY

On the instructions of Arup, ("the Client's Representative"), acting on the behalf of Galway City Council ("the Client"), a ground investigation was undertaken at the above location to provide geotechnical and environmental information for input to the design of the proposed BusConnects Galway scheme.

This report details the work carried out both on site and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. No responsibility can be taken for conditions not encountered through the scope of work commissioned, for example between exploratory hole points, or beneath the termination depths achieved.

This report was prepared by Causeway Geotech Ltd for the use of the Client and the Client's Representative in response to a particular set of instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 SCOPE

The extent of the investigation, as instructed by the Client's Representative, included boreholes, soil sampling, rock core sampling, environmental sampling, groundwater monitoring, in-situ and laboratory testing and the preparation of a factual report on the findings.

3 DESCRIPTION OF SITE

As shown on the site location plans in Appendix A, the works were conducted across two main areas as outlined below, east of Galway City.

College Road and Lough Atalia intersection
Works were conducted in the area of Lough Atalia Road, College Road and Old Dublin Road in a mixture of grassy public areas, housing developments and private property including Circle K forecourt on College Road. The area is bounded by Lough Atalia and the Galway Bay Complex Special Area of Conservation (SAC).

St. Brendan's Avenue
BH106 was undertaken on the northbound lane of St. Brendan's Avenue, 30m south of its junction with Bóthar na mBan. The site is bounded by residential properties on all sides.

4 SITE OPERATIONS

4.1 Summary of site works

Site operations, which were conducted between 29th November 2021 and 25th January 2022, comprised:

- Thirteen boreholes
    - one light cable percussion borehole (only hand pit attempted)
    - four boreholes by light cable percussive extended by rotary follow-on drilling
    - six boreholes by dynamic (windowless) sampling
    - one borehole by dynamic (windowless) sampling extended by rotary follow-on drilling
    - one borehole by rotary drilling methods

- a standpipe installation in seven boreholes

- groundwater and surface water sampling and monitoring

The exploratory holes were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

4.2 Boreholes

A total of thirteen boreholes were put down in a minimum diameter of 150mm through soils and rock strata to their completion depths by a combination of methods, including light percussion boring using a Dando Terrier rig, light cable percussion boring by a Dando 2000 rigs, and rotary drilling by a Comacchio 205, tracked rotary drilling rig.

The borehole logs state the methodology and plant used for each location, as well as the appropriate depth ranges.

A summary of the boreholes, subdivided by category in accordance with the methods employed for their completion, is presented in the following sub-sections.

4.2.1 Boreholes by combined percussion boring and rotary follow-on drilling

Four boreholes (BH101, BH104, BH105A and BH106) were put down by a combination of light cable percussion boring and rotary follow-on drilling techniques with core recovery in bedrock.

Hand dug inspection pits were carried out between ground level and 1.20m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions.

Disturbed (bulk and small bag) samples were taken within the encountered strata. Undisturbed (U100) samples were taken where appropriate and as directed within fine soils. Environmental samples were taken at standard intervals, as directed by the Client's Representative.

Standard penetration tests were carried out in accordance with BS EN 22476-3:2005+A1:2011 at standard depth intervals using the split spoon sampler ($SPT_{(s)}$) or solid cone attachment ($SPT_{(c)}$). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The N-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix G.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded. Where water was added to assist with boring, a note has been added to the log to account for same.

Where the cable percussion borehole had not been advanced onto bedrock, rotary percussive methods were employed to advance the borehole to bedrock after which rotary coring methods were used to recover core samples of the bedrock. Symmetrix cased full-hole drilling was used in the overburden, with SPTs carried out at standard intervals as required.

Where coring was carried out within bedrock strata, conventional coring methods were used with a metric T2-101 core barrel which produced core lengths up to 1.5m in lengths, 84mm in diameter, and placed in triple channel wooden core boxes.

The core was subsequently photographed and examined by a qualified and experienced Engineering Geologist, thus enabling the production of an engineering log in accordance with *BS 5930: 2015+A1:2020: Code of practice for ground investigations*.

Appendix B presents the borehole logs, with core photographs presented in Appendix C.

4.2.2 Rotary drilled borehole

One borehole (BH103) was put to its completion by rotary drilling techniques only. The borehole was completed using a Comacchio 205 tracked drilling rig.

A hand dug inspection pit was carried out between ground level and 1.20m depth to ensure borehole was put down at a location clear of services or subsurface obstructions.

Symmetrix-cased full hole rotary percussive drilling techniques was employed to advance the borehole to bedrock, after which rotary coring was employed to recover core samples of the bedrock. SPTs were carried out at standard intervals throughout the overburden, with environmental samples taken at standard intervals, as directed by the Client's Representative.

The core was extracted in up to 1.5m lengths using a metric T2-101 core barrel, which produced core of nominal 84mm diameter, and was placed in triple channel wooden core boxes.

The core was subsequently photographed and examined by a qualified and experienced Engineering Geologist, thus enabling the production of an engineering log in accordance with *BS 5930: 2015+A1:2020: Code of practice for ground investigations*.

Appendix B presents the borehole logs, with core photographs presented in Appendix C.

4.2.3 Dynamic sampled boreholes

Six boreholes (BH102A, BH103WS, WS101 and WS104-WS106) were put down to completion by light percussion boring techniques using a Dando Terrier dynamic sampling rig. The boreholes were put down initially in 150mm diameter, reducing in diameter with depth as required, down to 50mm by use of the smallest sampler.

Hand dug inspection pits were carried out between ground level and 1.20m depth to ensure boreholes were put down clear of services or subsurface obstructions. The boreholes were taken to depths ranging between 1.30m and 4.00m where they were terminated on encountering virtual refusal.

Disturbed (bulk and small bag) samples were taken within the encountered strata. Environmental samples were taken at standard intervals, as directed by the Client's Representative.

Appendix B presents the borehole logs.

4.2.4 Borehole by combined dynamic sampling and rotary follow-on drilling

One borehole (BH102) was put down by a combination of dynamic sampling techniques using a Dando Terrier rig and rotary follow-on drilling techniques with core recovery in bedrock. The borehole was put down initially in 150mm diameter, reducing in diameter with depth as required, down to 50mm by use of the smallest sampler.

A hand dug inspection pit was carried out between ground level and 1.00m depth to ensure the borehole was put down clear of services or subsurface obstructions. The dynamic sampling section of the borehole was taken to a depth of 1.00m where it was terminated on encountering virtual refusal.

Disturbed (bulk and small bag) samples were taken within the encountered strata. Environmental samples were taken at standard intervals, as directed by the Client's Representative.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded.

Rotary percussive methods were employed to advance the borehole to bedrock, with SPTs carried out at standard intervals as required throughout the overburden, after which rotary coring was undertaken to recover core samples of the bedrock.

The core was extracted in up to 1.5m lengths using a metric T2-101 core barrel, which produced core of nominal 84mm diameter, and was placed in triple channel wooden core boxes.

The core was subsequently photographed and examined by a qualified and experienced Engineering Geologist, thus enabling the production of an engineering log in accordance with *BS 5930: 2015+A1:2020: Code of practice for ground investigations*.

Appendix B presents the borehole logs, with core photographs presented in Appendix C.

4.3 Standpipe installations

A groundwater monitoring standpipe was installed in several boreholes as shown in Table 1 below.

Table 1 Summary of standpipe installations

GI Ref	Standpipe type	Response Zone (mbgl)
BH102	50mm standpipe	1.30-4.50
BH103	50mm standpipe	4.50-8.00
BH103WS	50mm standpipe	1.50-2.60
BH104	50mm standpipe	4.50-8.00
BH105	50mm standpipe	4.50-8.00
BH106	50mm standpipe	2.40-6.00

WS104	50mm standpipe	1.50-3.00

Details of the installations, including the depth range of the response zone, are provided in Appendix B on the individual borehole logs.

4.4 PID tests

PID (Photo ionizing detection) testing was undertaken on small, disturbed samples recovered from all boreholes using a hand-held PID meter, to determine if any volatile organic compound contamination was present in the overburden.

Results of the PID tests are presented on the individual borehole logs in Appendix B.

4.5 Surveying

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R10 GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (Irish Transverse Mercator) and ground elevation (mOD Malin) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

4.6 Groundwater and surface water monitoring

Following completion of site works, groundwater monitoring was conducted over two weeks using groundwater data loggers and manually, using a water interface probe.

Surface water samples were also taken from two locations (SW1 and SW2), on the banks of Lough Atalia.

The monitoring records are presented in Appendix D, including data logger installation records and graphs over the monitoring period.

5 LABORATORY WORK

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described, and their descriptions incorporated into the borehole logs.

5.1 Geotechnical laboratory testing of soils

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests and particle size distribution analysis.
- **soil chemistry:** organic matter content

Laboratory testing of soils samples was carried out in accordance with British Standards Institute:
BS 1377, Methods of test for soils for civil engineering purposes; Part 1 (2016), and Parts 2-9 (1990).

The test results are presented in Appendix E.

5.2 Geotechnical laboratory testing of rock

Laboratory testing of rock sub-samples comprised:

- point load index

- unconfined compressive strength (UCS) tests

Test	Test carried out in accordance with
Point load index	ISRM Suggested Methods (1985) Suggested method for determining point-load strength. Int. J. Rock Mech. Min. Sci. Geomech. Abstr. 22, pp. 53–60
Uniaxial compression strength tests	ISRM Suggested Methods (1981) Suggested method for determining deformability of rock materials in uniaxial compression, Part 2 and ISRM (2007) Ulusay R, Hudson JA (eds) The complete ISRM suggested methods for rock characterization, testing and monitoring, 2007

The test results are presented in Appendix E.

5.3 Environmental laboratory testing of soils and water

Environmental testing, as specified by the Client's Representative was conducted on selected environmental soil and water samples by Chemtest at its laboratory in Newmarket, Suffolk.

Testing was carried out for the following Arup suites of soil and groundwater testing:

- Arup Soil Suite Ei – Leachate
- Arup Soil Suite Eii – Soil Total Pollutant
- Arup Soil Suite Eiii – Volatiles Soil
- Arup Soil Suite Eiv – Asbestos Soil
- Arup Soil Suite Ev – Asbestos Quantification
- Arup Soil Suite Eviii – Fuel Additives
- Arup Groundwater Suite

Results of environmental laboratory testing are presented in Appendix F.

6 GROUND CONDITIONS

6.1 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprise made ground and around the Lough Atalia area, estuarine silts and clay. These deposits are underlain by the Burren Formation in the Lough Atalia area and by an unnamed igneous intrusion in the St. Brendan's Avenue area comprising Metagabbro and Orthogneiss.

6.2 Ground types encountered during investigation of the site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Paved surface:** BH101, BH103, BH103WS, BH106 and WS104 encountered 50-100mm of bitmac. BH102 and BH102A encountered 300mm of concrete,
- **Topsoil:** BH104A, BH105A, WS101, WS105 and WS106 encountered 100-300mm of topsoil.
- **Made Ground (sub-base):** 100-600mm of aggregate fill beneath the paved surface in BH102, BH102A, BH103, BH103WS, BH106 and WS104.
- **Made Ground (fill):** reworked sandy gravelly clay or gravelly sand or sandy gravel fill encountered across the site, to a maximum depth of 2.30m in BH102. Varying amounts of plastic, glass, crockery, red brick and concrete fragments were encountered in BH106, WS101, WS105 and WS106.
- **Estuarine deposits:** encountered in the Lough Atalia area in BH103, BH104, BH105A, WS101, WS105 and WS106 to a maximum depth of 4.90m in BH104 comprising peat, soft grey silt and loose sandy silty gravels.
- **Bedrock (Limestone, Diorite, Gabbro):** Rockhead was encountered at depths ranging from 2.30m in BH102 to 6.70m in BH104.

6.3 Groundwater

Details of the individual groundwater strikes, along with any relative changes in levels as works proceeded, are presented on the exploratory hole logs for each location.

Groundwater was encountered during percussion boring, dynamic sampling and rotary drilling through soil as water strikes as shown in Table 2 below.

Table 2 Groundwater strikes encountered during the ground investigation

GI Ref	Water Level (mbgl)	Comments
BH101	2.60	
BH103	7.10	Rose to 2.00m after 20 mins
BH103WS	2.10	
BH104	4.90	Rose to 3.00m after 20 mins
BH105A	5.90	
BH106	5.70	Rose to 1.55m after 20 mins
WS101	1.50	Rose to 0.90m after 20 mins
WS104	2.10	

Groundwater was not noted during drilling at some of the borehole locations. However, it should be noted that the casing used in supporting the borehole walls during drilling may have sealed out any or additional groundwater strikes and the possibility of encountering groundwater at other depths during excavation works should not be ruled out.

It should be noted that any groundwater strikes within bedrock may have been masked by the fluid used as the drilling flush medium.

Seasonal variation in groundwater levels should also be factored into design considerations and continued monitoring of the installed standpipes will give an indication of the seasonal variation.

7 REFERENCES

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland.

IS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing. National Standards Authority of Ireland.

BS 5930: 2015+A1:2020: Code of practice for ground investigations. British Standards Institution.

BS EN ISO 14688-1:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 1 Identification and description.

BS EN ISO 14688-2:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 2 Principles for a classification.

BS 1377: 1990: Methods of test for soils for civil engineering purposes. British Standards Institution.

BS EN ISO 14689-1:2018: Geotechnical investigation and testing. Identification and classification of rock. Identification and description.

BS EN ISO 22476-3:2005+A1:2011: Geotechnical investigation and testing. Field testing. Standard penetration test.

APPENDIX A

SITE AND EXPLORATORY HOLE LOCATION PLANS

CAUSEWAY
GEOTECH

Project No.: 21-1298

Project Name: BusConnects Galway

Client: Galway City Council

Client's Representative: Arup

Legend Key

Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation

Title:

Site Location Plan

Last Revised:	Scale:
10/03/2022	1:25000

CAUSEWAY
GEOTECH

Project No.:	21-1298	**Client:**	Galway City Council
Project Name:	BusConnects Galway	**Client's Representative:**	Arup

Legend Key

⊕	Locations By Type - CP
⊗	Locations By Type - CP+RC
⊕	Locations By Type - DS
⊗	Locations By Type - DS+RC
⊗	Locations By Type - RO+RC
▽	Locations By Type - SL
⊕	Locations By Type - WS

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Title:
Exploratory Hole Location Plan (Sheet 1 of 2)

Last Revised:	**Scale:**
10/03/2022	1:2000

Project No.:	21-1298	**Client:**	Galway City Council
Project Name:	BusConnects Galway	**Client's Representative:**	Arup

Legend Key

⊗ Locations By Type - CP+RC

Title:

Exploratory Hole Location Plan (Sheet 2 of 2)

Last Revised:	**Scale:**
10/03/2022	1:1000

APPENDIX B

BOREHOLE LOGS

CAUSEWAY GEOTECH	**Project No.** **21-1298**	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup	**Borehole ID** **BH101**

Method	**Plant Used**	**Top (m)**	**Base (m)**	**Coordinates**
Cable Percussion	Dando 2000	0.00	2.60	531035.03 E
Rotary Drilling	Comacchio 205	2.60	3.60	726236.38 N
Rotary Coring	Comacchio 205	3.60	5.40	

Final Depth: 5.40 m	**Start Date:** 30/11/2021	**Driller:** RP+JA	Sheet 1 of 1 Scale: 1:50
Elevation: 4.80 mOD	**End Date:** 20/01/2022	**Logger:** SR+TH	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)
0.10 - 0.60	B5			
0.50	ES1			
0.60 - 1.20	B6			
1.00	ES2			
1.20 - 2.00	B7			
1.20 - 1.65	SPT (C)	N=17 (3,3/4,4,5,4) Hammer SN = 1369	0.00	Dry
1.50	D9			
2.00	3			
2.00	ES3			
2.00 - 2.50	B8			
2.00 - 2.32	SPT (C)	N=50 (4,3/50 for 170mm) Hammer SN = 1369	2.00	Dry
2.50	D10			
2.50 - 2.61	SPT (C)	N=50 (25 for 70mm/50 for 40mm) Hammer SN = 1369 Strike at 2.60m.	2.50	Dry
3.50 - 3.65	SPT(C) N=50 (25 for 75mm/50 for 75mm) Hammer SN = 0200			
3.80				
4.20				
4.30	C			
4.60				
5.00	C			
5.20				
5.40				

Depth (m)	TCR	SCR	RQD	FI
3.60 - 3.80	100	100	100	8
3.80 - 4.20	100	100	40	
4.20 - 4.60	100	100	100	3
4.60 - 5.20	100	100	93	
5.20 - 5.40	100	75	0	5

Level mOD	Depth (m)	Description	Water	Backfill
4.70	0.10	BITMAC		■
4.20	0.60	MADE GROUND: Firm brown sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular fine to medium.		■
3.60	1.20	Firm brown sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to medium. Cobbles are subangular to subrounded.		■
2.30	2.50	Stiff brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular.		■
2.20	2.60	Dense grey sandy subangular fine to coarse GRAVEL. Sand is fine to coarse.	▼	■
1.20	3.60	Dense grey sandy subangular fine to coarse GRAVEL. (Driller's description)		■
-0.60	(1.80) 5.40	Medium strong massive grey LIMESTONE with rare fossils. Partially weathered: grey discolouration on some fracture surfaces. Discontinuities: 1. 0 to 10 degree joints, at 3.80m and 65.00m, slightly undulating, rough. 2. 25 to 40 degree joints, medium spaced (85/450/1000), undulating, rough.		■

End of Borehole at 5.40m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.60			

Chiselling Details

From (m)	To (m)	Time (hh:mm)
2.50	2.60	01:00

Remarks

Hand dug inspection pit excavated to 1.20m.

Casing Details

To (m)	Diam (mm)
2.60	200

Water Added

From (m)	To (m)

Core Barrel	**Flush Type**	**Termination Reason**	**Last Updated**
	Water	Terminated at scheduled depth.	10/03/2022

AGS

CAUSEWAY GEOTECH	**Project No.** **21-1298**	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup	**Borehole ID** **BH102**

Method	**Plant Used**	**Top (m)**	**Base (m)**	**Coordinates**
Dynamic Sampling	Dando Terrier	0.00	1.00	530985.98 E
Rotary Drilling	Comacchio 205	1.00	2.30	726161.37 N
Rotary Coring	Comacchio 205	2.30	4.50	

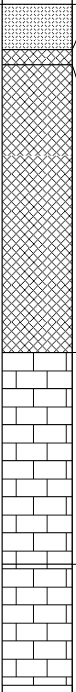
Final Depth:	4.50 m	**Start Date:**	01/12/2021	**Driller:**	JC+JA	Sheet 1 of 1 Scale: 1:50
Elevation:	4.08 mOD	**End Date:**	13/01/2022	**Logger:**	SR+TH	FINAL

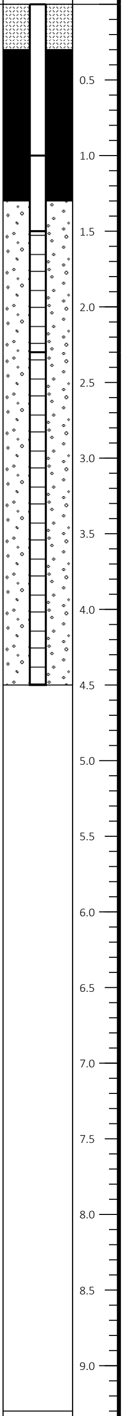
Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)
0.40 - 1.00	B3			
0.50	ES1			
0.50		PID = 0.60ppm		
1.00	ES2			
1.00 - 1.10	SPT (S)	N=50 (25 for 75mm/50 for 20mm) Hammer SN = 0696	1.00	Dry
1.00		PID = 0.30ppm		
2.10	EW1			
2.30 - 2.31	SPT(S) N=50 (25 for 7mm/50 for 0mm) Hammer SN = 0200		2.30	Dry
3.40				
3.80	C			
4.00				
4.30				
4.50				

TCR	SCR	RQD	FI
86	83	83	4
100	78	78	
100	70	33	9
100	75	0	

Level mOD	Depth (m)	Description
3.78	0.30	CONCRETE
3.68	0.40	MADE GROUND: Grey sandy silty angular to subangular fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subangular.
1.78	2.30	MADE GROUND: Grey gravelly fine to coarse SAND with low cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular.
0.38	(1.40) 3.70	Strong massive grey LIMESTONE with rare fossil fragments. Partially weathered: dark orangish brown discolouration on some joint surfaces. Discontinuities: 1. 0 to 25 degree joints, medium spaced (49/280/420) slightly undulating, rough, grey discolouration on some joint surfaces. 2. 60 to 65 degree joint at 2.98m to 306m, planar, rough orangish brown staining on joint surface.
-0.42	(0.80) 4.50	Medium strong massive grey LIMESTONE. Partially weathered: slightly reduced strength, closer fracture spacing, orangish brown discolouration on some fracture surfaces. Discontinuities: Medium strong massive grey LIMESTONE. Partially weathered: slightly reduced strength, closer fracture spacing, orangish brown discolouration on some joint surfaces. Discontinuities: 1. 20 to 40 egree joints, medium spaced (65/265/450) planar, rough. 2. 60 to 90 degree joints at 3.80 to 4.00m, 4.10m to 4.50m, 4.25m to 4.45m, planar to undulating, rough, orangish brown staining on joint surfaces.

End of Borehole at 4.50m





Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.00m.
No noticeable groundwater strikes encountered - water added during drilling.

Casing Details

To (m)	Diam (mm)
2.30	200

Water Added

From (m)	To (m)

Core Barrel	**Flush Type**	**Termination Reason**	**Last Updated**
T2-101	Water	Terminated at scheduled depth.	10/03/2022

AGS

CAUSEWAY GEOTECH

Project No. 21-1298	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup	**Borehole ID** BH102A

Method	Plant Used	Top (m)	Base (m)	Coordinates
Dynamic Sampling	Dando Terrier	0.00	1.30	530987.16 E 726161.44 N

Final Depth: 1.30 m	**Start Date:** 01/12/2021	**Driller:** JC	Sheet 1 of 1 Scale: 1:50
Elevation: 4.06 mOD	**End Date:** 01/12/2021	**Logger:** SR	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
					3.76	0.30		CONCRETE		
0.40 - 1.30	B3				3.66	0.40		MADE GROUND: Grey sandy silty angular to subangular fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subangular.		
0.50	ES1									
0.50		PID = 0.20ppm								
1.00	ES2									
1.00		PID = 0.30ppm			2.76	1.30		MADE GROUND: Grey gravelly fine to coarse SAND with low cobble content. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular.		
								End of Borehole at 1.30m		

Water Strikes				Casing Details	
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	To (m)	Diameter

Remarks

Hand dug inspection pit excavated to 1.20m.
No groundwater encountered.

Termination Reason	Last Updated
Terminated on refusal.	10/03/2022

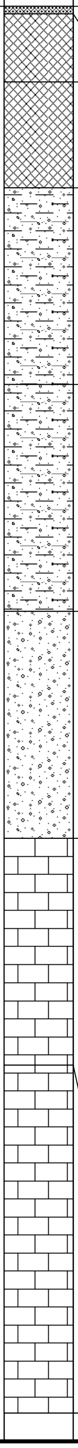
AGS

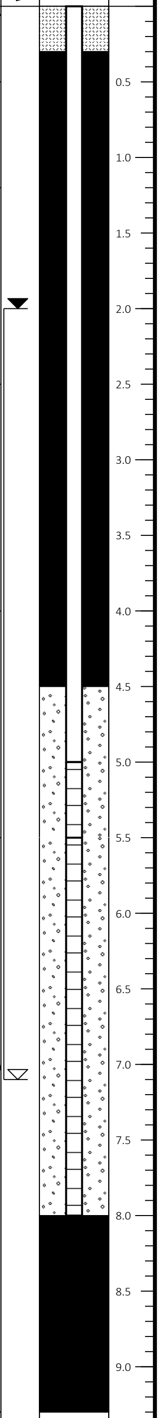
CAUSEWAY GEOTECH	**Project No.** **21-1298**	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup	**Borehole ID** **BH103**

Method	**Plant Used**	**Top (m)**	**Base (m)**	**Coordinates**
Rotary Drilling	Comacchio 205	0.00	5.50	531009.47 E
Rotary Coring	Comacchio 205	5.50	10.40	726189.14 N

Final Depth: 10.40 m	**Start Date:** 14/01/2022	**Driller:** JA	Sheet 1 of 2 Scale: 1:50
Elevation: 3.98 mOD	**End Date:** 17/01/2022	**Logger:** SR+TH	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	TCR	SCR	RQD	FI	Level mOD	Depth (m)	Description
									3.93	0.05	BITMAC
											MADE GROUND: Grey sandy silty subangular fine to coarse GRAVEL. Sand is fine to coarse.
0.50	ES1								3.48	0.50	MADE GROUND: Brownish grey sandy subangular fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subangular.
1.00	ES2										
1.00 - 1.45	SPT (S)	N=14 (5,3/4,3,3,4) Hammer SN = 0200	1.00	Dry					2.78	1.20	Firm brown sandy gravelly CLAY. (Driller's description)
1.95	EW1										
2.50 - 2.95	SPT (S)	N=4 (3,2/1,1,1,1) Hammer SN = 0200	2.50	Dry					1.48	2.50	Soft brown sandy gravelly CLAY. (Driller's description)
4.00 - 4.39	SPT (S)	N=50 (3,4/50 for 240mm) Hammer SN = 0200	4.00	Dry					-0.02	4.00	Dense grey sandy subangular fine to coarse GRAVEL. (Driller'd description)
5.60	C				83	67	56	5	-1.52	5.50 (1.50)	Medium strong to strong massive grey LIMESTONE with occasional fossil fragments. Partially weathered: slightly reduced strength, slightly closer fracture spacing, orangish brown discolouration and clay infill on some fracture surfaces. Discontinuities: 1. 20 to 30 degree joints, medium spaced (50/300/900) slightly undulating, rough, orangish brown discolouration on some joint surfaces, stiff orangish brown clay infill on joint at 6.60m (15mm thick). 2. 70 to 90 degree joints at 6.00m to 6.54m, and 6.65m to 6.75m, undulating, rough, orangish brown staining on joint surfaces. Stiff orangish brown clay infill on joint at 6.00m (up to 40mm thick).
6.40					85	61	51				
	Strike at 7.10m								-3.02	7.00 (3.40)	Medium strong massive grey LIMESTONE with occasional fossil fragments. Partially weathered: slightly reduced strength. Discontinuities: 1. 10 to 30 degree joint, medium spaced (30/340/500) planar, rough light orangish brown staining on some joint surfaces.
7.40											
7.40	C				100	97	97	3			
8.90											





Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
7.10	5.50	20	2.00

Remarks

Hand dug inspection pit excavated to 1.20m.

Casing Details		**Water Added**	
To (m)	Diam (mm)	From (m)	To (m)
5.50	200		

Core Barrel	**Flush Type**	**Termination Reason**	**Last Updated**
T2-101	Water	Terminated at scheduled depth.	10/03/2022

AGS

CAUSEWAY GEOTECH

Project No. **21-1298**	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup		**Borehole ID** **BH103**

Method	**Plant Used**	**Top (m)**	**Base (m)**	**Coordinates**
Rotary Drilling	Comacchio 205	0.00	5.50	531009.47 E
Rotary Coring	Comacchio 205	5.50	10.40	726189.14 N

Final Depth: 10.40 m	**Start Date:** 14/01/2022	**Driller:** JA	Sheet 2 of 2 Scale: 1:50
Elevation: 3.98 mOD	**End Date:** 17/01/2022	**Logger:** SR+TH	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
		100	100	100							Medium strong massive grey LIMESTONE with occasional fossil fragments. Partially weathered: slightly reduced strength. Discontinuities: 1. 10 to 30 degree joint, medium spaced (30/340/500) planar, rough light orangish brown staining on some joint surfaces.		
10.40								-6.42	10.40		End of Borehole at 10.40m		

Water Strikes			
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
7.10	5.50	20	2.00

Chiselling Details		
From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.

Casing Details		**Water Added**	
To (m)	Diam (mm)	From (m)	To (m)
5.50	200		

Core Barrel	**Flush Type**	**Termination Reason**	**Last Updated**
T2-101	Water	Terminated at scheduled depth.	10/03/2022

AGS

CAUSEWAY GEOTECH	**Project No.** **21-1298**	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup	**Borehole ID** **BH103WS**

Method	**Plant Used**	**Top (m)**	**Base (m)**	**Coordinates**
Dynamic Sampling	Dando Terrier	0.00	4.00	531009.69 E 726188.87 N

Final Depth: 4.00 m	**Start Date:** 20/01/2022	**Driller:** JC	Sheet 1 of 1 Scale: 1:50
Elevation: 3.96 mOD	**End Date:** 20/01/2022	**Logger:** SR	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
					3.86	0.10		BITMAC		
								MADE GROUND: Grey silty angular to subangular fine to coarse GRAVEL with high cobble content and fragments of plastic. Sand is fine to coarse. Cobbles are subangular.		
0.50	ES1									
0.50		PID = 0.10ppm								
					3.26	0.70		Grey slightly sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subangular.		
1.00	ES2									
1.00		PID = 0.10ppm								
1.50	ES3									
1.50		PID = 0.10ppm								
1.95	EW1									
		Water strike at 2.10m							▼	
2.50	ES4									
2.50		PID = 0.10ppm								
					-0.04	4.00		End of Borehole at 4.00m		

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.10			

Casing Details

To (m)	Diameter
2.00	200

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason

Terminated on refusal.

Last Updated

10/03/2022

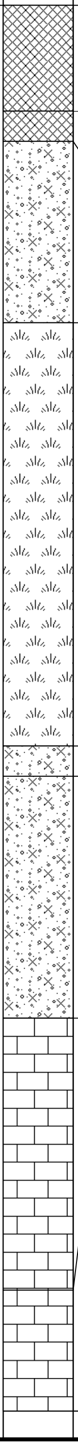
AGS

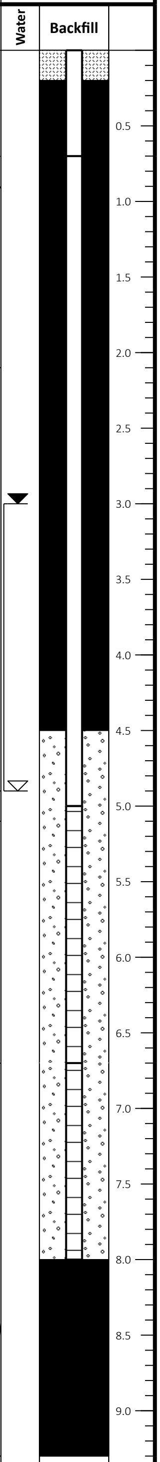
	Project No. **21-1298**	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup	**Borehole ID** **BH104**

Method	**Plant Used**	**Top (m)**	**Base (m)**	**Coordinates**
Cable Percussion	Dando 2000	0.00	0.70	531072.68 E
Rotary Drilling	Comacchio 205	0.70	6.70	726115.50 N
Rotary Coring	Comacchio 205	6.70	11.80	

Final Depth: 11.80 m	**Start Date:** 02/12/2021	**Driller:** RP+JA	Sheet 1 of 2 Scale: 1:50
Elevation: 3.63 mOD	**End Date:** 24/01/2022	**Logger:** SR+EM	FINAL

Depth (m)	Sample / Tests	Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Description
0.00 - 0.70	B2										MADE GROUND: Dark greyish brown sandy clayey subangular to subrounded GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subangular.
0.50	ES1										
									2.93	0.70	MADE GROUND: Dark greyish brown sandy GRAVEL. (Driller's description)
									2.73	0.90	Brown sandy silty GRAVEL. (Driller's description)
2.04	EW1										
2.10 - 2.55	SPT (C)	N=17 (5,8/4,4,3,6) Hammer SN = 0200					2.10		1.53	2.10	Black PEAT. (Driller's description)
3.50 - 3.95	SPT (C)	N=6 (0,1/1,1,2,2) Hammer SN = 0200					3.50				
4.50 - 4.95	SPT (C)	N=15 (4,6/4,4,3,4) Hammer SN = 0200					4.50				
		Water strike at 4.90m.							-1.27	4.90	Dense greyish brown sandy silty GRAVEL. (Driller's description)
									-1.47	5.10	Grey sandy silty GRAVEL. (Possible weathered bedrock)
5.50 - 5.95	SPT (C)	N=43 (10,11/10,11,10,12) Hammer SN = 0200					5.50				
6.50 - 6.58	SPT (C)	N=50 (25 for 3mm/50 for 75mm) Hammer SN = 0200					6.50				
									-3.07	6.70	Medium strong to strong grey massive LIMESTONE. Partially weathered: slightly closer fracture spacing. Discontinuities: 1. 10 to 15 degree joints, closely spaced (70/300/300), slightly undulating, smooth to rough with light grey clay deposits (<1mm thick) on rare joint surfaces, otherwise clean.
7.00	C		85	80	66						
7.30						3					
										(1.80)	
			100	100	97	20					
									-4.87	8.50	Medium strong to strong dark grey massive LIMESTONE. Partially weathered: slightly closer fracture spacing with clay deposits on some joint surfaces. Discontinuities: 1. 10 to 15 degree joints medium spaced (100/490/500) undulating, rough with grey clay deposits (up to 3mm thick) on some joint surfaces. 2. 0 to 50 degree joints widely spaced (150/1100/1500) planar, rough, with patchy clay deposits (<1mm thick) on few joint surfaces.
8.70	C										
8.80											





Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
4.90	4.90	20	3.00

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 0.70m.

Casing Details

To (m)	Diam (mm)
6.70	200

Water Added

From (m)	To (m)

Core Barrel	**Flush Type**	**Termination Reason**	**Last Updated**
T2-101	Water	Terminated at scheduled depth.	10/03/2022

CAUSEWAY GEOTECH	**Project No.** **21-1298**	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup	**Borehole ID** **BH104**

Method	**Plant Used**	**Top (m)**	**Base (m)**
Cable Percussion	Dando 2000	0.00	0.70
Rotary Drilling	Comacchio 205	0.70	6.70
Rotary Coring	Comacchio 205	6.70	11.80

Coordinates
531072.68 E
726115.50 N

Final Depth: 11.80 m	**Start Date:** 02/12/2021	**Driller:** RP+JA	Sheet 2 of 2 Scale: 1:50
Elevation: 3.63 mOD	**End Date:** 24/01/2022	**Logger:** SR+EM	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
		100	100	94							Medium strong to strong dark grey massive LIMESTONE. Partially weathered: slightly closer fracture spacing with clay deposits on some joint surfaces. Discontinuities: 1. 10 to 15 degree joints medium spaced (100/490/500) undulating, rough with grey clay deposits (up to 3mm thick) on some joint surfaces. 2. 0 to 50 degree joints widely spaced (150/1100/1500) planar, rough, with patchy clay deposits (<1mm thick) on few joint surfaces.		
10.30					3				(3.30)				
		100	100	90									
11.80								-8.17	11.80		End of Borehole at 11.80m		
		TCR	SCR	RQD	FI								

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
4.90	4.90	20	3.00

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks
Hand dug inspection pit excavated to 0.70m.

Casing Details

To (m)	Diam (mm)
6.70	200

Water Added

From (m)	To (m)

Core Barrel	**Flush Type**	**Termination Reason**	**Last Updated**
T2-101	Water	Terminated at scheduled depth.	10/03/2022

AGS

CAUSEWAY GEOTECH

Project No.	**Project Name:** BusConnects Galway		**Borehole ID**
21-1298	**Client:** Galway City Council		**BH104A**
	Client's Rep: Arup		

Method	**Plant Used**	**Top (m)**	**Base (m)**	**Coordinates**
Cable Percussion	Dando 2000	0.00	0.40	531078.75 E 726098.94 N

Final Depth: 0.40 m	**Start Date:** 03/12/2021	**Driller:** RP	Sheet 1 of 1 Scale: 1:40
Elevation: 3.36 mOD	**End Date:** 03/12/2021	**Logger:** SR	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.10 - 0.40	B2				3.26	0.10	▨	TOPSOIL		■
0.40	ES1				2.96	0.40	▦	MADE GROUND: Firm dark greyish brown sandy gravelly SILT. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular.		■
								End of Borehole at 0.40m		

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 0.40m.
No groundwater encountered.

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Termination Reason	**Last Updated**
Terminated on boulder and instruction of the engineer.	10/03/2022

AGS

Project No. 21-1298	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup		**Borehole ID** BH105A

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	2.40	531033.11 E
Rotary Drilling	Comacchio 205	2.40	6.50	726069.97 N
Rotary Coring	Comacchio 205	6.50	11.60	

Final Depth: 11.60 m	**Start Date:** 01/12/2021	**Driller:** RP+JA	Sheet 1 of 2 Scale: 1:50
Elevation: 3.98 mOD	**End Date:** 25/01/2022	**Logger:** SR+EM	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)
0.10 - 1.20	B5			
0.50	ES1			
1.00	ES2			
1.20 - 2.40	B6			
1.20 - 1.65	SPT (C)	N=30 (6,7/9,7,8,6) Hammer SN = 1369	1.20	Dry
1.50	D7			
1.50	ES3			
2.00	ES4			
2.00 - 2.40	SPT (C)	N=50 (8,7/50 for 245mm) Hammer SN = 1369	2.00	Dry
2.40	D8			
2.40 - 2.46	SPT (C)	N=50 (25 for 40mm/50 for 15mm) Hammer SN = 1369	2.40	Dry
2.45	EW1			
2.50 - 2.95	SPT (S)	N=33 (6,17/10,7,10,6) Hammer SN = 0200	2.50	
2.50				
4.00 - 4.45	SPT (S)	N=16 (3,5/3,4,5,4) Hammer SN = 0200	4.00	
5.50 - 5.50	SPT (C)	N=50 (25 for 0mm/50 for 0mm) Hammer SN = 0200	5.50	
5.80		Water strike at 5.90m.		

Depth (m)	TCR	SCR	RQD	FI
6.50 - 7.10	83	80	79	2
7.10 - 8.60	100	97	95	
8.60				

Level mOD	Depth (m)	Description	Water
3.88	0.10	TOPSOIL	
		MADE GROUND: Firm becoming stiff sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular.	
1.98	2.00	Black boulder of LIMESTONE.	
1.48	2.50	Stiff to very stiff brown sandy gravelly CLAY (Driller's description)	
-0.62	4.60	Grey BOULDERS of limestone. (Driller's description)	
-1.22	5.20	Black boulder of LIMESTONE.	
-1.82	5.80	Grey sandy silty GRAVEL. (Driller's description) (Possible weathered bedrock)	▼
-2.52	6.50 (1.80)	Medium strong massive grey LIMESTONE. partially weathered: slightly closer fracture spacing. Discontinuities: 1. 5 to 10 degree joint closely spaced (100/295/350) undulating, rough, clean.	
-4.32	8.30	Medium strong to strong massive dark grey LIMESTONE. Partially weathered: clay deposits on rare joint surfaces. Discontinuities: 1. 20 to 30 degree joints widely spaced (100/725/1010), undulating rough, with patchy light grey clay deposits (up to 2mm thick) on rare joint surfaces, otherwise clean.	

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
5.90	5.50		

Chiselling Details

From (m)	To (m)	Time (hh:mm)
2.40	2.40	01:00

Remarks

Hand dug inspection pit excavated to 1.20m.
Two CP attempts, first terminated on boulder at 0.40m.

Casing Details

To (m)	Diam (mm)
2.40	200
6.50	200

Water Added

From (m)	To (m)

Core Barrel	Flush Type	Termination Reason	Last Updated
T2-101	Water	Terminated at scheduled depth.	10/03/2022

CAUSEWAY GEOTECH

Project No.	**Project Name:** BusConnects Galway		**Borehole ID**
21-1298	**Client:** Galway City Council		**BH105A**
	Client's Rep: Arup		

Method	**Plant Used**	**Top (m)**	**Base (m)**	**Coordinates**
Cable Percussion	Dando 2000	0.00	2.40	531033.11 E
Rotary Drilling	Comacchio 205	2.40	6.50	726069.97 N
Rotary Coring	Comacchio 205	6.50	11.60	

Final Depth:	11.60 m	**Start Date:**	01/12/2021	**Driller:**	RP+JA	Sheet 2 of 2 Scale: 1:50
Elevation:	3.98 mOD	**End Date:**	25/01/2022	**Logger:**	SR+EM	FINAL

Depth (m)	Samples / Field Records	TCR	SCR	RQD	FI	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
		100	99	99							Medium strong to strong massive dark grey LIMESTONE. Partially weathered: clay deposits on rare joint surfaces. Discontinuities: 1. 20 to 30 degree joints widely spaced (100/725/1010), undulating rough, with patchy light grey clay deposits (up to 2mm thick) on rare joint surfaces, otherwise clean.		
10.10					1				(3.30)				
		86	85	80									
11.60								-7.62	11.60		End of Borehole at 11.60m		

Depth scale: 9.5, 10.0, 10.5, 11.0, 11.5, 12.0, 12.5, 13.0, 13.5, 14.0, 14.5, 15.0, 15.5, 16.0, 16.5, 17.0, 17.5, 18.0, 18.5

TCR SCR RQD FI

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
5.90	5.50		

Chiselling Details

From (m)	To (m)	Time (hh:mm)
2.40	2.40	01:00

Remarks

Hand dug inspection pit excavated to 1.20m.
Two CP attempts, first terminated on boulder at 0.40m.

Casing Details

To (m)	Diam (mm)
2.40	200
6.50	200

Water Added

From (m)	To (m)

Core Barrel	**Flush Type**	**Termination Reason**	**Last Updated**
T2-101	Water	Terminated at scheduled depth.	10/03/2022

AGS

CAUSEWAY GEOTECH	**Project No.** **21-1298**	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup	**Borehole ID** **BH106**

Method	Plant Used	Top (m)	Base (m)	Coordinates
Cable Percussion	Dando 2000	0.00	2.10	529914.25 E
Rotary Drilling	Comacchio 205	2.10	2.50	725704.49 N
Rotary Coring	Comacchio 205	2.50	6.00	

Final Depth: 6.00 m	**Start Date:** 06/12/2021	**Driler:** RP+JA	Sheet 1 of 1	Scale: 1:50
Elevation: 7.04 mOD	**End Date:** 19/01/2022	**Logger:** SR+TH	FINAL	

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)
0.20 - 1.20	B5			
0.50	ES1			
1.00	ES2			
1.20 - 2.10	B6			
1.20 - 1.65	SPT (S)	N=5 (1,2/1,1,2,1) Hammer SN = 1369	1.20	Dry
1.50	D7			
1.50	ES3			
2.00	ES4			
2.00 - 2.10	SPT (S)	N=50 (25 for 15mm/50 for 85mm) Hammer SN = 1369	2.00	Dry
2.30 - 2.45	SPT(C) N=50 (25 for 75mm/50 for 75mm) Hammer SN = 1369			
3.00				
3.40				
3.70	C			
3.90				
4.00	C			
4.90				
5.20	C			
5.40				
	Strike at 5.70m			
6.00				

Core run (m)	TCR	SCR	RQD	FI
2.50 - 3.00	100	100	68	7
3.00 - 3.40	100	100	83	
3.40 - 3.90	100	70	70	
3.90 - 4.90	100	97	75	4
4.90 - 5.40	100	100	100	
5.40 - 6.00	100	92	92	4

Level mOD	Depth (m)	Description
6.94	0.10	BITMAC
6.84	0.20	MADE GROUND: Grey sandy silty subangular fine to coarse GRAVEL. Sand is fine to coarse.
		MADE GROUND: Soft brown sandy gravelly CLAY with low cobble content and fragment of red brick, concrete and bitmac. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular.
5.84	1.20	Soft grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium. Cobbles are subangular.
4.94	2.10	Dense sandy silty subangular fine to coarse GRAVEL. (Driller's description)
4.54	2.50 (2.20)	Medium strong to strong dark grey GABBRO with greyish white diorite vein intrusions (4 to 6cm thick). Partially weathered: slightly reduced strength, slightly closer fracture spacing, orangish brown discolouration on some fracture surfaces. Discontinuities: 1. 10 to 20 degree joints, medium spaced (40/210/230) planar, rough, dark orangish brown staining on joint surfaces. 2. 30 to 50 degree joints, medium spaced (50/275/620), planar, smooth to rough. 3. 70 to 80 degree joints at 2.85m to 3.10m and 3.12m to 3.37m, undulating, rough, orangish, brown staining on joint surfaces. 2. 30 to 50 degree joints, medium spaced (50/275/620) planar, smooth to rough. 3. 70 to 80 degree joints, at 2.85m to 3.10m and 3.12m to 3.38m, undulating, rough, orangish brown staining on joint surfaces.
2.34	4.70 (0.45)	Strong greyish white DIORITE. Partially weathered: patchy greenish grey discolouration on fracture surfaces. Discontinuities: 1. 20 to 30 degree joint at 4.90m, planar, rough, greenish grey staining on joint surface. 2. 60 to 70 degree joint at 5.15m, planar, rough, patchy greenish grey staining on joint surface.
1.89	5.15 (0.85)	Strong dark grey GABBRO. Largely unweathered. Discontinuities: 1. 20 to 30 degree joints, at 5.40m, 5.4 and 5.5, slightly undulating, rough. 2. 40 to 50 degree joint, at 4.60m to 4.68m, planar, rough, greenish grey mineralisation on joint surface (8 to 10mm thick).
1.04	6.00	

End of Borehole at 6.00m

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
5.70	2.50	20	1.55

Chiselling Details

From (m)	To (m)	Time (hh:mm)
2.10	2.10	01:00

Remarks

Hand dug inspection pit excavated to 1.20m.

Casing Details

To (m)	Diam (mm)
2.10	200
2.50	200

Water Added

From (m)	To (m)

Core Barrel	Flush Type	Termination Reason	Last Updated
T2-101	Water	Terminated at scheduled depth.	10/03/2022

AGS

Project No. **21-1298**	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup	**Borehole ID** **WS101**

Method	**Plant Used**	**Top (m)**	**Base (m)**	**Coordinates**
Dynamic Sampling	Dando Terrier	0.00	3.25	531084.08 E 726208.68 N

Final Depth: 3.25 m	**Start Date:** 29/11/2021	**Driller:** JC	Sheet 1 of 1 Scale: 1:50
Elevation: 3.81 mOD	**End Date:** 29/11/2021	**Logger:** SR	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)
0.50	D4			
0.50	ES1			
1.00	ES2			
		Water strike at 1.50m		
1.56	D5			
1.90	D6			
2.00	ES3			
3.00	D7			

Level mOD	Depth (m)	Legend	Description	Water	Backfill
3.41	0.40	▨	MADE GROUND: TOPSOIL with roots and fragments of plastic		■
3.21	0.60	▨	MADE GROUND: Soft grey slightly sandy slightly gravelly CLAY with fragments of plastic and glass. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse.		■
2.51	1.30	▨	Soft brownish grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.	▼	■
2.16	1.65	▨	Grey slightly sandy subangular to subrounded fine to coarse GRAVEL. Sand is fine to coarse.	▽	■
1.71	2.10	▨	Very soft greyish brown slightly sandy SILT with organic fibres.		■
0.91	2.90	▨	Very soft dark brown PEAT.		■
0.56	3.25	▨	Grey sandy angular to subangular fine to coarse GRAVEL. Sand is fine to coarse.		■

End of Borehole at 3.25m

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.50	1.50	20	0.90

Casing Details

To (m)	Diameter

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason

Terminated on refusal.

Last Updated

10/03/2022

CAUSEWAY GEOTECH

Project No. **21-1298**	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup	**Borehole ID** **WS104**

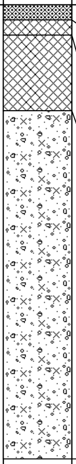
Method	**Plant Used**	**Top (m)**	**Base (m)**	**Coordinates**
Dynamic Sampling	Dando Terrier	0.00	3.00	530997.95 E 726165.53 N

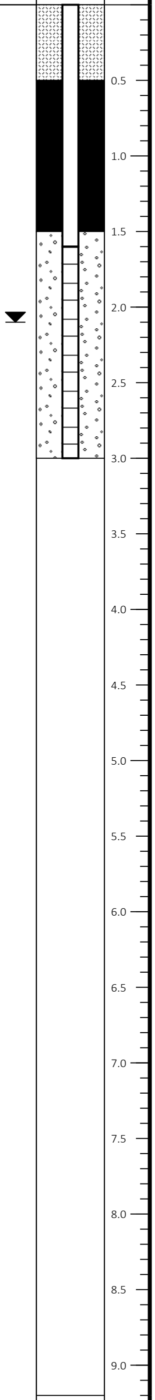
Final Depth: 3.00 m	**Start Date:** 19/01/2022	**Driller:** JC	Sheet 1 of 1 Scale: 1:50
Elevation: 3.90 mOD	**End Date:** 19/01/2022	**Logger:** SR	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)
0.50	B5			
0.50	ES1			
0.50		PID = 0.10ppm		
1.00	B6			
1.00	ES2			
1.00		PID = 0.80ppm		
1.20 - 2.00	B7			
1.50	ES3			
1.50		PID = 0.60ppm		
1.85	EW1			
2.00	ES4			
2.00 - 3.00	B8			
2.00		PID = 0.80ppm Strike at 2.10m.		

Level mOD	Depth (m)	Description
3.80	0.10	BITMAC
3.70	0.20	MADE GROUND: Grey silty angular to subangular fine to coarse GRAVEL.
3.20	0.70	MADE GROUND: Grey sandy silty angular to subangular fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded.
0.90	3.00	Grey sandy silty subangular to subrounded fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded.

End of Borehole at 3.00m





Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
2.10	2.10		

Casing Details

To (m)	Diameter

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason	**Last Updated**
Terminated on refusal.	10/03/2022

AGS

CAUSEWAY GEOTECH	**Project No.** **21-1298**	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup	**Borehole ID** **WS105**

Method	**Plant Used**	**Top (m)**	**Base (m)**	**Coordinates**
Dynamic Sampling	Danod Terrier	0.00	2.90	530903.19 E 726025.43 N

Final Depth: 2.90 m	**Start Date:** 30/11/2021	**Driller:** JC	Sheet 1 of 1 Scale: 1:50
Elevation: 4.35 mOD	**End Date:** 30/11/2021	**Logger:** SR	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)
0.30 - 1.00	B4			
0.50	ES1			
1.00	ES2			
1.00 - 1.90	B5			
2.00	D6			
2.00	ES3			
2.50	D7			

Level mOD	Depth (m)	Legend	Description	Water	Backfill
			MADE GROUND: TOPSOIL with roots and rootlets		
4.05	0.30		MADE GROUND: Soft brown sandy gravelly CLAY with plastic fragments. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
3.35	1.00		Soft greyish brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subrounded.		
2.45	1.90		Firm greyish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
2.05	2.30		Stiff grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
1.45	2.90		End of Borehole at 2.90m		

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0

Water Strikes				Casing Details	
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	To (m)	Diameter

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason	**Last Updated**
Terminated on refusal.	10/03/2022

AGS

CAUSEWAY GEOTECH	**Project No.** **21-1298**	**Project Name:** BusConnects Galway **Client:** Galway City Council **Client's Rep:** Arup	**Borehole ID** **WS106**

Method	**Plant Used**	**Top (m)**	**Base (m)**	**Coordinates**
Dynamic Sampling	Dando Terrier	0.00	2.80	530922.85 E 726032.93 N

Final Depth: 2.80 m	**Start Date:** 30/12/2021	**Driller:** JC	Sheet 1 of 1 Scale: 1:50
Elevation: 3.67 mOD	**End Date:** 30/12/2021	**Logger:** SR	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								MADE GROUND: TOPSOIL with rootlets		
0.30 - 1.00	B4				3.37	0.30		MADE GROUND: Soft brown sandy gravelly CLAY with fragments of crockery. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse.		
0.50	ES1									
1.00	ES2				2.67	1.00		Dark grey sandy silty subangular fine to coarse GRAVEL with low cobble content. Sand is fine to coarse. Cobbles are subrounded.		
1.20	D5									
1.30 - 2.80	B6				2.37	1.30		Firm to stiff grey sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse. Cobbles are subangular.		
2.00	ES3									
					0.87	2.80		End of Borehole at 2.80m		

Water Strikes				Casing Details	
Struck at (m)	Casing to (m)	Time (min)	Rose to (m)	To (m)	Diameter

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason	**Last Updated**
Terminated on refusal.	10/03/2022

AGS

APPENDIX C

CORE PHOTOGRAPHS

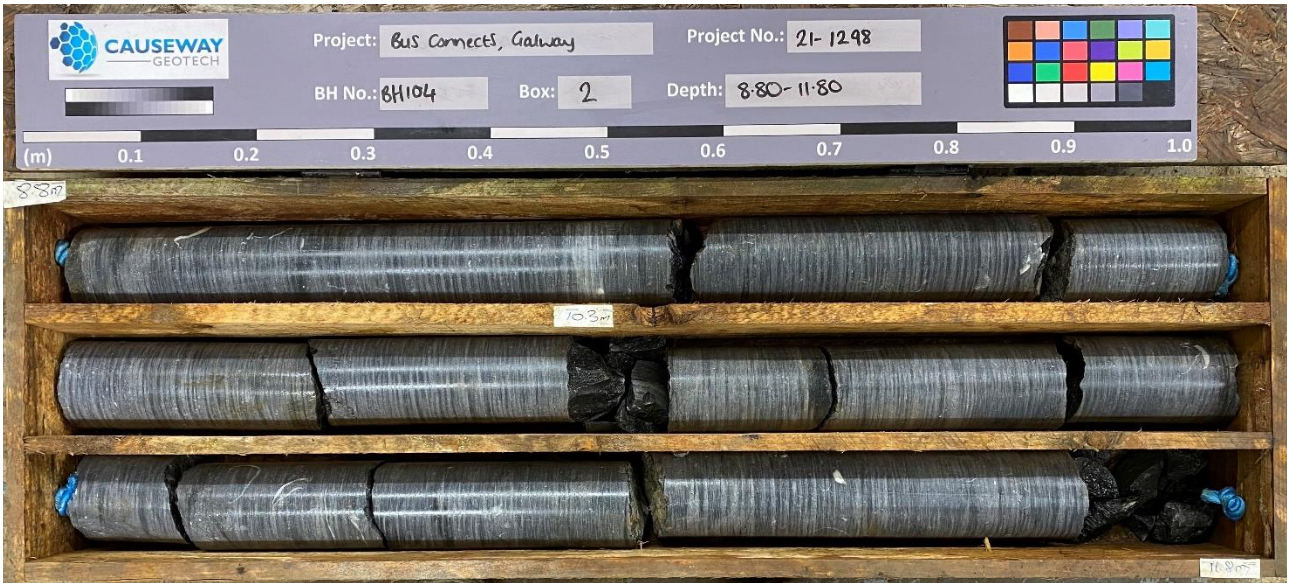
BH101 Box 1 3.60-5.40m

BH102 Box 1 2.30-4.50m

BH103 Box 1 5.50-7.40m

BH103 Box 1 7.40-10.40m

BH104 Box 1 6.70-8.80m



BH104 Box 2 8.80-11.80m

BH105 Box 1 2.00-8.60m

BH105 Box 2 8.60-11.60m

BH106 Box 1 2.50-5.40m

BH106 Box 2 5.40-6.00m

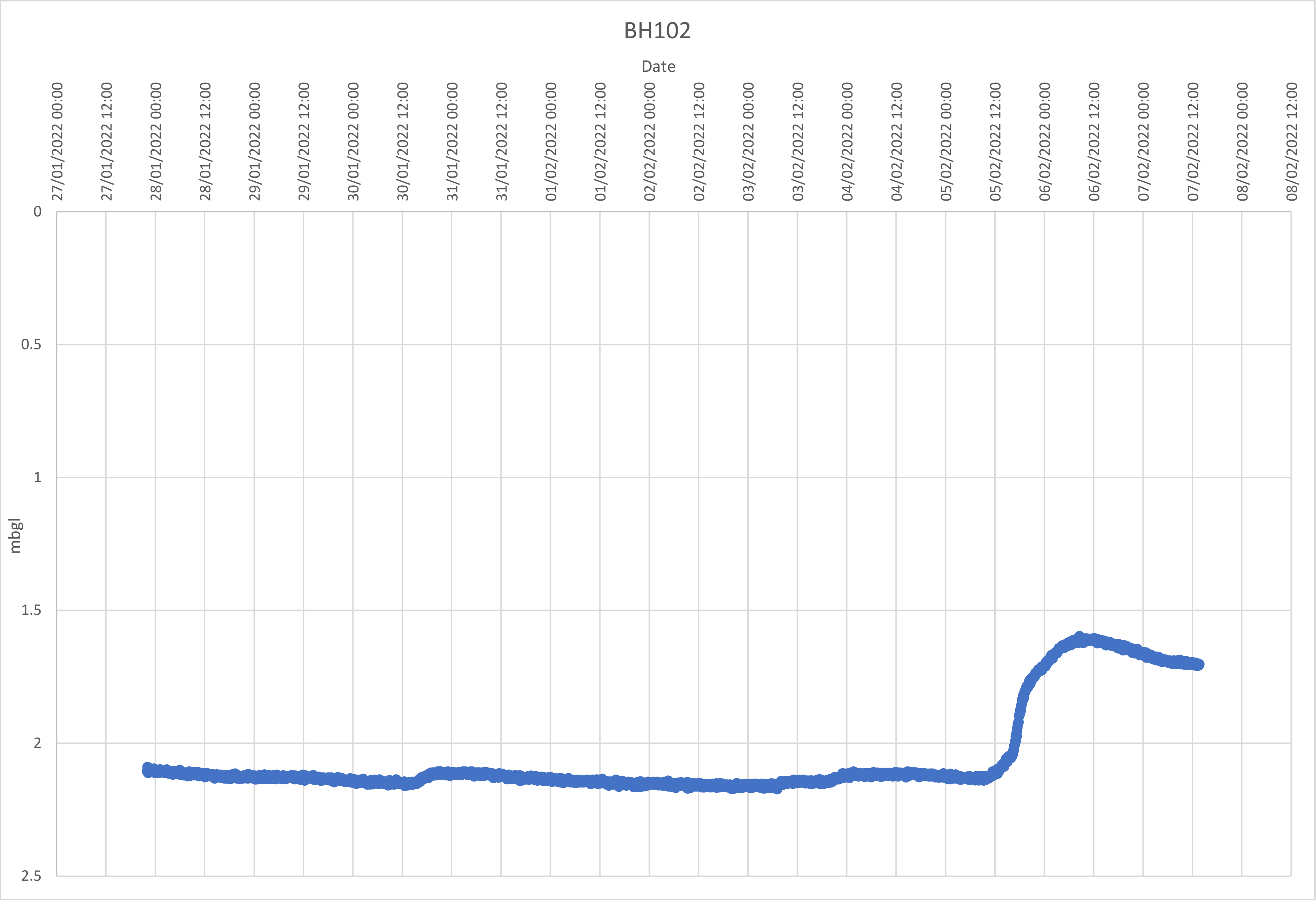
CAUSEWAY
GEOTECH

APPENDIX D

GROUND WATER AND GAS MONITORING RECORDS

Bus Connects Galway
21-1298
DIVER INSTALL RECORDS

INSTALL RECORDS							REMOVAL RECORDS			
BH	**Serial No. of Diver**	**Depth to GW**	**Time In**	**Date In**	**Depth of BH**	**Diver Depth**	**Date Out**	**Time Out**	**Depth to GW**	**No. of days in Ground**
		mbgl			mbgl	mbgl			m	
BH102	SN696083	2.1	17:30	27/01/2022	4.5m	3.5	07/02/2022	13:43	1.7	11
BH103WS	SN721194(Baro) SN708127(Diver)	1.95	14:20	27/01/2022	2.6m	2	07/02/2022	13:53	1.5	11
BH103	SN696783	1.95	15:00	27/01/2022	8m	2	07/02/2022	13:51	1.5	11
BH104	SN708398	2.04	09:00	27/01/2022	8m	7	07/02/2022	13:22	1.9	11
BH105	SN553442	2.45	10:40	27/01/2022	8m	7	07/02/2022	13:31	2.2	11
BH106	No Diver Install	1.23	\	27/01/2022	6m	5	-	-	-	-
WS104	SN696170	1.85	16:12	27/01/2022	2.95m	2.5	07/02/2022	13:47	1.5	11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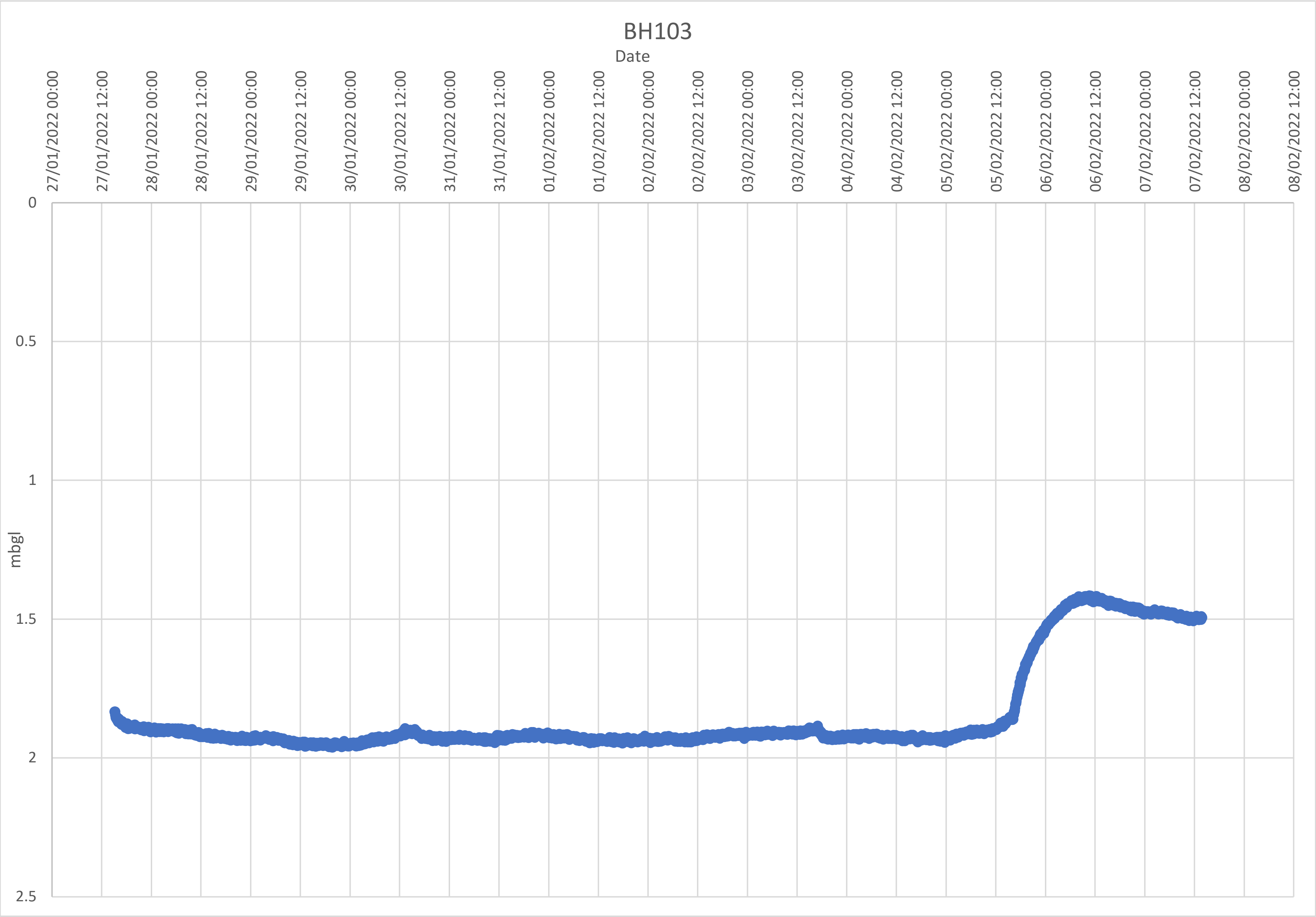BH103
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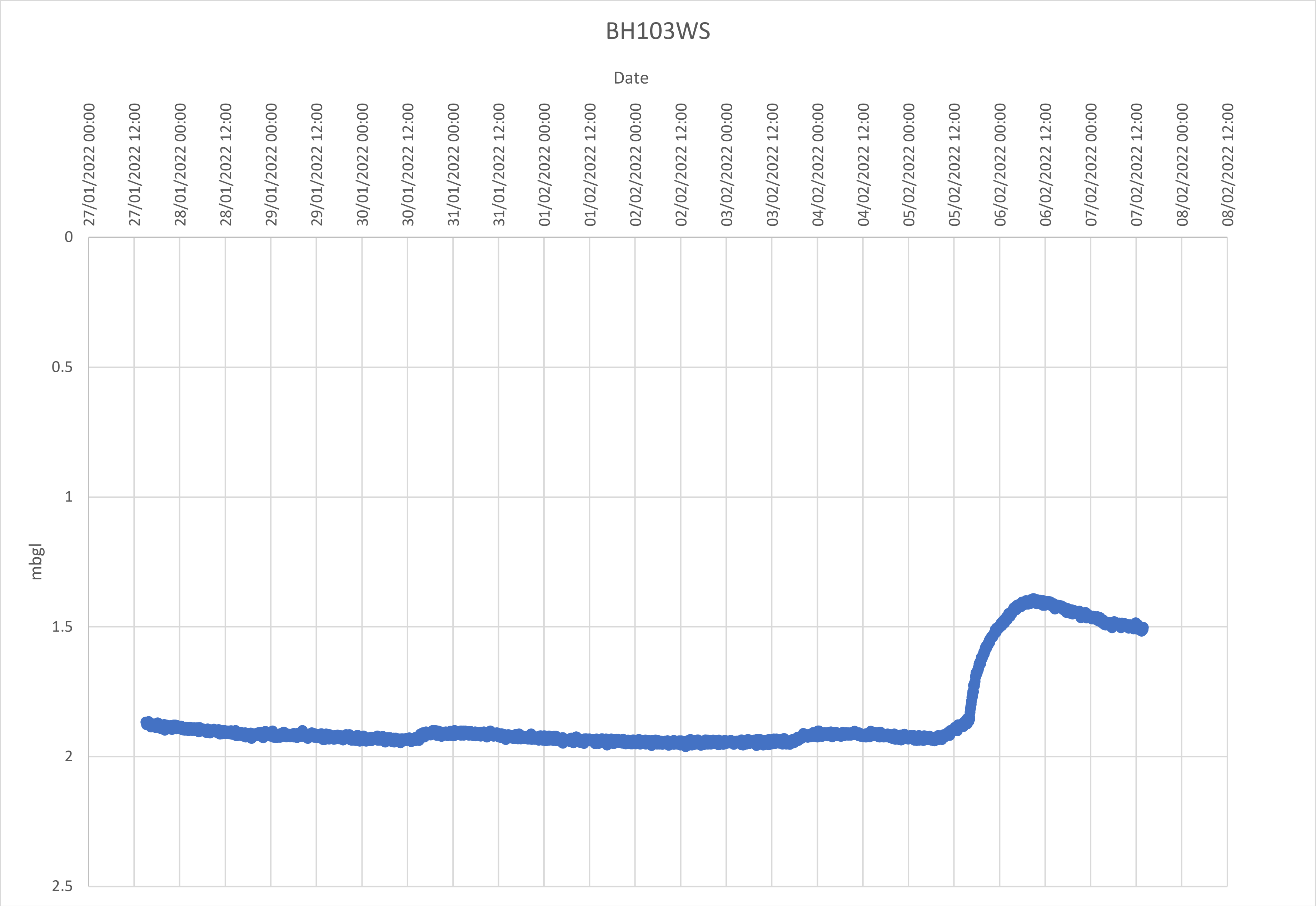
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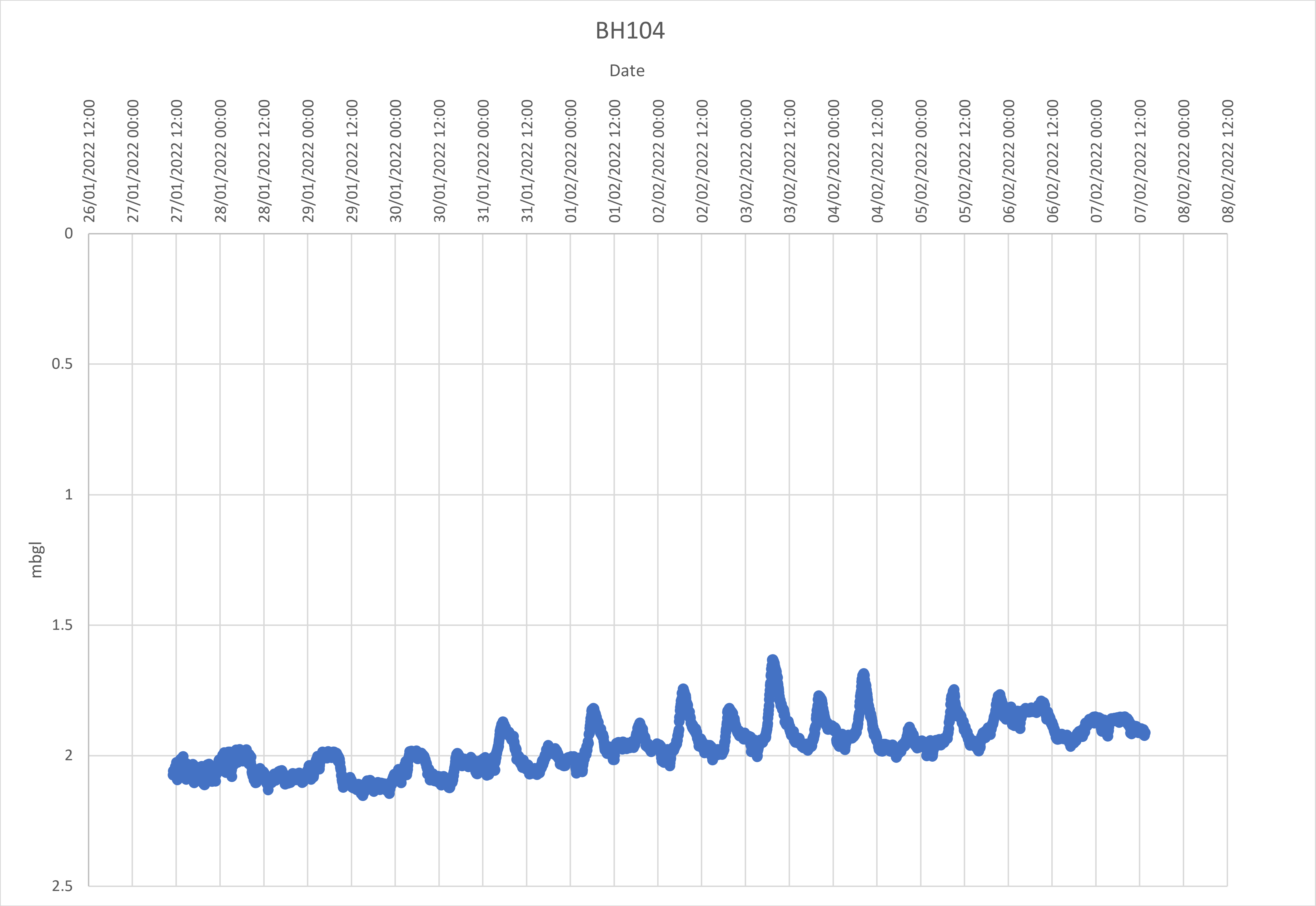
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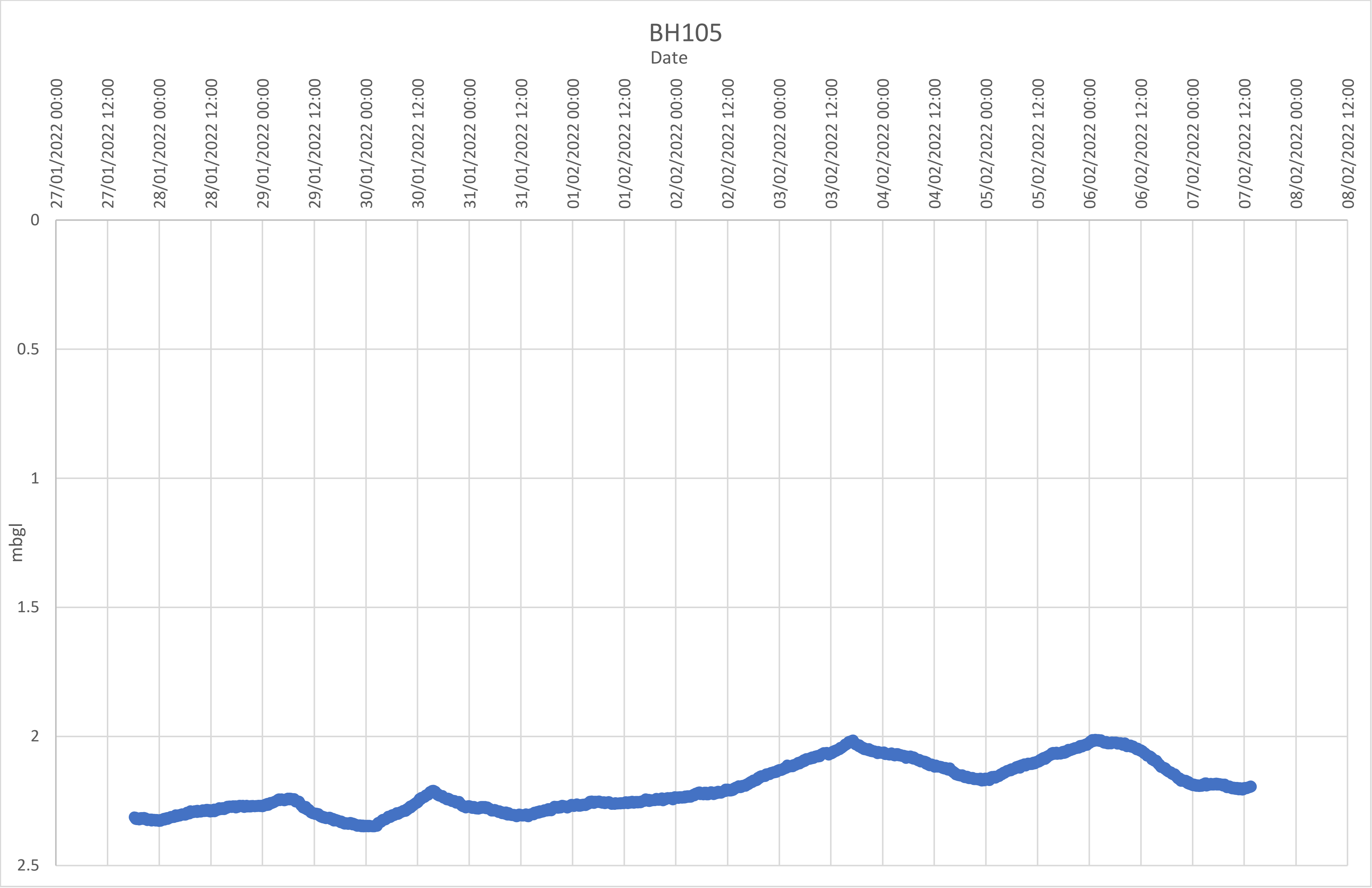

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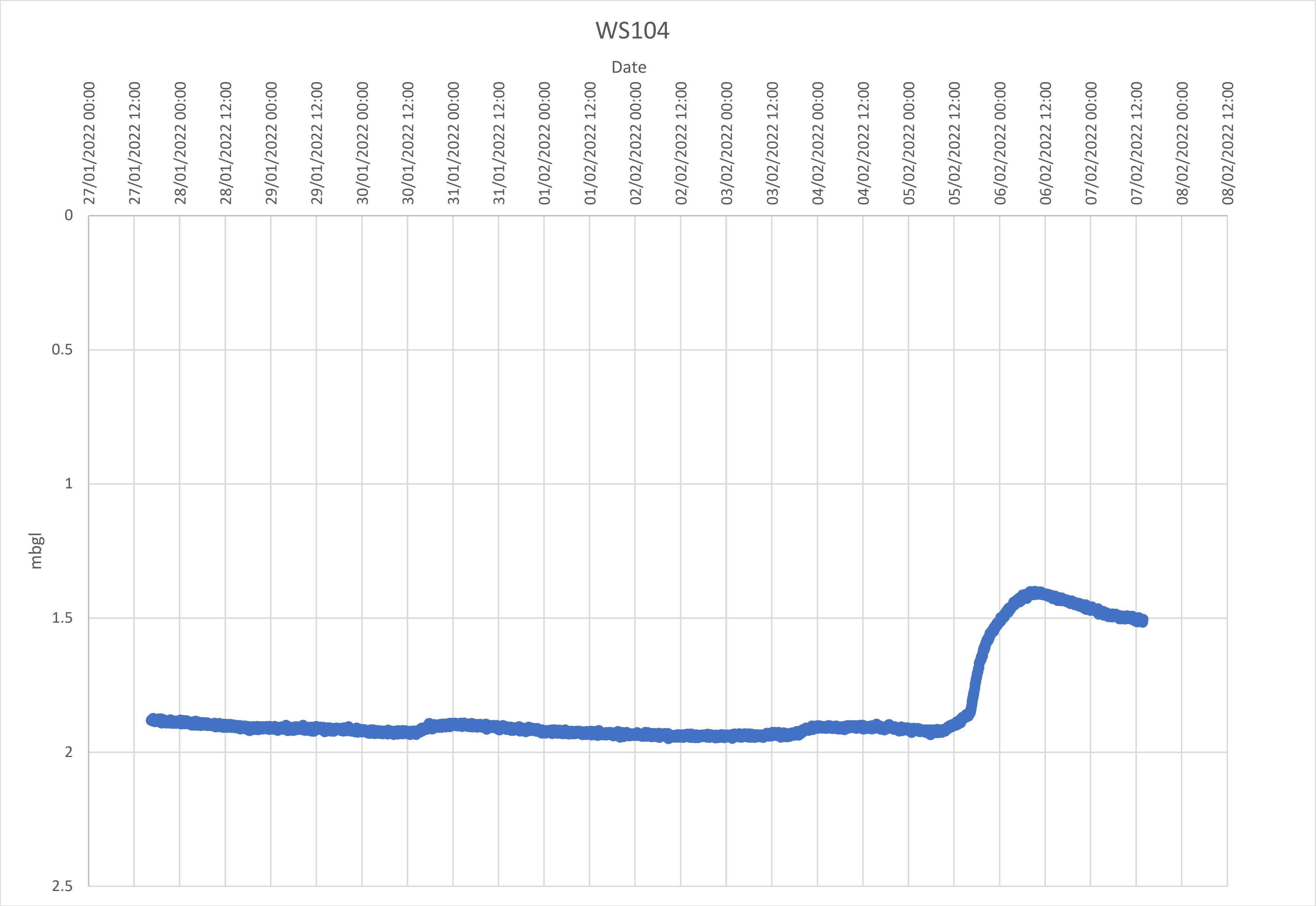
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CAUSEWAY
GEOTECH

APPENDIX E

GEOTECHNICAL LABORATORY TEST RESULTS

CAUSEWAY GEOTECH

HEAD OFFICE
Causeway Geotech Ltd
8 Drumahiskey Road
Ballymoney
Co. Antrim, N. Ireland, BT53 7QL
NI: +44 (0)28 276 66640
Registered in Northern Ireland.
Company Number: NI610766

REGIONAL OFFICE
Causeway Geotech (IRL) Ltd
Unit 1 Fingal House
Stephenstown Industrial Estate
Balbriggan, Co Dublin, Ireland, K32 VR66
ROI: +353 (0)1 526 7465
Registered in Ireland.
Company Number: 633786

www.causewaygeotech.com

SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

2 February 2022

Project Name:	BusConnects Galway
Project No.:	21-1298
Client:	Galway City Council
Engineer:	ARUP

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s). This testing was performed between 17/01/2022 and 02/02/2022.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd

Project Name: BusConnects Galway

Report Reference: Schedule 1

The table below details the tests carried out, the specifications used, and the number of tests included in this report. The results contained in this report relate to the sample(s) as received

Tests marked with* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL	Moisture Content of Soil	BS 1377-2: 1990: Cl 3.2	12
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	BS 1377-2: 1990: Cl 4.4, 5.3 & 5.4	10
SOIL	Particle size distribution - wet sieving	BS 1377-2: 1990: Cl 9.2	6
SOIL	Particle size distribution - sedimentation hydrometer method	BS 1377-2: 1990: Cl 9.5	6

SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL – Subcontracted to Eurofins Chemtest Ltd *(UKAS 2183)*	Organic Matter Content		1

Summary of Classification Test Results

Project No. 21-1298	Project Name BusConnects Galway

Hole No.	Sample Ref	Sample Top	Sample Base	Sample Type	Soil Description	Density bulk Mg/m3	Density dry Mg/m3	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
BH101	6	0.60	1.20	B	Greyish brown sandy slightly gravelly silty CLAY.			27.0	69	37 -1pt	20	17		CI
BH101	10	2.50		D	Greyish brown sandy very gravelly silty CLAY.			17.0	49	30 -1pt	17	13		CL
BH104A	2	0.10	0.40	B	Greyish brown sandy slightly gravelly clayey SILT.			24.0	46	44 -1pt	28	16		MI
BH105A	7	1.50		D	Greyish brown sandy gravelly silty CLAY.			13.0	47	33 -1pt	20	13		CL
BH105A	8	2.40		D	Greyish brown slightly sandy subangular fine to coarse GRAVEL.			8.2						
BH106	7	1.50		D	Greyish brown sandy slightly gravelly silty CLAY.			10.0	57	21 -1pt	11	10		CL
WS101	6	1.90		D	Greyish brown sandy gravelly clayey SILT.			37.0	97	64 -1pt	45	19		MH
WS101	7	3.00		D	Greyish brown sandy clayey subangular fine to coarse GRAVEL.			4.9						
WS105	6	2.00		D	Greyish brown sandy gravelly silty CLAY.			25.0	78	29 -1pt	17	12		CL
WS105	7	2.50		D	Greyish brown slightly gravelly clayey fien to coarse SAND.			16.0	66	20 -1pt	14	6		ML/CL
WS106	5	1.20		D	Greyish brown sandy clayey subangular fine to coarse GRAVEL with some cobbles.			7.5	61	22 -1pt	3	19		CL
WS106	6	1.30	2.80	B	Greyish brown sandy clayey subangular fine to coarse GRAVEL with some cobbles.			5.6	63	25 -1pt	12	13		CL

All tests performed in accordance with BS1377:1990 unless specified otherwise

LAB 01R Version 4

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed

18/02/2022

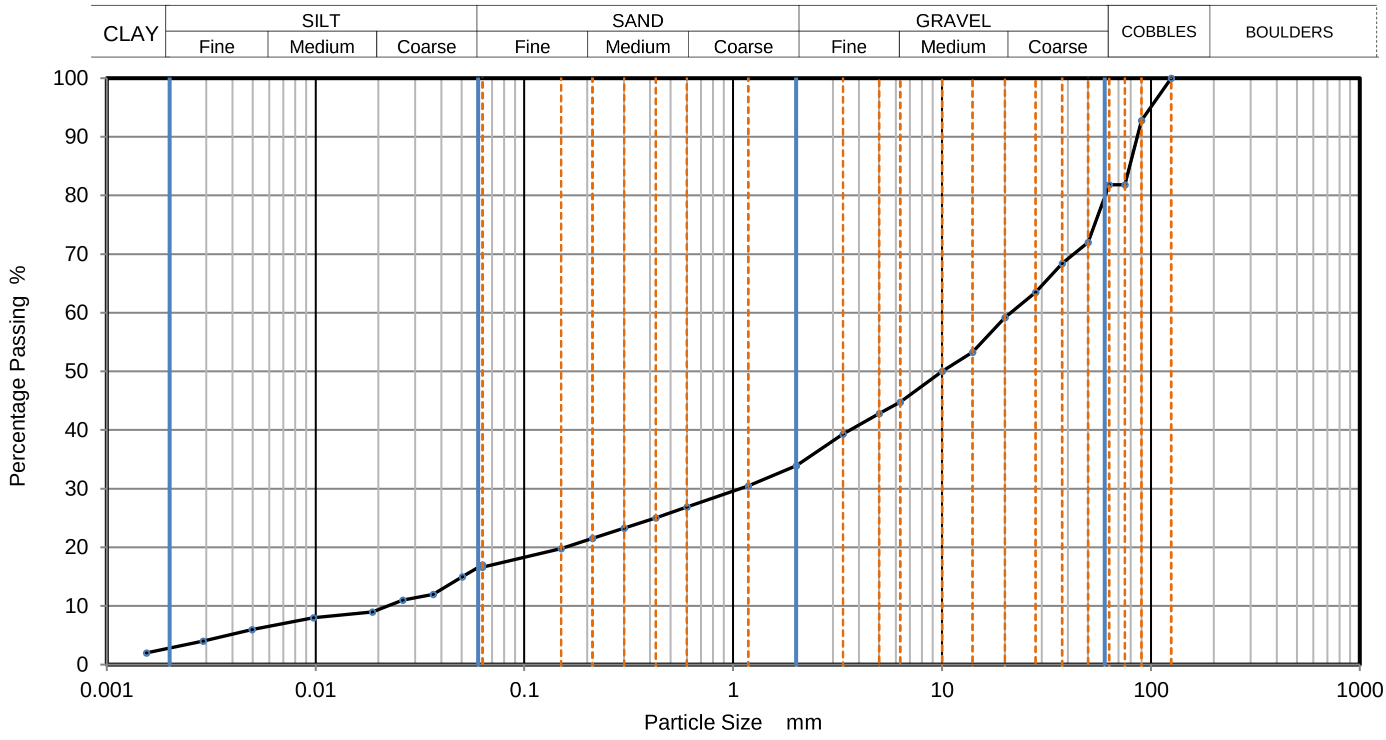
Approved By

Stephen.Watson

UKAS TESTING

10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**	Job Ref	**21-1298**
		Borehole/Pit No.	BH101
Site Name	BusConnects Galway	Sample No.	7
Soil Description	Greyish brown sandy gravelly silty CLAY with cobbles.	Depth, m	1.20
Specimen Reference	2 Specimen Depth 1.2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5	KeyLAB ID	Caus202112141



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	17
90	93	0.05033	15
75	82	0.03649	12
63	82	0.02611	11
50	72	0.01868	9
37.5	68	0.00976	8
28	64	0.00496	6
20	59	0.00290	4
14	53	0.00155	2
10	50		
6.3	45		
5	43		
3.35	39		
2	34		
1.18	31		
0.6	27	Particle density	(assumed)
0.425	25	2.65	Mg/m3
0.3	23		
0.212	22		
0.15	20		
0.063	17		

Dry Mass of sample, g	17838

Sample Proportions	% dry mass
Cobbles	18.2
Gravel	47.9
Sand	17.3
Silt	13.5
Clay	3.1

Grading Analysis		
D100	mm	125
D60	mm	21.3
D30	mm	1.07
D10	mm	0.0216
Uniformity Coefficient		990
Curvature Coefficient		2.5

Remarks

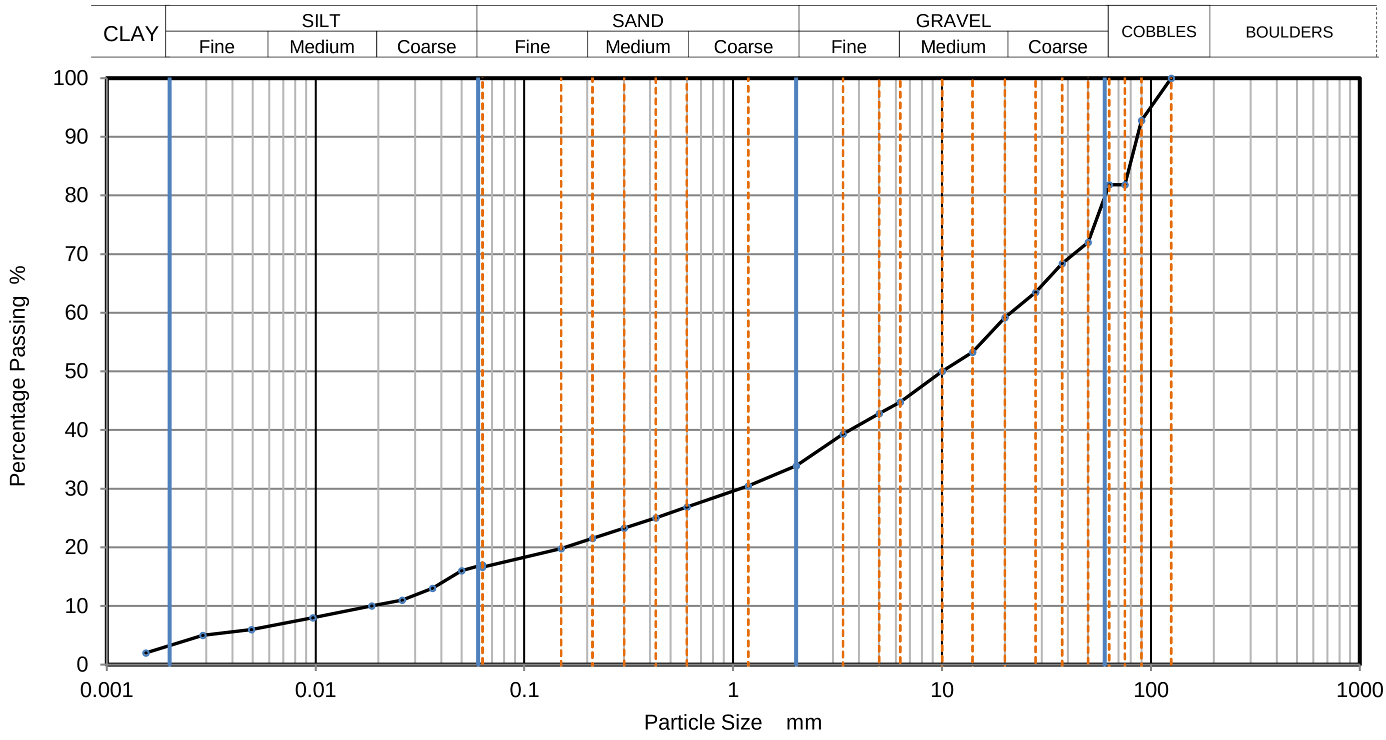
Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

LAB 05R Version 4

UKAS TESTING
10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**21-1298**
				Borehole/Pit No.	BH101
Site Name	BusConnects Galway			Sample No.	8
Soil Description	Greyish brown sandy gravelly silty CLAY with cobbles.			Depth, m	2.00
Specimen Reference	3	Specimen Depth	2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202112142



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	17
90	93	0.05000	16
75	82	0.03626	13
63	82	0.02595	11
50	72	0.01857	10
37.5	68	0.00970	8
28	64	0.00493	6
20	59	0.00288	5
14	53	0.00154	2
10	50		
6.3	45		
5	43		
3.35	39		
2	34		
1.18	31		
0.6	27	Particle density	(assumed)
0.425	25	2.65	Mg/m3
0.3	23		
0.212	22		
0.15	20		
0.063	17		

Dry Mass of sample, g	17838

Sample Proportions	% dry mass
Cobbles	18.2
Gravel	47.9
Sand	17.3
Silt	13.4
Clay	3.2

Grading Analysis		
D100	mm	125
D60	mm	21.3
D30	mm	1.07
D10	mm	0.0194
Uniformity Coefficient		1100
Curvature Coefficient		2.8

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

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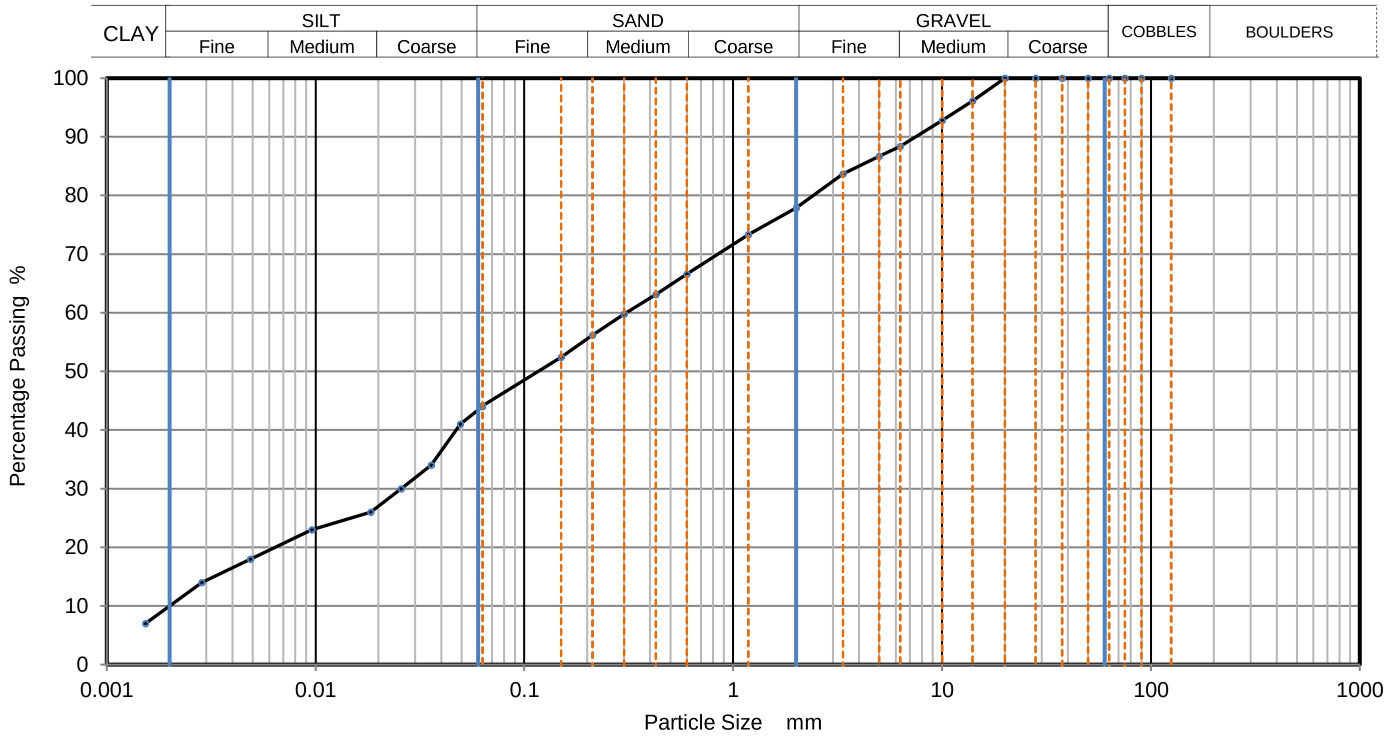
10122

CAUSEWAY GEOTECH

PARTICLE SIZE DISTRIBUTION

Job Ref	**21-1298**				
Borehole/Pit No.	BH106				
Site Name	BusConnects Galway			Sample No.	6
Soil Description	Greyish brown sandy slightly gravelly silty CLAY.			Depth, m	1.20
Specimen Reference	3	Specimen Depth	1.2 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus202112147



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	44
90	100	0.04935	41
75	100	0.03581	34
63	100	0.02564	30
50	100	0.01835	26
37.5	100	0.00959	23
28	100	0.00488	18
20	100	0.00285	14
14	96	0.00153	7
10	93		
6.3	88		
5	87		
3.35	84		
2	78		
1.18	73		
0.6	67	Particle density	(assumed)
0.425	63	2.65	Mg/m3
0.3	60		
0.212	56		
0.15	52		
0.063	44		

Dry Mass of sample, g	511

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	22.1
Sand	33.8
Silt	34.0
Clay	10.1

Grading Analysis		
D100	mm	
D60	mm	0.305
D30	mm	0.0257
D10	mm	0.00198
Uniformity Coefficient		150
Curvature Coefficient		1.1

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

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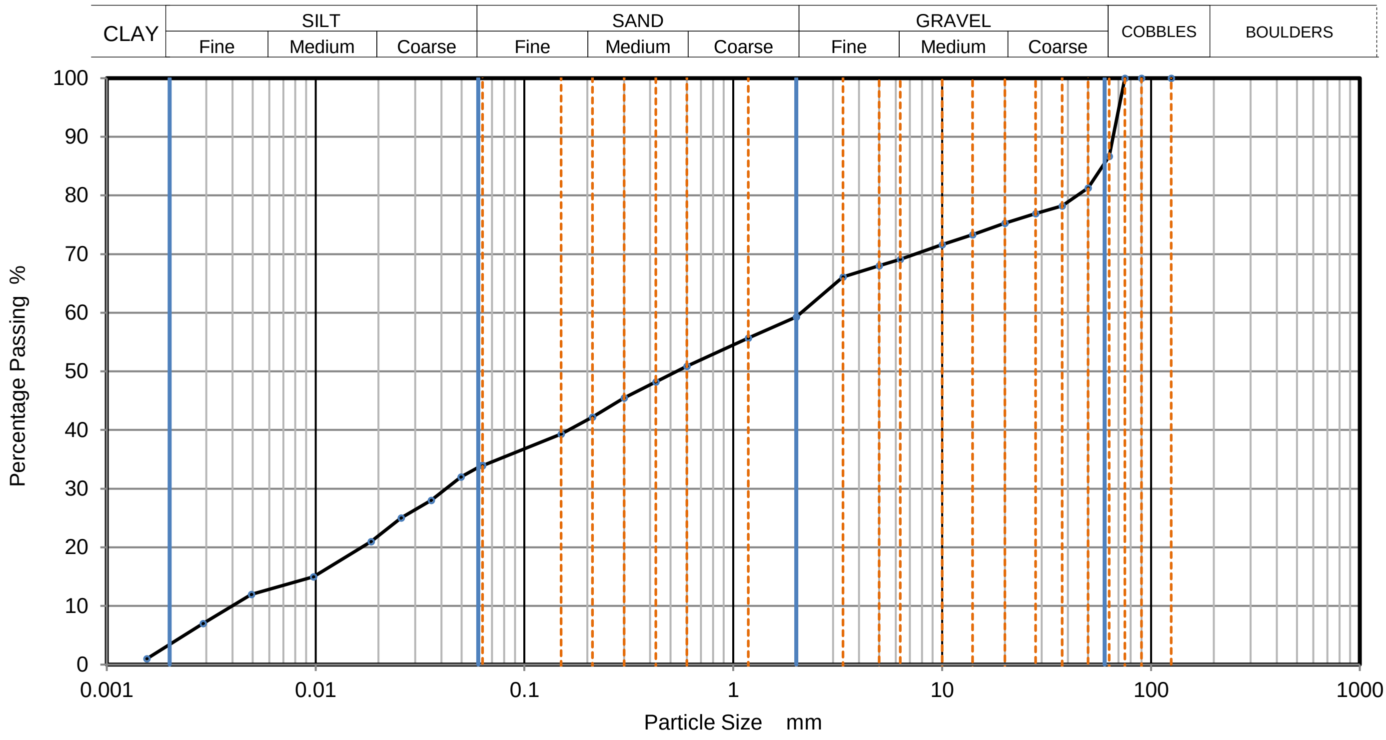
10122

PARTICLE SIZE DISTRIBUTION

				Job Ref	**21-1298**
				Borehole/Pit No.	WS105
Site Name	BusConnects Galway			Sample No.	5
Soil Description	Greyish brown sandy gravelly silty CLAY with cobbles.			Depth, m	1.00
Specimen Reference	3	Specimen Depth	1 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2021121412



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	34
90	100	0.04968	32
75	100	0.03581	28
63	87	0.02564	25
50	81	0.01846	21
37.5	78	0.00976	15
28	77	0.00493	12
20	75	0.00289	7
14	73	0.00156	1
10	72		
6.3	69		
5	68		
3.35	66		
2	59		
1.18	56		
0.6	51	Particle density	(assumed)
0.425	48	2.65	Mg/m3
0.3	46		
0.212	42		
0.15	39		
0.063	34		

Dry Mass of sample, g	6037

Sample Proportions	% dry mass
Cobbles	13.3
Gravel	27.5
Sand	25.4
Silt	29.9
Clay	3.9

Grading Analysis		
D100	mm	
D60	mm	2.12
D30	mm	0.0415
D10	mm	0.00398
Uniformity Coefficient		530
Curvature Coefficient		0.2

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

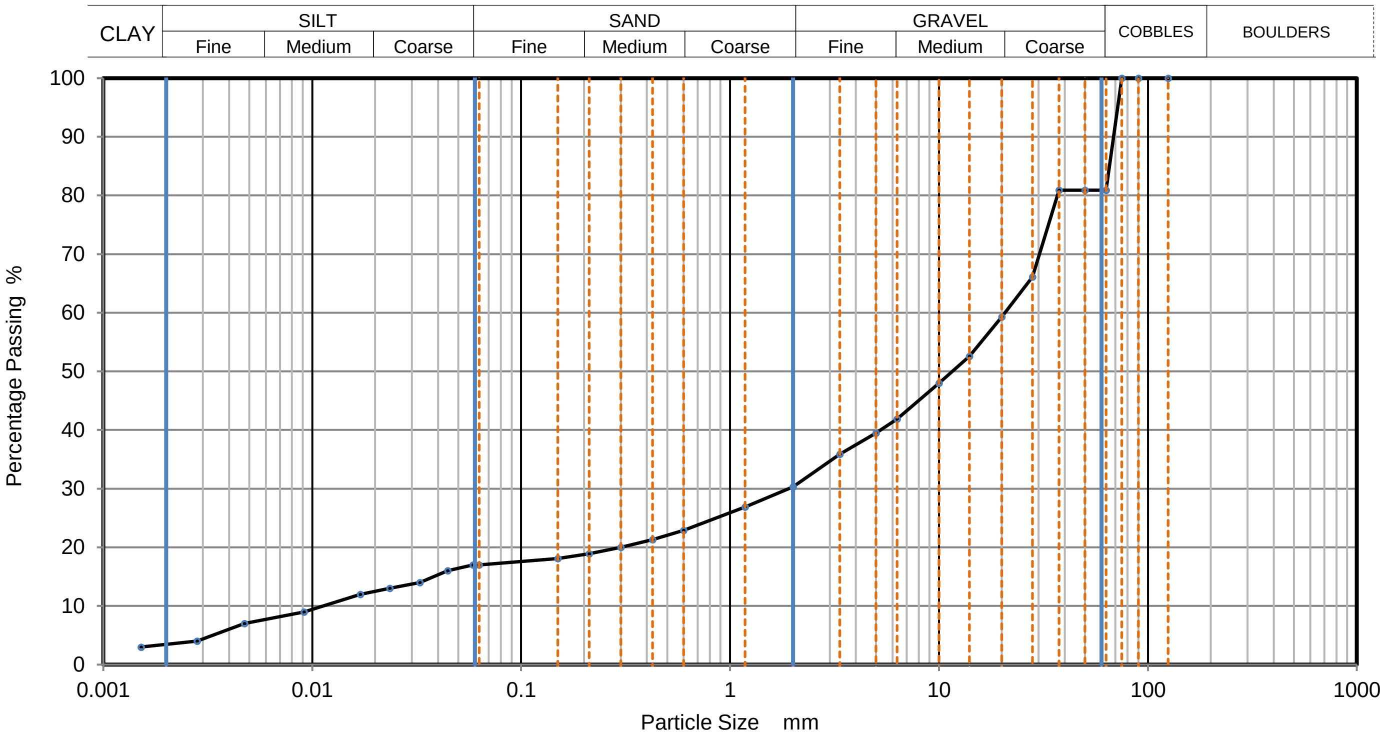
Approved
Stephen.Watson

LAB 05R Version 4

UKAS TESTING

10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**21-1298**
				Borehole/Pit No.	WS106
Site Name	BusConnects Galway			Sample No.	5
Soil Description	Greyish brown sandy clayey subangular fine to coarse GRAVEL with some cobbles.			Depth, m	1.20
Specimen Reference	6	Specimen Depth	1.2 m	Sample Type	D
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	Caus2021121415



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.05891	17
90	100	0.04454	16
75	100	0.03275	14
63	81	0.02350	13
50	81	0.01698	12
37.5	81	0.00913	9
28	66	0.00474	7
20	59	0.00282	4
14	53	0.00152	3
10	48		
6.3	42		
5	40		
3.35	36		
2	30		
1.18	27		
0.6	23	Particle density	(assumed)
0.425	21	2.65	Mg/m3
0.3	20		
0.212	19		
0.15	18		
0.063	17		

Dry Mass of sample, g	2351

Sample Proportions	% dry mass
Cobbles	19.1
Gravel	50.6
Sand	13.3
Silt	13.6
Clay	3.4

Grading Analysis		
D100	mm	
D60	mm	20.7
D30	mm	1.92
D10	mm	0.0112
Uniformity Coefficient		1900
Curvature Coefficient		16

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

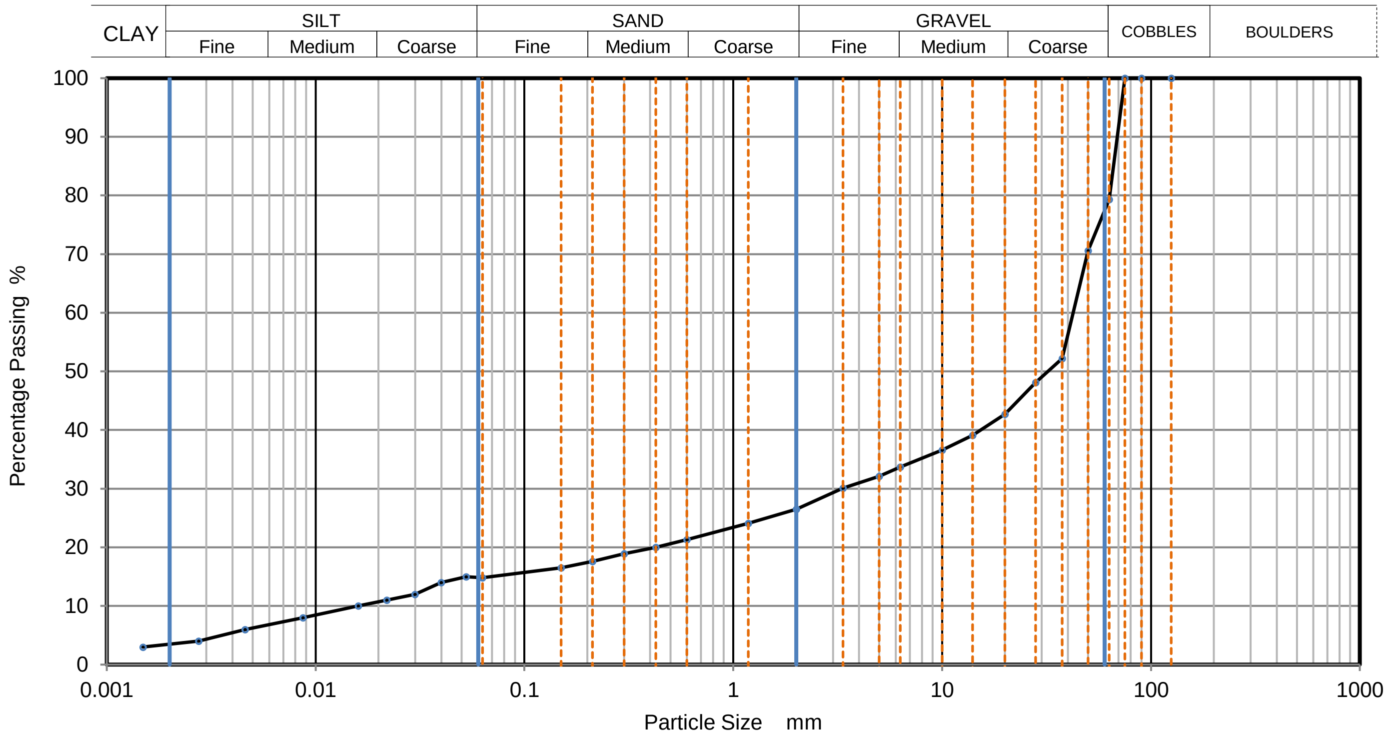
Approved
Stephen.Watson

LAB 05R Version 4

UKAS TESTING
10122

PARTICLE SIZE DISTRIBUTION

		Job Ref	**21-1298**
		Borehole/Pit No.	WS106
Site Name	BusConnects Galway	Sample No.	6
Soil Description	Greyish brown sandy clayey subangular fine to coarse GRAVEL with some cobbles.	Depth, m	1.30
Specimen Reference	6 Specimen Depth 1.3 m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5	KeyLAB ID	Caus2021121416



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.05262	15
90	100	0.03995	14
75	100	0.02991	12
63	79	0.02190	11
50	71	0.01600	10
37.5	52	0.00871	8
28	48	0.00459	6
20	43	0.00275	4
14	39	0.00149	3
10	37		
6.3	34		
5	32		
3.35	30		
2	27		
1.18	24		
0.6	21	Particle density	(assumed)
0.425	20	2.65	Mg/m3
0.3	19		
0.212	18		
0.15	17		
0.063	15		

Dry Mass of sample, g	3231

Sample Proportions	% dry mass
Cobbles	20.7
Gravel	52.9
Sand	11.6
Silt	11.5
Clay	3.3

Grading Analysis		
D100	mm	
D60	mm	42.3
D30	mm	3.31
D10	mm	0.0153
Uniformity Coefficient		2800
Curvature Coefficient		17

Remarks

Preparation and testing in accordance with BS1377-2 :1990 unless noted below

Approved
Stephen.Watson

UKAS TESTING

10122

UKAS
TESTING
2183

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-02179-1		
Initial Date of Issue:	26-Jan-2022		
Client	Causeway Geotech Ltd		
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL		
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Michelle Gaffney Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen Watson Stuart Abraham Thomas McAllist		
Project	21-1298 Bus Connects Galway		
Quotation No.:		**Date Received:**	24-Jan-2022
Order No.:		**Date Instructed:**	24-Jan-2022
No. of Samples:	1		
Turnaround (Wkdays):	7	**Results Due:**	01-Feb-2022
Date Approved:	26-Jan-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				22-02179
Quotation No.:	**Chemtest Sample ID.:**				1356500
Order No.:	Client Sample Ref.:				6
	Sample Location:				WS101
	Sample Type:				SOIL
	Top Depth (m):				1.9
	Date Sampled:				20-Jan-2022
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Moisture	N	2030	%	0.020	53
Organic Matter	U	2625	%	0.40	8.6

Test Methods

SOP	Title	Parameters included	Method summary
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

LABORATORY RESTRICTION REPORT

Project Reference	21-1298	To	Sean Ross
		Position	Project Manager
Project Name	BusConnects Galway	From	Joseph Nicholl
TR reference	21-1298 / G01	Position	Laboratory Quality Manager

The following sample(s) and test(s) are restricted as detailed below. Could you please complete the "Required Action" column and return the completed form to the laboratory.

Hole Number	Sample			Test Type	Reason for Restriction	Required Action
	Number	Depth (m)	Type			
BH105A	8	2.40	D	Atterberg limits	Insufficient cohesive material to conduct test	CANCEL
WS101	5	1.56	D	PSD	Insufficient material to conduct test	CANCEL

For electronic reporting a form of electronic signature or printed name is acceptable

Laboratory Signature Joseph Nicholl	Project Manager Signature Sean Ross
Date 20 January 2022	Date 17 January 2022

CAUSEWAY
GEOTECH

HEAD OFFICE
Causeway Geotech Ltd
8 Drumahiskey Road
Ballymoney
Co. Antrim, N. Ireland, BT53 7QL
NI: +44 (0)28 276 66640

Registered in Northern Ireland.
Company Number: NI610766

REGIONAL OFFICE
Causeway Geotech (IRL) Ltd
Unit 1 Fingal House
Stephenstown Industrial Estate
Balbriggan, Co Dublin, Ireland, K32 VR66
ROI: +353 (0)1 526 7465

Registered in Ireland.
Company Number: 633786

www.causewaygeotech.com

SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

9 March 2022

Project Name:	BusConnects Galway
Project No.:	21-1298
Client:	Galway City Council
Engineer:	ARUP

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s). This testing was performed between 17/01/2022 and 02/02/2022.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Stephen Watson

Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd

Project Name: BusConnects Galway

Report Reference: Schedule 2 - ROCK

The table below details the tests carried out, the specifications used, and the number of tests included in this report. The results contained in this report relate to the sample(s) as received

Tests marked with* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
ROCK	Point load index	ISRM Commission on Testing Methods. Suggested Method for Determining Point Load Strength 1985	6

SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
ROCK – Subcontracted to MATtest Ltd *(UKAS 2643)*	Uniaxial compressive strength	ASTM D7012-14	4

Point Load Strength Index Tests
Summary of Results

Project No.

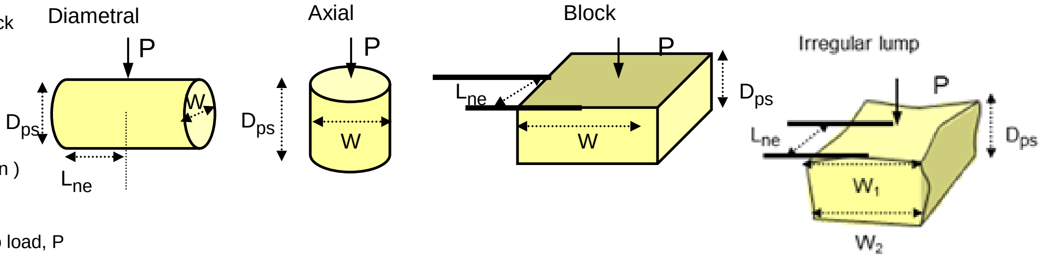
21-1298

Project Name

BusConnects Galway

Borehole No.	Sample Depth m	Sample Ref.	Sample Type	Specimen Ref.	Specimen Depth m	Rock Type	Test Type see ISRM: Type (D, A, I, B)	Test Type see ISRM: Direction (L, P or U)	Failure Valid (Y/N)	Dimensions: Lne mm	Dimensions: W mm	Dimensions: Dps mm	Dimensions: Dps' mm	Force P kN	Equivalent diameter, De mm	Point Load Strength Index: Is MPa	Point Load Strength Index: Is(50) MPa	Remarks (including water content if measured)
BH101	5.00		C	1	5.00	LIMESTONE	A	U	NO		83.2	111.0	106.0	21.1	106.0	1.9	2.6	
BH102	3.80		C	1	3.80	LIMESTONE	D	U	NO	90.4	82.8	82.8	81.0	13.3	81.9	2.0	2.5	
BH103	7.40		C	1	7.40	LIMESTONE	D	U	NO	62.4	82.3	82.3	78.0	16.4	80.1	2.6	3.2	
BH104	8.70		C	1	8.70	LIMESTONE	A	U	NO		81.9	86.0	84.0	13.8	93.6	1.6	2.1	
BH106	3.70		C	1	3.70	LIMESTONE	D	U	NO	97.9	83.0	83.0	81.0	24.5	82.0	3.6	4.6	
BH106	5.20		C	2	5.20	LIMESTONE	A	U	NO		83.3	103.0	101.0	41.1	103.5	3.8	5.3	

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise

Detailed legend for test and dimensions, based on ISRM, is shown above.

Size factor, F = (De/50)0.45 for all tests.

LAB 17R Version 4

Date Printed

03/09/2022 00:00

Approved By

Stephen.Watson

10122

10 Queenslie Point
Queenslie Industrial Estate
120 Stepps Road
Glasgow
G33 3NQ

Tel: 0141 774 4032

email: info@mattest.org
Website: www.mattest.org

LABORATORY TEST CERTIFICATE

Certificate No :	**22/273 - 01**
To :	**Stephen Watson**
Client :	**Causeway Geotech Limited** 8 Drumahiskey Road Ballymoney Co. Antrim BT53 7QL

LABORATORY TESTING OF ROCK

Introduction

We refer to samples taken from BusConnects, Galway and delivered to our laboratory on 01st March 2022.

Material & Source

Sample Reference	:	See Report Plates
Sampled By	:	Client
Sampling Certificate	:	Not Supplied
Location	:	See Report Plates
Description	:	Rock Cores
Date Sampled	:	Not Supplied
Date Tested	:	01st March 2022 Onwards
Source	:	21-1298 - BusConnects, Galway

Test Results

As Detailed On Page 2 to Page 5 inclusive

Comments

The results contained in this report relate to the sample(s) as received
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
All remaining samples for this project will be disposed of 28 days after issue of this test certificate

Remarks

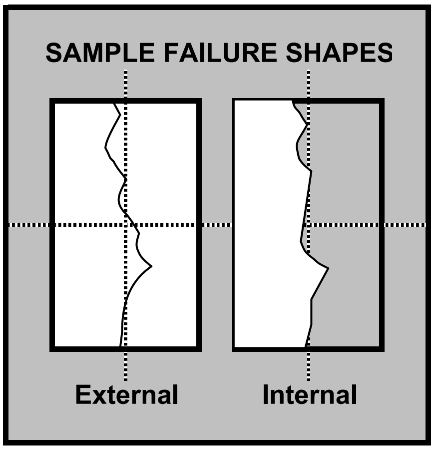
Approved for Issue

T McLelland (Director)

Date 09/03/2022

2643

BOREHOLE		**BH101**
SAMPLE		**C**
DEPTH	m	**4.30-4.60**
SAMPLE DIAMETER	mm	**83.73**
SAMPLE HEIGHT	mm	**189.48**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**1.3**
TEST DURATION	min.sec	**3.52**
DATE OF TESTING		**08/03/2022**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**271.1**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**49.2**
WATER CONTENT (ISRM Suggested Methods)	%	**0.2**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.68**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.67**



BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

SAMPLE FAILURE SHAPES

External **Internal**

BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

SAMPLE FAILURE SHAPES

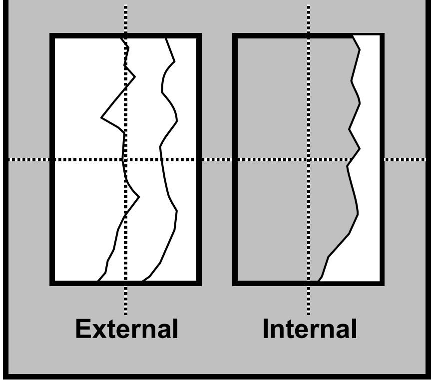
External **Internal**

Tested in accordance with ASTM D7012 - 14

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

BOREHOLE		**BH103**
SAMPLE		**C**
DEPTH	m	**5.60-6.00**
SAMPLE DIAMETER	mm	**83.75**
SAMPLE HEIGHT	mm	**165.36**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**1.2**
TEST DURATION	min.sec	**4.25**
DATE OF TESTING		**08/03/2022**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**304.6**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**55.3**
WATER CONTENT (ISRM Suggested Methods)	%	**1.2**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.57**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.54**

SAMPLE FAILURE SHAPES



BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

SAMPLE FAILURE SHAPES

External Internal

BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

SAMPLE FAILURE SHAPES

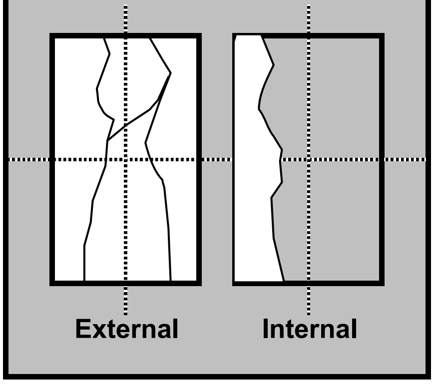
External Internal

Tested in accordance with ASTM D7012 - 14

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

BOREHOLE		**BH104**
SAMPLE		**C**
DEPTH	m	**7.00-7.30**
SAMPLE DIAMETER	mm	**80.30**
SAMPLE HEIGHT	mm	**188.35**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**1.2**
TEST DURATION	min.sec	**4.24**
DATE OF TESTING		**08/03/2022**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**304.4**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**60.1**
WATER CONTENT (ISRM Suggested Methods)	%	**0.2**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.65**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.65**

SAMPLE FAILURE SHAPES



BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

SAMPLE FAILURE SHAPES

External **Internal**

BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

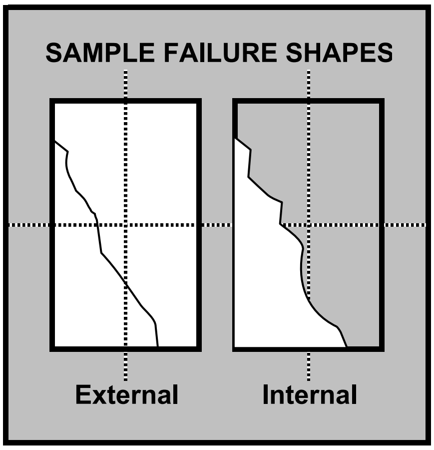
SAMPLE FAILURE SHAPES

External **Internal**

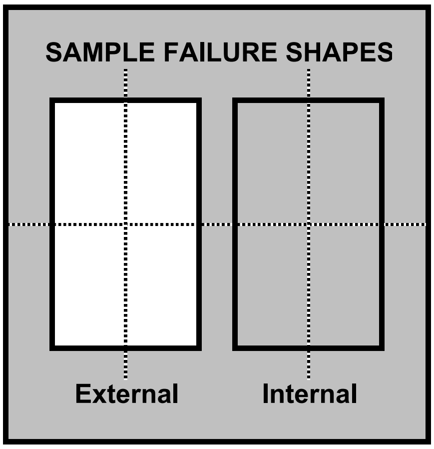
Tested in accordance with ASTM D7012 - 14

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

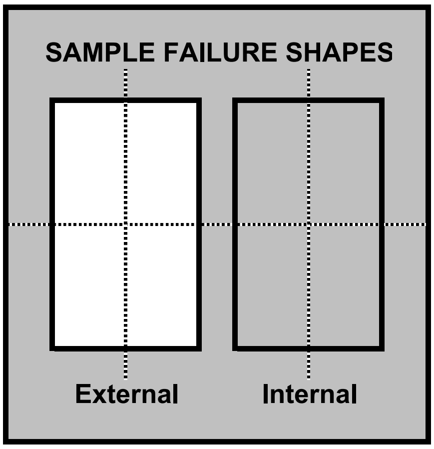
BOREHOLE		**BH106**
SAMPLE		**C**
DEPTH	m	**4.00-4.20**
SAMPLE DIAMETER	mm	**83.56**
SAMPLE HEIGHT	mm	**174.42**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**1.3**
TEST DURATION	min.sec	**4.06**
DATE OF TESTING		**08/03/2022**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**308.9**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**56.3**
WATER CONTENT (ISRM Suggested Methods)	%	**0.1**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.84**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.84**



BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	



BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	



Tested in accordance with ASTM D7012 - 14

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

CAUSEWAY
GEOTECH

APPENDIX F

ENVIRONMENTAL LABORATORY TEST RESULTS

UKAS TESTING
2183

Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	21-42918-1
Initial Date of Issue:	16-Dec-2021
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Michelle Gaffney Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen Watson Stuart Abraham Thomas McAllist
Project	21-1298 Busconnects Galway

Quotation No.:	Q21-25429	**Date Received:**	06-Dec-2021
Order No.:		**Date Instructed:**	08-Dec-2021
No. of Samples:	2		
Turnaround (Wkdays):	7	**Results Due:**	16-Dec-2021
Date Approved:	16-Dec-2021		

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Leachate

Project: 21-1298 Busconnects Galway

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	21-42918	21-42918
Quotation No.: Q21-25429					**Chemtest Sample ID.:**	1333978	1333979
Order No.:					Client Sample Ref.:	Ev	Ev
					Sample Location:	BH101	BH101
					Sample Type:	SOIL	SOIL
					Top Depth (m):	0.50	1.00
					Date Sampled:	30-Nov-2021	30-Nov-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**		
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	120	44
Chloride	U	1220	10:1	mg/l	1.0	< 1.0	< 1.0
Fluoride	U	1220	10:1	mg/l	0.050	0.37	0.13
Sulphate	U	1220	10:1	mg/l	1.0	6.0	1.2
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	0.76	1.5
Barium (Dissolved)	U	1455	10:1	µg/l	5.00	13	5.9
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11	< 0.11
Chromium (Dissolved)	U	1455	10:1	µg/l	0.50	0.69	< 0.50
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	5.1	4.3
Molybdenum (Dissolved)	U	1455	10:1	µg/l	0.20	0.64	0.53
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	0.71	< 0.50
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	15	1.0
Antimony (Dissolved)	U	1455	10:1	µg/l	0.50	0.73	0.76
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	< 0.50
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	5.5	< 2.5
Mercury Low Level	U	1460	10:1	µg/l	0.010	< 0.010	< 0.010
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	8.5	4.7
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030

Results - Soil

Project: 21-1298 Busconnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-42918	21-42918
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1333978	1333979
Order No.:				Client Sample Ref.:	Ev	Ev
				Sample Location:	BH101	BH101
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	30-Nov-2021	30-Nov-2021
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	15	14
pH	M	2010		4.0	8.5	8.5
Arsenic	M	2450	mg/kg	1.0	7.9	5.3
Barium	M	2450	mg/kg	10	35	29
Cadmium	M	2450	mg/kg	0.10	0.97	0.73
Mercury Low Level	M	2450	mg/kg	0.05	0.07	0.06
Molybdenum	M	2450	mg/kg	2.0	< 2.0	< 2.0
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0
Copper	M	2450	mg/kg	0.50	9.7	9.2
Nickel	M	2450	mg/kg	0.50	18	13
Lead	M	2450	mg/kg	0.50	22	25
Selenium	M	2450	mg/kg	0.20	< 0.20	< 0.20
Zinc	M	2450	mg/kg	0.50	43	32
Chromium (Trivalent)	N	2490	mg/kg	1.0	23	14
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
LOI	M	2610	%	0.10	4.8	4.8
Total Organic Carbon	M	2625	%	0.20	0.60	1.1
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0

Results - Soil

Project: 21-1298 Busconnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-42918	21-42918
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1333978	1333979
Order No.:				Client Sample Ref.:	Ev	Ev
				Sample Location:	BH101	BH101
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	30-Nov-2021	30-Nov-2021
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10
Dichlorodifluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Vinyl Chloride	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trichlorofluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trans 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
cis 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromochloromethane	N	2760	µg/kg	0.50	< 0.50	< 0.50
Trichloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,1-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tetrachloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Benzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0
1,2-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Dibromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromodichloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
cis-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Toluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,2-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tetrachloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3-Dichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Dibromochloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dibromoethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,1,2-Tetrachloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Ethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0
m & p-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20

Results - Soil

Project: 21-1298 Busconnects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				21-42918	21-42918
Quotation No.: Q21-25429	**Chemtest Sample ID.:**				1333978	1333979
Order No.:	Client Sample Ref.:				Ev	Ev
	Sample Location:				BH101	BH101
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.50	1.00
	Date Sampled:				30-Nov-2021	30-Nov-2021
	Asbestos Lab:				DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0
o-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0
Styrene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tribromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Isopropylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,3-Trichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
N-Propylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
2-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3,5-Trimethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
4-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tert-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,4-Trimethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Sec-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
4-Isopropyltoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,4-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
N-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dibromo-3-Chloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,4-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Hexachlorobutadiene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,3-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	N	2760	µg/kg	0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0
N-Nitrosodimethylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050
Phenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Chlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis-(2-Chloroethyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,3-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,4-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,2-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis(2-Chloroisopropyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachloroethane	N	2790	mg/kg	0.050	< 0.050	< 0.050
N-Nitrosodi-n-propylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050

Results - Soil

Project: 21-1298 Busconnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-42918	21-42918
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1333978	1333979
Order No.:				Client Sample Ref.:	Ev	Ev
				Sample Location:	BH101	BH101
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	30-Nov-2021	30-Nov-2021
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Nitrobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Isophorone	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4-Dimethylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis(2-Chloroethoxy)Methane	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4-Dichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,2,4-Trichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Naphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Chloroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorobutadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Chloro-3-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methylnaphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorocyclopentadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4,6-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4,5-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Chloronaphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Acenaphthylene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Dimethylphthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,6-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Acenaphthene	N	2790	mg/kg	0.050	< 0.050	< 0.050
3-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Dibenzofuran	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Chlorophenylphenylether	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Fluorene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Diethyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Azobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Bromophenylphenyl Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Pentachlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Phenanthrene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Anthracene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Carbazole	N	2790	mg/kg	0.050	< 0.050	< 0.050
Di-N-Butyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Fluoranthene	N	2790	mg/kg	0.050	< 0.050	< 0.050

Results - Soil

Project: 21-1298 Busconnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-42918	21-42918
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1333978	1333979
Order No.:				Client Sample Ref.:	Ev	Ev
				Sample Location:	BH101	BH101
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	30-Nov-2021	30-Nov-2021
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Pyrene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Butylbenzyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[a]anthracene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Chrysene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Di-N-Octyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[b]fluoranthene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[k]fluoranthene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[a]pyrene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Indeno(1,2,3-c,d)Pyrene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Dibenz(a,h)Anthracene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[g,h,i]perylene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Chrysene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010

Results - Soil

Project: 21-1298 Busconnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-42918	21-42918
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1333978	1333979
Order No.:				Client Sample Ref.:	Ev	Ev
				Sample Location:	BH101	BH101
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	30-Nov-2021	30-Nov-2021
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10	< 0.10
SVOC TIC	N	2790	mg/kg	N/A	None Detected	None Detected
VOC TIC	N	2760	µg/kg	N/A	None Detected	None Detected

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using ‘Aquakem 600’ Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by ‘Aquakem 600’ Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS

Test Methods

SOP	Title	Parameters included	Method summary
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

UKAS TESTING 2183

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	21-42988-1		
Initial Date of Issue:	16-Dec-2021		
Client	Causeway Geotech Ltd		
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL		
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Michelle Gaffney Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen Watson Stuart Abraham Thomas McAllist		
Project	21-1298 Busconnects Galway		
Quotation No.:	Q21-25429	**Date Received:**	06-Dec-2021
Order No.:		**Date Instructed:**	08-Dec-2021
No. of Samples:	2		
Turnaround (Wkdays):	7	**Results Due:**	16-Dec-2021
Date Approved:	16-Dec-2021		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Leachate

Project: 21-1298 Busconnects Galway

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	21-42988	21-42988
Quotation No.: Q21-25429					**Chemtest Sample ID.:**	1334317	1334318
					Sample Location:	WS101	WS101
					Sample Type:	SOIL	SOIL
					Top Depth (m):	0.50	1.00
					Date Sampled:	29-Nov-2021	29-Nov-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**		
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	78	56
Chloride	U	1220	10:1	mg/l	1.0	< 1.0	< 1.0
Fluoride	U	1220	10:1	mg/l	0.050	0.50	0.21
Sulphate	U	1220	10:1	mg/l	1.0	< 1.0	< 1.0
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	0.46	0.73
Barium (Dissolved)	U	1455	10:1	µg/l	5.00	7.0	5.9
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11	< 0.11
Chromium (Dissolved)	U	1455	10:1	µg/l	0.50	0.82	< 0.50
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	3.5	4.3
Molybdenum (Dissolved)	U	1455	10:1	µg/l	0.20	0.83	1.7
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	0.59	< 0.50
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	3.1	0.70
Antimony (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	0.83
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	< 0.50
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	< 2.5	< 2.5
Mercury Low Level	U	1460	10:1	µg/l	0.010	< 0.010	< 0.010
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	9.6	11
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030

Results - Soil

Project: 21-1298 Busconnects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				21-42988	21-42988
Quotation No.: Q21-25429	**Chemtest Sample ID.:**				1334317	1334318
	Sample Location:				WS101	WS101
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.50	1.00
	Date Sampled:				29-Nov-2021	29-Nov-2021
	Asbestos Lab:				DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	21	14
pH	M	2010		4.0	8.4	8.5
Arsenic	M	2450	mg/kg	1.0	8.0	6.9
Barium	M	2450	mg/kg	10	84	33
Cadmium	M	2450	mg/kg	0.10	1.4	0.51
Mercury Low Level	M	2450	mg/kg	0.05	0.20	0.08
Molybdenum	M	2450	mg/kg	2.0	< 2.0	< 2.0
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0
Copper	M	2450	mg/kg	0.50	26	24
Nickel	M	2450	mg/kg	0.50	14	7.2
Lead	M	2450	mg/kg	0.50	270	56
Selenium	M	2450	mg/kg	0.20	0.25	< 0.20
Zinc	M	2450	mg/kg	0.50	160	65
Chromium (Trivalent)	N	2490	mg/kg	1.0	14	7.4
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
LOI	M	2610	%	0.10	7.8	4.3
Total Organic Carbon	M	2625	%	0.20	3.6	2.3
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10	3100	38
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	94	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	360	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	1100	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	1100	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	390	38
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	3100	38
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	53	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	400	44
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	270	210
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	54	460
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	780	710

Results - Soil

Project: 21-1298 Busconnects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				21-42988	21-42988
Quotation No.: Q21-25429	**Chemtest Sample ID.:**				1334317	1334318
	Sample Location:				WS101	WS101
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.50	1.00
	Date Sampled:				29-Nov-2021	29-Nov-2021
	Asbestos Lab:				DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	3800	750
Dichlorodifluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Vinyl Chloride	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trichlorofluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trans 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
cis 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromochloromethane	N	2760	µg/kg	0.50	< 0.50	< 0.50
Trichloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,1-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tetrachloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Benzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0
1,2-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Dibromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromodichloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
cis-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Toluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,2-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tetrachloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3-Dichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Dibromochloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dibromoethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,1,2-Tetrachloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Ethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0
m & p-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0
o-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20

Results - Soil

Project: 21-1298 Busconnects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				21-42988	21-42988
Quotation No.: Q21-25429	**Chemtest Sample ID.:**				1334317	1334318
	Sample Location:				WS101	WS101
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.50	1.00
	Date Sampled:				29-Nov-2021	29-Nov-2021
	Asbestos Lab:				DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0
Styrene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tribromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Isopropylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,3-Trichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
N-Propylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
2-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3,5-Trimethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
4-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tert-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,4-Trimethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Sec-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
4-Isopropyltoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,4-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
N-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dibromo-3-Chloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,4-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Hexachlorobutadiene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,3-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	N	2760	µg/kg	0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0
N-Nitrosodimethylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050
Phenol	N	2790	mg/kg	0.050	< 0.050	0.070
2-Chlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis-(2-Chloroethyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,3-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,4-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,2-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis(2-Chloroisopropyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachloroethane	N	2790	mg/kg	0.050	< 0.050	< 0.050
N-Nitrosodi-n-propylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Nitrobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Isophorone	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050

Results - Soil

Project: 21-1298 Busconnects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				21-42988	21-42988
Quotation No.: Q21-25429	**Chemtest Sample ID.:**				1334317	1334318
	Sample Location:				WS101	WS101
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.50	1.00
	Date Sampled:				29-Nov-2021	29-Nov-2021
	Asbestos Lab:				DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
2,4-Dimethylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis(2-Chloroethoxy)Methane	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4-Dichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,2,4-Trichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Naphthalene	N	2790	mg/kg	0.050	< 0.050	0.070
4-Chloroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorobutadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Chloro-3-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methylnaphthalene	N	2790	mg/kg	0.050	< 0.050	0.058
Hexachlorocyclopentadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4,6-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4,5-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Chloronaphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Acenaphthylene	N	2790	mg/kg	0.050	0.076	0.15
Dimethylphthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,6-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Acenaphthene	N	2790	mg/kg	0.050	< 0.050	< 0.050
3-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Dibenzofuran	N	2790	mg/kg	0.050	< 0.050	0.070
4-Chlorophenylphenylether	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Fluorene	N	2790	mg/kg	0.050	< 0.050	0.070
Diethyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Azobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Bromophenylphenyl Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Pentachlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Phenanthrene	N	2790	mg/kg	0.050	0.34	0.94
Anthracene	N	2790	mg/kg	0.050	0.076	0.15
Carbazole	N	2790	mg/kg	0.050	< 0.050	0.11
Di-N-Butyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Fluoranthene	N	2790	mg/kg	0.050	0.99	1.4
Pyrene	N	2790	mg/kg	0.050	0.84	1.2
Butylbenzyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[a]anthracene	N	2790	mg/kg	0.050	0.57	0.58
Chrysene	N	2790	mg/kg	0.050	0.59	0.64

Results - Soil

Project: 21-1298 Busconnects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				21-42988	21-42988
Quotation No.: Q21-25429	**Chemtest Sample ID.:**				1334317	1334318
	Sample Location:				WS101	WS101
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.50	1.00
	Date Sampled:				29-Nov-2021	29-Nov-2021
	Asbestos Lab:				DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.050	< 0.050	0.22
Di-N-Octyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[b]fluoranthene	N	2790	mg/kg	0.050	0.90	0.87
Benzo[k]fluoranthene	N	2790	mg/kg	0.050	0.28	0.30
Benzo[a]pyrene	N	2790	mg/kg	0.050	0.65	0.71
Indeno(1,2,3-c,d)Pyrene	N	2790	mg/kg	0.050	0.37	0.41
Dibenz(a,h)Anthracene	N	2790	mg/kg	0.050	0.12	0.12
Benzo[g,h,i]perylene	N	2790	mg/kg	0.050	0.47	0.54
4-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Naphthalene	M	2800	mg/kg	0.10	0.22	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	0.76	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	0.11	< 0.10
Fluorene	M	2800	mg/kg	0.10	0.45	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	5.7	< 0.10
Anthracene	M	2800	mg/kg	0.10	0.82	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	9.5	0.67
Pyrene	M	2800	mg/kg	0.10	8.1	0.54
Benzo[a]anthracene	M	2800	mg/kg	0.10	4.5	0.36
Chrysene	M	2800	mg/kg	0.10	4.9	0.30
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	6.2	0.54
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	3.0	0.20
Benzo[a]pyrene	M	2800	mg/kg	0.10	4.9	0.37
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	3.7	0.32
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	1.7	0.12
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	3.0	0.29
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	58	3.7
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10	< 0.10
SVOC TIC	N	2790	mg/kg	N/A	None Detected	None Detected
VOC TIC	N	2760	µg/kg	N/A	None Detected	None Detected

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using ‘Aquakem 600’ Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by ‘Aquakem 600’ Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS

Test Methods

SOP	Title	Parameters included	Method summary
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING 2183

Final Report

Report No.: 21-43005-1

Initial Date of Issue: 16-Dec-2021

Client Causeway Geotech Ltd

Client Address:
8 Drumahiskey Road
Balnamore
Ballymoney
County Antrim
BT53 7QL

Contact(s):
Carin Cornwall
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Matthew Gilbert
Michelle Gaffney
Neil Haggan
Paul Dunlop
Sean Ross
Stephen Franey
Stephen Watson
Stuart Abraham
Thomas McAllist

Project 21-1298 BusConnects Galway

Quotation No.: Q21-25429

Date Received: 06-Dec-2021

Order No.:

Date Instructed: 08-Dec-2021

No. of Samples: 2

Turnaround (Wkdays): 7

Results Due: 16-Dec-2021

Date Approved: 16-Dec-2021

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Leachate

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**					21-43005	21-43005
Quotation No.: Q21-25429	**Chemtest Sample ID.:**					1334433	1334434
	Sample Location:					WS106	WS106
	Sample Type:					SOIL	SOIL
	Top Depth (m):					0.50	1.00
	Date Sampled:					30-Nov-2021	30-Nov-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**		
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	100	72
Chloride	U	1220	10:1	mg/l	1.0	1.4	< 1.0
Fluoride	U	1220	10:1	mg/l	0.050	0.21	0.13
Sulphate	U	1220	10:1	mg/l	1.0	< 1.0	< 1.0
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	2.0	3.0
Barium (Dissolved)	U	1455	10:1	µg/l	5.00	18	< 5.0
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11	0.54
Chromium (Dissolved)	U	1455	10:1	µg/l	0.50	0.53	< 0.50
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	4.6	3.3
Molybdenum (Dissolved)	U	1455	10:1	µg/l	0.20	0.56	2.7
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	0.68	2.9
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	3.8	2.9
Antimony (Dissolved)	U	1455	10:1	µg/l	0.50	1.4	1.4
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	< 0.50
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	4.7	13
Mercury Low Level	U	1460	10:1	µg/l	0.010	< 0.010	< 0.010
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	6.4	3.8
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030

Results - Soil

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				21-43005	21-43005
Quotation No.: Q21-25429	**Chemtest Sample ID.:**				1334433	1334434
	Sample Location:				WS106	WS106
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.50	1.00
	Date Sampled:				30-Nov-2021	30-Nov-2021
	Asbestos Lab:				NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	18	8.9
pH	M	2010		4.0	8.2	8.4
Arsenic	M	2450	mg/kg	1.0	8.4	8.4
Barium	M	2450	mg/kg	10	67	16
Cadmium	M	2450	mg/kg	0.10	0.52	0.47
Mercury Low Level	M	2450	mg/kg	0.05	0.25	0.05
Molybdenum	M	2450	mg/kg	2.0	< 2.0	< 2.0
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0
Copper	M	2450	mg/kg	0.50	30	7.2
Nickel	M	2450	mg/kg	0.50	11	7.4
Lead	M	2450	mg/kg	0.50	89	20
Selenium	M	2450	mg/kg	0.20	< 0.20	< 0.20
Zinc	M	2450	mg/kg	0.50	85	26
Chromium (Trivalent)	N	2490	mg/kg	1.0	12	6.7
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
LOI	M	2610	%	0.10	4.7	3.0
Total Organic Carbon	M	2625	%	0.20	2.6	0.30
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0

Results - Soil

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43005	21-43005
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1334433	1334434
				Sample Location:	WS106	WS106
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	30-Nov-2021	30-Nov-2021
				Asbestos Lab:	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10
Dichlorodifluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Vinyl Chloride	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trichlorofluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trans 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
cis 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromochloromethane	N	2760	µg/kg	0.50	< 0.50	< 0.50
Trichloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,1-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tetrachloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Benzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0
1,2-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Dibromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromodichloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
cis-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Toluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,2-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tetrachloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3-Dichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Dibromochloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dibromoethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,1,2-Tetrachloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Ethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0
m & p-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0
o-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20

Results - Soil

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43005	21-43005
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1334433	1334434
				Sample Location:	WS106	WS106
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	30-Nov-2021	30-Nov-2021
				Asbestos Lab:	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0
Styrene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tribromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Isopropylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,3-Trichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
N-Propylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
2-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3,5-Trimethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
4-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tert-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,4-Trimethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Sec-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
4-Isopropyltoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,4-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
N-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dibromo-3-Chloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,4-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Hexachlorobutadiene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,3-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	N	2760	µg/kg	0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0
N-Nitrosodimethylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050
Phenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Chlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis-(2-Chloroethyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,3-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,4-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,2-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis(2-Chloroisopropyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachloroethane	N	2790	mg/kg	0.050	< 0.050	< 0.050
N-Nitrosodi-n-propylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Nitrobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Isophorone	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050

Results - Soil

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43005	21-43005
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1334433	1334434
				Sample Location:	WS106	WS106
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	30-Nov-2021	30-Nov-2021
				Asbestos Lab:	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
2,4-Dimethylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis(2-Chloroethoxy)Methane	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4-Dichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,2,4-Trichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Naphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Chloroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorobutadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Chloro-3-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methylnaphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorocyclopentadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4,6-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4,5-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Chloronaphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Acenaphthylene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Dimethylphthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,6-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Acenaphthene	N	2790	mg/kg	0.050	< 0.050	< 0.050
3-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Dibenzofuran	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Chlorophenylphenylether	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Fluorene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Diethyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Azobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Bromophenylphenyl Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Pentachlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Phenanthrene	N	2790	mg/kg	0.050	0.27	0.62
Anthracene	N	2790	mg/kg	0.050	0.073	0.14
Carbazole	N	2790	mg/kg	0.050	< 0.050	0.066
Di-N-Butyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Fluoranthene	N	2790	mg/kg	0.050	0.58	1.1
Pyrene	N	2790	mg/kg	0.050	0.51	0.89
Butylbenzyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[a]anthracene	N	2790	mg/kg	0.050	0.35	0.48
Chrysene	N	2790	mg/kg	0.050	0.32	0.52

Results - Soil

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				21-43005	21-43005
Quotation No.: Q21-25429	**Chemtest Sample ID.:**				1334433	1334434
	Sample Location:				WS106	WS106
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.50	1.00
	Date Sampled:				30-Nov-2021	30-Nov-2021
	Asbestos Lab:				NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Di-N-Octyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[b]fluoranthene	N	2790	mg/kg	0.050	0.48	0.64
Benzo[k]fluoranthene	N	2790	mg/kg	0.050	0.17	0.22
Benzo[a]pyrene	N	2790	mg/kg	0.050	0.35	0.47
Indeno(1,2,3-c,d)Pyrene	N	2790	mg/kg	0.050	0.18	0.26
Dibenz(a,h)Anthracene	N	2790	mg/kg	0.050	< 0.050	0.066
Benzo[g,h,i]perylene	N	2790	mg/kg	0.050	0.21	0.25
4-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	1.8	0.25
Anthracene	M	2800	mg/kg	0.10	1.2	0.13
Fluoranthene	M	2800	mg/kg	0.10	4.7	0.42
Pyrene	M	2800	mg/kg	0.10	4.3	0.32
Benzo[a]anthracene	M	2800	mg/kg	0.10	3.0	0.25
Chrysene	M	2800	mg/kg	0.10	2.4	0.22
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	2.9	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.81	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	2.1	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	1.6	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	0.52	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	1.3	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	27	< 2.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10	< 0.10
SVOC TIC	N	2790	mg/kg	N/A	None Detected	None Detected
VOC TIC	N	2760	µg/kg	N/A	None Detected	None Detected

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS

Test Methods

SOP	Title	Parameters included	Method summary
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

UKAS TESTING
2183

MCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

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Eurofins Chemtest Ltd
Depot Road
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CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	21-43006-1		
Initial Date of Issue:	17-Dec-2021		
Client	Causeway Geotech Ltd		
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL		
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Michelle Gaffney Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen Watson Stuart Abraham Thomas McAllist		
Project	21-1298 BusConnects Galway		
Quotation No.:	Q21-25429	**Date Received:**	06-Dec-2021
Order No.:		**Date Instructed:**	08-Dec-2021
No. of Samples:	2		
Turnaround (Wkdays):	7	**Results Due:**	16-Dec-2021
Date Approved:	17-Dec-2021		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Leachate

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	21-43006	21-43006
Quotation No.: Q21-25429					**Chemtest Sample ID.:**	1334436	1334437
					Sample Location:	WS105	WS105
					Sample Type:	SOIL	SOIL
					Top Depth (m):	0.50	1.00
					Date Sampled:	30-Nov-2021	30-Nov-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**		
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	85	78
Chloride	U	1220	10:1	mg/l	1.0	< 1.0	1.0
Fluoride	U	1220	10:1	mg/l	0.050	0.23	0.38
Sulphate	U	1220	10:1	mg/l	1.0	< 1.0	2.1
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	2.0	0.67
Barium (Dissolved)	U	1455	10:1	µg/l	5.00	24	14
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11	0.81
Chromium (Dissolved)	U	1455	10:1	µg/l	0.50	0.52	1.3
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	8.3	6.4
Molybdenum (Dissolved)	U	1455	10:1	µg/l	0.20	1.0	4.4
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	0.73	0.70
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	7.6	31
Antimony (Dissolved)	U	1455	10:1	µg/l	0.50	1.0	1.2
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	0.83
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	6.3	14
Mercury Low Level	U	1460	10:1	µg/l	0.010	0.018	< 0.010
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	5.6	17
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030

Results - Soil

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				21-43006	21-43006
Quotation No.: Q21-25429	**Chemtest Sample ID.:**				1334436	1334437
	Sample Location:				WS105	WS105
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.50	1.00
	Date Sampled:				30-Nov-2021	30-Nov-2021
	Asbestos Lab:				DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	12	12
pH	M	2010		4.0	8.5	8.2
Arsenic	M	2450	mg/kg	1.0	10	12
Barium	M	2450	mg/kg	10	12	100
Cadmium	M	2450	mg/kg	0.10	0.47	0.94
Mercury Low Level	M	2450	mg/kg	0.05	< 0.05	0.13
Molybdenum	M	2450	mg/kg	2.0	< 2.0	< 2.0
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0
Copper	M	2450	mg/kg	0.50	5.1	18
Nickel	M	2450	mg/kg	0.50	10	12
Lead	M	2450	mg/kg	0.50	5.6	250
Selenium	M	2450	mg/kg	0.20	< 0.20	< 0.20
Zinc	M	2450	mg/kg	0.50	14	72
Chromium (Trivalent)	N	2490	mg/kg	1.0	11	10
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
LOI	M	2610	%	0.10	2.9	4.9
Total Organic Carbon	M	2625	%	0.20	< 0.20	0.60
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	6.8	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	52	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	59	< 5.0

Results - Soil

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		21-43006	21-43006
Quotation No.: Q21-25429			**Chemtest Sample ID.:**		1334436	1334437
			Sample Location:		WS105	WS105
			Sample Type:		SOIL	SOIL
			Top Depth (m):		0.50	1.00
			Date Sampled:		30-Nov-2021	30-Nov-2021
			Asbestos Lab:		DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	59	< 10
Dichlorodifluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Vinyl Chloride	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trichlorofluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trans 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
cis 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromochloromethane	N	2760	µg/kg	0.50	< 0.50	< 0.50
Trichloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,1-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tetrachloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Benzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0
1,2-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Dibromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromodichloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
cis-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Toluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,2-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tetrachloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3-Dichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Dibromochloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dibromoethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,1,2-Tetrachloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Ethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0
m & p-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0
o-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20

Results - Soil

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43006	21-43006
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1334436	1334437
				Sample Location:	WS105	WS105
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	30-Nov-2021	30-Nov-2021
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0
Styrene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tribromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Isopropylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,3-Trichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
N-Propylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
2-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3,5-Trimethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
4-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tert-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,4-Trimethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Sec-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
4-Isopropyltoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,4-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
N-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dibromo-3-Chloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,4-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Hexachlorobutadiene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,3-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	N	2760	µg/kg	0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0
N-Nitrosodimethylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050
Phenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Chlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis-(2-Chloroethyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,3-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,4-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,2-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis(2-Chloroisopropyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachloroethane	N	2790	mg/kg	0.050	< 0.050	< 0.050
N-Nitrosodi-n-propylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Nitrobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Isophorone	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050

Results - Soil

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43006	21-43006
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1334436	1334437
				Sample Location:	WS105	WS105
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	30-Nov-2021	30-Nov-2021
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
2,4-Dimethylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis(2-Chloroethoxy)Methane	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4-Dichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,2,4-Trichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Naphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Chloroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorobutadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Chloro-3-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methylnaphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorocyclopentadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4,6-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4,5-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Chloronaphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Acenaphthylene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Dimethylphthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,6-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Acenaphthene	N	2790	mg/kg	0.050	< 0.050	0.079
3-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Dibenzofuran	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Chlorophenylphenylether	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Fluorene	N	2790	mg/kg	0.050	< 0.050	0.079
Diethyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Azobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Bromophenylphenyl Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Pentachlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Phenanthrene	N	2790	mg/kg	0.050	0.25	0.66
Anthracene	N	2790	mg/kg	0.050	0.13	0.24
Carbazole	N	2790	mg/kg	0.050	< 0.050	< 0.050
Di-N-Butyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Fluoranthene	N	2790	mg/kg	0.050	0.91	2.1
Pyrene	N	2790	mg/kg	0.050	0.73	1.6
Butylbenzyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[a]anthracene	N	2790	mg/kg	0.050	0.48	0.96
Chrysene	N	2790	mg/kg	0.050	0.45	0.87

Results - Soil

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43006	21-43006
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1334436	1334437
				Sample Location:	WS105	WS105
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	30-Nov-2021	30-Nov-2021
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Di-N-Octyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[b]fluoranthene	N	2790	mg/kg	0.050	0.58	1.1
Benzo[k]fluoranthene	N	2790	mg/kg	0.050	0.23	0.36
Benzo[a]pyrene	N	2790	mg/kg	0.050	0.46	0.71
Indeno(1,2,3-c,d)Pyrene	N	2790	mg/kg	0.050	0.23	0.36
Dibenz(a,h)Anthracene	N	2790	mg/kg	0.050	0.10	0.13
Benzo[g,h,i]perylene	N	2790	mg/kg	0.050	0.27	0.43
4-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	6.1
Anthracene	M	2800	mg/kg	0.10	< 0.10	2.4
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	12
Pyrene	M	2800	mg/kg	0.10	< 0.10	8.8
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	5.8
Chrysene	M	2800	mg/kg	0.10	< 0.10	4.1
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	5.0
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	2.5
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	3.6
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	50
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10	< 0.10
SVOC TIC	N	2790	mg/kg	N/A	None Detected	None Detected
VOC TIC	N	2760	µg/kg	N/A	None Detected	None Detected

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS

Test Methods

SOP	Title	Parameters included	Method summary
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	21-43198-1		
Initial Date of Issue:	16-Dec-2021		
Client	Causeway Geotech Ltd		
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL		
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Michelle Gaffney Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen Watson Stuart Abraham Thomas McAllist		
Project	21-1298 Bus Connects Galway		
Quotation No.:	Q21-25429	**Date Received:**	07-Dec-2021
Order No.:		**Date Instructed:**	08-Dec-2021
No. of Samples:	3		
Turnaround (Wkdays):	7	**Results Due:**	16-Dec-2021
Date Approved:	16-Dec-2021		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Leachate

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	21-43198	21-43198	21-43198
Quotation No.: Q21-25429					**Chemtest Sample ID.:**	1335242	1335246	1335248
Order No.:					Client Sample Ref.:	2	1	3
					Sample Location:	BH104	BH105A	BH105A
					Sample Type:	SOIL	SOIL	SOIL
					Top Depth (m):	0.50	0.50	1.50
					Date Sampled:	06-Dec-2021	06-Dec-2021	06-Dec-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	65	62	61
Chloride	U	1220	10:1	mg/l	1.0	1.9	1.3	1.8
Fluoride	U	1220	10:1	mg/l	0.050	0.48	0.25	0.22
Sulphate	U	1220	10:1	mg/l	1.0	11	5.1	6.8
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	1.3	5.4	12
Barium (Dissolved)	U	1455	10:1	µg/l	5.00	5.1	12	7.4
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11	< 0.11	< 0.11
Chromium (Dissolved)	U	1455	10:1	µg/l	0.50	0.87	0.62	0.82
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	2.7	15	36
Molybdenum (Dissolved)	U	1455	10:1	µg/l	0.20	9.7	2.1	1.9
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	0.74	< 0.50	< 0.50
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	0.78	0.96	1.1
Antimony (Dissolved)	U	1455	10:1	µg/l	0.50	1.2	1.0	1.0
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	6.3	0.53	0.63
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	< 2.5	11	12
Mercury Low Level	U	1460	10:1	µg/l	0.010	< 0.010	0.017	0.076
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	4.9	4.8	6.0
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43198	21-43198	21-43198
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1335242	1335246	1335248
Order No.:				Client Sample Ref.:	2	1	3
				Sample Location:	BH104	BH105A	BH105A
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	0.50	1.50
				Date Sampled:	06-Dec-2021	06-Dec-2021	06-Dec-2021
				Asbestos Lab:	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type	U	2192		N/A	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	3.0	4.3	9.8
pH	M	2010		4.0	8.8	8.4	8.7
Arsenic	M	2450	mg/kg	1.0	12	21	8.2
Barium	M	2450	mg/kg	10	70	50	27
Cadmium	M	2450	mg/kg	0.10	4.0	0.49	0.27
Mercury Low Level	M	2450	mg/kg	0.05	1.2	0.69	0.40
Molybdenum	M	2450	mg/kg	2.0	< 2.0	2.1	< 2.0
Antimony	N	2450	mg/kg	2.0	2.1	< 2.0	< 2.0
Copper	M	2450	mg/kg	0.50	200	14	7.9
Nickel	M	2450	mg/kg	0.50	8.9	13	7.8
Lead	M	2450	mg/kg	0.50	82	37	20
Selenium	M	2450	mg/kg	0.20	< 0.20	1.1	0.82
Zinc	M	2450	mg/kg	0.50	850	41	20
Chromium (Trivalent)	N	2490	mg/kg	1.0	12	11	5.7
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
LOI	M	2610	%	0.10	3.0	4.3	4.1
Total Organic Carbon	M	2625	%	0.20	1.8	2.5	2.0
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43198	21-43198	21-43198
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1335242	1335246	1335248
Order No.:				Client Sample Ref.:	2	1	3
				Sample Location:	BH104	BH105A	BH105A
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	0.50	1.50
				Date Sampled:	06-Dec-2021	06-Dec-2021	06-Dec-2021
				Asbestos Lab:	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10
Dichlorodifluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Chloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Vinyl Chloride	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Bromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Chloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Trichlorofluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,1-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Trans 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,1-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
cis 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Bromochloromethane	N	2760	µg/kg	0.50	< 0.50	< 0.50	< 0.50
Trichloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,1,1-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Tetrachloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,1-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Benzene	N	2760	µg/kg	0.20	1.4	< 0.20	< 0.20
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Trichloroethene	N	2760	µg/kg	0.20	2.5	< 0.20	1.3
1,2-Dichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Dibromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Bromodichloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
cis-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Toluene	N	2760	µg/kg	0.20	3.1	1.7	2.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,1,2-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Tetrachloroethene	N	2760	µg/kg	0.20	15	11	6.7
1,3-Dichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Dibromochloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,2-Dibromoethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Chlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,1,1,2-Tetrachloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Ethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43198	21-43198	21-43198
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1335242	1335246	1335248
Order No.:				Client Sample Ref.:	2	1	3
				Sample Location:	BH104	BH105A	BH105A
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	0.50	1.50
				Date Sampled:	06-Dec-2021	06-Dec-2021	06-Dec-2021
				Asbestos Lab:	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Styrene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Tribromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Isopropylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Bromobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,2,3-Trichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
N-Propylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
2-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,3,5-Trimethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
4-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Tert-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,2,4-Trimethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Sec-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,3-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
4-Isopropyltoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,4-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
N-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,2-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,2-Dibromo-3-Chloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,2,4-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Hexachlorobutadiene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
1,2,3-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
N-Nitrosodimethylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Phenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
2-Chlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Bis-(2-Chloroethyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
1,3-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
1,4-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
1,2-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
2-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Bis(2-Chloroisopropyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Hexachloroethane	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
N-Nitrosodi-n-propylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
4-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43198	21-43198	21-43198
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1335242	1335246	1335248
Order No.:				Client Sample Ref.:	2	1	3
				Sample Location:	BH104	BH105A	BH105A
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	0.50	1.50
				Date Sampled:	06-Dec-2021	06-Dec-2021	06-Dec-2021
				Asbestos Lab:	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Nitrobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Isophorone	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
2-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
2,4-Dimethylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Bis(2-Chloroethoxy)Methane	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
2,4-Dichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
1,2,4-Trichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Naphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
4-Chloroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Hexachlorobutadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
4-Chloro-3-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
2-Methylnaphthalene	N	2790	mg/kg	0.050	< 0.050	0.063	< 0.050
Hexachlorocyclopentadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
2,4,6-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
2,4,5-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
2-Chloronaphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
2-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Acenaphthylene	N	2790	mg/kg	0.050	< 0.050	0.073	< 0.050
Dimethylphthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
2,6-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Acenaphthene	N	2790	mg/kg	0.050	< 0.050	0.094	< 0.050
3-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Dibenzofuran	N	2790	mg/kg	0.050	< 0.050	0.052	< 0.050
4-Chlorophenylphenylether	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
2,4-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Fluorene	N	2790	mg/kg	0.050	< 0.050	0.12	< 0.050
Diethyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
4-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Azobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
4-Bromophenylphenyl Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Hexachlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Pentachlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Phenanthrene	N	2790	mg/kg	0.050	< 0.050	0.94	0.29
Anthracene	N	2790	mg/kg	0.050	< 0.050	0.36	0.10
Carbazole	N	2790	mg/kg	0.050	< 0.050	0.073	< 0.050
Di-N-Butyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Fluoranthene	N	2790	mg/kg	0.050	0.082	2.1	0.64

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43198	21-43198	21-43198
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1335242	1335246	1335248
Order No.:				Client Sample Ref.:	2	1	3
				Sample Location:	BH104	BH105A	BH105A
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	0.50	1.50
				Date Sampled:	06-Dec-2021	06-Dec-2021	06-Dec-2021
				Asbestos Lab:	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Pyrene	N	2790	mg/kg	0.050	0.093	1.6	0.53
Butylbenzyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Benzo[a]anthracene	N	2790	mg/kg	0.050	< 0.050	1.1	0.37
Chrysene	N	2790	mg/kg	0.050	< 0.050	1.0	0.39
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Di-N-Octyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Benzo[b]fluoranthene	N	2790	mg/kg	0.050	0.093	1.3	0.47
Benzo[k]fluoranthene	N	2790	mg/kg	0.050	< 0.050	0.46	0.17
Benzo[a]pyrene	N	2790	mg/kg	0.050	< 0.050	1.0	0.34
Indeno(1,2,3-c,d)Pyrene	N	2790	mg/kg	0.050	< 0.050	0.53	0.18
Dibenz(a,h)Anthracene	N	2790	mg/kg	0.050	< 0.050	0.13	0.055
Benzo[g,h,i]perylene	N	2790	mg/kg	0.050	< 0.050	0.64	0.22
4-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.15
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	0.13
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.14
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	1.0	0.97
Anthracene	M	2800	mg/kg	0.10	< 0.10	0.37	0.34
Fluoranthene	M	2800	mg/kg	0.10	0.31	2.3	2.2
Pyrene	M	2800	mg/kg	0.10	0.34	1.8	1.8
Benzo[a]anthracene	M	2800	mg/kg	0.10	0.23	1.6	1.2
Chrysene	M	2800	mg/kg	0.10	0.20	1.3	1.1
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	0.39	2.0	1.7
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.22	0.77	0.75
Benzo[a]pyrene	M	2800	mg/kg	0.10	0.33	1.5	1.4
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	1.1	0.97
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	0.31	0.21
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	0.90	0.78
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	2.0	15	14
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43198	21-43198	21-43198
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1335242	1335246	1335248
Order No.:				Client Sample Ref.:	2	1	3
				Sample Location:	BH104	BH105A	BH105A
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	0.50	1.50
				Date Sampled:	06-Dec-2021	06-Dec-2021	06-Dec-2021
				Asbestos Lab:	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10	< 0.10	< 0.10
SVOC TIC	N	2790	mg/kg	N/A	None Detected	None Detected	None Detected
VOC TIC	N	2760	µg/kg	N/A	None Detected	None Detected	None Detected

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS

Test Methods

SOP	Title	Parameters included	Method summary
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

2183

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	21-43771-1
Initial Date of Issue:	23-Dec-2021
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Michelle Gaffney Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen Watson Stuart Abraham Thomas McAllist
Project	21-1298 BusConnects Galway

Quotation No.:	Q21-25429	**Date Received:**	10-Dec-2021
Order No.:		**Date Instructed:**	14-Dec-2021
No. of Samples:	1		
Turnaround (Wkdays):	7	**Results Due:**	22-Dec-2021
Date Approved:	23-Dec-2021		

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Leachate

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	21-43771
Quotation No.: Q21-25429					**Chemtest Sample ID.:**	1337966
Order No.:					Client Sample Ref.:	1
					Sample Location:	BH106
					Sample Type:	SOIL
					Top Depth (m):	0.50
					Date Sampled:	06-Dec-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**	
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	39
Chloride	U	1220	10:1	mg/l	1.0	< 1.0
Fluoride	U	1220	10:1	mg/l	0.050	0.11
Sulphate	U	1220	10:1	mg/l	1.0	4.6
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	0.72
Barium (Dissolved)	U	1455	10:1	µg/l	5.00	< 5.0
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11
Chromium (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	1.2
Molybdenum (Dissolved)	U	1455	10:1	µg/l	0.20	2.1
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Antimony (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	< 2.5
Mercury Low Level	U	1460	10:1	µg/l	0.010	< 0.010
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	3.0
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030

Results - Soil

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43771
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1337966
Order No.:				Client Sample Ref.:	1
				Sample Location:	BH106
				Sample Type:	SOIL
				Top Depth (m):	0.50
				Date Sampled:	06-Dec-2021
				Asbestos Lab:	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
ACM Type	U	2192		N/A	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected
Moisture	N	2030	%	0.020	6.5
pH	M	2010		4.0	8.3
Arsenic	M	2450	mg/kg	1.0	7.1
Barium	M	2450	mg/kg	10	57
Cadmium	M	2450	mg/kg	0.10	0.62
Mercury Low Level	M	2450	mg/kg	0.05	0.18
Molybdenum	M	2450	mg/kg	2.0	< 2.0
Antimony	N	2450	mg/kg	2.0	< 2.0
Copper	M	2450	mg/kg	0.50	30
Nickel	M	2450	mg/kg	0.50	15
Lead	M	2450	mg/kg	0.50	29
Selenium	M	2450	mg/kg	0.20	< 0.20
Zinc	M	2450	mg/kg	0.50	37
Chromium (Trivalent)	N	2490	mg/kg	1.0	25
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50
LOI	M	2610	%	0.10	4.0
Total Organic Carbon	M	2625	%	0.20	1.7
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10	11
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	11
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	11
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	77
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0

Results - Soil

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	21-43771
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1337966
Order No.:				Client Sample Ref.:	1
				Sample Location:	BH106
				Sample Type:	SOIL
				Top Depth (m):	0.50
				Date Sampled:	06-Dec-2021
				Asbestos Lab:	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	77
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	87
Benzene	M	2760	µg/kg	1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0
Naphthalene	M	2800	mg/kg	0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	0.14
Anthracene	M	2800	mg/kg	0.10	0.11
Fluoranthene	M	2800	mg/kg	0.10	0.31
Pyrene	M	2800	mg/kg	0.10	0.34
Benzo[a]anthracene	M	2800	mg/kg	0.10	0.34
Chrysene	M	2800	mg/kg	0.10	0.23
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	0.37
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.29
Benzo[a]pyrene	M	2800	mg/kg	0.10	0.34
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.35
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	0.23
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.31
Coronene	N	2800	mg/kg	0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	3.4
PCB 28	U	2815	mg/kg	0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.

Test Methods

SOP	Title	Parameters included	Method summary
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

UKAS TESTING 2183

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Eurofins Chemtest Ltd
Depot Road
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CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-01488-1		
Initial Date of Issue:	02-Feb-2022		
Client	Causeway Geotech Ltd		
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL		
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Michelle Gaffney Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen Watson Stuart Abraham Thomas McAllist		
Project	21-1298 Bus Connects Galway		
Quotation No.:	Q21-25429	**Date Received:**	18-Jan-2022
Order No.:		**Date Instructed:**	25-Jan-2022
No. of Samples:	2		
Turnaround (Wkdays):	7	**Results Due:**	02-Feb-2022
Date Approved:	02-Feb-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Leachate

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	22-01488	22-01488
Quotation No.: Q21-25429					**Chemtest Sample ID.:**	1353352	1357450
Order No.:					Client Sample Ref.:	1	2
					Sample Location:	BH103	BH103
					Sample Type:	SOIL	SOIL
					Top Depth (m):	0.50	1.00
					Date Sampled:	17-Jan-2022	21-Jan-2022
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**		
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	46	42
Chloride	U	1220	10:1	mg/l	1.0	1.1	< 1.0
Fluoride	U	1220	10:1	mg/l	0.050	0.22	0.12
Sulphate	U	1220	10:1	mg/l	1.0	4.7	1.7
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	0.60	1.3
Barium (Dissolved)	U	1455	10:1	µg/l	5.00	< 5.0	< 5.0
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11	0.14
Chromium (Dissolved)	U	1455	10:1	µg/l	0.50	0.82	< 0.50
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	1.1	1.6
Molybdenum (Dissolved)	U	1455	10:1	µg/l	0.20	1.1	1.9
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	0.81
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	< 0.50
Antimony (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	< 0.50
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	1.2	< 0.50
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	< 2.5	< 2.5
Mercury Low Level	U	1460	10:1	µg/l	0.010	0.13	< 0.010
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	2.1	3.8
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				22-01488	22-01488
Quotation No.: Q21-25429	**Chemtest Sample ID.:**				1353352	1357450
Order No.:	Client Sample Ref.:				1	2
	Sample Location:				BH103	BH103
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.50	1.00
	Date Sampled:				17-Jan-2022	21-Jan-2022
	Asbestos Lab:				DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	2.2	6.4
pH	M	2010		4.0	10.1	9.4
Arsenic	M	2450	mg/kg	1.0	15	16
Barium	M	2450	mg/kg	10	20	35
Cadmium	M	2450	mg/kg	0.10	0.40	0.60
Mercury Low Level	M	2450	mg/kg	0.05	< 0.05	0.13
Molybdenum	M	2450	mg/kg	2.0	< 2.0	< 2.0
Antimony	N	2450	mg/kg	2.0	3.2	< 2.0
Copper	M	2450	mg/kg	0.50	10	12
Nickel	M	2450	mg/kg	0.50	18	17
Lead	M	2450	mg/kg	0.50	9.0	20
Selenium	M	2450	mg/kg	0.20	1.2	< 0.20
Zinc	M	2450	mg/kg	0.50	13	37
Chromium (Trivalent)	N	2490	mg/kg	1.0	8.8	13
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
LOI	M	2610	%	0.10	1.1	1.3
Total Organic Carbon	M	2625	%	0.20	5.0	4.1
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10	79	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	79	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	79	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	170	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	22-01488	22-01488
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1353352	1357450
Order No.:				Client Sample Ref.:	1	2
				Sample Location:	BH103	BH103
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	17-Jan-2022	21-Jan-2022
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	170	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	250	< 10
Dichlorodifluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tetraethyl Lead	N	2760	µg/kg	10	< 10	< 10
Tetramethyl Lead	N	2760	µg/kg	10	< 10	< 10
Chloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Vinyl Chloride	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chloroethane	N	2760	µg/kg	0.20	< 0.20	1.1
Trichlorofluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trans 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
cis 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromochloromethane	N	2760	µg/kg	0.50	< 0.50	< 0.50
Trichloromethane	N	2760	µg/kg	0.20	5.4	8.9
1,1,1-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tetrachloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Benzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0
1,2-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Trichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Dibromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromodichloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
cis-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Toluene	N	2760	µg/kg	0.20	3.5	< 0.20
Toluene	M	2760	µg/kg	1.0	3.5	< 1.0
Trans-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,2-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tetrachloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3-Dichloropropane	N	2760	µg/kg	0.20	1.5	< 0.20
Dibromochloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dibromoethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Chlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,1,1,2-Tetrachloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Ethylbenzene	N	2760	µg/kg	0.20	1.2	< 0.20

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	22-01488	22-01488
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1353352	1357450
Order No.:				Client Sample Ref.:	1	2
				Sample Location:	BH103	BH103
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	17-Jan-2022	21-Jan-2022
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Ethylbenzene	M	2760	µg/kg	1.0	1.2	< 1.0
m & p-Xylene	N	2760	µg/kg	0.20	4.5	< 0.20
m & p-Xylene	M	2760	µg/kg	1.0	4.4	< 1.0
o-Xylene	N	2760	µg/kg	0.20	2.4	< 0.20
o-Xylene	M	2760	µg/kg	1.0	2.4	< 1.0
Styrene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tribromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20
Isopropylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Bromobenzene	N	2760	µg/kg	0.20	0.57	< 0.20
1,2,3-Trichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
N-Propylbenzene	N	2760	µg/kg	0.20	2.6	< 0.20
2-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3,5-Trimethylbenzene	N	2760	µg/kg	0.20	0.89	< 0.20
4-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Tert-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,4-Trimethylbenzene	N	2760	µg/kg	0.20	3.3	< 0.20
Sec-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,3-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
4-Isopropyltoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,4-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
N-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2-Dibromo-3-Chloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,4-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Hexachlorobutadiene	N	2760	µg/kg	0.20	< 0.20	< 0.20
1,2,3-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	N	2760	µg/kg	0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0
N-Nitrosodimethylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050
Phenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Chlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis-(2-Chloroethyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,3-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,4-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,2-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis(2-Chloroisopropyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachloroethane	N	2790	mg/kg	0.050	< 0.050	< 0.050

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	22-01488	22-01488
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1353352	1357450
Order No.:				Client Sample Ref.:	1	2
				Sample Location:	BH103	BH103
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	17-Jan-2022	21-Jan-2022
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
N-Nitrosodi-n-propylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Nitrobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Isophorone	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4-Dimethylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis(2-Chloroethoxy)Methane	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4-Dichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
1,2,4-Trichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Naphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Chloroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorobutadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Chloro-3-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methylnaphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorocyclopentadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4,6-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4,5-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Chloronaphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Acenaphthylene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Dimethylphthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,6-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Acenaphthene	N	2790	mg/kg	0.050	< 0.050	< 0.050
3-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
Dibenzofuran	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Chlorophenylphenylether	N	2790	mg/kg	0.050	< 0.050	< 0.050
2,4-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Fluorene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Diethyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Azobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Bromophenylphenyl Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050
Hexachlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Pentachlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Phenanthrene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Anthracene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Carbazole	N	2790	mg/kg	0.050	< 0.050	< 0.050

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	22-01488	22-01488
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1353352	1357450
Order No.:				Client Sample Ref.:	1	2
				Sample Location:	BH103	BH103
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	17-Jan-2022	21-Jan-2022
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Di-N-Butyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Fluoranthene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Pyrene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Butylbenzyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[a]anthracene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Chrysene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Di-N-Octyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[b]fluoranthene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[k]fluoranthene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[a]pyrene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Indeno(1,2,3-c,d)Pyrene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Dibenz(a,h)Anthracene	N	2790	mg/kg	0.050	< 0.050	< 0.050
Benzo[g,h,i]perylene	N	2790	mg/kg	0.050	< 0.050	< 0.050
4-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	0.16	0.13
Pyrene	M	2800	mg/kg	0.10	0.12	0.13
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Chrysene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	22-01488	22-01488
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1353352	1357450
Order No.:				Client Sample Ref.:	1	2
				Sample Location:	BH103	BH103
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.00
				Date Sampled:	17-Jan-2022	21-Jan-2022
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10	< 0.10
SVOC TIC	N	2790	mg/kg	N/A	None Detected	None Detected
VOC TIC	N	2760	µg/kg	N/A	None Detected	None Detected

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2730	Organo-Leads	Organo-Leads	Solvent extraction / GCMS detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS

Test Methods

SOP	Title	Parameters included	Method summary
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-02373-1		
Initial Date of Issue:	31-Jan-2022		
Client	Causeway Geotech Ltd		
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL		
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Michelle Gaffney Neil Haggan Paul Dunlop Sean Ross Stephen Franey Stephen Watson Stuart Abraham Thomas McAllist		
Project	21-1298 Bus Connects Galway		
Quotation No.:	Q21-25429	**Date Received:**	24-Jan-2022
Order No.:		**Date Instructed:**	25-Jan-2022
No. of Samples:	4		
Turnaround (Wkdays):	5	**Results Due:**	31-Jan-2022
Date Approved:	31-Jan-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Leachate

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**					22-02373	22-02373	22-02373	22-02373
Quotation No.: Q21-25429	**Chemtest Sample ID.:**					1357445	1357446	1357449	1357451
Order No.:	Client Sample Ref.:					1	2	1	3
	Sample Location:					WS104	WS104	BH103WS	BH103WS
	Sample Type:					SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.50	1.00	0.50	1.50
	Date Sampled:					21-Jan-2022	21-Jan-2022	21-Jan-2022	21-Jan-2022
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**				
Total Dissolved Solids	N	1020	10:1	mg/l	1.0	39	68	39	65
Chloride	U	1220	10:1	mg/l	1.0	< 1.0	1.1	< 1.0	1.7
Fluoride	U	1220	10:1	mg/l	0.050	0.17	0.11	0.21	0.20
Sulphate	U	1220	10:1	mg/l	1.0	2.8	< 1.0	4.1	2.8
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	1.2	2.3	0.50	2.3
Barium (Dissolved)	U	1455	10:1	µg/l	5.00	< 5.0	< 5.0	< 5.0	< 5.0
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.11	< 0.11	< 0.11	< 0.11	0.20
Chromium (Dissolved)	U	1455	10:1	µg/l	0.50	0.92	0.52	0.75	1.2
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	1.1	14	1.4	3.4
Molybdenum (Dissolved)	U	1455	10:1	µg/l	0.20	0.75	0.86	1.1	3.0
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	< 0.50	< 0.50	2.1
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	1.0	< 0.50	1.2
Antimony (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	< 0.50	< 0.50	0.52
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	< 0.50	0.93	2.3
Zinc (Dissolved)	U	1455	10:1	µg/l	2.5	< 2.5	< 2.5	< 2.5	< 2.5
Mercury Low Level	U	1460	10:1	µg/l	0.010	0.24	0.23	< 0.010	< 0.010
Dissolved Organic Carbon	U	1610	10:1	mg/l	2.0	4.3	11	< 2.0	9.0
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030	< 0.030

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	22-02373	22-02373	22-02373	22-02373
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1357445	1357446	1357449	1357451
Order No.:				Client Sample Ref.:	1	2	1	3
				Sample Location:	WS104	WS104	BH103WS	BH103WS
				Sample Type:	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	1.00	0.50	1.50
				Date Sampled:	21-Jan-2022	21-Jan-2022	21-Jan-2022	21-Jan-2022
				Asbestos Lab:	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
ACM Type	U	2192		N/A	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	0.25	6.9	1.5	5.9
pH	M	2010		4.0	9.3	8.6	9.9	8.9
Arsenic	M	2450	mg/kg	1.0	12	5.1	15	16
Barium	M	2450	mg/kg	10	19	12	17	15
Cadmium	M	2450	mg/kg	0.10	0.39	0.37	0.43	0.60
Mercury Low Level	M	2450	mg/kg	0.05	< 0.05	0.07	< 0.05	< 0.05
Molybdenum	M	2450	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Copper	M	2450	mg/kg	0.50	6.1	15	9.4	5.7
Nickel	M	2450	mg/kg	0.50	6.8	3.8	14	8.8
Lead	M	2450	mg/kg	0.50	15	12	7.6	6.6
Selenium	M	2450	mg/kg	0.20	< 0.20	< 0.20	0.99	< 0.20
Zinc	M	2450	mg/kg	0.50	8.2	8.8	11	9.1
Chromium (Trivalent)	N	2490	mg/kg	1.0	6.8	5.7	7.2	10
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
LOI	M	2610	%	0.10	0.93	2.0	0.88	0.74
Total Organic Carbon	M	2625	%	0.20	6.5	4.3	6.3	4.0
Mineral Oil (TPH Calculation)	N	2670	mg/kg	10	< 10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				22-02373	22-02373	22-02373	22-02373
Quotation No.: Q21-25429	**Chemtest Sample ID.:**				1357445	1357446	1357449	1357451
Order No.:	Client Sample Ref.:				1	2	1	3
	Sample Location:				WS104	WS104	BH103WS	BH103WS
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.50	1.00	0.50	1.50
	Date Sampled:				21-Jan-2022	21-Jan-2022	21-Jan-2022	21-Jan-2022
	Asbestos Lab:				NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10
Dichlorodifluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Tetraethyl Lead	N	2760	µg/kg	10	< 10	< 10	< 10	< 10
Tetramethyl Lead	N	2760	µg/kg	10	< 10	< 10	< 10	< 10
Chloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Vinyl Chloride	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Bromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Trichlorofluoromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,1-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Trans 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,1-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
cis 1,2-Dichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Bromochloromethane	N	2760	µg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Trichloromethane	N	2760	µg/kg	0.20	5.3	< 0.20	6.5	< 0.20
1,1,1-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Tetrachloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,1-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Benzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Trichloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,2-Dichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Dibromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Bromodichloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
cis-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Toluene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,1,2-Trichloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Tetrachloroethene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,3-Dichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Dibromochloromethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,2-Dibromoethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,1,1,2-Tetrachloroethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Ethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	22-02373	22-02373	22-02373	22-02373
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1357445	1357446	1357449	1357451
Order No.:				Client Sample Ref.:	1	2	1	3
				Sample Location:	WS104	WS104	BH103WS	BH103WS
				Sample Type:	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	1.00	0.50	1.50
				Date Sampled:	21-Jan-2022	21-Jan-2022	21-Jan-2022	21-Jan-2022
				Asbestos Lab:	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Tribromomethane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Isopropylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Bromobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,2,3-Trichloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
N-Propylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
2-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,3,5-Trimethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
4-Chlorotoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Tert-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,2,4-Trimethylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Sec-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,3-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
4-Isopropyltoluene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,4-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
N-Butylbenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,2-Dichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,2-Dibromo-3-Chloropropane	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,2,4-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Hexachlorobutadiene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,2,3-Trichlorobenzene	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	N	2760	µg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
N-Nitrosodimethylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Phenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
2-Chlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Bis-(2-Chloroethyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
1,3-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
1,4-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
1,2-Dichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
2-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Bis(2-Chloroisopropyl)Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Hexachloroethane	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	22-02373	22-02373	22-02373	22-02373
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1357445	1357446	1357449	1357451
Order No.:				Client Sample Ref.:	1	2	1	3
				Sample Location:	WS104	WS104	BH103WS	BH103WS
				Sample Type:	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	1.00	0.50	1.50
				Date Sampled:	21-Jan-2022	21-Jan-2022	21-Jan-2022	21-Jan-2022
				Asbestos Lab:	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
N-Nitrosodi-n-propylamine	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
4-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Nitrobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Isophorone	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
2-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
2,4-Dimethylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Bis(2-Chloroethoxy)Methane	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
2,4-Dichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
1,2,4-Trichlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Naphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
4-Chloroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Hexachlorobutadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
4-Chloro-3-Methylphenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
2-Methylnaphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Hexachlorocyclopentadiene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
2,4,6-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
2,4,5-Trichlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
2-Chloronaphthalene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
2-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Acenaphthylene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Dimethylphthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
2,6-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Acenaphthene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
3-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Dibenzofuran	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
4-Chlorophenylphenylether	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
2,4-Dinitrotoluene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Fluorene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Diethyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
4-Nitroaniline	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Azobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
4-Bromophenylphenyl Ether	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Hexachlorobenzene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Pentachlorophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Phenanthrene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Anthracene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Carbazole	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				22-02373	22-02373	22-02373	22-02373
Quotation No.: Q21-25429	**Chemtest Sample ID.:**				1357445	1357446	1357449	1357451
Order No.:	Client Sample Ref.:				1	2	1	3
	Sample Location:				WS104	WS104	BH103WS	BH103WS
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.50	1.00	0.50	1.50
	Date Sampled:				21-Jan-2022	21-Jan-2022	21-Jan-2022	21-Jan-2022
	Asbestos Lab:				NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Di-N-Butyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Fluoranthene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Pyrene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Butylbenzyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Benzo[a]anthracene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Chrysene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Di-N-Octyl Phthalate	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Benzo[b]fluoranthene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Benzo[k]fluoranthene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Benzo[a]pyrene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Indeno(1,2,3-c,d)Pyrene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Dibenz(a,h)Anthracene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Benzo[g,h,i]perylene	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
4-Nitrophenol	N	2790	mg/kg	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010

Results - Soil

Project: 21-1298 Bus Connects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	22-02373	22-02373	22-02373	22-02373
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1357445	1357446	1357449	1357451
Order No.:				Client Sample Ref.:	1	2	1	3
				Sample Location:	WS104	WS104	BH103WS	BH103WS
				Sample Type:	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	1.00	0.50	1.50
				Date Sampled:	21-Jan-2022	21-Jan-2022	21-Jan-2022	21-Jan-2022
				Asbestos Lab:	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
SVOC TIC	N	2790	mg/kg	N/A	None Detected	None Detected	None Detected	None Detected
VOC TIC	N	2760	µg/kg	N/A	None Detected	None Detected	None Detected	None Detected

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2730	Organo-Leads	Organo-Leads	Solvent extraction / GCMS detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS

Test Methods

SOP	Title	Parameters included	Method summary
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

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SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

UKAS TESTING
2183

eurofins
Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-03384-1		
Initial Date of Issue:	10-Feb-2022		
Client	Causeway Geotech Ltd		
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL		
Contact(s):	Sean Ross Carin Cornwall Colm Hurley Darren O'Mahony Gabriella Horan Joe Gervin John Cameron Lucy Newland Martin Gardiner Matthew Gilbert Michelle Gaffney Neil Haggan Patrick Higgins Paul Dunlop Stephen Franey Stephen Watson Stuart Abraham		
Project	21-1298 BusConnects Galway		
Quotation No.:	Q21-25429	**Date Received:**	31-Jan-2022
Order No.:		**Date Instructed:**	31-Jan-2022
No. of Samples:	6		
Turnaround (Wkdays):	10	**Results Due:**	11-Feb-2022
Date Approved:	10-Feb-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Water

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	22-03384	22-03384	22-03384	22-03384	22-03384	22-03384
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1362304	1362305	1362306	1362307	1362308	1362310
				Sample Location:	BH102	BH103WS	BH103	BH104	BH105	WS104
				Sample Type:	WATER	WATER	WATER	WATER	WATER	WATER
				Date Sampled:	27-Jan-2022	27-Jan-2022	27-Jan-2022	27-Jan-2022	27-Jan-2022	27-Jan-2022
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Suspended Solids At 105C	U	1030	mg/l	5.0	140	540	180	220	64	18
Total Dissolved Solids	N	1020	mg/l	1.0	380	530	530	7200	600	470
Biochemical Oxygen Demand Low Level	N	1090	mg O2/l	1.0	[B] < 1.0	[B] 1.1	[B] < 1.0	[B] 1.1	[B] < 1.0	[B] 3.4
Chemical Oxygen Demand	U	1100	mg O2/l	10	[B] 12	[B] 10	[B] < 10	[B] 57	[B] < 10	[B] < 10
Alkalinity (Total)	U	1220	mg/l	10	190	370	300	580	300	260
Chloride	U	1220	mg/l	1.0	36	46	66	3200	54	48
Ammoniacal Nitrogen	U	1220	mg/l	0.050	0.093	0.078	0.47	2.6	0.12	0.12
Nitrate	U	1220	mg/l	0.50	4.5	7.2	< 0.50	< 0.50	5.1	4.4
Phosphate	U	1220	mg/l	0.200	< 0.20	< 0.20	< 0.20	< 0.20	0.20	< 0.20
Sulphate	U	1220	mg/l	1.0	66	72	54	380	73	60
Calcium	U	1455	mg/l	2.00	130	49	160	170	93	97
Potassium	U	1455	mg/l	0.50	5.0	4.7	7.0	66	7.8	5.8
Magnesium	U	1455	mg/l	0.20	5.7	7.1	10	200	14	5.5
Sodium	U	1455	mg/l	1.50	22	140	45	1900	140	30
Arsenic (Dissolved)	U	1455	µg/l	0.20	2.9	0.86	19	87	4.4	0.50
Barium (Dissolved)	U	1455	µg/l	5.00	53	40	50	60	35	27
Cadmium (Dissolved)	U	1455	µg/l	0.11	0.70	4.8	1.1	0.13	2.0	0.54
Copper (Dissolved)	U	1455	µg/l	0.50	14	18	52	0.73	9.8	2.9
Iron (Dissolved)	N	1455	µg/l	5.0	2000	340	2800	110	180	6.7
Manganese (Dissolved)	U	1455	µg/l	0.50	250	27	1500	120	39	180
Molybdenum (Dissolved)	U	1455	µg/l	0.20	360	140	50	27	19	3.0
Nickel (Dissolved)	U	1455	µg/l	0.50	4.5	4.2	4.3	78	6.4	1.6
Lead (Dissolved)	U	1455	µg/l	0.50	13	7.5	32	< 0.50	4.3	0.76
Antimony (Dissolved)	U	1455	µg/l	0.50	4.8	0.79	1.2	9.2	1.3	0.72
Selenium (Dissolved)	U	1455	µg/l	0.50	5.6	29	< 0.50	1.2	13	3.0
Zinc (Dissolved)	U	1455	µg/l	2.5	41	55	150	7.1	41	7.5
Mercury Low Level	U	1460	µg/l	0.010	< 0.010	< 0.010	< 0.010	0.047	0.081	0.16
Low-Level Chromium (Hexavalent)	U	1495	µg/l	0.10	[B] 3.9	[B] 2.6	[B] 3.5	[B] 0.20	[B] < 0.10	[B] 2.1
Chromium (Trivalent) LL	U	1450	µg/l	1	3	< 1	< 1	2	1	< 1
Mineral Oil (TPH Calculation)	N	1670	µg/l	10	< 10	< 10	< 10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Water

Project: 21-1298 BusConnects Galway

Client: Causeway Geotech Ltd	**Chemtest Job No.:**				22-03384	22-03384	22-03384	22-03384	22-03384	22-03384
Quotation No.: Q21-25429	**Chemtest Sample ID.:**				1362304	1362305	1362306	1362307	1362308	1362310
	Sample Location:				BH102	BH103WS	BH103	BH104	BH105	WS104
	Sample Type:				WATER	WATER	WATER	WATER	WATER	WATER
	Date Sampled:				27-Jan-2022	27-Jan-2022	27-Jan-2022	27-Jan-2022	27-Jan-2022	27-Jan-2022
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10	< 10	< 10	< 10	< 10
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10	< 10	< 10	< 10	< 10
Organolead Compounds	N	1730	µg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1362304			BH102	27-Jan-2022	B	Coloured Winchester 1000ml
1362304			BH102	27-Jan-2022	B	EPA Vial 40ml
1362304			BH102	27-Jan-2022	B	Plastic Bottle 1000ml
1362305			BH103WS	27-Jan-2022	B	Coloured Winchester 1000ml
1362305			BH103WS	27-Jan-2022	B	EPA Vial 40ml
1362305			BH103WS	27-Jan-2022	B	Plastic Bottle 1000ml
1362306			BH103	27-Jan-2022	B	Coloured Winchester 1000ml
1362306			BH103	27-Jan-2022	B	EPA Vial 40ml
1362306			BH103	27-Jan-2022	B	Plastic Bottle 1000ml
1362307			BH104	27-Jan-2022	B	Coloured Winchester 1000ml
1362307			BH104	27-Jan-2022	B	EPA Vial 40ml
1362307			BH104	27-Jan-2022	B	Plastic Bottle 1000ml
1362308			BH105	27-Jan-2022	B	Coloured Winchester 1000ml
1362308			BH105	27-Jan-2022	B	EPA Vial 40ml
1362308			BH105	27-Jan-2022	B	Plastic Bottle 1000ml
1362310			WS104	27-Jan-2022	B	Coloured Winchester 1000ml
1362310			WS104	27-Jan-2022	B	EPA Vial 40ml
1362310			WS104	27-Jan-2022	B	Plastic Bottle 1000ml

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1030	Total Suspended Solids	Total suspended solids	Filtration of a mixed sample through a standard glass fibre filter and determination of the mass of residue retained dried at 105°C.
1090	Biochemical Oxygen Demand	Biochemical Oxygen demand (BOD)	Colorimetric determination of dissolved oxygen in seeded sample after 5 days incubation at 20°C.
1100	Chemical Oxygen Demand	Chemical Oxygen demand (COD)	Dichromate oxidation of organic matter in sample followed by colorimetric determination of residual Cr[VI].
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1495	Low Level Hexavalent Chromium in Waters	Chromium [VI]	Colorimetric determination of hexavalent chromium expressed as Cr (VI) µg/l in water, using Ion Chromatography and UV-visible spectrophotometry.
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1730	Organo-Leads	Organo-Leads	Solvent extraction / GCMS detection
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.

Report Information

Key	
U	UKAS accredited
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N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
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All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

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Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

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A - Date of sampling not supplied
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customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

2183

Final Report

Report No.: 22-03745-1

Initial Date of Issue: 15-Feb-2022

Client Causeway Geotech Ltd

Client Address:
8 Drumahiskey Road
Balnamore
Ballymoney
County Antrim
BT53 7QL

Contact(s):
Carin Cornwall
Colm Hurley
Darren O'Mahony
Gabriella Horan
Joe Gervin
John Cameron
Lucy Newland
Martin Gardiner
Matthew Gilbert
Michelle Gaffney
Neil Haggan
Paul Dunlop
Sean Ross
Stephen Franey
Stephen Watson
Stuart Abraham
Thomas McAllist

Project 21-1296 BusConnects Galway

Quotation No.: Q21-25429

Date Received: 02-Feb-2022

Order No.:

Date Instructed: 02-Feb-2022

No. of Samples: 2

Turnaround (Wkdays): 10

Results Due: 15-Feb-2022

Date Approved: 15-Feb-2022

Approved By:

Details: Stuart Henderson, Technical Manager

Results - Water

Project: 21-1296 BusConnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	22-03745	22-03745
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1364157	1364158
Order No.:				Client Sample Ref.:	1	1
				Sample Location:	SW1	SW2
				Sample Type:	WATER	WATER
				Top Depth (m):	0.00	0.00
				Date Sampled:	31-Jan-2022	31-Jan-2022
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Suspended Solids At 105C	U	1030	mg/l	5.0	550	55
Total Dissolved Solids	N	1020	mg/l	1.0	380	5500
Biochemical Oxygen Demand Low Level	N	1090	mg O2/l	1.0	18	4.0
Chemical Oxygen Demand	U	1100	mg O2/l	10	66	91
Alkalinity (Total)	U	1220	mg/l	10	230	200
Chloride	U	1220	mg/l	1.0	50	2600
Ammoniacal Nitrogen	U	1220	mg/l	0.050	0.44	0.14
Nitrate	U	1220	mg/l	0.50	5.4	1.7
Phosphate	U	1220	mg/l	0.200	0.40	< 0.20
Sulphate	U	1220	mg/l	1.0	58	410
Calcium	U	1455	mg/l	2.00	84	120
Potassium	U	1455	mg/l	0.50	3.8	51
Magnesium	U	1455	mg/l	0.20	5.3	160
Sodium	U	1455	mg/l	1.50	32	1800
Arsenic (Dissolved)	U	1455	µg/l	0.20	0.70	0.50
Barium (Dissolved)	U	1455	µg/l	5.00	20	18
Cadmium (Dissolved)	U	1455	µg/l	0.11	0.14	< 0.11
Copper (Dissolved)	U	1455	µg/l	0.50	3.7	4.8
Iron (Dissolved)	N	1455	µg/l	5.0	42	< 5.0
Manganese (Dissolved)	U	1455	µg/l	0.50	38	6.8
Molybdenum (Dissolved)	U	1455	µg/l	0.20	7.9	7.7
Nickel (Dissolved)	U	1455	µg/l	0.50	9.3	1.1
Lead (Dissolved)	U	1455	µg/l	0.50	2.3	< 0.50
Antimony (Dissolved)	U	1455	µg/l	0.50	1.8	0.65
Selenium (Dissolved)	U	1455	µg/l	0.50	1.4	1.5
Zinc (Dissolved)	U	1455	µg/l	2.5	190	14
Mercury Low Level	U	1460	µg/l	0.010	< 0.010	< 0.010
Low-Level Chromium (Hexavalent)	U	1495	µg/l	0.10	< 0.10	< 0.10
Chromium (Trivalent) LL	U	1450	µg/l	1	2	13
Mineral Oil (TPH Calculation)	N	1670	µg/l	10	< 10	< 10
Aliphatic TPH >C5-C6	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0

Results - Water

Project: 21-1296 BusConnects Galway

Client: Causeway Geotech Ltd				**Chemtest Job No.:**	22-03745	22-03745
Quotation No.: Q21-25429				**Chemtest Sample ID.:**	1364157	1364158
Order No.:				Client Sample Ref.:	1	1
				Sample Location:	SW1	SW2
				Sample Type:	WATER	WATER
				Top Depth (m):	0.00	0.00
				Date Sampled:	31-Jan-2022	31-Jan-2022
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Aromatic TPH >C5-C7	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10
Organolead Compounds	N	1730	µg/l	0.050	< 0.050	< 0.050

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1030	Total Suspended Solids	Total suspended solids	Filtration of a mixed sample through a standard glass fibre filter and determination of the mass of residue retained dried at 105°C.
1090	Biochemical Oxygen Demand	Biochemical Oxygen demand (BOD)	Colorimetric determination of dissolved oxygen in seeded sample after 5 days incubation at 20°C.
1100	Chemical Oxygen Demand	Chemical Oxygen demand (COD)	Dichromate oxidation of organic matter in sample followed by colorimetric determination of residual Cr[VI].
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using ‘Aquakem 600’ Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1495	Low Level Hexavalent Chromium in Waters	Chromium [VI]	Colorimetric determination of hexavalent chromium expressed as Cr (VI) µg/l in water, using Ion Chromatography and UV-visible spectrophotometry.
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1730	Organo-Leads	Organo-Leads	Solvent extraction / GCMS detection
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

CAUSEWAY
GEOTECH

APPENDIX G

SPT HAMMER ENERGY MEASUREMENT REPORT

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Southern Testing
Unit 11
Charlwood Road
East Grinstead
West Sussex
RH19 2HU

SPT Hammer Ref: 0200
Test Date: 27/02/2021
Report Date: 01/03/2021
File Name: 0200.spt
Test Operator: NPB

Instrumented Rod Data

Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.3
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	6458
Accelerometer No.2:	9607

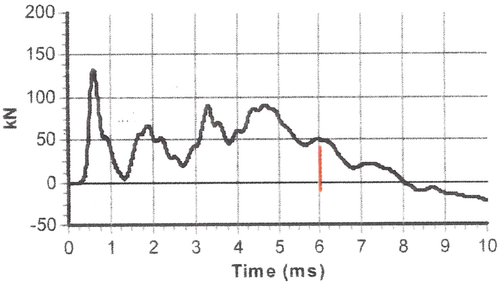
SPT Hammer Information

Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	11.0

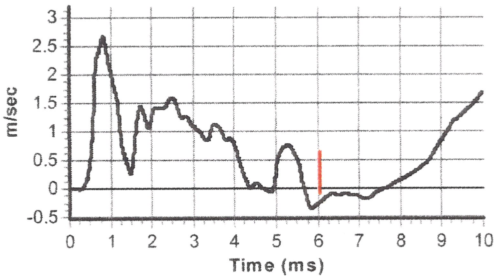
Comments / Location

BALLYMONEY

Force



Velocity



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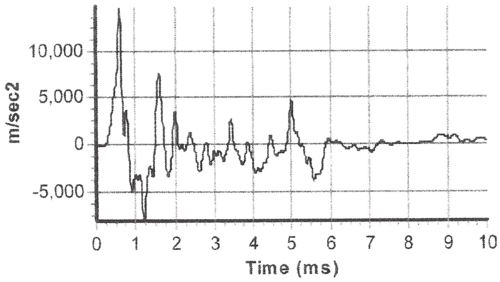
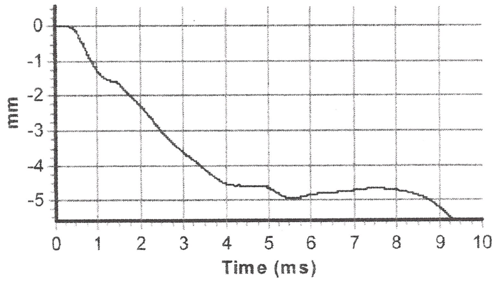


Displacement



Calculations

Area of Rod A (mm2):	944
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	282
Energy Ratio E_r (%):	**60**

NPBurrows

Signed: N P Burrows
Title: Field Operations Manager

The recommended calibration interval is 12 months

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SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Southern Testing
Unit 11
Charlwood Road
East Grinstead
West Sussex
RH19 2HU

SPT Hammer Ref:	T7
Test Date:	27/02/2021
Report Date:	01/03/2021
File Name:	T7.spt
Test Operator:	NPB

Instrumented Rod Data

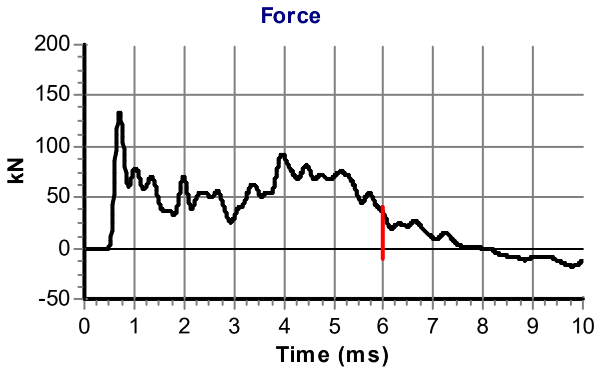
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.3
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	6458
Accelerometer No.2:	9607

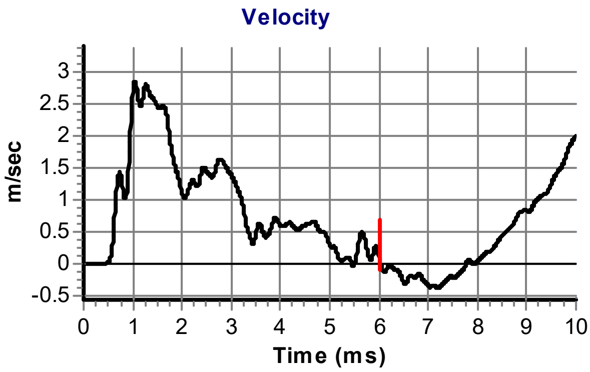
SPT Hammer Information

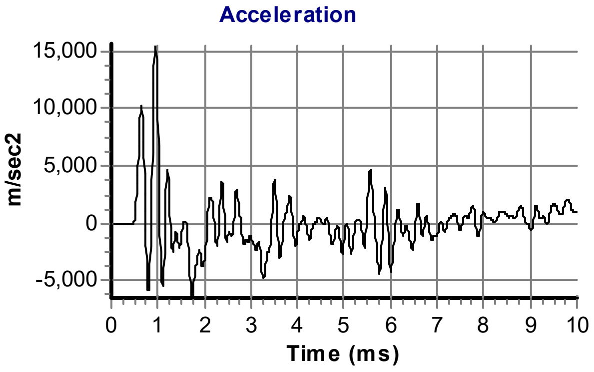
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	11.0

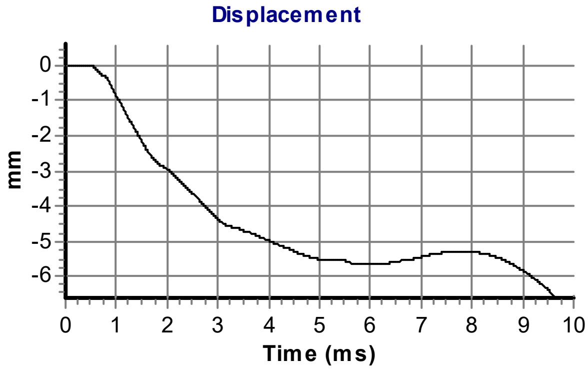
Comments / Location

CHARLWOODS









Calculations

Area of Rod A (mm2):	944
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	330

Energy Ratio E_r (%): 70

N P Burrows

Signed: N P Burrows
Title: Field Operations Manager

The recommended calibration interval is 12 months

Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Dynamic sampling
Unit 8
Victory parkway
Victory rd
Derby
DE24 8ZF

Hammer Ref:	D114
Test Date:	20/07/2021
Report Date:	20/04/2021
File Name:	D114.spt
Test Operator:	AP

Instrumented Rod Data

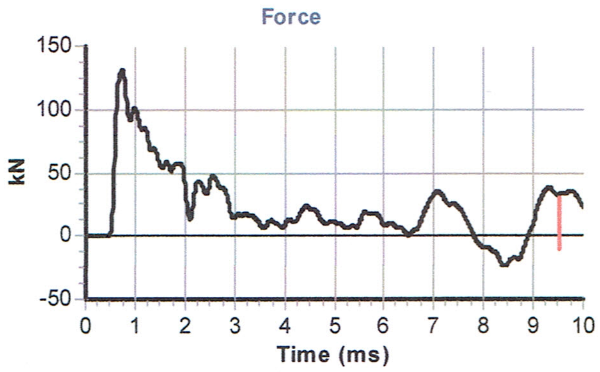
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	62901
Accelerometer No.2:	62902

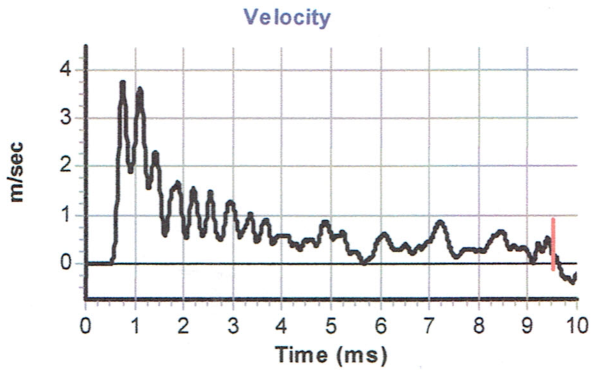
Hammer Information

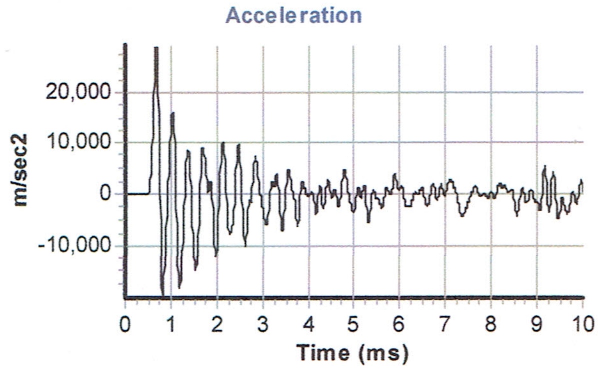
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
String Length L (m):	15.0

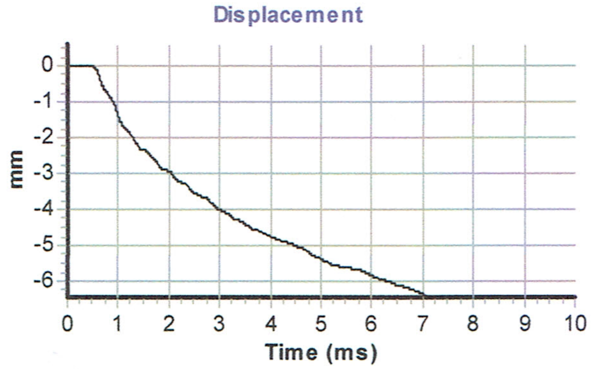
Comments / Location

Drillwell hammer tested at Dynamic samplings yard.


Force


Velocity


Acceleration


Displacement

Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	325

Energy Ratio E_r (%): **69**

Signed: A.parker
Title: Associate Director

The recommended calibration interval is 12 months

Geospatial certainty you can trust murphygs.com

Seismic, ERT and GPR Survey Report

Project Name – Bus connect Galway Geophysical Survey

Project Number – 43796

Client – Arup Consulting Engineers

Company Profile

- Over 30 Years in Business
- Eleven offices over Europe
- Over 30 varieties of surveys
- ISO 9001, ISO 14001 & OHSAS18001 registered
- Over 200 highly qualified and experienced staff
- Experience all over the globe
- Latest and most advanced technologies
- Highly skilled, qualified and experienced personnel

Overview

Established in 1983, Murphy Geospatial is committed to providing world class survey solutions cost-effectively, through a combination of highly qualified personnel and the most cutting-edge technological equipment available. With our substantial experience and client-centred approach, we thoroughly understand the challenges faced by our clientele, and currently offer more than thirty varieties of survey that are customizable to meet any requirement. We understand the importance of keeping costs to a minimum in the current climate; our ongoing investments in the latest technologies allow us to provide the most efficient surveying solutions that cut costs and risks for clients across a vast range of industries. As a result, we are widely recognized as one of the most experienced, professional, innovative and technically proficient surveying companies in the UK and Ireland today.

We work with clients across the globe, operating from our offices throughout the UK and Ireland mainly. The foundation of our success is based upon stringent quality control, reliability, efficient turnaround times and effectiveness to provide superior customer service at all times. This is reflected in our long-term relationships with our clients.

Associations and Accreditations

Document Register

Rev	Date	Prepared by	Role	Checked by	Role	Revision Reason
00	09/12/2021	Romaric Limacher/Bláthnaid McKevitt	Geophysicists	Dáire Conlon	Operations Manager	First issues

Table of Contents

Table of figures

1. Introduction

1.1 Terms of Reference

Location:	**College Road, Galway, Co. Galway**
Client:	**Arup**
Survey Date start:	**14/11/2021**

This document is the technical report for this investigation; it therefore supersedes any previous reports whether written or oral.

1.2 Background/Purpose of Investigation

Murphy Geospatial was requested to carry out a geophysical survey on behalf of Arup Consulting Engineers Galway. The purpose of this geophysical survey is to obtain information on the materials in the subsurface to aid in the environmental impact assessment for the BusConnects Galway transport scheme.

1.3 Objective of project

The main objectives of the survey are to determine the soil and rock types, depths to interfaces of materials and irregularities in the materials, and also provide information on the possible contamination in the area using the following non-intrusive survey techniques:

- Seismic refraction
- Electrical resistivity tomography

As the main investigative techniques used are largely non-destructive, the findings given in this report are based on indirect measurements and the interpretation of seismic and resistivity signals. The findings represent the best professional opinions of the authors, based on our experience and the results carried out elsewhere on similar materials and projects.

1.4 Site aerial view

Figure 1 - Aerial view of the surveyed site. In yellow, the area covered by the GPR survey (GPR101). Seismic and ERT lines are in blue (GP101 to 104).

1.5 Key personnel

Project Manager:	**Daire Conlon** *Responsible for the management of the project overall*
Project Coordinator:	**Aidan Doherty** *Responsible for scheduling and coordinating site works.*
Office Processing Manager:	**Zuzana Knotkova** *Responsible for processing and quality assessment of data.*
Head Geophysicist:	**Sophie Mann** *Supervision and quality assessment of geophysical data and results*
Geophysicist:	**Romaric Limacher** *Daily Task briefings, toolbox talks, signing and guarding on site and management of daily activities. Responsible for acquisition, processing and interpretation of seismic, resistivity and GPR data*
Lead Surveyor:	**Maxim Barbos** *Daily Task briefings, toolbox talks, signing and guarding on site and management of daily activities. Responsible for the utility survey and the acquisition of GPR, seismic and resistivity data.*
Geophysicist:	**Bláthnaid McKevitt** *Responsible for the processing and interpretation of seismic, resistivity and GPR data*
Surveyor:	**Ion Turcan** *Responsible for the utility survey and the acquisition of GPR, seismic and resistivity data.*
Safety Advisor:	**Dermot Guiney** *Responsible for safety inductions (internal requirements only), site visitations and advising on safe-working practices; and for environment-related tasks and issues in conjunction with the Environmental Advisor.*

1.6 Specifications and International Standards

All survey works were carried out in accordance with the following guidelines and standards:

- European GPR Association - Policy on the Use of GPR in Utility Detection
- American Society of Civil Engineers- Standard Guideline for the collection and depiction of existing subsurface utility data.
- Radio detection- abc & xyz of locating buried pipes and cables.
- PAS128: 2014 – Publicly Available Specification 128 2014
- British Standards BS5930:2015 +A2:2010'Code of Practice for Site Investigations'

2. Survey Report

2.1 Survey Restrictions

None. The survey was done at night for limiting traffic noise on seismic data.

2.2 Field Data Survey

The survey was carried out in ITM OSGM 15 coordinate system. All levels are related to Malin Head Datum.

Results from the three geophysical methods (Seismic refraction and ERT) are presented in the accompanying Cad drawing. Results are overlaid on the acquired topographical information.

2.3 Traffic Management

In agreement with the owner of the hotel-restaurant, one side of the parking space was blocked to traffic in order to record Line 4/GP101 on the night from Monday the 15th November (evening) to Tuesday the 16th of November (morning). (See Figure 2).

Figure 2 - The red ellipse delimits the blocked access to the parking space.

2.4 Methodology

Seismic Refraction

The names given by the client to the lines are respectively:

- GP101
- GP102
- GP103
- GP104

They have been recorded as Line 1, 2, 3, 4 and 5, the last line being a reshoot of line 2.

All seismic lines have a different geophone spacing for fitting the dimensions of the investigated field, delimited by natural obstacles like walls, bushes and roads.

Line	Direction of Acquisition	Type	Client’s Line Name	Line Length
L1	North-East➔South-West	Refraction	GP104	46m
L2	North-East➔South-West	Refraction	GP103	57.5m
L3	North-East➔South-West	Refraction	GP102	23m
L4	North-West➔South-East	Refraction	GP101	217.5m
L5	North-East➔South-West	Refraction	GP103	46m

Table 1 - Recap of Lines respective names and lengths

Lines 1, 2, 3 and 5 are all made of a single section of 24 geophones.

Line 4 is made of multiple sections which, when assembled, make a line of a total length of about 220m.

The achievable depth of investigation is theoretically proportional to the length of a section. Therefore, the longer a section, the deeper the depth of investigation. As the client requested to reach 30m investigation depth, the solution is then to have the longest spread. However, this solution poses 2 problems:

1. Several lines (GP102, 103 and 104) are delimited by natural barriers like walls, bushes, etc. preventing the extension of the section. For this reason, it has not been possible to reach the required investigation depth for these lines.
2. Lengthening a section requires increasing the spacing between geophones, which itself means reducing the lateral resolution.

In this second case, and for GP101, techniques from marine geophysics have been used for having the maximum possible investigation depth by making fewer compromises with resolution. For this line, investigation depth has naturally been limited by the presence of weathered bedrock (and not by the seismic section length), by keeping at the same time the advantages of a 2m lateral resolution.

Here is a summary of the lateral resolution for each line:

Line	Client's Line Name	Line Length	Lateral resolution	Approx. Max. depth
L1	GP104	46 m	2m	12 m
L2	GP103	57.5 m	2.5m	14m
L3	GP102	23 m	1m	5 m
L4	GP101	217.5 m	2m	14 m
L5	GP103	46 m	2m	11 m

Table 2 - Recap of seismic refraction lines respective length, resolution, and maximum investigation depth.

Post site processing took place in Kilcullen office, using the specialized software ZonST2D. Several processing stages were involved, including trigger time correction for each shot, inclusion of topography, and merging sections to virtually recreate the lines.

A 10 kg hammer hitting a plate was used as a seismic source. The source locations were at geophones 1, 6, 12, 18 and 24, and where possible (i.e., if there is no obstruction), off-shots were taken at either end of the lines, at a certain distance from geophones 1 and 24 (distances varying with the presence of natural obstacles). Each shot was stacked at least 4 times.

In instances where seismic lines were crossing a road (L4/GP 101 and L2/GP103), geophones were either:

- planted 50cm~1m before after the planned position. This position change was later considered during processing in office.
- Placed on tripods (see Figure 3)

Each solution had a negligible effect on the final seismic inversion results.

Figure 3 - Geophone on tripod and unplanted/deactivated electrodes on a line crossing an asphalt pathway.

The seismic dataset of L3/GP102 is very clean. Despite having been recorded at night, the rest of the seismic dataset is very noisy. It has been affected (sometimes severely) by the following sources of noise:

- Occasional traffic noise (each line), which was handled either by redoing the shot, or waiting for the vehicle to pass.
- The wind (especially L4/GP101) moving the branches of nearby trees and bushes, and generating vibrations recorded by the geophones
- Rain/drizzle (all lines except L3/GP102), which droplets hit the geophones during the acquisition.

However, after processing, inversion results from the seismic data displayed features which are consistent with ERT inversion features. L4/GP101 is the best example for proving that the noise in the dataset has been properly handled, as both methods constantly shared similar features over their entire length (see Figure 4)

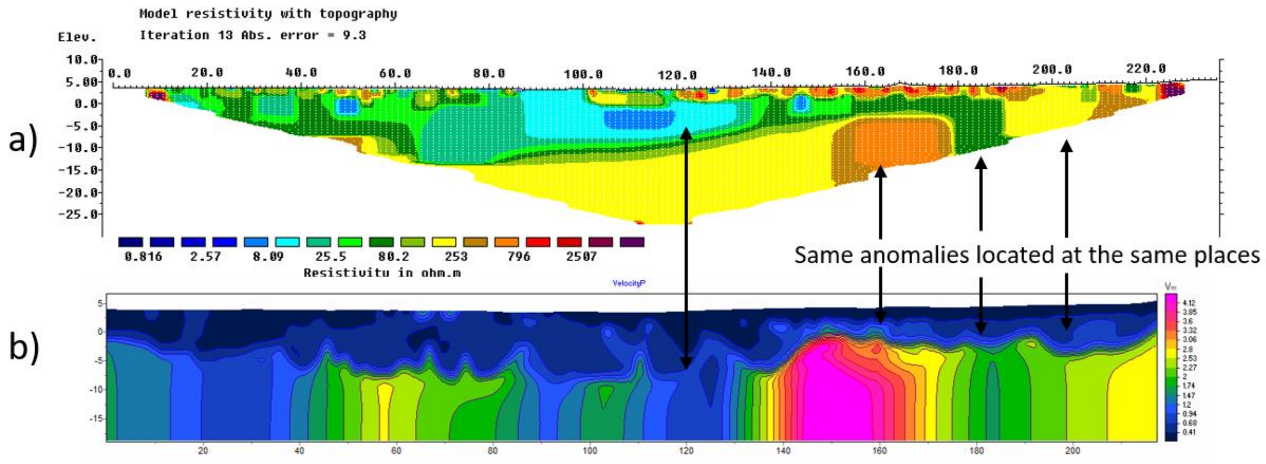


Figure 4 – a) On top, the resistivity section. b) At the bottom, the seismic section. High ad low resistivity anomalies match high and low velocity anomalies, confirming the consistency of both datasets.

Once the raw data was processed, overburden type and thickness, geological features and individual targets were identified on each survey line and mapped out over the survey areas. The seismic results are displayed in AutoCAD.

Resistivity

Unlike seismic refraction, resistivity has not been affected by noise. It has even benefited from the rain as it improved the contact resistance for each single section. In general, the resistivity dataset is very clean and of good quality.

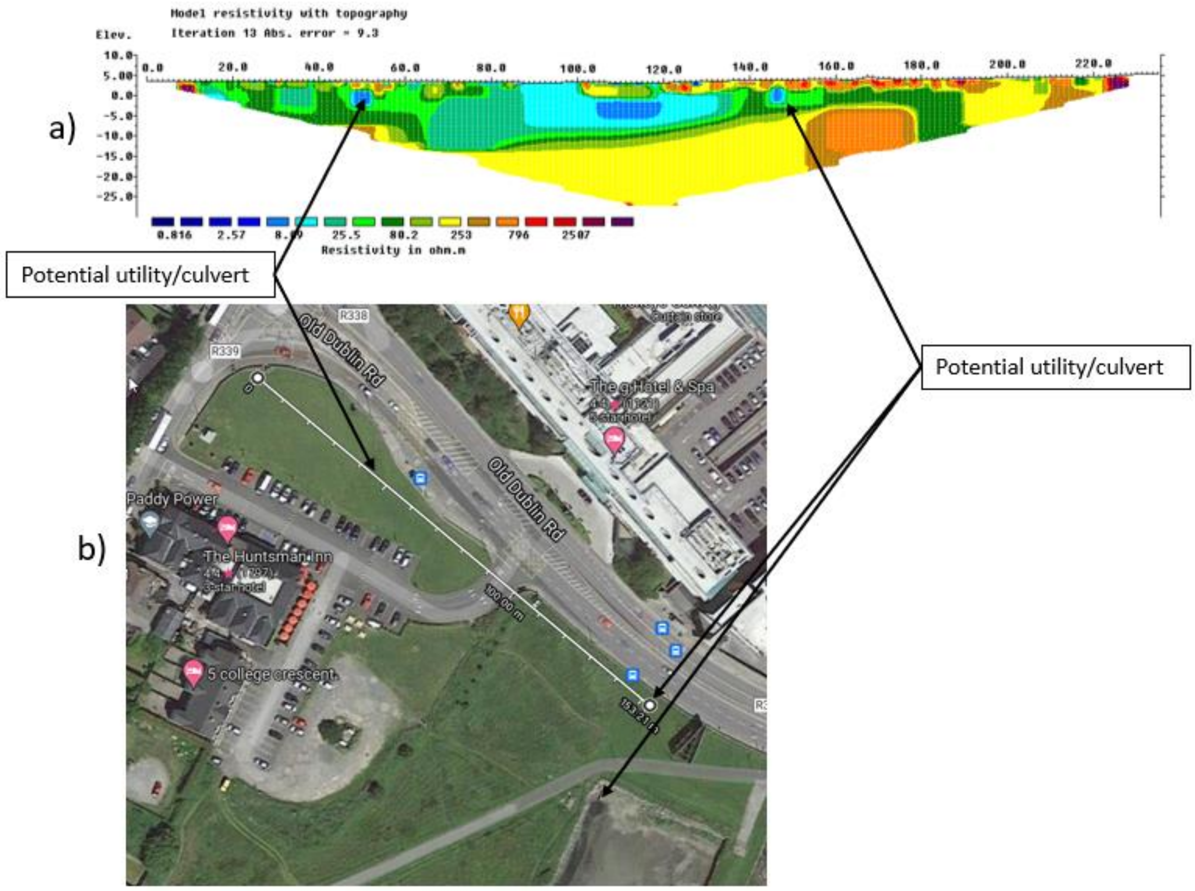


Figure 5 - The quality of the resistivity dataset is such that even potential culverts/utilities have been spotted on the dataset with the lowest spatial resolution (i.e. 2.5m). Positions on this map are only approximate. (Source of the Map: Google Map).

As was the case in the seismic survey:

- L1/GP104, L2-L5/GP103 and L3/GP102 had their respective lengths delimited by natural obstacles met on the field.
- Survey geometry from marine geophysics has been used with L4/GP101 for meeting both targets of 30m depth and lateral resolution of 2.5m.

Here is a summary of all resistivity lines recorded along seismic lines:

Line	Direction of Acquisition	Type	Client's Line Name
L1	North-East➔South-West	ERT	GP104
L2	North-East➔South-West	ERT	GP103
L3	North-East➔South-West	ERT	GP102
L4	North-West➔South-East	ERT	GP101
L5	North-East➔South-West	ERT	GP103

Table 3 - Recap of all resistivity lines recorded on this survey

Unlike seismic, where electrodes could not be planted (like on asphalt road/pathway in Figure 3), electrodes had to be de-activated, as was the case on both L4/GP101 and L2/GP103.

While L4 was minimally affected by the issue, up to 40% of the dataset was missing on L2/GP103 due to electrode deactivation (60 readings were missing out of a total of 155). For this reason, resistivity dataset from line 2 are not exploitable. It has then been agreed with the client to move this line further East: this second line has been recorded as L5.

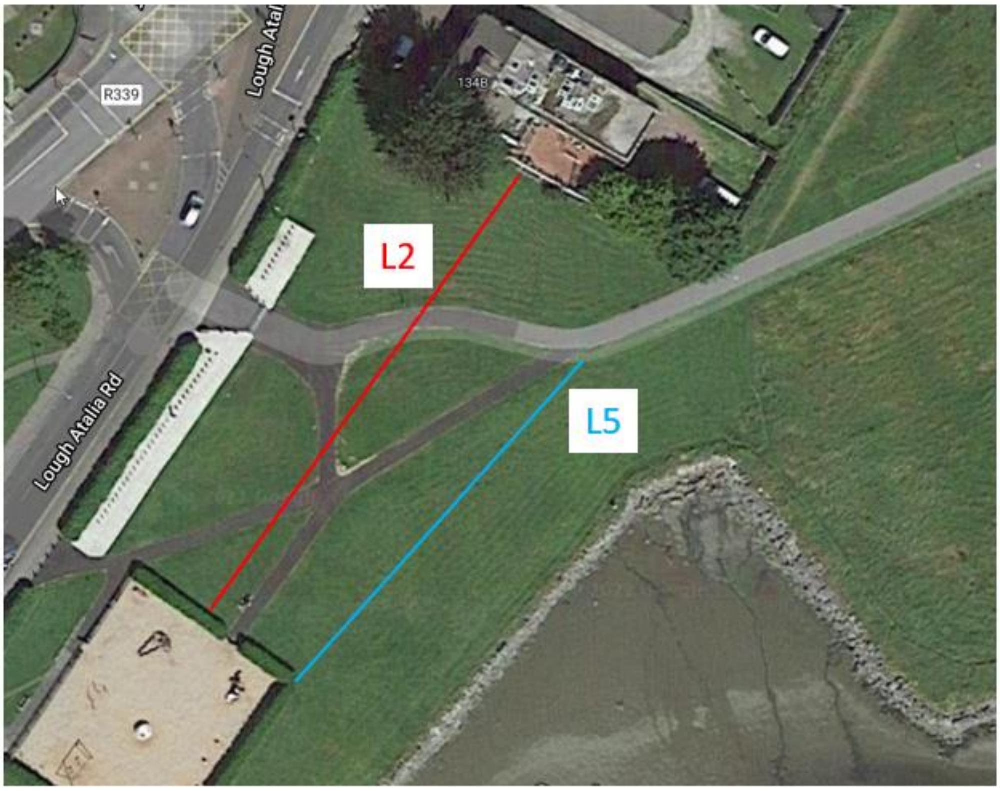


Figure 6 - In red, the initial Line 2 from the project plan, missing 40% of the dataset because it crosses asphalt 3 times. In blue, the new line not affected by the asphalt crossroads. (Source of the Map: Google Map)

Finally, as discussed in the precedent 'Seismic Refraction' paragraph, section length is theoretically related to maximum investigation depth; this is also the case with ERT surveys. For this reason, it was only physically possible (in other terms, having recording sections long enough) to reach the required 30m maximum depth with line GP101/L4.

Line	Client's Line Name	Total line length	Approx. Max. Depth	Lateral resolution
L1	GP104	46 m	5 m	2 m
L2	GP103	62 m	7 m	2 m
L3	GP102	62 m	4 m	1 m
L4	GP101	235 m	30 m	2.5 m
L5	GP103	54m	7 m	2 m

Table 4 - List of ERT lines, their respective length and lateral resolution.

Post site processing then took place in Kilcullen office, using the specialized software Res2DInv. Processing stages involved combination of roll-along sections, topography inclusion and inversion.

2.5 Equipment Used

Geode seismic recording equipment, 24 Geophones

Allied Tigre 64 resistivity metre

GSSI Utility Scan DF

GPS, Total Station

2.6 Surveyors and Geophysicists Involved

Romaric Limacher, Maxim Barbos, Ion Turcan

2.7 Works Programme

Site Works Commenced on **14/11/2021**

Delivery of Final Results – **09/12/2021**

2.8 Software Used for Processing

ZondST2D, Res2DInv, AutoCAD 2018, AutoCAD Civil 3D

2.9 Quality Assurance Site Procedures

Equipment used was calibrated and tested in line with manufacturer guidelines.

Calibration certificates can be provided on request. Distance & angle checks were carried out on site regularly.

2.10 Geology

The geology map from Geological Survey Ireland (GSI) indicates that the bedrock geology in the survey area is pale grey clean skeletal limestone from the Lower Carboniferous (Figure 7). The bedrock geology is part of the Burren Formation.

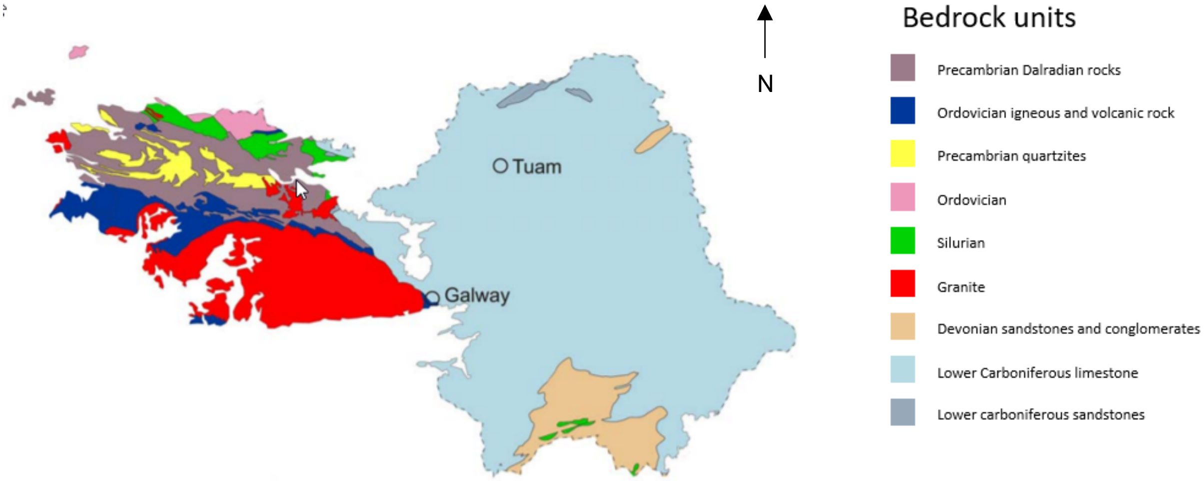


Figure 7 – A geological map of County Galway (source: www.geoschool .com)

Quaternary Sediments in the survey area are listed as being Urban for most of the survey area, with Esturine silts and clays present in south and east. Till derived from limestones area also present in the eastern most part of the survey area (Figure 8)

Groundwater vulnerability is classified as being high in the north of the survey area (in the approximate locations of lines 3 and 4) and as being moderate in the southern part of the survey area (in the approximate locations of lines 1, 2, and 5).

Figure 8 - Map of Quaternary sediments in the survey area (source: www.gsi.ie)

2.11 Findings

As the main investigative technique used is largely non-destructive, the findings given in this report are based on indirect measurements, and the interpretation of both ERT and seismic measurements. The findings represent the best professional opinions of the authors, based on our experience and the results of non-intrusive surveys carried out elsewhere on similar materials and projects.

Data Collection

A Geode seismograph was used with 24x14Hz vertical geophones.

A 10kg hammer and plate were used as a source for seismic acquisition.

ERT acquisition was run alongside the seismic lines at the same time, by an acquisition fully controlled by a field computer. Contact resistances were of good quality (as already mentioned in '2.4-Methodology').

The consistency between ERT and seismic inversions (see Figure 4) prove that the overall quality of the dataset is good.

Seismic Refraction

Seismic refraction is based on the first wave arrivals. At near offsets, the first arrivals are related to the direct wave, which travels in the most superficial layer.

The deeper, more consolidated layer is a rock/layer, and the higher the velocity; consequently, at far offsets, the first arrivals are related to the deeper layers.

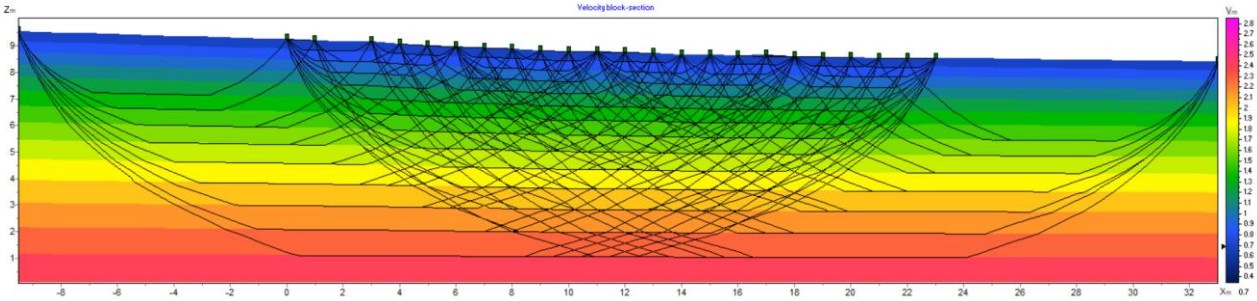
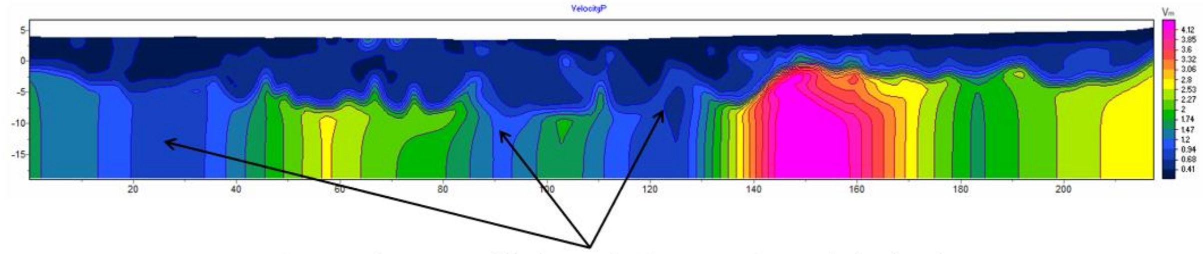


Figure 9 – In black, example of first arrivals trajectories in a representative geological environment, where gradually compacted geological layers lead to gradually increasing velocities.

As discussed previously, the maximum theoretical depth is dependent of the section length. For example, with 46m long sections, a theoretical depth of about 15m is initially expected. On the field, the investigation depth is limited by the bedrock, which sends back all the refracted energy. The maximum investigation depth of each line has been listed on Table 2.

As the purpose of the survey is more environmental than geotechnical, inversion parameters have been set up for improving the detection of low velocity zones, suspected to be sediments not fully saturated with water.



Inversion artefacts caused by low velocity zones above the bedrock

Figure 10 - Inversion artefacts caused by Low velocity sediments above the bedrock. These artifacts have been used for improving the localization of these zones, at the expense of the delineation of the bedrock.

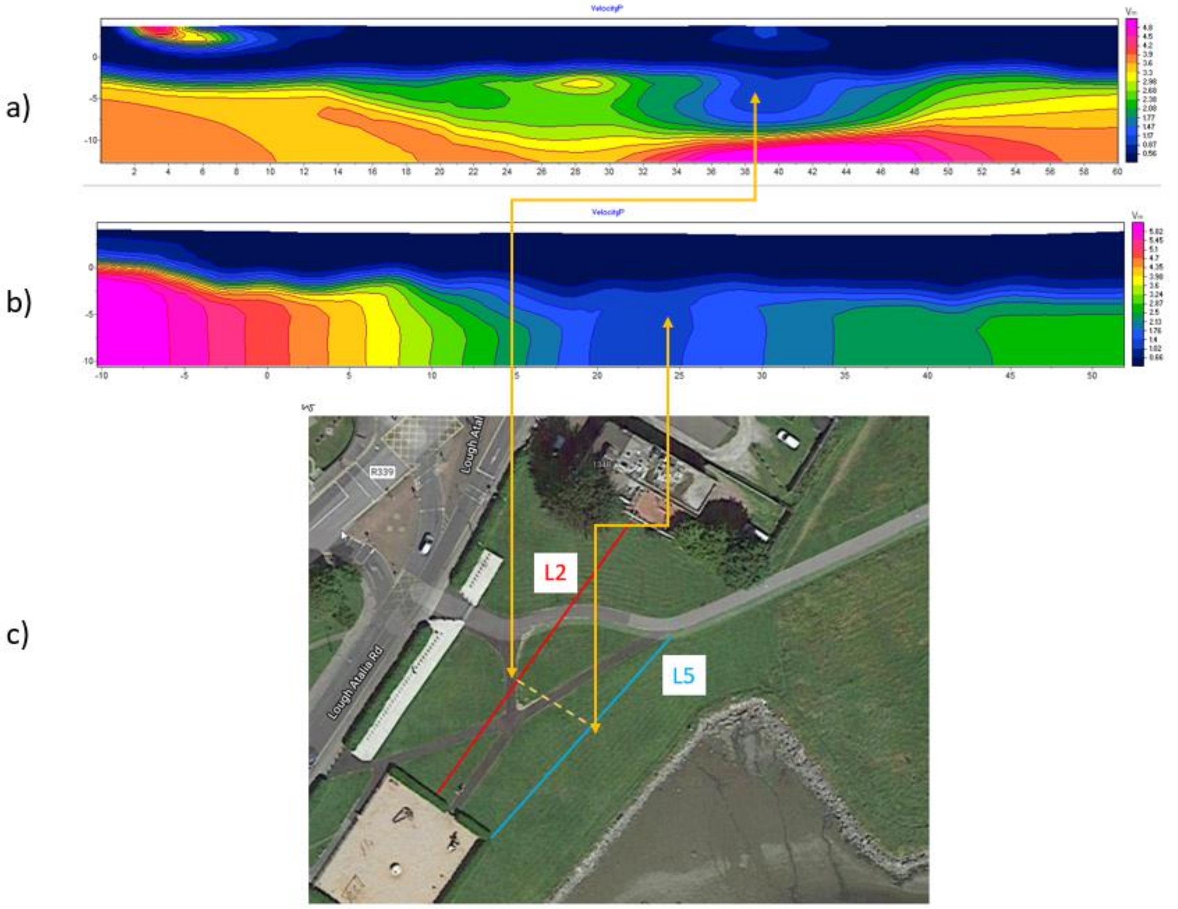


Figure 11 - Another example of low velocity anomaly seen on both L2 (inversion section a) and L5(inversion section b), which seem to consistently align when looking on a map (c).

Other features observed on seismic inversion by-products have also been consistently spotted at the same locations.

Electrical Resistivity Tomography

The most robust configuration is Wenner-Alpha, which has a poor lateral resolution, and would therefore not be fit for detecting lateral variations or buried objects. Wenner-Beta has then been selected to get a good compromise between horizontal and vertical velocity, at the expense of both maximal depth (from 12m with Wenner-Alpha to 8m with Wenner-Beta when using 32 electrodes) and recorded noise. As previously mentioned, the resistance contact was good over the site, and the overall quality of the resistivity dataset is good.

The resistivity data of L2 is non exploitable for reasons mentioned in Section 2.4. Its replacement by L5 solved the problem, with the low resistivity anomaly location matching the low velocity location of seismic inversions, as was observed on L4 (see Figure 4).

In general, the resistivity anomalies complement the observed seismic velocity anomalies well; this fact underlines the consistency of the geophysical dataset.

In relation to the detection of possible contamination in the survey area, the resistivity of the contaminated zone in comparison to the surroundings is dependent on the age of the contamination. As discussed by Shevnin et al., (2006), where the contamination of the soil is recent, high resistivity anomalies are created. However, when the contamination is aged (for example greater than four months) a low resistivity anomaly is caused (due to degradation).

In addition, environmental conditions of the survey area have an impact on whether or not contamination can be detected. Conditions such as the presence of clayish sediments, water, and buried objects, could interfere in the delineation of the contamination zone (Arrubarrena-Moreno et al., 2013).

Apart from line 1, no high resistivity anomalies were recorded on the dataset acquired on this survey. Meanwhile, on this site, the potential causes generating low resistivity records are:

- Higher water content
- Higher salinity in the ground than in mainland (proximity to Lough Atalia)
- Presence of clay
- Presence of contamination plume.

As there are 4 different potential scenarios for the same reading, it is not possible to delineate contamination zones in the area (if there is any).

For this reason, it is recommended to perform a geochemical survey in the area to detect possible contamination.

Further details about the combined interpretation of Seismic and resistivity are coming in the next paragraph ‘Interpretation’.

Interpretation

Three layers were observed in the obtained seismic refraction data. Overburden (made ground / peat), sandy gravelly clays and weathered limestone bedrock. These three layers can be clearly observed in the seismic refraction results from this survey. Lateral variations in seismic velocity may indicate that the degree of weathering varies in the survey area.

Resistivity results also show lateral variations along the profiles, these variations may indicate varying levels of water content in the survey area and variations in materials.

Three distinctive geological units were observed:

1) The first unit ranged in thickness from submeter to approx. 4.5 m. P-wave velocity (Vp) is in the range of 0.2-0.4 km/s. Electrical resistivity for this layer varied significantly along each survey line. Average electrical resistivity measurements were in the range of approx. 40 to 500 Ω.m, with anomalies of lower and higher resistivities also present. High resistivities in the near surface may be due to features on the surface, for example tarmac or trees, or features in the near surface such as utilities. Low resistivity anomalies may be due to clay pockets or areas with a higher water content (e.g. water utilities). This layer is interpreted as being made ground and overburden material (e.g. gravelly peat).

2) The second layer ranges in thickness between 2 – 11 m (thickest layer is observed along line 4). Vp is in the range of 0.4 – 1.4 km/s. Electrical resistivity for this layer is lower than the layer above (layer 1), with the exception of line 1. Electrical resistivity for this layer is in the range of 4 to 37 Ω.m, for lines 2 - 5. Based on these values this layer is being interpreted as being composed of sandy gravelly clays, with varying levels of water saturation. Resistivities for line 1 are between 90 – 500 Ω.m. The higher resistivities on line 1 suggest that the lithology in the subsurface may differ in comparison to the other four lines. The nature of this material is unclear however, the obtained values suggest the clay content/ water content is significantly lower along this line. Material could be manmade infilled material such as sandy gravelly material. This would account for the higher resistivity values.

3) The third unit is comprised of varying degrees of moderately to highly weathered limestone bedrock. Vp for this layer is >1.4 km/s. The depth achieved with ERT was shallower in comparison to seismics, due to this the third layer was not detected in several of the ERT profiles. On lines where this layer was detected with ERT, resistivity values were approx. 100 to 1500 Ω.m. Lateral variations in both Vp and electrical resistivity are observed for almost all profile (where bedrock was detected). A decrease in the velocity indicates a possible decrease in the strength of the rock / increase of fractures in the rock. Lower resistivity materials from upper layers can fill in these fractured/ weathered zones. In addition, weathering helps facilitate the infiltration of water. Therefore, these lateral variations are interpreted as being caused by varying degrees of weathering and / or water content.

Layer	Resistivity (Ω.m)	Seismic velocity (km/s)	Material Interpretation
1	40 - 500	0.2 – 0.4	Overburden (made ground / peat)
2	4 - 37	0.4 – 1.4	Sandy gravelly clay
4	100 - 1500	>1.4	moderately – highly weathered limestone bedrock

Table 5 - Interpretation Table

Line 1

Line 1 was acquired in the southwestern section of the survey area. The subsurface along this survey line is interpreted as consisting of materials with a lower clay and/or water content in comparison to the other surveyed lines. As mentioned above, the nature of the material is unclear. Based on the values it is interpreted as possible infill consisting of sandy gravel. In addition, lateral variations in resistivity are also observed on the profile. An area of high resistivity (approx. 460 – 1000 Ω.m) is observed between approx. 22 – 30 m along the survey line. This high resistivity area extends from the bottom of the profile to the near surface. The nature of this high resistivity is unclear. It is possible that this is an area of compact sand or is man-made material such as concrete from an old structure.

Line 2

The terrain constraints (i.e. tarmac pathways) present along this line, had an impact on the quality of the acquired results. As noted in section 2.4) Methodology, several electrodes were unable to be planted due to the pathways. This caused a loss of resolution in the data. Regardless of this, the obtained seismic and ERT profiles were compared, and a combined interpretation was made. The high resistivity anomalies observed in the near surface are possibly due to the presence of tarmac on the surface and/or gravel and cobbles in the near surface.

There is a decrease in the seismic velocities at approx. 36 to 46 m along the survey line. It is unclear if this is caused by a high velocity feature in the near surface which is impacting the inversion and creating this artefact or if this is a highly weathered area. Similarly, the high velocity anomaly observed between 2 and 8 m along the survey line is possibly an artefact from the inversion.

Line 3

Low resistivity anomalies (approx. 6- 16 Ω.m) are observed in the middle layer of this profile. The decrease of resistivity in this layer may be cause by an increase in water saturation and/or clay content.

A low velocity zone was observed in the resulting seismic inversion from this line. This indicates that an additional fourth layer may also be present along this line. This layer is between layers 1 and 2 and has Vp in the range of approx. 0.14 – 0.19 km/s. This may be an artefact of the inversion or may be caused by a slight change in the lithology or degree of compaction in comparison to the layers above and below.

Line 4

As was the cause in line 2, the presence of tarmac along this survey line prevented some electrodes being planted. This caused a loss of resolution in this area of the profile. This may account for the low resistivity zone observed on the profile between approx. 80 to 120 m. Additional low resistivity anomalies are observed on this profile, one located between approx. 30 – 40 m along the survey line, a second one at approx. 48 m and a third at approx. 145 m.

These anomalies may be due to an increase in water in these areas, for example, the presence of water-filled utilities, or clay pockets.

In the third layer, lateral variations are observed in both the seismic velocities and resistivity values. These lateral variations are interpreted as being due to varying degrees of weathering. As stated previously, seismic velocity decreases with increasing porosity / fracturing. Therefore, the decreases in velocity are interpreted as being caused by areas where the degree of weathering is higher in comparison the surrounding rock. The corresponding decrease in resistivity may be due to an increase in water content as weathering facilitates the infiltration of water or due to an infill of less resistive material.

Line 5

This line was acquired to the east of line 2, near the shore of the lough.

Low resistivities (3-10 Ω.m) are associated with the middle layer of materials along this line. These values may be due to water saturation in this layer.

Bedrock was not reached in the ERT profile however, in the seismic profile a lateral decrease in seismic velocity was observed at approx. 20 – 30 m. As was explained in relation to seismic profile for line 4, the decrease in velocity may be due to an increase in the degree of weathering in this area. The lower velocities may indicate a fracture zone / weaker zone in the bedrock or a channel of erosion.

Conclusion

The data collected from our ERT and Seismic refraction surveys has been affected by contact resistance (ERT), and from Seismic refraction is of good quality. A high quality and a full and accurate picture of the ground has been produced. Nonetheless, as for every indirect measurement, values are given with a 15% of error in average.

Soil and rock types in the survey area were delineated based on the acquired datasets. The thickness of each layer and depth to the interface of materials was able to be determined. The bedrock interface delineation has been slightly sacrificed to enhance the detection of higher water content areas. Despite this compromise, a good delineation has been reached between the weathered bedrock and its overburden. This enabled us to determine the depth to bedrock in the survey area. This objective of the survey was therefore achieved.

The environmental conditions did not permit to detect the potential presence of contamination. We recommend a geochemical survey be carried out in the survey area to detect possible contamination zones.

This report represents the best professional opinion of the authors. Every effort has been made to ensure that all results are accurate and reliable. As in any method of indirect measurement, these results depend upon the interpretation of the information received.

APPENDIX I Methodology

Seismic Refraction

Principle

Seismic method consists in imaging the earth by observing the propagation of seismic waves. To do so, regularly spaced geophones are laid on the surface of the ground along a straight line, before generating a seismic wave with a 10 to 15 kg sledgehammer and a plate.

Seismic energy is then divided between:

1) Reflected waves: between source and receiver, these waves will follow a path similar to the ones depicted in Figure 12, and followed by electromagnetic waves. The principle of a seismic reflection survey is shown in Figure 12. This type of wave is efficient for deep targets investigation, like in oil exploration, but cannot be used in this survey due to constraints inhere to Snell's Law.

2) Refracted waves: these waves follow a ray-path (shown Figure 13) which is governed by Snell's law. Travel-times of first arrivals are picked on records, and their numerical values are added or/and subtracted with first arrivals picked on different geophones or/and with different shots to deduce the velocity of the refractor in one hand, and the depth of the layer on the other.

3) Surface waves: generally, contain an average of 2/3 of the seismic energy, but might be non-existent in some cases, like water saturated peat over bedrock. This specific type of wave has a low attenuation horizontally, but a high attenuation with depth. Its velocity can be related to Shear Wave velocity, which can itself directly be related to the strength of, for example, an embankment.

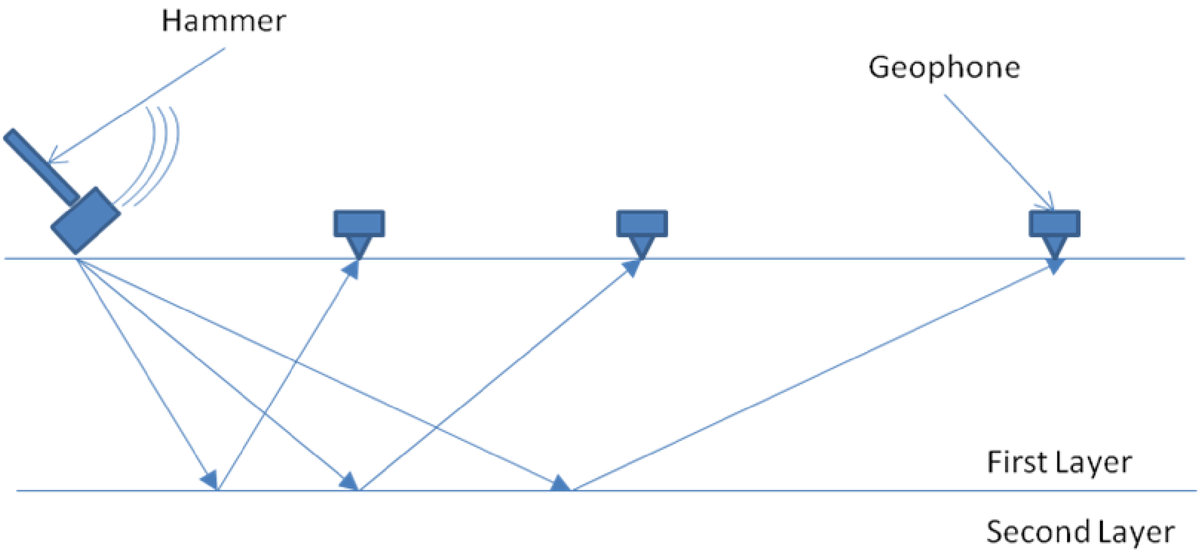


Figure 12: Principle of a Seismic Reflection Survey

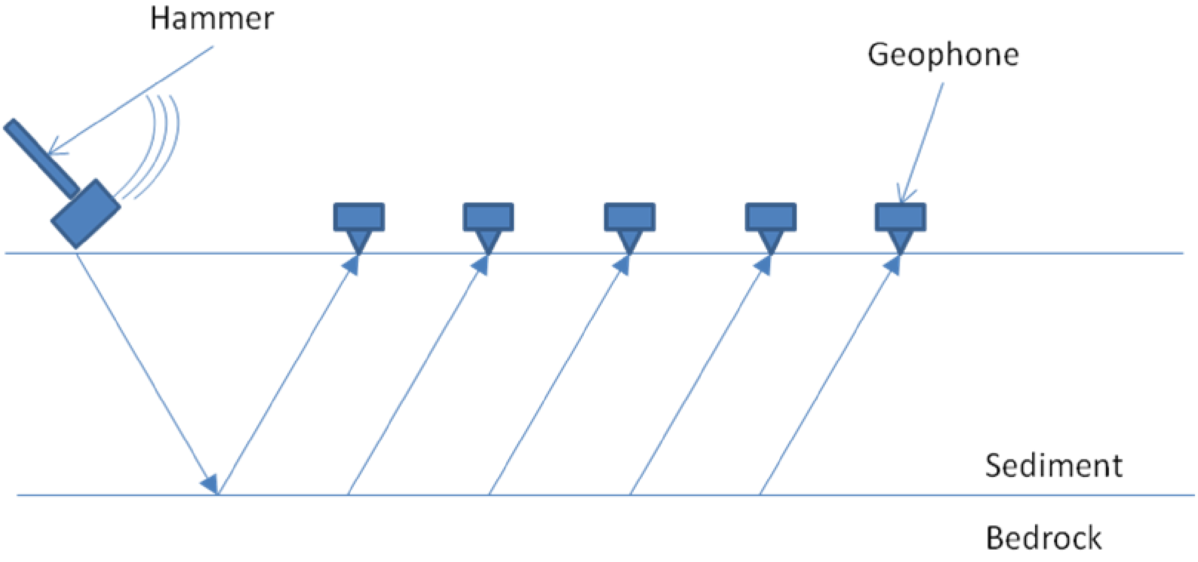


Figure 13: Principle of a Seismic Refraction Survey

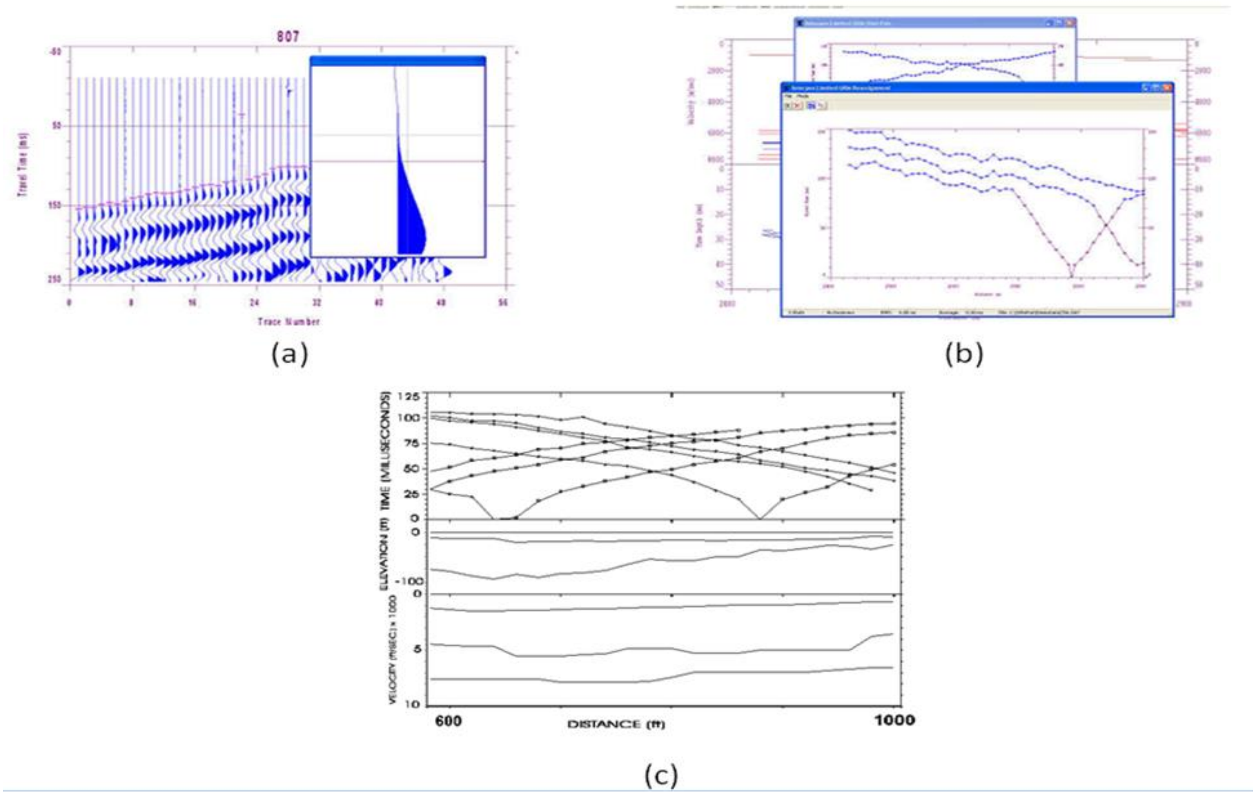


Figure 14: (a) Example of first break picking on a seismic record. (b) Example of first break peaks, before their inversion for (c) getting an interpreted seismic refraction profile.

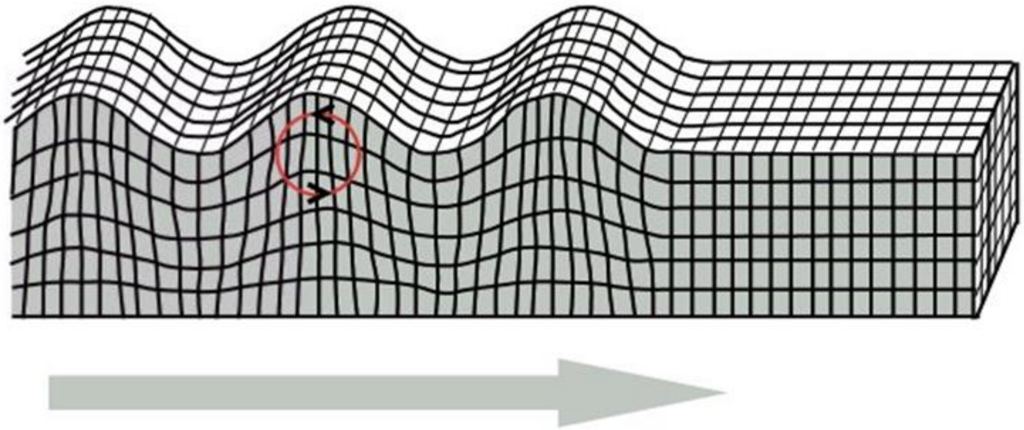


Figure 15: Propagation of a Rayleigh Wave. The grey arrow indicates the direction of propagation, the red circle with the black arrow shows the movement of a particle during the propagation.

Seismic Refraction and MASW methods are complementary, as:

1) Seismic refraction can provide a more accurate information on the dip of each respective lithology, Vp and delineation of layers.
2) MASW can provide more information on Vs and Shear Modulus.

Moreover, while an operator can check and assess the difference between a good and bad first break for a refracted wave, the main concern related to MASW is that the suitability of a surface wave for inversion can only be checked in office, during the processing step.

Implementation on site

The seismic survey will be carried out using a Geode, made by Geometrics, with 24 geophones. This will include mainly a rolled streamed cable (of about 20 to 25 kg), 24 to 26 geophones, the acquisition unit (3.6 kg), a laptop and a standard 12V car battery for alimentation.

Geophones were towed on a land streamer for record for recording the first half of a MASW section, then stopped for recording a refraction section, before resuming the towing and finishing the MASW section.

The source being 10m away from the first geophone while on MASW mode, the MASW section is shifted horizontally compared to the refraction section.

Processing

After the field survey, the seismic data have been processed in two ways with the software ZondST2D:

1) By using a tomography for the seismic refraction. The results of this inversion have later on been used as an initial model for running an inversion for delineating the different geological layers in the same software, in order to find refine the results, which can, in some cases, detect the eventual presence of voids.
2) By using the surface wave analysis module of this same software.

Processing stages for both seismic methods include anthropic noise muting, data picking, velocity assessment, proper inversion settings selection, topographical corrections, etc. Once the raw data are processed in these three different ways, the resulting inverse model MASW section is ready to be interpreted.

Electrical Resistivity Tomography (ERT)

Principle

An electric current I is injected into the ground with two electrodes and the resulting potential ΔV is measured between two other electrodes then the apparent resistivity ρ_a is calculated (Figure 16 - Principle of Electric resistivity measurements).

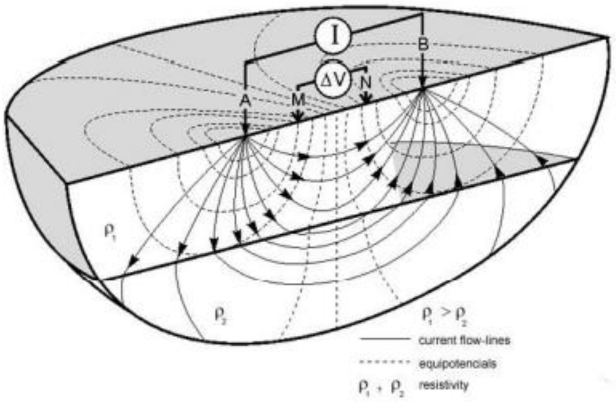
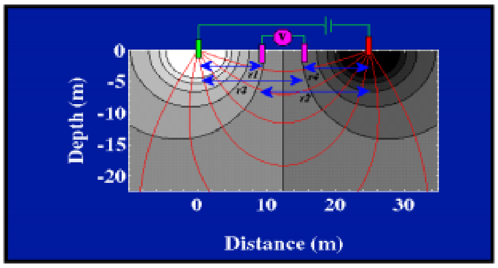


Figure 16 - Principle of Electric resistivity measurements

Apparent resistivity is a weighted average of the resistivities under the four electrodes (Figure 17 - determination of resulting apparent resistivity).



Resulting apparent resistivity:

$$\rho_a = \frac{2\pi\Delta V}{i}\left[\frac{1}{\left(\frac{1}{r_1}-\frac{1}{r_2}-\frac{1}{r_3}+\frac{1}{r_4}\right)}\right]$$

Figure 17 - determination of resulting apparent resistivity

The "true" resistivity of the ground is then determined by inverting field data from apparent resistivity. Figure 18 - Resistivity values of several materials shows a range of resistivity for different materials.

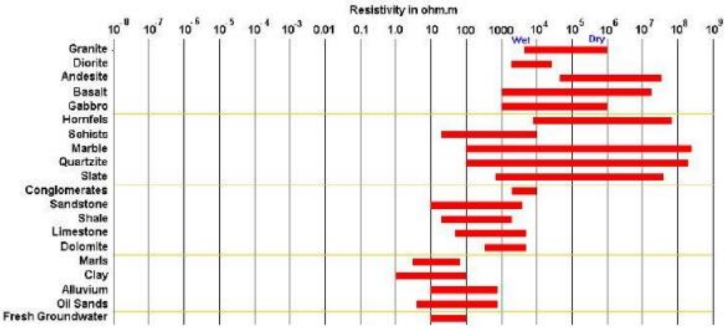
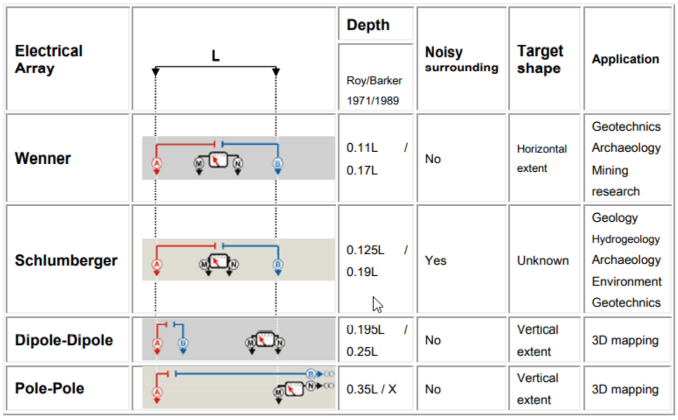


Figure 18 - Resistivity values of several materials

Depth of the measurement depends on array configuration, number of probes and their spacing. Four main electrical arrays can be used, depending on depth investigation and target intended (Figure 19 - Array properties).



Electrical Array	L	Depth Roy/Barker 1971/1989	Noisy surrounding	Target shape	Application
Wenner		0.11L / 0.17L	No	Horizontal extent	Geotechnics Archaeology Mining research
Schlumberger		0.125L / 0.19L	Yes	Unknown	Geology Hydrogeology Archaeology Environment Geotechnics
Dipole-Dipole		0.195L / 0.25L	No	Vertical extent	3D mapping
Pole-Pole		0.35L / X	No	Vertical extent	3D mapping

Figure 19 - Array properties

By measuring the electrical properties of the sub surface, a profile of the strata with depths and thicknesses can be produced. This is done by placing regularly spaced electrodes into the ground along a straight line. Because of the large amounts of data needed, the survey is performed by an automatic system. The resistivity difference between the expected lithologies should lead to a good delineation of the different layers present in this area.

Implementation on site

The resistivity survey has been carried out using an Allied Tigre 64 resistivity meter (Figure 20 - Allied Tigre Resistivity Meter) provided with 64 electrodes. This will include mainly a rolled streamer cable (of about 20 to 25 kg), 64 electrodes (metal stick, max 0.3 m length), the acquisition unit (6kg), a laptop and a standard 12V car battery for alimentation. Using a Wenner array seems to be the best option for mapping the surrounding geology, and for handling the topographical effect generated by the slope because we expect to find horizontal layers in a simple configuration scheme and the expected depth of penetration should be enough.

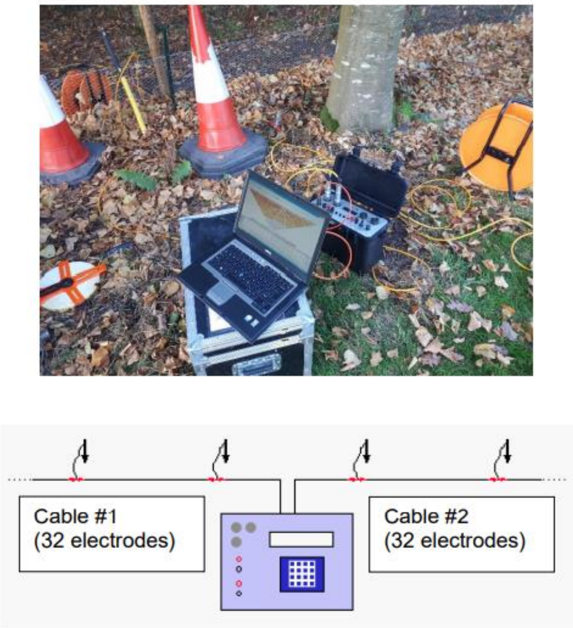


Figure 20 - Allied Tigre Resistivity Meter

By choosing a Wenner-Beta array with 64 electrodes and 2 metres spacing, an average depth of investigation of 8 metres has been reached.

Each resistivity line is surveyed using a total station or a GPS to ensure that the location and orientation of the lines is recorded. All data is stored digitally and has been downloaded each evening.

Processing

After the field survey, the resistivity measurements are usually reduced to apparent resistivity values. A conversion needs to be carried out in order to obtain a resistivity model section that can be used for interpretation ("true" resistivity section). Post site processing is done using specialised software, Res2DInv and Res3DInv. A number of processing stages are involved, including bad data points removal (due to bad contacts, failures during the survey, etc.), proper inversion settings selection, topographical corrections, etc. Once the raw data (measured apparent resistivity pseudo section) are processed, the resulting inverse model resistivity section is ready to be interpreted.

APPENDIX II - UBC or IBC site classification and seismic interpretation

The International Building Code (IBC) specifies the weighted average of S-wave velocity in the top 30 meters or 100 feet as one criterion for determining Site Class.

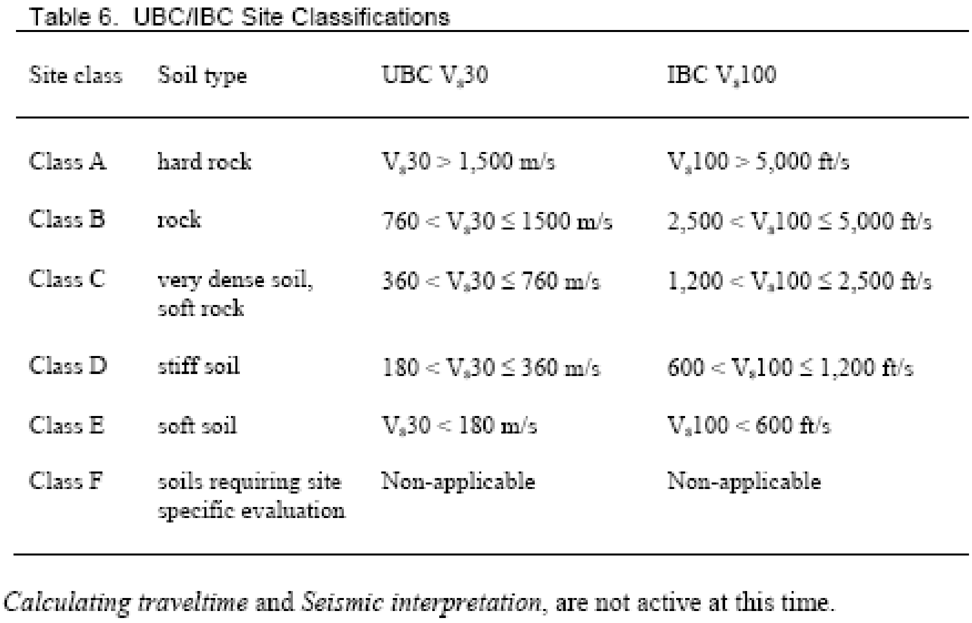


Table 6. UBC/IBC Site Classifications

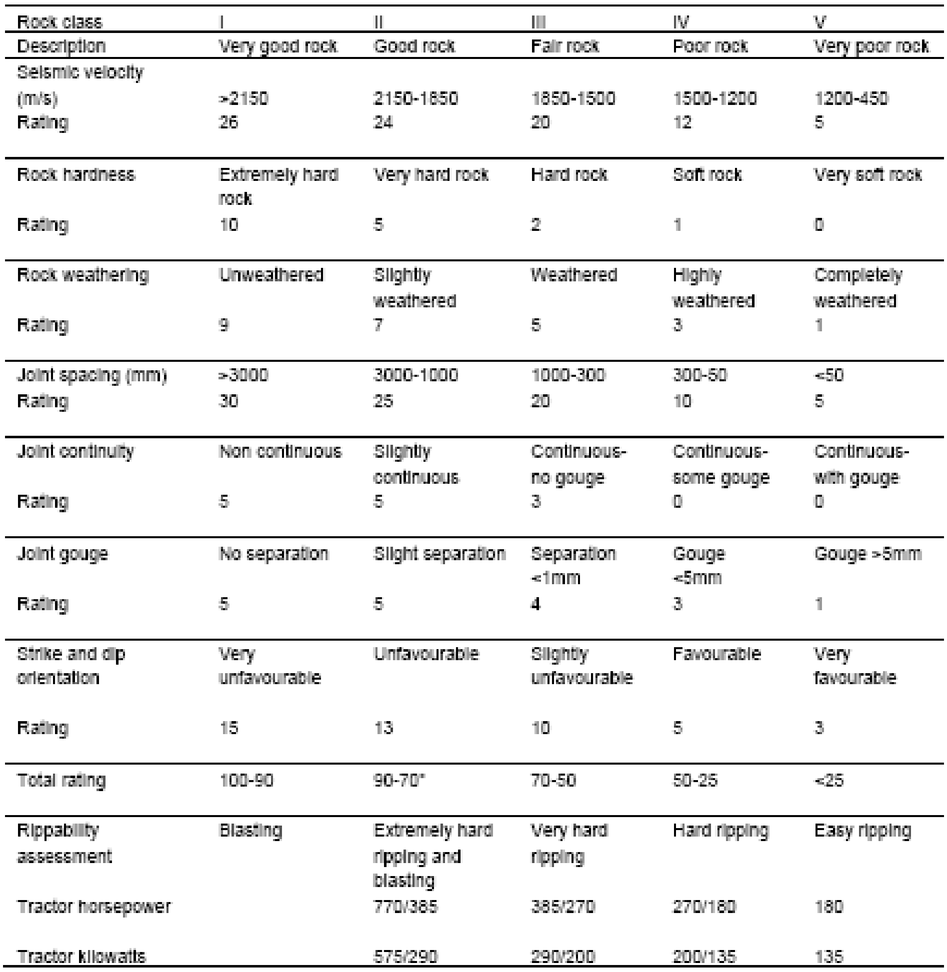
Site class	Soil type	UBC V_s30	IBC V_s100
Class A	hard rock	$V_s30 > 1{,}500$ m/s	$V_s100 > 5{,}000$ ft/s
Class B	rock	$760 < V_s30 \leq 1500$ m/s	$2{,}500 < V_s100 \leq 5{,}000$ ft/s
Class C	very dense soil, soft rock	$360 < V_s30 \leq 760$ m/s	$1{,}200 < V_s100 \leq 2{,}500$ ft/s
Class D	stiff soil	$180 < V_s30 \leq 360$ m/s	$600 < V_s100 \leq 1{,}200$ ft/s
Class E	soft soil	$V_s30 < 180$ m/s	$V_s100 < 600$ ft/s
Class F	soils requiring site specific evaluation	Non-applicable	Non-applicable

Calculating traveltime and *Seismic interpretation*, are not active at this time.

Figure 21 - UBC/IBC site classification

APPENDIX III - Link between P-wave velocity and rock quality

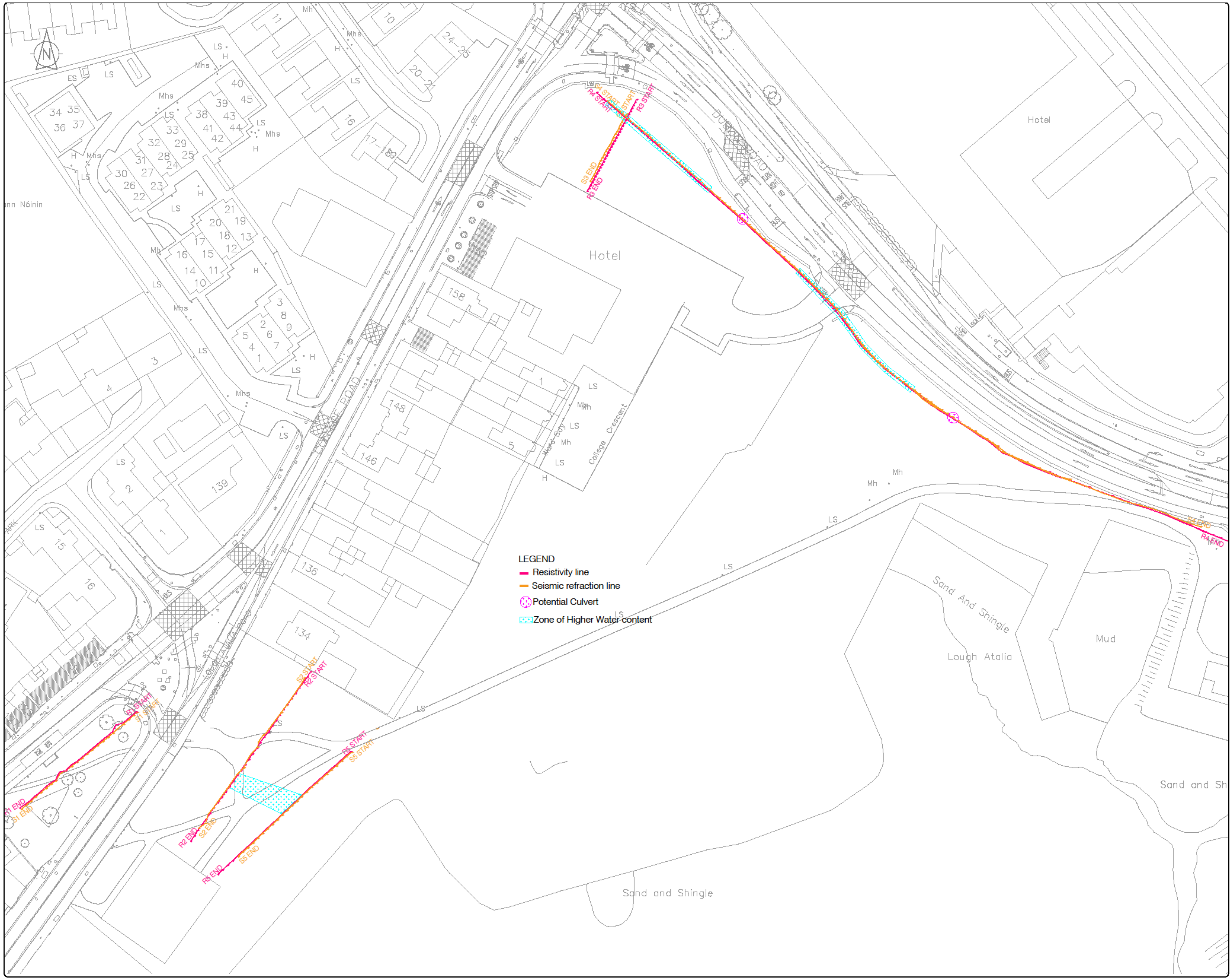
The following chart, defined by Weaver(1975), has been used for assessing the bedrock quality/rippability.



Rock class	I	II	III	IV	V
Description	Very good rock	Good rock	Fair rock	Poor rock	Very poor rock
Seismic velocity (m/s)	>2150	2150-1850	1850-1500	1500-1200	1200-450
Rating	26	24	20	12	5
Rock hardness	Extremely hard rock	Very hard rock	Hard rock	Soft rock	Very soft rock
Rating	10	5	2	1	0
Rock weathering	Unweathered	Slightly weathered	Weathered	Highly weathered	Completely weathered
Rating	9	7	5	3	1
Joint spacing (mm)	>3000	3000-1000	1000-300	300-50	<50
Rating	30	25	20	10	5
Joint continuity	Non continuous	Slightly continuous	Continuous-no gouge	Continuous-some gouge	Continuous-with gouge
Rating	5	5	3	0	0
Joint gouge	No separation	Slight separation	Separation <1mm	Gouge <5mm	Gouge >5mm
Rating	5	5	4	3	1
Strike and dip orientation	Very unfavourable	Unfavourable	Slightly unfavourable	Favourable	Very favourable
Rating	15	13	10	5	3
Total rating	100-90	90-70*	70-50	50-25	<25
Rippability assessment	Blasting	Extremely hard ripping and blasting	Very hard ripping	Hard ripping	Easy ripping
Tractor horsepower		770/385	385/270	270/180	180
Tractor kilowatts		575/290	290/200	200/135	135

Figure 22 - Rippability chart

MAPS



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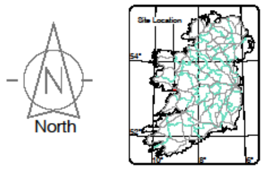

LEGEND
- Resistivity line
- Seismic refraction line
- Potential Culvert
- Zone of Higher Water content

Surveyed by : MG Date: November 2021 Datum : Malin Head
Drawn by : BM Date: 07.12.2021 Grid System:
Checked by : SM Date: 07.12.2021 Irish National Grid ☐ ITM ☒

Revisions

No	Date	Description
0	07.12.2021	First Drawing

Murphy GEOSPATIAL

Topographic surveys, Measured Building Surveys, Setting-Out, As-Built Surveys, Hydrographic Surveys, Legal Mapping, Pipeline Surveys, Services Location, Ground Penetrating Radar, Laser Scanning, Rectified Photography

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Ireland
Phone: (+353) 045 484040
Fax: (+353) 045 484004
Email: info@murphysurveys.ie

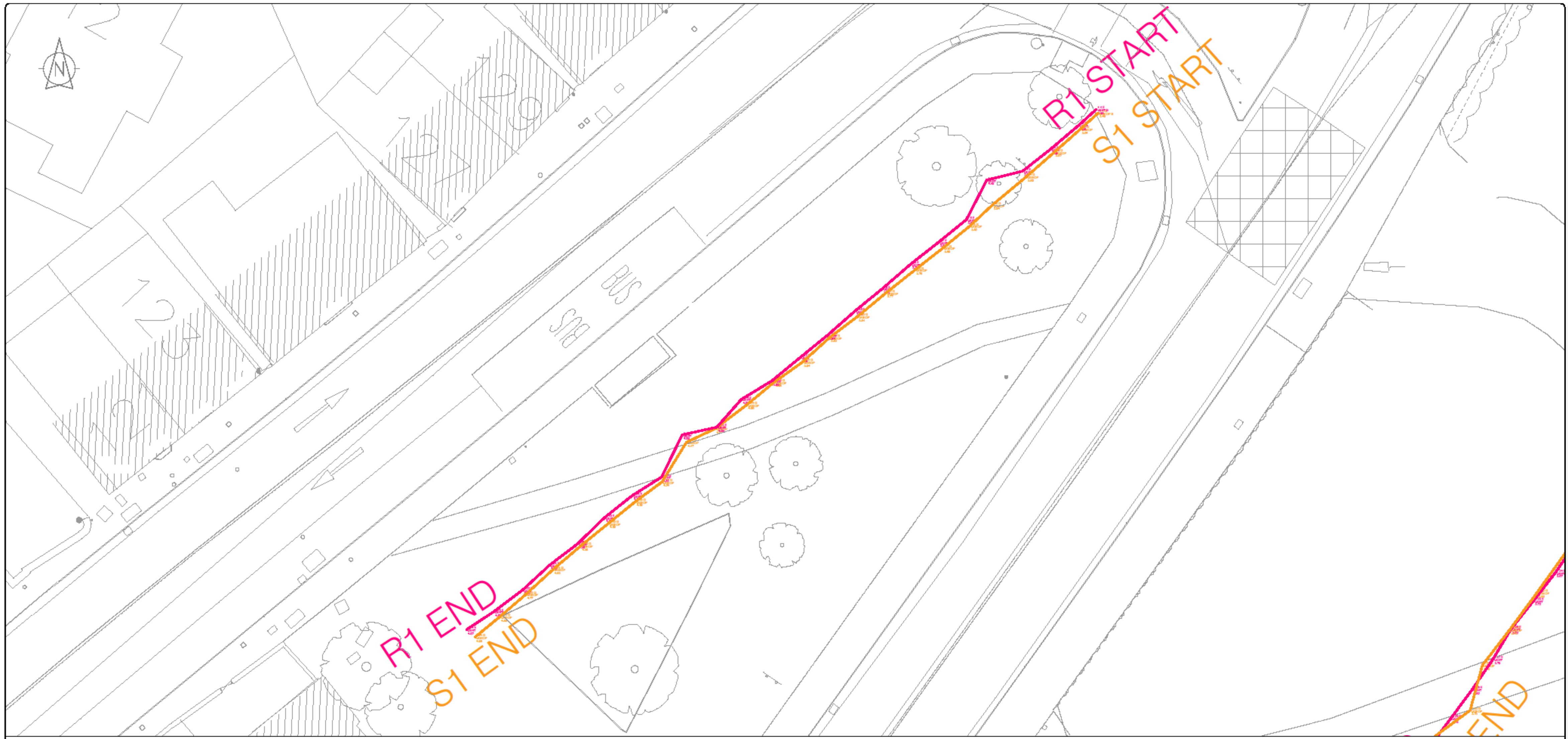
Client : Arup Consulting Engineers Galway

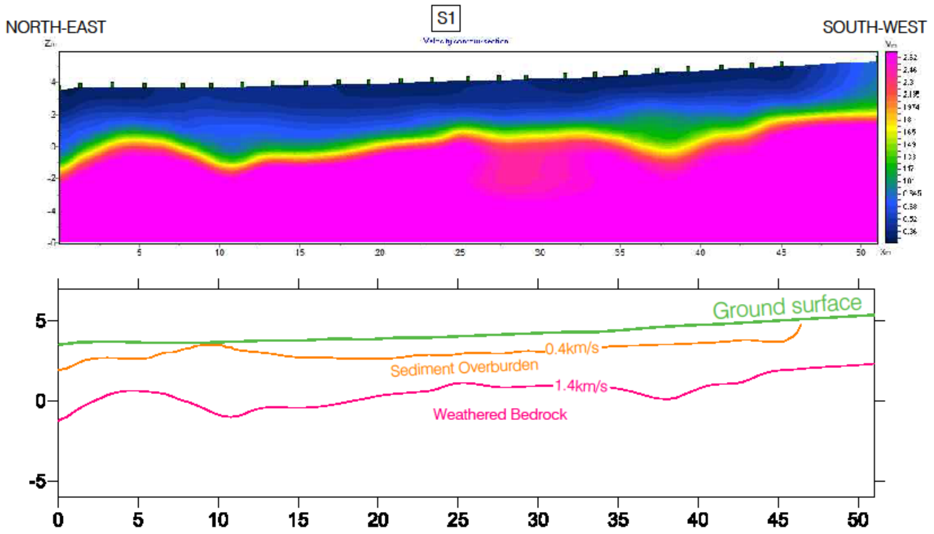
Project : BusConnects Galway Geophysical Survey

Date : 07.12.2021 **Scale :** 1:500@A1

Description : Geophysical Survey
Survey layout

Drawing Number : MGS43796_G





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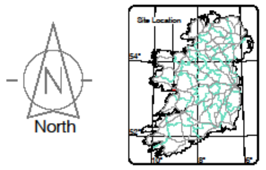

LEGEND

- ▬ Resistivity line
- ▬ Seismic refraction line
- ○ Potential Culvert
- ▭ Zone of Higher Water content

Surveyed by : MG
Drawn by : BM
Checked by : SM
Date: November 2021
Date: 07.12.2021
Date: 07.12.2021
Datum : Main Head
Grid System:
Irish National Grid ☐ ITM ☒

Revisions

No	Date	Description
0	07.12.2021	First Drawing

Topographic surveys, Measured Building Surveys, Setting-Out, As-Built Surveys, Hydrographic Surveys, Legal Mapping, Pipeline Surveys, Services Location, Ground Penetrating Radar, Laser Scanning, Rectified Photography

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Ireland

Phone: (+353) 045 484040
Fax: (+353) 045 484004
Email: info@murphysurveys.ie

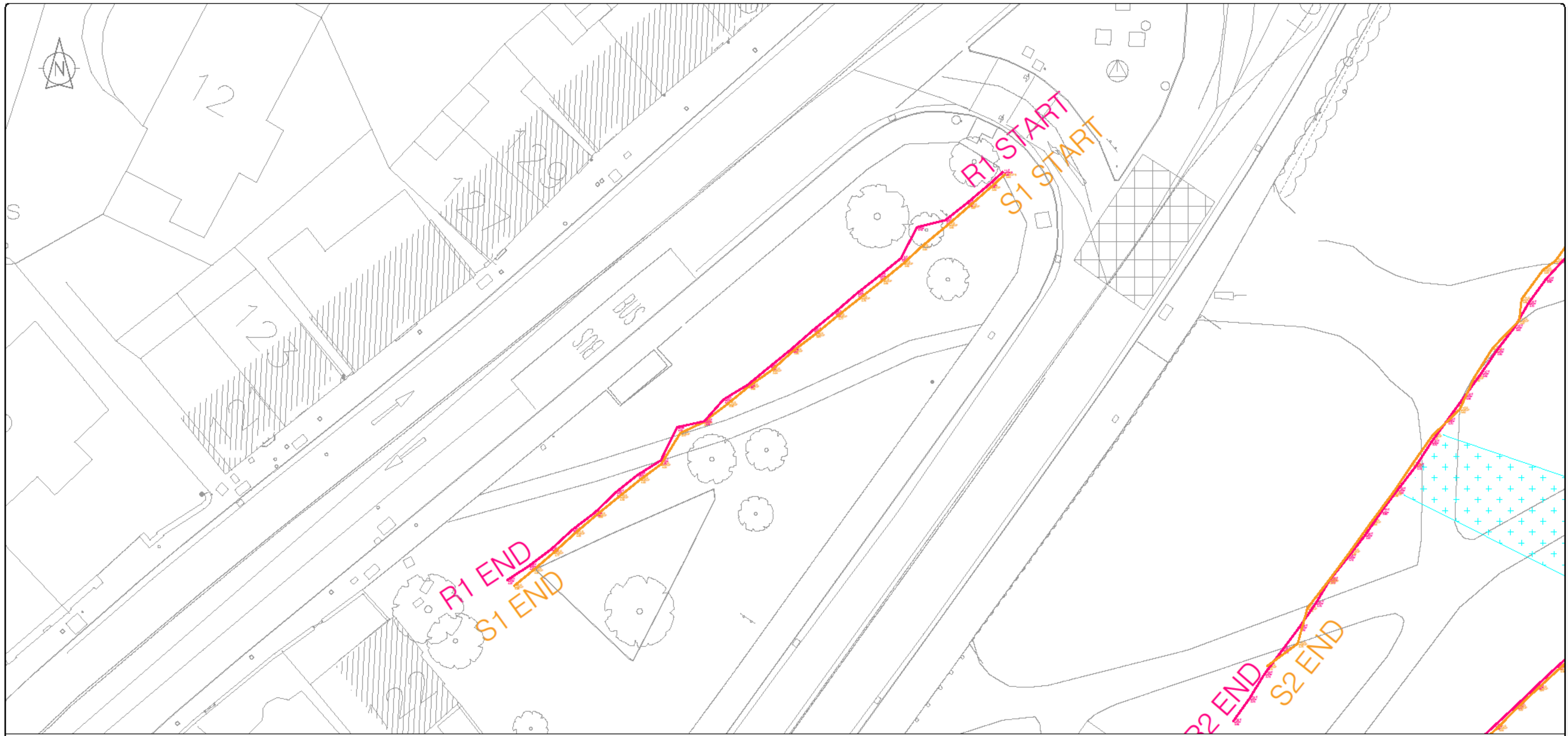
Client : Arup Consulting Engineers Galway

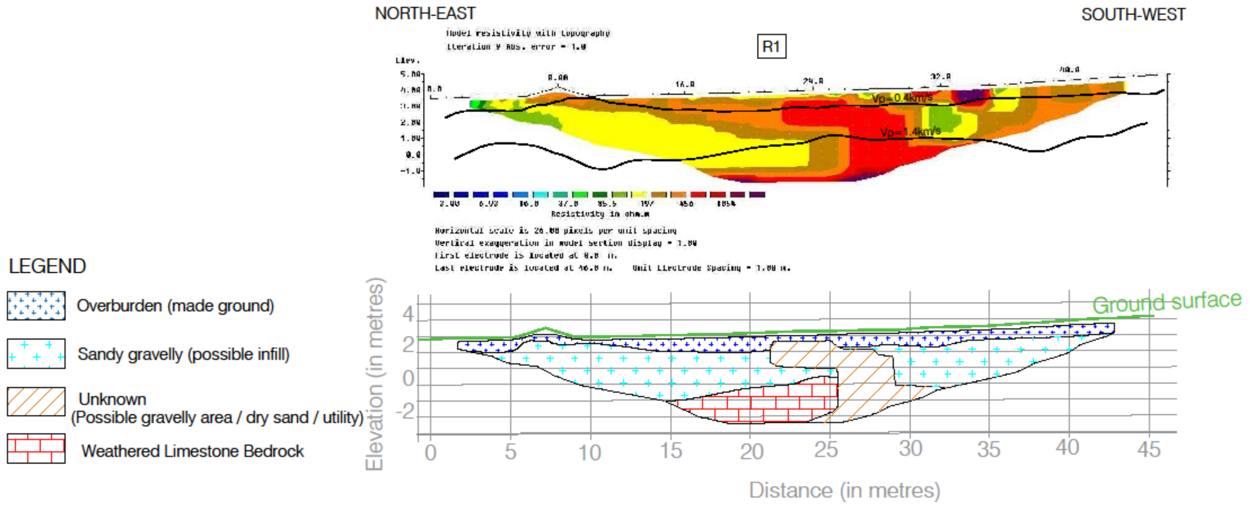
Project : BusConnects Galway Geophysical Survey

Date : 07.12.2021 **Scale :** 1:200@A1

Description : Geophysical Survey
Seismic results for S1

Drawing Number : MGS43796_G





LEGEND

- ▨ Overburden (made ground)
- ▨ Sandy gravelly (possible infill)
- ▨ Unknown (Possible gravelly area / dry sand / utility)
- ▨ Weathered Limestone Bedrock

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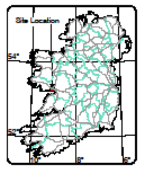
North



LEGEND

- ▬ Resistivity line
- ▬ Seismic refraction line
- ⊛ Potential Culvert
- ▨ Zone of Higher Water content

Surveyed by : MG
Drawn by : BM
Checked by : SM
Date: November 2021
Date: 07.12.2021
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Datum : Malin Head
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Revisions

No	Date	Description
0	07.12.2021	First Drawing

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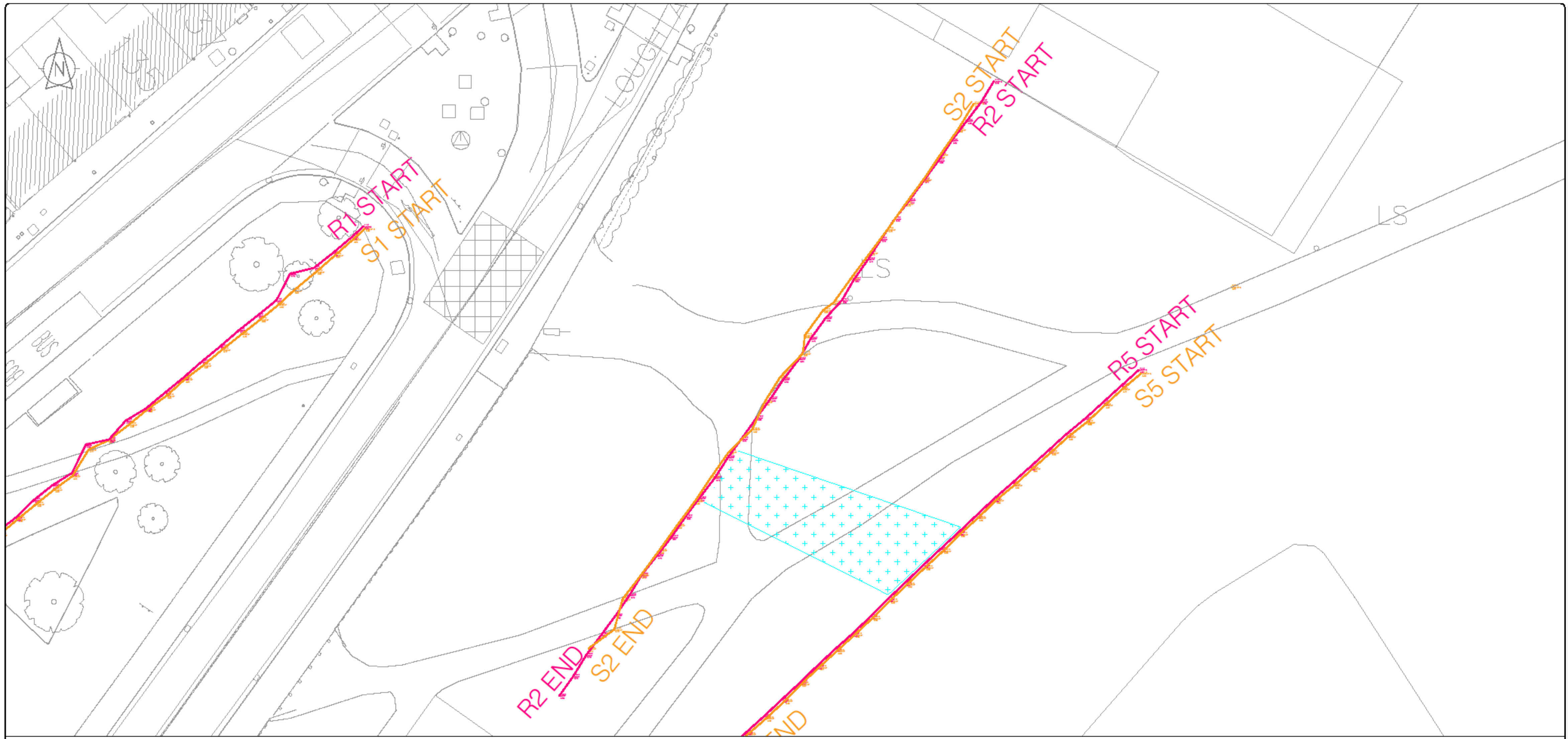
Client : Arup Consulting Engineers Galway

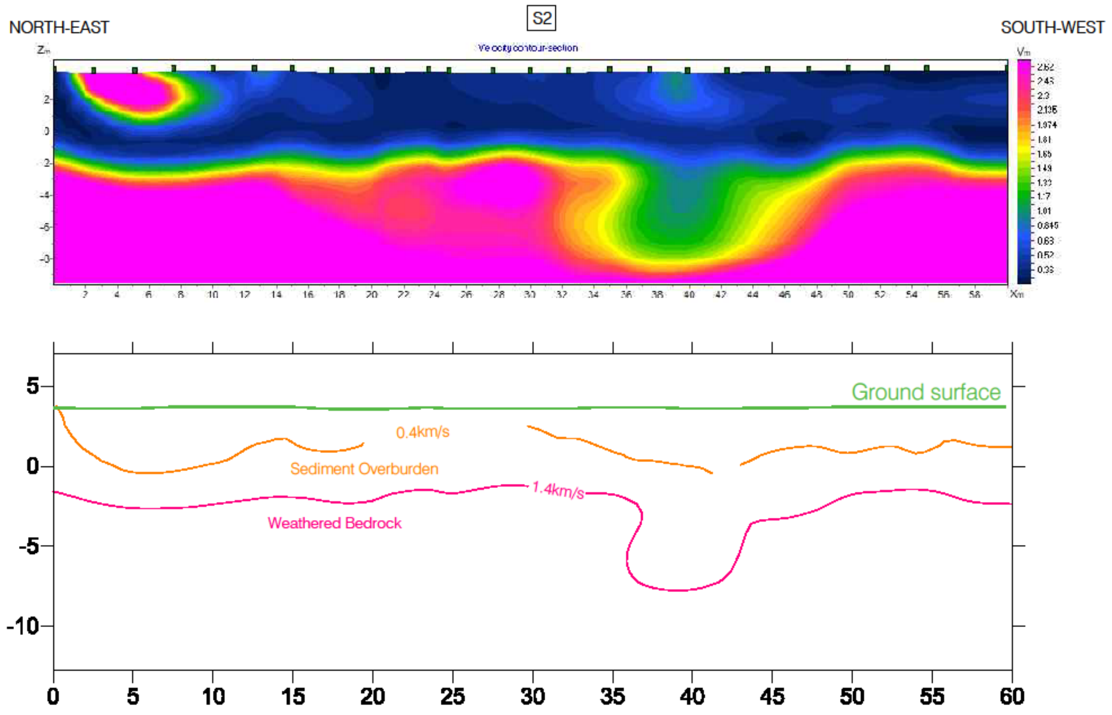
Project : BusConnects Galway Geophysical Survey

Date : 07.12.2021 **Scale :** 1:200@A1

Description : Geophysical Survey
Resistivity results for R1

Drawing Number : MGS43796_G





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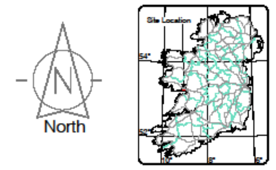

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Surveyed by : MG Date: November 2021 Datum : Malin Head
Drawn by : BM Date: 07.12.2021 Grid System:
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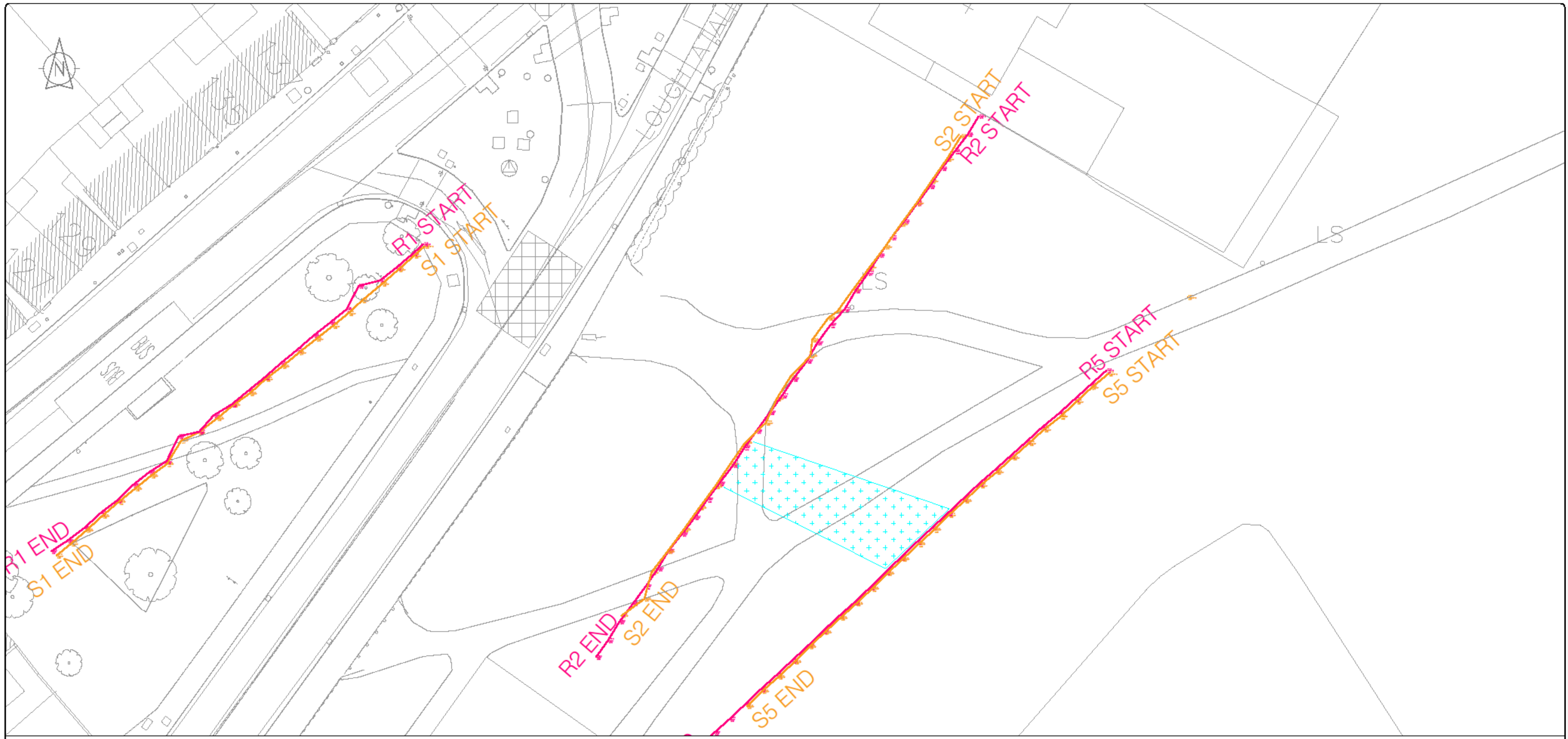
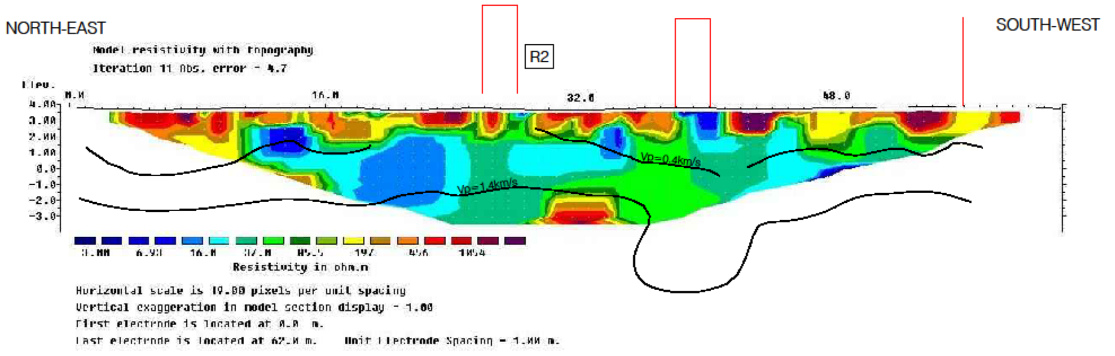
Date : 07.12.2021 **Scale :** 1:200@A1

Description : Geophysical Survey
Seismic results for S2

Drawing Number : MGS43796_G



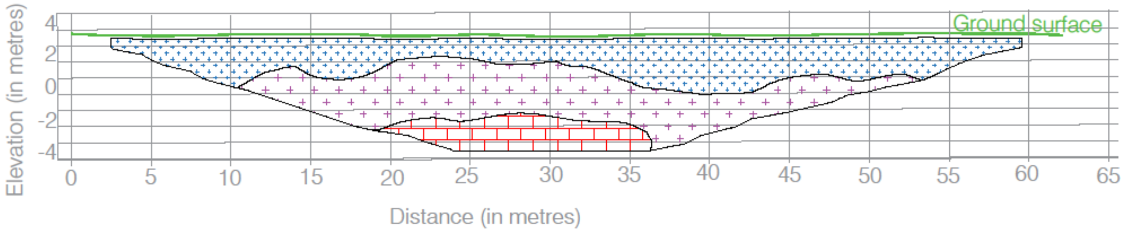
missing electrodes in these areas (loss of resolution)



```
Model resistivity with topography
Iteration 11 Abs. error = 4.7
Resistivity in ohm.m
Horizontal scale is 19.00 pixels per unit spacing
Vertical exaggeration in model section display = 1.00
First electrode is located at 0.0 m.
Last electrode is located at 62.0 m.     Unit Electrode Spacing = 1.00 m.
```

LEGEND

▒	Overburden (made ground / peat)
+	Sandy gravelly clay/ marl
▦	Weathered Limestone Bedrock



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- In ideal conditions these spatial accuracies for the underground utilities are +/- 5% for the RD4000 and +/- 10% of depth for the GPR to 2.5m deep. However, variations within the subsurface may alter this estimated accuracy.
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- The depth penetration and quality of the data depends on the ground conditions on the site. Poor data may be a result of areas with high conductivity. Also, high reflective materials close to the surface i.e. rebar may hide deeper anomalies.
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We exclude the following, except where otherwise specified and possible to do so:

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- Small diameter cables less than 17mm diameter, or pipes less than 38mm diameter.
- Above ground services unless specifically requested.
- Lifting manhole covers which require longer than 10 minute effort using standard heavy duty lifting apparatus.
- Services positioned directly below other pipes or cables etc (i.e. masking signal) - intrusive verification options available on request.
- Deep non metallic pipes, ducts or culverts (unless probing or Pipe Track 3d is specified as part of the fully invasive survey option).
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Please note that our Quotation does not allow for location of individual service feeds to properties unless reasonable to do so, as access would be required into each property to apply direct connections to inlet points and this would significantly increase the scope of work, survey cost and also cause possible disruption to occupants.
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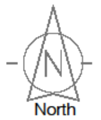

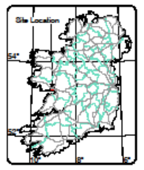

LEGEND

🟥	Resistivity line
🟧	Seismic refraction line
✣	Potential Culvert
▒	Zone of Higher Water content

Surveyed by : MG Date: November 2021 Datum : Malin Head
Drawn by : BM Date: 07.12.2021 Grid System:
Checked by : SM Date: 07.12.2021 Irish National Grid ☐ ITM ☒

Revisions

No.	Date	Description
0	07.12.2021	First Drawing

Murphy
GEOSPATIAL

Topographic surveys, Measured Building Surveys, Setting-Out, As-Built Surveys, Hydrographic Surveys, Legal Mapping, Pipeline Surveys, Services Location, Ground Penetrating Radar, Laser Scanning, Rectified Photography

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Kilcullen Business Campus
Kilcullen Co. Kildare
Ireland

Phone: (+353) 045 484040
Fax: (+353) 045 484004
Email: info@murphysurveys.ie

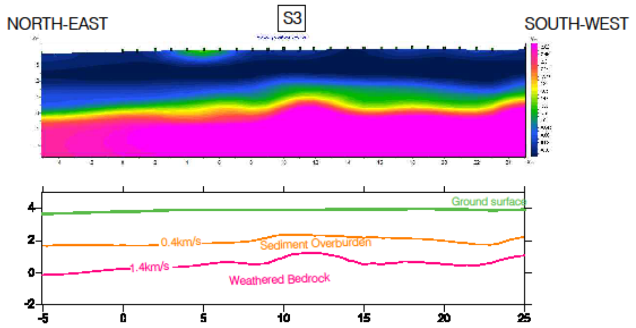
Client : Arup Consulting Engineers Galway

Project : BusConnects Galway Geophysical Survey

Date : 07.12.2021 **Scale :** 1:200@A1

Description : Geophysical Survey
Resistivity results for R2

Drawing Number : MGS43796_G



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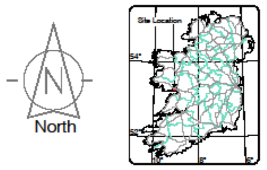

LEGEND

▬	Resistivity line
▬	Seismic refraction line
⊕	Potential Culvert
▭	Zone of Higher Water content

Surveyed by : MG Date: November 2021 Datum : Malin Head
Drawn by : BM Date: 07.12.2021 Grid System:
Checked by : SM Date: 07.12.2021 Irish National Grid ☐ ITM ☒

Revisions		
No	Date	Description
0	07.12.2021	First Drawing

Topographic surveys, Measured Building Surveys,
Setting-Out, As-Built Surveys, Hydrographic Surveys, Legal Mapping,
Pipeline Surveys, Services Location, Ground Penetrating Radar,
Laser Scanning, Rectified Photography

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Ireland

Phone: (+353) 045 484040
Fax: (+353) 045 484004
Email: info@murphysurveys.ie

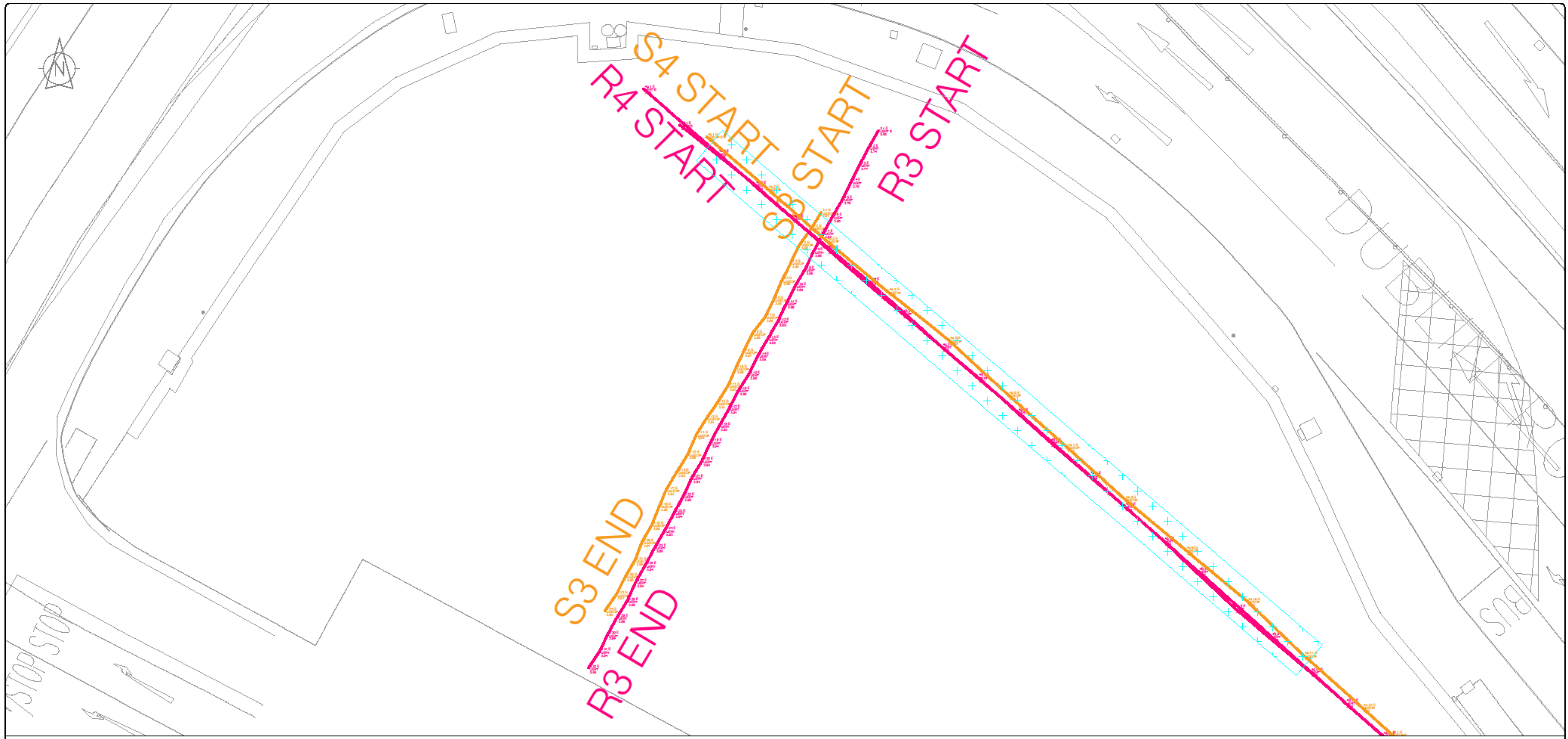
Client : Arup Consulting Engineers Galway

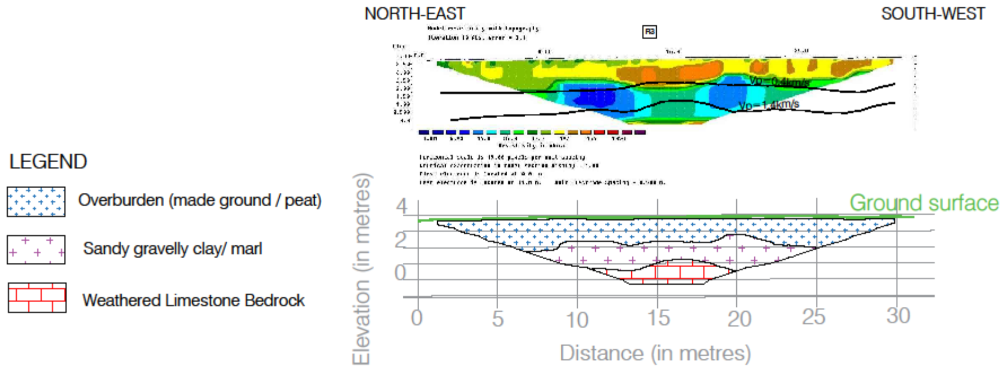
Project : BusConnects Galway Geophysical Survey

Date : 07.12.2021 **Scale :** 1:100@A1

Description : Geophysical Survey
Seismic results for S3

Drawing Number : MGS43796_G





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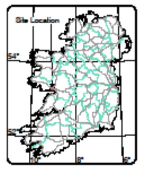
North



LEGEND

- ▬ Resistivity line
- ▬ Seismic refraction line
- ⊕ Potential Culvert
- ▨ Zone of Higher Water content

Surveyed by : MG Date: November 2021 Datum : Malin Head
Drawn by : SM Date: 07.12.2021 Grid System:
Checked by : SM Date: 07.12.2021 Irish National Grid ☐ ITM ☒

Revisions

No.	Date	Description
0	07.12.2021	First Drawing

Murphy
GEOSPATIAL

Topographic surveys, Measured Building Surveys,
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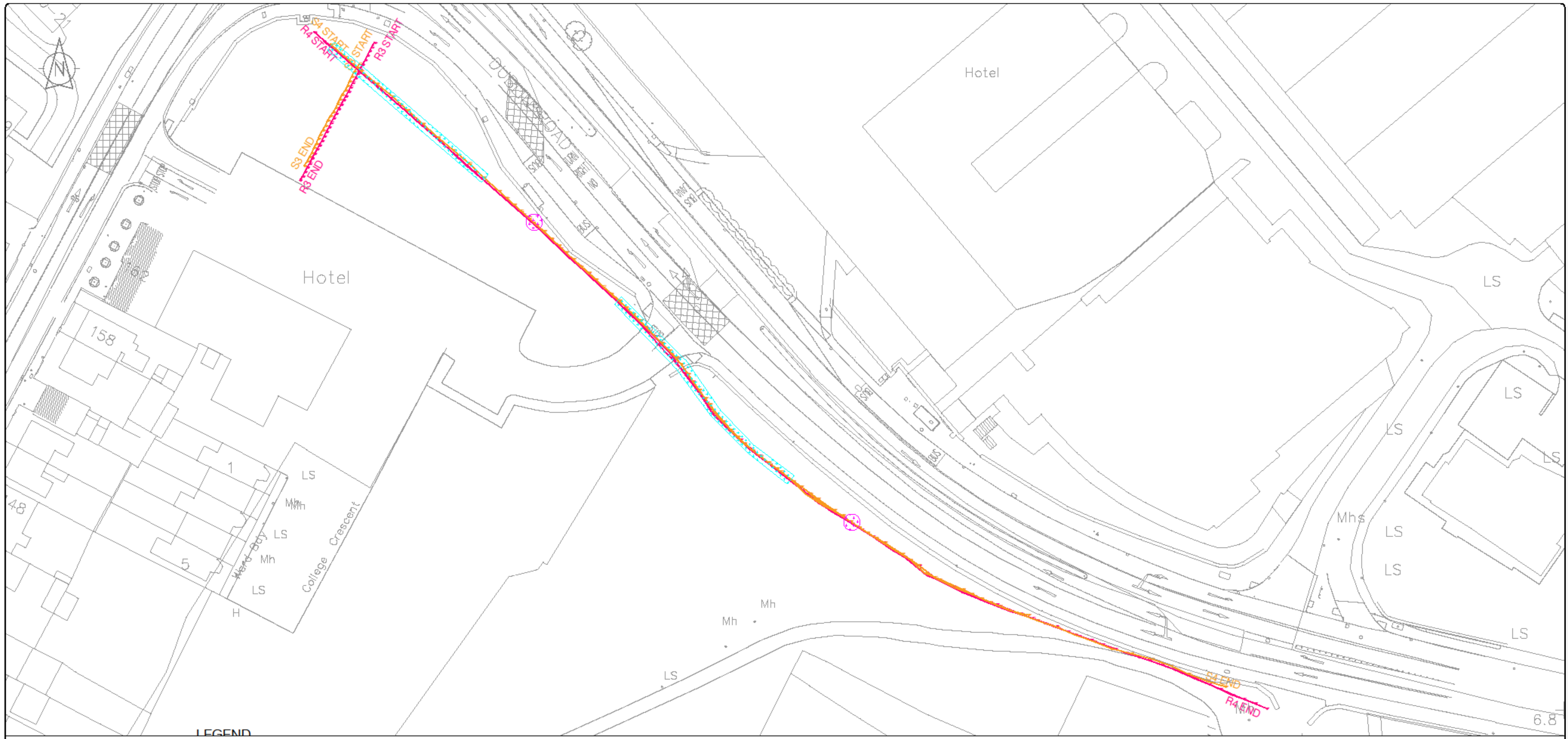
Client : Arup Consulting Engineers Galway

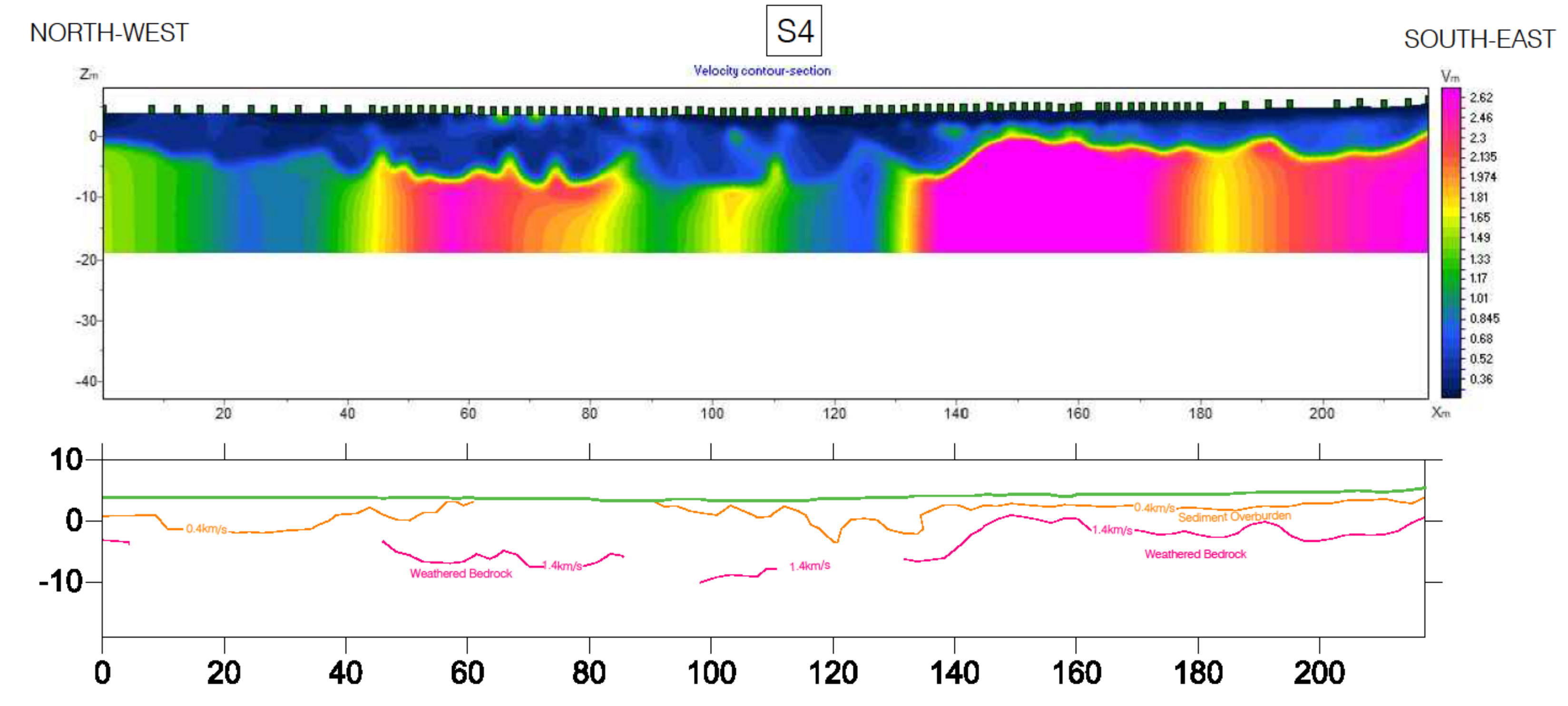
Project : BusConnects Galway Geophysical Survey

Date : 07.12.2021 **Scale :** 1:200@A1

Description : Geophysical Survey
Resistivity results for R3

Drawing Number : MGS43796_G





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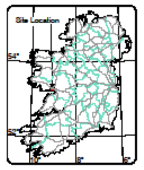

LEGEND
- Resistivity line
- Seismic refraction line
- Potential Culvert
- Zone of Higher Water content

Surveyed by : MG
Drawn by : BM
Checked by : SM
Date: November 2021
Date: 07.12.2021
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Datum : Malin Head
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Revisions

No	Date	Description
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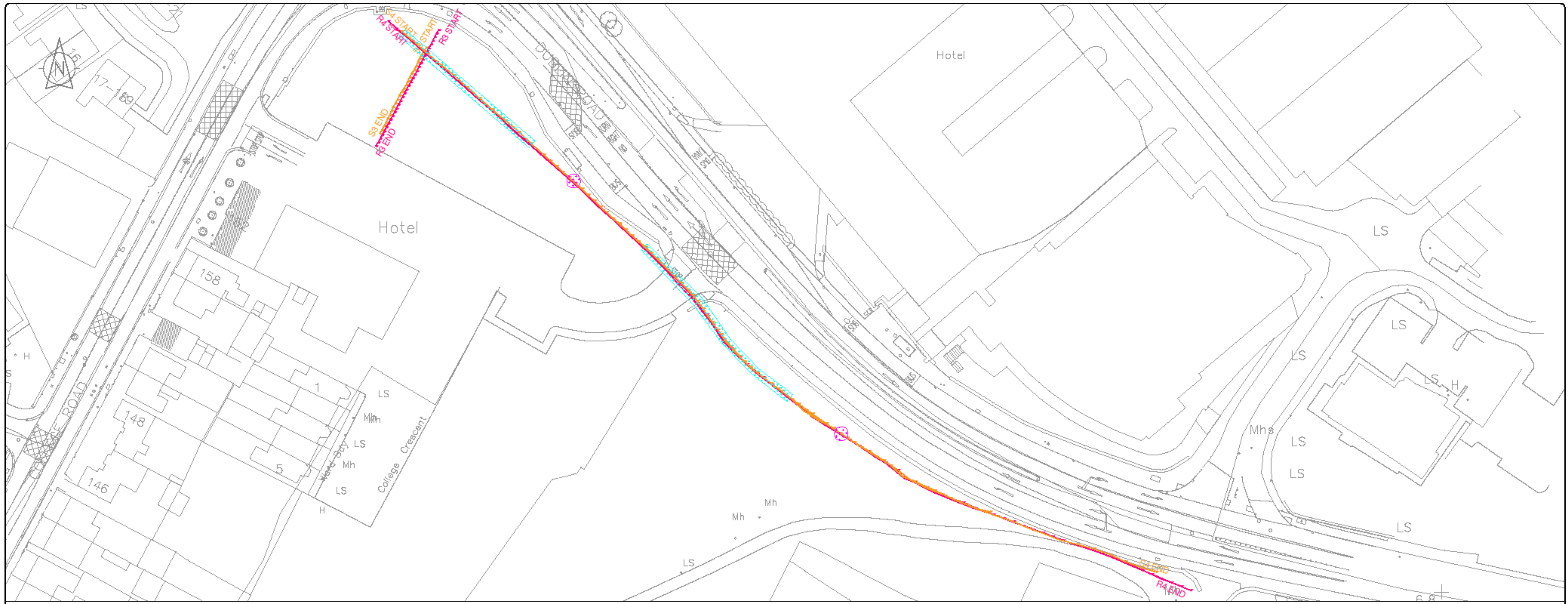
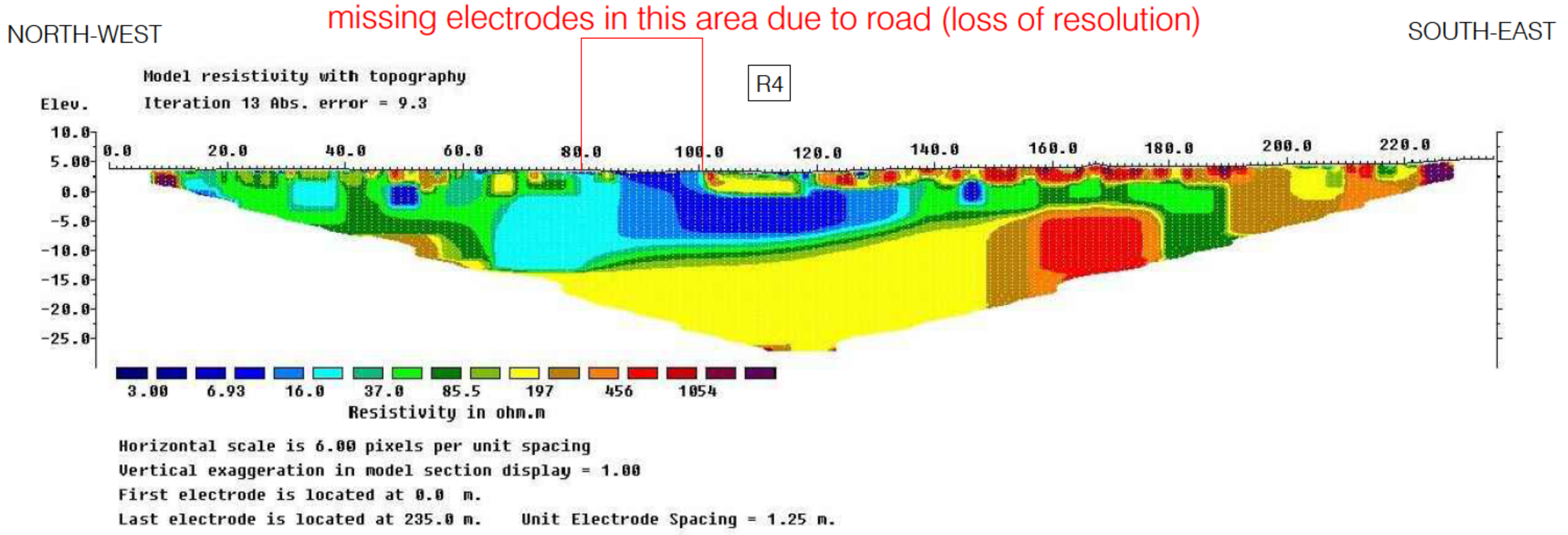
Client :	Arup Consulting Engineers Galway
Project :	BusConnects Galway Geophysical Survey
Date :	07.12.2021
Scale :	1:500@A1
Description :	Geophysical Survey Seismic results for S4
Drawing Number :	MGS43796_G



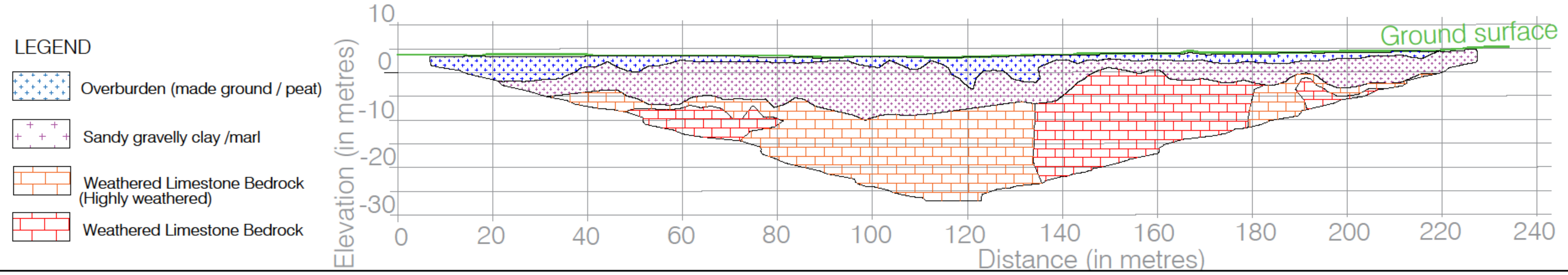


missing electrodes in this area due to road (loss of resolution)

```
Model resistivity with topography
Iteration 13 Abs. error = 9.3

Resistivity in ohm.m

Horizontal scale is 6.00 pixels per unit spacing
Vertical exaggeration in model section display = 1.00
First electrode is located at 0.0  m.
Last electrode is located at 235.0 m.    Unit Electrode Spacing = 1.25 m.
```



LEGEND

- ▨ Overburden (made ground / peat)
- ▨ Sandy gravelly clay /marl
- ▨ Weathered Limestone Bedrock (Highly weathered)
- ▨ Weathered Limestone Bedrock

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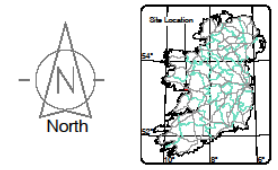

LEGEND

- Resistivity line
- Seismic refraction line
- Potential Culvert
- Zone of Higher Water content

Surveyed by : MG	Date: November 2021	Datum : Malin Head
Drawn by : BM	Date: 07.12.2021	Grid System:
Checked by : SM	Date: 07.12.2021	Irish National Grid ☐ ITM ☒

Revisions

No.	Date	Description
0	07.12.2021	First Drawing

Murphy GEOSPATIAL

Topographic surveys, Measured Building Surveys, Setting-Out, As-Built Surveys, Hydrographic Surveys, Legal Mapping, Pipeline Surveys, Services Location, Ground Penetrating Radar, Laser Scanning, Rectified Photography

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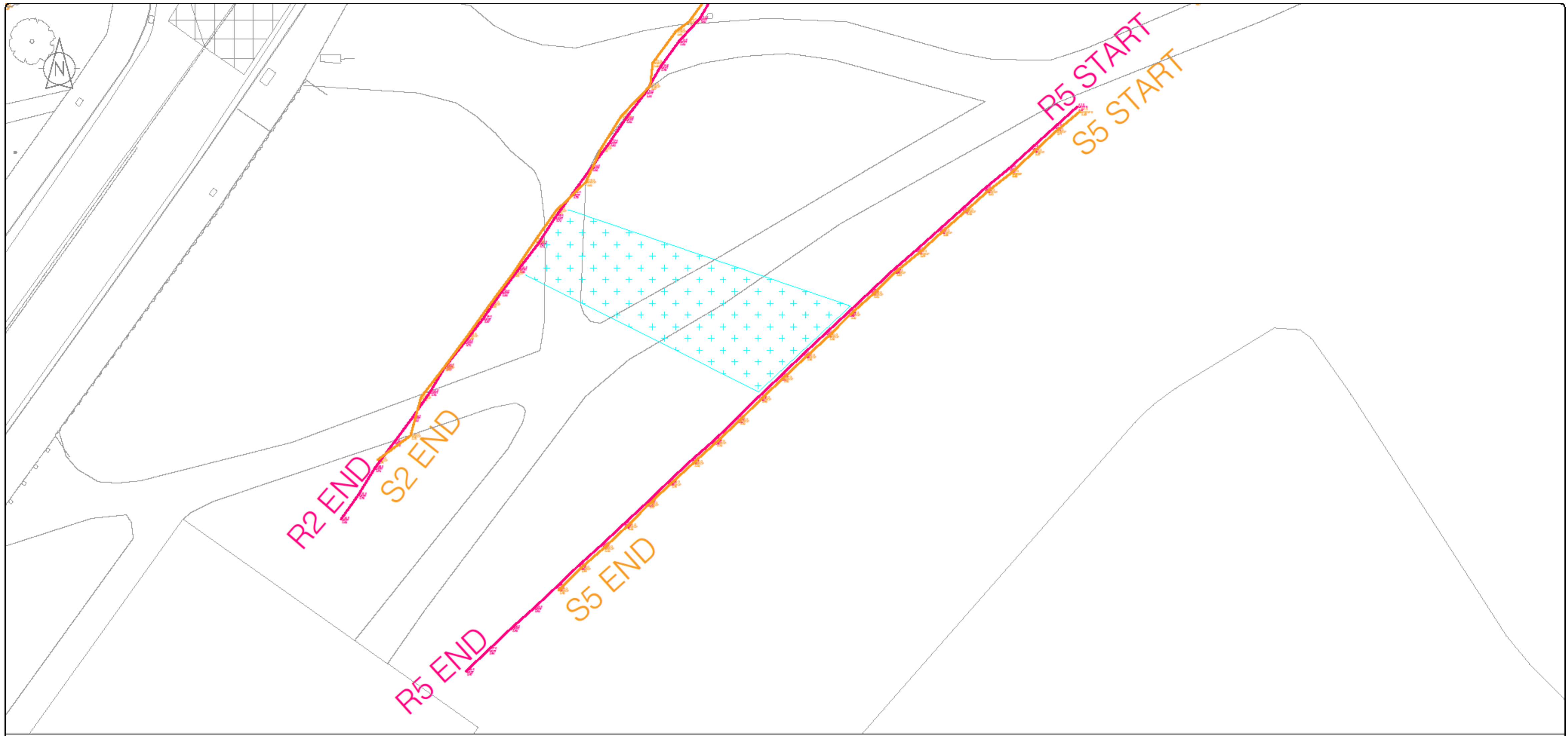
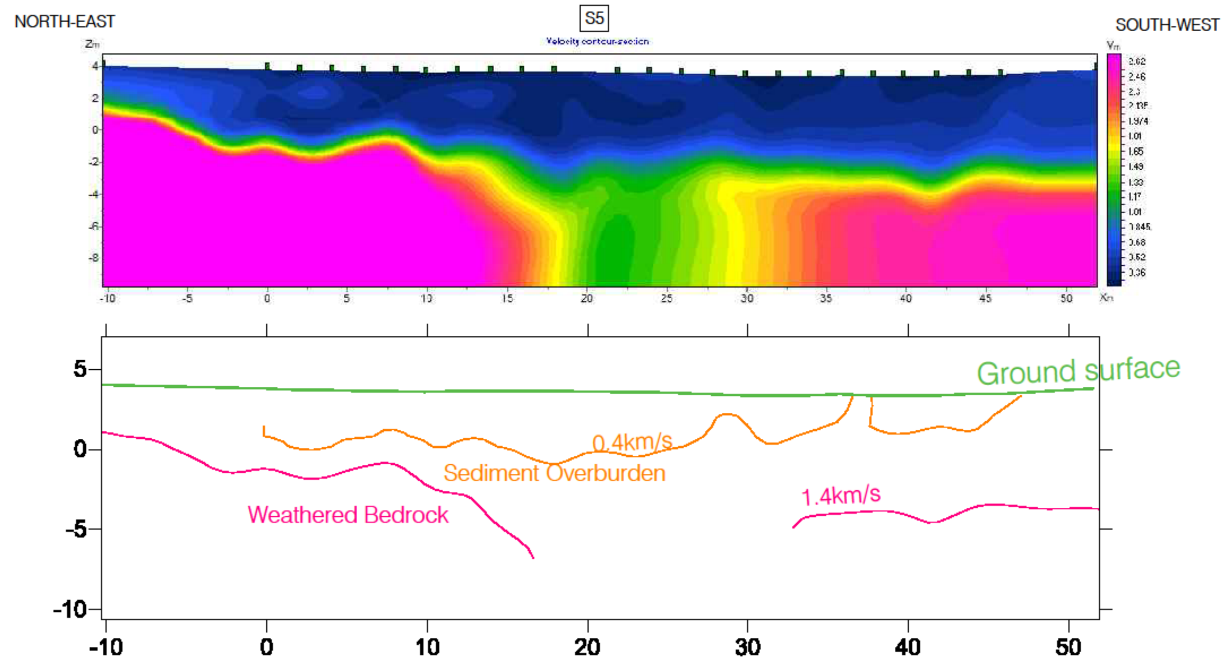
Email: info@murphysurveys.ie

Client :	Arup Consulting Engineers Galway
Project :	BusConnects Galway Geophysical Survey
Date :	07.12.2021
Scale :	1:500@A1
Description :	Geophysical Survey Resistivity results for R4
Drawing Number :	MGS43796_G





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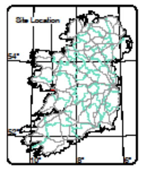
North



LEGEND
- 🟥 Resistivity line
- 🟧 Seismic refraction line
- ⊛ Potential Culvert
- ▨ Zone of Higher Water content

Surveyed by : MG
Date: November 2021
Datum : Malin Head
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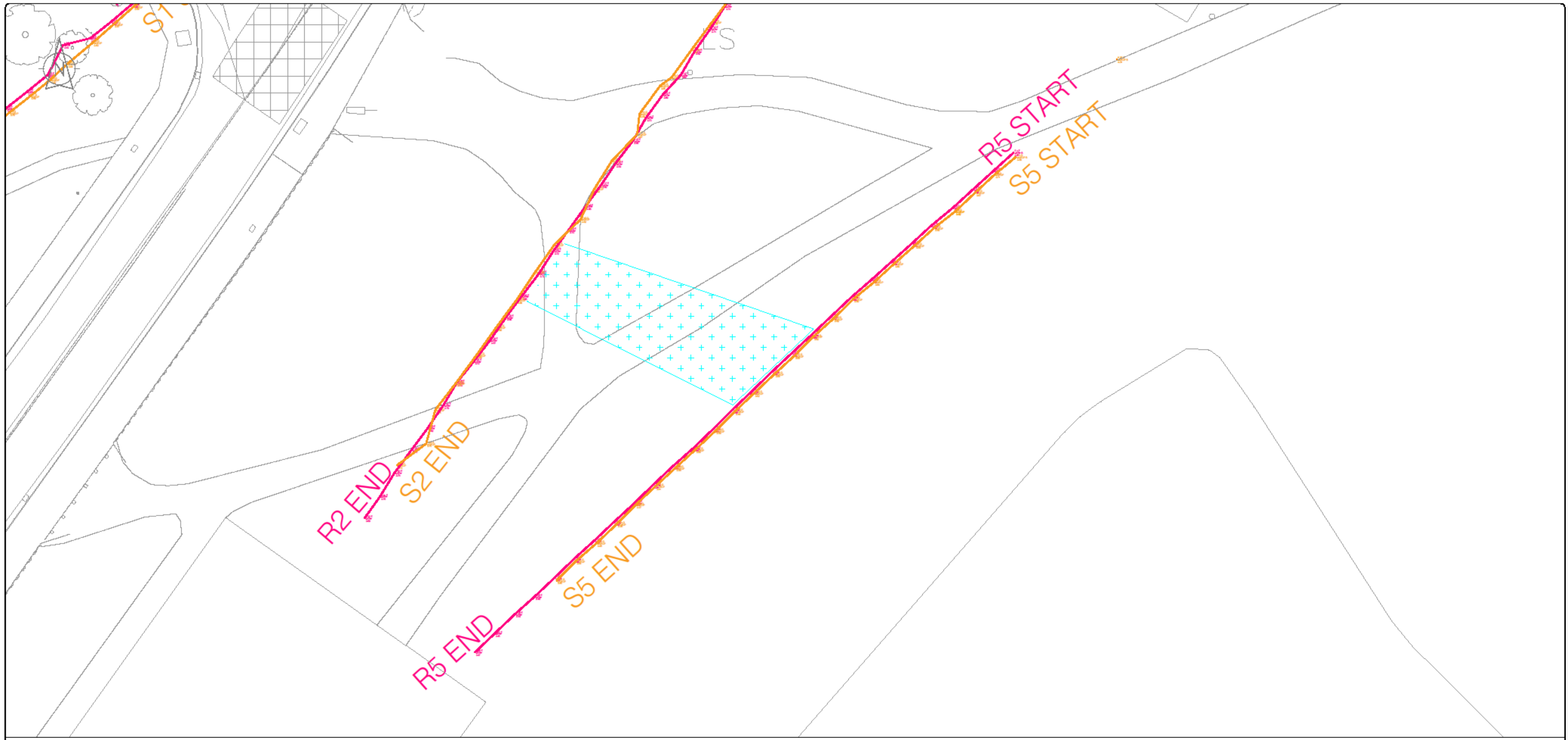
Client : Arup Consulting Engineers Galway

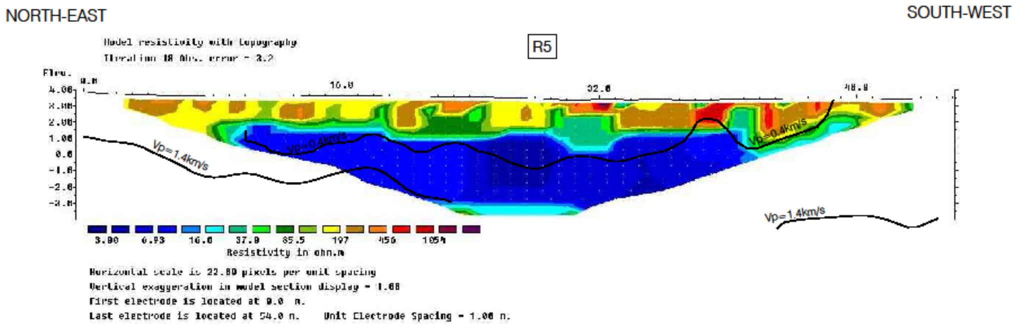
Project : BusConnects Galway Geophysical Survey

Date : 07.12.2021 **Scale :** 1:200@A1

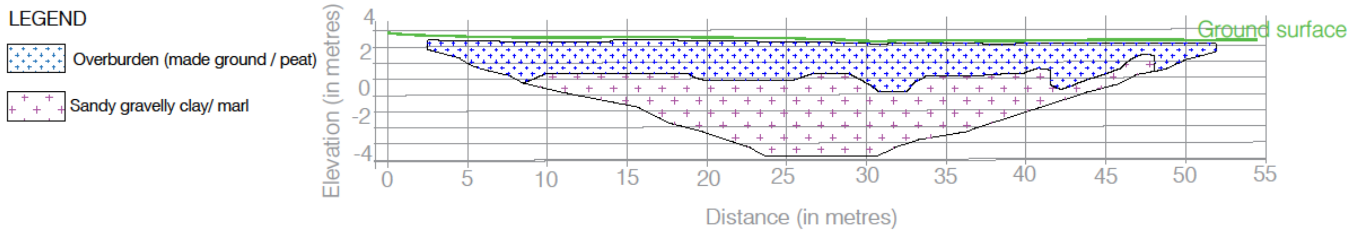
Description : Geophysical Survey
Seismic results for S5

Drawing Number : MGS43796_G





Horizontal scale is 22.80 pixels per unit spacing
Vertical exaggeration in model section display = 1.00
First electrode is located at 0.0 m.
Last electrode is located at 54.0 m. Unit Electrode Spacing = 1.00 m.



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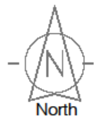

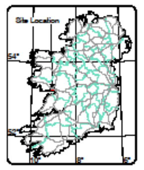

LEGEND
- ▬ Resistivity line
- ▬ Seismic refraction line
- ⚙ Potential Culvert
- ▨ Zone of Higher Water content

Surveyed by : MG | Date: November 2021 | Datum : Malin Head
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Revisions

No	Date	Description
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Client :	Arup Consulting Engineers Galway
Project :	BusConnects Galway Geophysical Survey
Date : 07.12.2021	**Scale :** 1:200@A1
Description :	Geophysical Survey Resistivity results for R5
Drawing Number :	MGS43796_G

References

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Vladimir Shevnin & al., (2006) *Estimation of soil petrophysical parameters from resistivity data: Application to oil-contaminated site characterization,* Estimation of soil petrophysical parameters from resistivity data: Application to oil-contaminated site characterization (scielo.org.mx)

Concentration exceeds GAC	100.00
Limit of Detection value exceeds GAC	<0.1
Concentration exceeds saturation value but not GAC	50

ARUP

											BH101&0.5&202	BH101&1&20211	BH103&0.5&202	BH103&1&20220	BH103WS&0.5&	BH103WS&1.5&
										Hole Ref	BH101	BH101	BH103	BH103	BH103WS	BH103WS
										Sample Ref	Ev	Ev	1	2	1	3
										Easting	531035.03	531035.03	531009.47	531009.47	531009.69	531009.69
										Northing	726236.38	726236.38	726189.14	726189.14	726188.87	726188.87
										Hole Elevation (mOD)	4.8	4.8	3.98	3.98	3.96	3.96
										Sample Depth (mbgl)	0.5	1	0.5	1	0.5	1.5
										Sample Date	30/11/21	30/11/21	17/01/22	21/01/22		
										Investigation						
										Geology	MG	MG	MG	MG	MG	GG
Contaminant Name	**GAC**	**GAC Source**	**Units**	**Total > LOD**	**Total > GAC**	**Min**	**Max**	**Saturation Value**	**Total > Saturation**							
Antimony	1070	AGAC	mg/kg	2 of 18	0	<2	#VALUE!		0		<2	<2	3.2	<2	<2	<2
Arsenic	79	C4SL/S4U	mg/kg	18 of 18	0	5.1	#VALUE!		0		7.9	5.3	15	16	15	16
Cadmium	106	AGAC	mg/kg	18 of 18	0	0.27	#VALUE!		0		0.97	0.73	0.4	0.6	0.43	0.6
Chromium (Hexavalent)	7.7	GAC/S4U	mg/kg	0 of 18	0	<0.5	#VALUE!		0		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium (Trivalent)	1539	AGAC	mg/kg	18 of 18	0	5.7	#VALUE!		0		23	14	8.8	13	7.2	10
Copper	12000	GAC/S4U	mg/kg	18 of 18	0	5.1	#VALUE!		0		9.7	9.2	10	12	9.4	5.7
Lead	630	C4SL	mg/kg	18 of 18	0	5.6	#VALUE!		0		22	25	9	20	7.6	6.6
Mercury Low Level	120	AC (inorga	mg/kg	13 of 18	0	<0.05	#VALUE!		0		0.07	0.06	<0.05	0.13	<0.05	<0.05
Nickel	231	AGAC	mg/kg	18 of 18	0	3.8	#VALUE!		0		18	13	18	17	14	8.8
Selenium	1140	AGAC	mg/kg	5 of 18	0	<0.2	#VALUE!		0		<0.2	<0.2	1.2	<0.2	0.99	<0.2
Zinc	80500	AGAC	mg/kg	18 of 18	0	8.2	#VALUE!		0		43	32	13	37	11	9.1
pH			-	No GAC	-	8.2	#VALUE!		0		8.5	8.5	10.1	9.4	9.9	8.9
Total Organic Carbon			%	No GAC	-	<0.2	#VALUE!		0		0.6	1.1	5	4.1	6.3	4
Phenol	440	(direct co	mg/kg	1 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Aliphatic TPH >C10-C12	12600	AGAC	mg/kg	1 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aliphatic TPH >C12-C16	12600	AGAC	mg/kg	1 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aliphatic TPH >C16-C21	251000	C (Ali >C1	mg/kg	1 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aliphatic TPH >C21-C35	251000	C (Ali >C1	mg/kg	4 of 18	0	<1	#VALUE!		0		<1	<1	79	<1	<1	<1
Aliphatic TPH >C35-C44	251000	C (Ali >C1	mg/kg	0 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aliphatic TPH >C5-C6	575000	AGAC	mg/kg	0 of 18	0	<1	#VALUE!	304.0	0		<1	<1	<1	<1	<1	<1
Aliphatic TPH >C6-C8	597000	AGAC	mg/kg	0 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aliphatic TPH >C8-C10	12500	AGAC	mg/kg	1 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aromatic TPH >C10-C12	5040	AGAC	mg/kg	1 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aromatic TPH >C12-C16	5050	AGAC	mg/kg	2 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aromatic TPH >C16-C21	3770	AGAC	mg/kg	3 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aromatic TPH >C21-C35	3770	AGAC	mg/kg	5 of 18	0	<1	#VALUE!		0		<1	<1	170	<1	<1	<1
Aromatic TPH >C35-C44	3770	AGAC	mg/kg	0 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aromatic TPH >C7-C8	55800	AC (tolue	mg/kg	0 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aromatic TPH >C8-C10	5020	AGAC	mg/kg	0 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Acenaphthene	14800	AGAC	mg/kg	2 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dibenz(a,h)Anthracene	0.573	GAC/S4U	mg/kg	8 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoranthene	3080	AGAC	mg/kg	10 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	9870	AGAC	mg/kg	3 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)Pyrene	81.7	GAC/S4U	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	3070	AGAC	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	7410	AGAC	mg/kg	10 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Naphthalene	4890	AGAC	mg/kg	1 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Of 17 PAH's			mg/kg	No GAC	-	<2	#VALUE!		0		<2	<2	<2	<2	<2	<2
Acenaphthylene	14800	AGAC	mg/kg	3 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anthracene	74100	AGAC	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[a]anthracene	28.5	GAC/S4U	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[a]pyrene	5.72	GAC/S4U	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[g,h,i]perylene	636	GAC/S4U	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[b]fluoranthene	7.21	AGAC	mg/kg	10 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo[k]fluoranthene	190	AGAC	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chrysene	57	AGAC	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzene	72	GAC/S4U	mg/kg	1 of 18	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Toluene	55800	AGAC	mg/kg	4 of 18	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	0.0035	<0.0002	<0.0002	<0.0002
Ethylbenzene	23900	AGAC	mg/kg	1 of 18	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	0.0012	<0.0002	<0.0002	<0.0002

Concentration exceeds GAC	100.00
Limit of Detection value exceeds GAC	<0.1
Concentration exceeds saturation value but not GAC	50

ARUP

Contaminant Name	GAC	GAC Source	Units	Total > LOD	Total > GAC	Min	Max	Saturation Value	Total > Saturation						
Hole Ref										BH101	BH101	BH103	BH103	BH103WS	BH103WS
Sample Ref										Ev	Ev	1	2	1	3
Easting										531035.03	531035.03	531009.47	531009.47	531009.69	531009.69
Northing										726236.38	726236.38	726189.14	726189.14	726188.87	726188.87
Hole Elevation (mOD)										4.8	4.8	3.98	3.98	3.96	3.96
Sample Depth (mbgl)										0.5	1	0.5	1	0.5	1.5
Sample Date										30/11/21	30/11/21	17/01/22	21/01/22		
Investigation															
Geology										MG	MG	MG	MG	MG	GG
m & p-Xylene	40700	AC (p-xyle	mg/kg	1 of 18	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	0.0045	<0.0002	<0.0002	<0.0002
o-Xylene	41000	GAC/S4U	mg/kg	1 of 18	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	0.0024	<0.0002	<0.0002	<0.0002
PCB 118	0.000171	backgrou	mg/kg	0 of 18	0	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 138			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 153			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 180			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 28			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 52			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 90+101			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1,2-Tetrachloroethane	1410	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,1,1-Trichloroethane	137000	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,1,2-Trichloroethane	985	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,1-Dichloroethane	45900	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,1-Dichloroethene	10200	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!	2230.0	0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,1-Dichloropropene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,2,3-Trichlorobenzene	1780	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,2,3-Trichloropropane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,2,4-Trichlorobenzene	14900	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2,4-Trimethylbenzene	248	AGAC	mg/kg	1 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	0.0033	<0.0002	<0.0002	<0.0002
1,2-Dibromo-3-Chloropropane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,2-Dibromoethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,2-Dichlorobenzene	89000	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2-Dichloroethane	28.9	GAC/S4U	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,2-Dichloropropane	1720	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,3,5-Trimethylbenzene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	0.00089	<0.0002	<0.0002	<0.0002
1,3-Dichlorobenzene	247	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,3-Dichloropropane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	0.0015	<0.0002	<0.0002	<0.0002
1,4-Dichlorobenzene	17200	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,4,5-Trichlorophenol	620	S4UL	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,4,6-Trichlorophenol	598	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,4-Dichlorophenol	597	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,4-Dimethylphenol	5020	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,4-Dinitrotoluene	501	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,6-Dinitrotoluene	251	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Chloronaphthalene	7490	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Chlorophenol	597	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Chlorotoluene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
2-Methyl-4,6-Dinitrophenol			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Methylphenol	25080	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Nitroaniline			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Nitrophenol			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3-Nitroaniline			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Bromophenylphenyl Ether			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Chloro-3-Methylphenol			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Chloroaniline			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Chlorophenylphenylether			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Chlorotoluene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
4-Isopropyltoluene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
4-Methylphenol	25080	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Nitroaniline			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Nitrophenol			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Azobenzene			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Concentration exceeds GAC	100.00
Limit of Detection value exceeds GAC	<0.1
Concentration exceeds saturation value but not GAC	50

ARUP

Hole Ref	BH101	BH101	BH103	BH103	BH103WS	BH103WS
Sample Ref	Ev	Ev	1	2	1	3
Easting	531035.03	531035.03	531009.47	531009.47	531009.69	531009.69
Northing	726236.38	726236.38	726189.14	726189.14	726188.87	726188.87
Hole Elevation (mOD)	4.8	4.8	3.98	3.98	3.96	3.96
Sample Depth (mbgl)	0.5	1	0.5	1	0.5	1.5
Sample Date	30/11/21	30/11/21	17/01/22	21/01/22		
Investigation						
Geology	MG	MG	MG	MG	MG	GG

Contaminant Name	GAC	GAC Source	Units	Total > LOD	Total > GAC	Min	Max	Saturation Value	Total > Saturation	BH101 Ev	BH101 Ev	BH103 1	BH103 2	BH103WS 1	BH103WS 3
Bis(2-Chloroethoxy)Methane			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Bis(2-Chloroisopropyl)Ether			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Bis(2-Ethylhexyl)Phthalate	9688	AGAC	mg/kg	1 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Bis-(2-Chloroethyl)Ether			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Bromobenzene	5217	AGAC	mg/kg	1 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	0.00057	<0.0002	<0.0002	<0.0002
Bromochloromethane			mg/kg	No GAC	-	<0.0005	#VALUE!		0	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bromodichloromethane	72.5	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Bromomethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Butylbenzyl Phthalate	126000	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Carbazole			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorobenzene	11450	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Chloroethane	601000	AGAC	mg/kg	1 of 17	0	<0.0002	#VALUE!	2610.0	0	<0.0002	<0.0002	<0.0002	0.0011	<0.0002	<0.0002
Chloromethane	543	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Di-N-Butyl Phthalate	1300	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Di-N-Octyl Phthalate	10700	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dibenzofuran			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dibromochloromethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Dibromomethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Diethyl Phthalate	49400	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dimethylphthalate			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene	15.6	.GAC/S4U	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobutadiene	25.2	.GAC/S4U	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorocyclopentadiene			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachloroethane	124	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Isophorone			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Isopropylbenzene	24500	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Methyl Tert-Butyl Ether	74600	AGAC	mg/kg	0 of 18	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Butylbenzene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Nitrosodi-n-propylamine			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-Nitrosodimethylamine			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-Propylbenzene	24900	AGAC	mg/kg	1 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	0.0026	<0.0002	<0.0002	<0.0002
Nitrobenzene			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pentachlorophenol	59.8	.GAC/S4U	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sec-Butylbenzene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Styrene	3016	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tert-Butylbenzene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tetrachloroethene	1390	AGAC	mg/kg	3 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tetrachloromethane	886	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Trans 1,2-Dichloroethene	3866	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Trans-1,3-Dichloropropene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tribromomethane	3930	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Trichloroethene	119	AGAC	mg/kg	2 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Trichlorofluoromethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Trichloromethane	2500	.GAC/S4U	mg/kg	4 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	0.0054	0.0089	0.0065	<0.0002
Vinyl Chloride	3.49	.GAC/S4U	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
cis 1,2-Dichloroethene	1320	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
cis-1,3-Dichloropropene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
ACM Type			-	No GAC	-		#VALUE!		0	-	-	-	-	-	-
Aromatic TPH >C5-C7			mg/kg	No GAC	-	<1	#VALUE!		0	<1	<1	<1	<1	<1	<1
Asbestos Identification			-	No GAC	-		#VALUE!		0	No Asbestos Detected	sbestos Detected	sbestos Detected	sbestos Detected	sbestos Detected	sbestos Detected
Barium			mg/kg	No GAC	-	12	#VALUE!		0	35	29	20	35	17	15
Coronene			mg/kg	No GAC	-	<0.1	#VALUE!		0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dichlorodifluoromethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

Concentration exceeds GAC	100.00
Limit of Detection value exceeds GAC	<0.1
Concentration exceeds saturation value but not GAC	50

ARUP

Hole Ref	BH101	BH101	BH103	BH103	BH103WS	BH103WS
Sample Ref	Ev	Ev	1	2	1	3
Easting	531035.03	531035.03	531009.47	531009.47	531009.69	531009.69
Northing	726236.38	726236.38	726189.14	726189.14	726188.87	726188.87
Hole Elevation (mOD)	4.8	4.8	3.98	3.98	3.96	3.96
Sample Depth (mbgl)	0.5	1	0.5	1	0.5	1.5
Sample Date	30/11/21	30/11/21	17/01/22	21/01/22		
Investigation						
Geology	MG	MG	MG	MG	MG	GG

Contaminant Name	GAC	GAC Source	Units	Total > LOD	Total > GAC	Min	Max	Saturation Value	Total > Saturation						
LOI			%	No GAC	-	0.74	#VALUE!		0	4.8	4.8	1.1	1.3	0.88	0.74
Molybdenum			mg/kg	No GAC	-	<2	#VALUE!		0	<2	<2	<2	<2	<2	<2
SVOC TIC			mg/kg	No GAC	-		#VALUE!		0	None Detected	None Detected	None Detected	None Detected	None Detected	None Detected
Tetraethyl Lead			mg/kg	No GAC	-	<0.01	#VALUE!		0			<0.01	<0.01	<0.01	<0.01
Tetramethyl Lead			mg/kg	No GAC	-	<0.01	#VALUE!		0			<0.01	<0.01	<0.01	<0.01
Total Aliphatic Hydrocarbons			mg/kg	No GAC	-	<5	#VALUE!		0	<5	<5	79	<5	<5	<5
Total Aromatic Hydrocarbons			mg/kg	No GAC	-	<5	#VALUE!		0	<5	<5	170	<5	<5	<5
Total PCBs (7 Congeners)			mg/kg	No GAC	-	<0.1	#VALUE!		0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Petroleum Hydrocarbons			mg/kg	No GAC	-	<10	#VALUE!		0	<10	<10	250	<10	<10	<10
VOC TIC			mg/kg	No GAC	-		#VALUE!		0	0	0	0	0	0	0

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2

Concentration exceeds GAC	100.00
Limit of Detection value exceeds GAC	<0.1
Concentration exceeds saturation value but not GAC	50

ARUP

	BH104&0.5&202	BH105A&0.5&	BH105A&1.5&	BH106&0.5&	WS101&0.5&202	WS101&1&2021
Hole Ref	BH104	BH105A	BH105A	BH106	WS101	WS101
Sample Ref	2	1	3	1		
Easting	531072.68	531033.11	531033.11	529914.25	531084.08	531084.08
Northing	726115.5	726069.97	726069.97	725704.49	726208.68	726208.68
Hole Elevation (mOD)	3.63	3.98	3.98	7.04	3.81	3.81
Sample Depth (mbgl)	0.5	0.5	1.5	0.5	0.5	1
Sample Date	06/12/21				29/11/21	29/11/21
Investigation						
Geology	MG	MG	MG	MG	MG	MG

Contaminant Name	GAC	GAC Source	Units	Total > LOD	Total > GAC	Min	Max	Saturation Value	Total > Saturation	BH104	BH105A	BH105A	BH106	WS101	WS101
Antimony	1070	AGAC	mg/kg	2 of 18	0	<2	#VALUE!		0	2.1	<2	<2	<2	<2	<2
Arsenic	79	C4SL/S4U	mg/kg	18 of 18	0	5.1	#VALUE!		0	12	21	8.2	7.1	8	6.9
Cadmium	106	AGAC	mg/kg	18 of 18	0	0.27	#VALUE!		0	4	0.49	0.27	0.62	1.4	0.51
Chromium (Hexavalent)	7.7	GAC/S4U	mg/kg	0 of 18	0	<0.5	#VALUE!		0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium (Trivalent)	1539	AGAC	mg/kg	18 of 18	0	5.7	#VALUE!		0	12	11	5.7	25	14	7.4
Copper	12000	GAC/S4U	mg/kg	18 of 18	0	5.1	#VALUE!		0	200	14	7.9	30	26	24
Lead	630	C4SL	mg/kg	18 of 18	0	5.6	#VALUE!		0	82	37	20	29	270	56
Mercury Low Level	120	AC (inorga	mg/kg	13 of 18	0	<0.05	#VALUE!		0	1.2	0.69	0.4	0.18	0.2	0.08
Nickel	231	AGAC	mg/kg	18 of 18	0	3.8	#VALUE!		0	8.9	13	7.8	15	14	7.2
Selenium	1140	AGAC	mg/kg	5 of 18	0	<0.2	#VALUE!		0	<0.2	1.1	0.82	<0.2	0.25	<0.2
Zinc	80500	AGAC	mg/kg	18 of 18	0	8.2	#VALUE!		0	850	41	20	37	160	65
pH			-	No GAC	-	8.2	#VALUE!		0	8.8	8.4	8.7	8.3	8.4	8.5
Total Organic Carbon			%	No GAC	-	<0.2	#VALUE!		0	1.8	2.5	2	1.7	3.6	2.3
Phenol	440	(direct co	mg/kg	1 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	0.07
Aliphatic TPH >C10-C12	12600	AGAC	mg/kg	1 of 18	0	<1	#VALUE!		0	<1	<1	<1	<1	360	<1
Aliphatic TPH >C12-C16	12600	AGAC	mg/kg	1 of 18	0	<1	#VALUE!		0	<1	<1	<1	<1	1100	<1
Aliphatic TPH >C16-C21	251000	C (Ali >C1	mg/kg	1 of 18	0	<1	#VALUE!		0	<1	<1	<1	<1	1100	<1
Aliphatic TPH >C21-C35	251000	C (Ali >C1	mg/kg	4 of 18	0	<1	#VALUE!		0	<1	<1	<1	11	390	38
Aliphatic TPH >C35-C44	251000	C (Ali >C1	mg/kg	0 of 18	0	<1	#VALUE!		0	<1	<1	<1	<1	<1	<1
Aliphatic TPH >C5-C6	575000	AGAC	mg/kg	0 of 18	0	<1	#VALUE!	304.0	0	<1	<1	<1	<1	<1	<1
Aliphatic TPH >C6-C8	597000	AGAC	mg/kg	0 of 18	0	<1	#VALUE!		0	<1	<1	<1	<1	<1	<1
Aliphatic TPH >C8-C10	12500	AGAC	mg/kg	1 of 18	0	<1	#VALUE!		0	<1	<1	<1	<1	94	<1
Aromatic TPH >C10-C12	5040	AGAC	mg/kg	1 of 18	0	<1	#VALUE!		0	<1	<1	<1	<1	53	<1
Aromatic TPH >C12-C16	5050	AGAC	mg/kg	2 of 18	0	<1	#VALUE!		0	<1	<1	<1	<1	400	44
Aromatic TPH >C16-C21	3770	AGAC	mg/kg	3 of 18	0	<1	#VALUE!		0	<1	<1	<1	<1	270	210
Aromatic TPH >C21-C35	3770	AGAC	mg/kg	5 of 18	0	<1	#VALUE!		0	<1	<1	<1	77	54	460
Aromatic TPH >C35-C44	3770	AGAC	mg/kg	0 of 18	0	<1	#VALUE!		0	<1	<1	<1	<1	<1	<1
Aromatic TPH >C7-C8	55800	AC (tolue	mg/kg	0 of 18	0	<1	#VALUE!		0	<1	<1	<1	<1	<1	<1
Aromatic TPH >C8-C10	5020	AGAC	mg/kg	0 of 18	0	<1	#VALUE!		0	<1	<1	<1	<1	<1	<1
Acenaphthene	14800	AGAC	mg/kg	2 of 18	0	<0.05	#VALUE!		0	<0.05	0.094	<0.05	<0.1	<0.05	<0.05
Dibenz(a,h)Anthracene	0.573	GAC/S4U	mg/kg	8 of 18	0	<0.05	#VALUE!		0	<0.05	0.13	0.055	0.23	0.12	0.12
Fluoranthene	3080	AGAC	mg/kg	10 of 18	0	<0.05	#VALUE!		0	0.082	2.1	0.64	0.31	0.99	1.4
Fluorene	9870	AGAC	mg/kg	3 of 18	0	<0.05	#VALUE!		0	<0.05	0.12	<0.05	<0.1	<0.05	0.07
Indeno(1,2,3-c,d)Pyrene	81.7	GAC/S4U	mg/kg	9 of 18	0	<0.05	#VALUE!		0	<0.05	0.53	0.18	0.35	0.37	0.41
Phenanthrene	3070	AGAC	mg/kg	9 of 18	0	<0.05	#VALUE!		0	<0.05	0.94	0.29	0.14	0.34	0.94
Pyrene	7410	AGAC	mg/kg	10 of 18	0	<0.05	#VALUE!		0	0.093	1.6	0.53	0.34	0.84	1.2
Naphthalene	4890	AGAC	mg/kg	1 of 18	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.1	<0.05	0.07
Total Of 17 PAH's			mg/kg	No GAC	-	<2	#VALUE!		0	2	15	14	3.4	58	3.7
Acenaphthylene	14800	AGAC	mg/kg	3 of 18	0	<0.05	#VALUE!		0	<0.05	0.073	<0.05	<0.1	0.076	0.15
Anthracene	74100	AGAC	mg/kg	9 of 18	0	<0.05	#VALUE!		0	<0.05	0.36	0.1	0.11	0.076	0.15
Benzo[a]anthracene	28.5	GAC/S4U	mg/kg	9 of 18	0	<0.05	#VALUE!		0	<0.05	1.1	0.37	0.34	0.57	0.58
Benzo[a]pyrene	5.72	GAC/S4U	mg/kg	9 of 18	0	<0.05	#VALUE!		0	<0.05	1	0.34	0.34	0.65	0.71
Benzo[g,h,i]perylene	636	GAC/S4U	mg/kg	9 of 18	0	<0.05	#VALUE!		0	<0.05	0.64	0.22	0.31	0.47	0.54
Benzo[b]fluoranthene	7.21	AGAC	mg/kg	10 of 18	0	<0.05	#VALUE!		0	0.093	1.3	0.47	0.37	0.9	0.87
Benzo[k]fluoranthene	190	AGAC	mg/kg	9 of 18	0	<0.05	#VALUE!		0	<0.05	0.46	0.17	0.29	0.28	0.3
Chrysene	57	AGAC	mg/kg	9 of 18	0	<0.05	#VALUE!		0	<0.05	1	0.39	0.23	0.59	0.64
Benzene	72	GAC/S4U	mg/kg	1 of 18	0	<0.0002	#VALUE!		0	0.0014	<0.0002	<0.0002	<0.001	<0.0002	<0.0002
Toluene	55800	AGAC	mg/kg	4 of 18	0	<0.0002	#VALUE!		0	0.0031	0.0017	0.002	<0.001	<0.0002	<0.0002
Ethylbenzene	23900	AGAC	mg/kg	1 of 18	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002

ARUP

Concentration exceeds GAC	100.00
Limit of Detection value exceeds GAC	<0.1
Concentration exceeds saturation value but not GAC	50

										Hole Ref	BH104	BH105A	BH105A	BH106	WS101	WS101
										Sample Ref	2	1	3	1		
										Easting	531072.68	531033.11	531033.11	529914.25	531084.08	531084.08
										Northing	726115.5	726069.97	726069.97	725704.49	726208.68	726208.68
										Hole Elevation (mOD)	3.63	3.98	3.98	7.04	3.81	3.81
										Sample Depth (mbgl)	0.5	0.5	1.5	0.5	0.5	1
										Sample Date	06/12/21				29/11/21	29/11/21
										Investigation						
										Geology	MG	MG	MG	MG	MG	MG
Contaminant Name	**GAC**	**GAC Source**	**Units**	**Total > LOD**	**Total > GAC**	**Min**	**Max**	**Saturation Value**	**Total > Saturation**							
m & p-Xylene	40700	AC (p-xyle	mg/kg	1 of 18	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002
o-Xylene	41000	.GAC/S4U	mg/kg	1 of 18	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002
PCB 118	0.000171	ı backgrou	mg/kg	0 of 18	0	<0.01	#VALUE!		0		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 138			mg/kg	No GAC	-	<0.01	#VALUE!		0		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 153			mg/kg	No GAC	-	<0.01	#VALUE!		0		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 180			mg/kg	No GAC	-	<0.01	#VALUE!		0		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 28			mg/kg	No GAC	-	<0.01	#VALUE!		0		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 52			mg/kg	No GAC	-	<0.01	#VALUE!		0		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 90+101			mg/kg	No GAC	-	<0.01	#VALUE!		0		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1,2-Tetrachloroethane	1410	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,1,1-Trichloroethane	137000	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,1,2-Trichloroethane	985	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,1-Dichloroethane	45900	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,1-Dichloroethene	10200	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!	2230.0	0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,1-Dichloropropene			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,2,3-Trichlorobenzene	1780	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,2,3-Trichloropropane			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,2,4-Trichlorobenzene	14900	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
1,2,4-Trimethylbenzene	248	AGAC	mg/kg	1 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,2-Dibromo-3-Chloropropane			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,2-Dibromoethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,2-Dichlorobenzene	89000	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
1,2-Dichloroethane	28.9	.GAC/S4U	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,2-Dichloropropane	1720	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,3,5-Trimethylbenzene			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,3-Dichlorobenzene	247	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
1,3-Dichloropropane			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
1,4-Dichlorobenzene	17200	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
2,4,5-Trichlorophenol	620	S4UL	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
2,4,6-Trichlorophenol	598	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
2,4-Dichlorophenol	597	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
2,4-Dimethylphenol	5020	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
2,4-Dinitrotoluene	501	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
2,6-Dinitrotoluene	251	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
2-Chloronaphthalene	7490	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
2-Chlorophenol	597	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
2-Chlorotoluene			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
2-Methyl-4,6-Dinitrophenol			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
2-Methylnaphthalene			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	0.063	<0.05		<0.05	0.058
2-Methylphenol	25080	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
2-Nitroaniline			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
2-Nitrophenol			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
3-Nitroaniline			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
4-Bromophenylphenyl Ether			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
4-Chloro-3-Methylphenol			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
4-Chloroaniline			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
4-Chlorophenylphenylether			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
4-Chlorotoluene			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
4-Isopropyltoluene			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
4-Methylphenol	25080	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
4-Nitroaniline			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
4-Nitrophenol			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05
Azobenzene			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05		<0.05	<0.05

Concentration exceeds GAC	100.00
Limit of Detection value exceeds GAC	<0.1
Concentration exceeds saturation value but not GAC	50

ARUP

Hole Ref	BH104	BH105A	BH105A	BH106	WS101	WS101
Sample Ref	2	1	3	1		
Easting	531072.68	531033.11	531033.11	529914.25	531084.08	531084.08
Northing	726115.5	726069.97	726069.97	725704.49	726208.68	726208.68
Hole Elevation (mOD)	3.63	3.98	3.98	7.04	3.81	3.81
Sample Depth (mbgl)	0.5	0.5	1.5	0.5	0.5	1
Sample Date	06/12/21				29/11/21	29/11/21
Investigation						
Geology	MG	MG	MG	MG	MG	MG

Contaminant Name	GAC	GAC Source	Units	Total > LOD	Total > GAC	Min	Max	Saturation Value	Total > Saturation	BH104	BH105A	BH105A	BH106	WS101	WS101
Bis(2-Chloroethoxy)Methane			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Bis(2-Chloroisopropyl)Ether			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Bis(2-Ethylhexyl)Phthalate	9688	AGAC	mg/kg	1 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	0.22
Bis-(2-Chloroethyl)Ether			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Bromobenzene	5217	AGAC	mg/kg	1 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Bromochloromethane			mg/kg	No GAC	-	<0.0005	#VALUE!		0	<0.0005	<0.0005	<0.0005		<0.0005	<0.0005
Bromodichloromethane	72.5	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Bromomethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Butylbenzyl Phthalate	126000	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Carbazole			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	0.073	<0.05		<0.05	0.11
Chlorobenzene	11450	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Chloroethane	601000	AGAC	mg/kg	1 of 17	0	<0.0002	#VALUE!	2610.0	0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Chloromethane	543	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Di-N-Butyl Phthalate	1300	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Di-N-Octyl Phthalate	10700	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Dibenzofuran			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	0.052	<0.05		<0.05	0.07
Dibromochloromethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Dibromomethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Diethyl Phthalate	49400	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Dimethylphthalate			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Hexachlorobenzene	15.6	.GAC/S4U	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Hexachlorobutadiene	25.2	.GAC/S4U	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Hexachlorocyclopentadiene			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Hexachloroethane	124	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Isophorone			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Isopropylbenzene	24500	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Methyl Tert-Butyl Ether	74600	AGAC	mg/kg	0 of 18	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002
N-Butylbenzene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
N-Nitrosodi-n-propylamine			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
N-Nitrosodimethylamine			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
N-Propylbenzene	24900	AGAC	mg/kg	1 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Nitrobenzene			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Pentachlorophenol	59.8	.GAC/S4U	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05		<0.05	<0.05
Sec-Butylbenzene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Styrene	3016	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Tert-Butylbenzene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Tetrachloroethene	1390	AGAC	mg/kg	3 of 17	0	<0.0002	#VALUE!		0	0.015	0.011	0.0067		<0.0002	<0.0002
Tetrachloromethane	886	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Trans 1,2-Dichloroethene	3866	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Trans-1,3-Dichloropropene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Tribromomethane	3930	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Trichloroethene	119	AGAC	mg/kg	2 of 17	0	<0.0002	#VALUE!		0	0.0025	<0.0002	0.0013		<0.0002	<0.0002
Trichlorofluoromethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Trichloromethane	2500	.GAC/S4U	mg/kg	4 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
Vinyl Chloride	3.49	.GAC/S4U	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
cis 1,2-Dichloroethene	1320	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
cis-1,3-Dichloropropene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002
ACM Type			-	No GAC	-		#VALUE!		0	-	-	-	-	-	-
Aromatic TPH >C5-C7			mg/kg	No GAC	-	<1	#VALUE!		0	<1	<1	<1	<1	<1	<1
Asbestos Identification			-	No GAC	-		#VALUE!		0	No Asbestos Detected	sbestos Detected	sbestos Detected	sbestos Detected	sbestos Detected	sbestos Detected
Barium			mg/kg	No GAC	-	12	#VALUE!		0	70	50	27	57	84	33
Coronene			mg/kg	No GAC	-	<0.1	#VALUE!		0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dichlorodifluoromethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002

Concentration exceeds GAC	**100.00**
Limit of Detection value exceeds GAC	<0.1
Concentration exceeds saturation value but not GAC	50

										Hole Ref	BH104	BH105A	BH105A	BH106	WS101	WS101
										Sample Ref	2	1	3	1		
										Easting	531072.68	531033.11	531033.11	529914.25	531084.08	531084.08
										Northing	726115.5	726069.97	726069.97	725704.49	726208.68	726208.68
										Hole Elevation (mOD)	3.63	3.98	3.98	7.04	3.81	3.81
										Sample Depth (mbgl)	0.5	0.5	1.5	0.5	0.5	1
										Sample Date	06/12/21				29/11/21	29/11/21
										Investigation						
										Geology	MG	MG	MG	MG	MG	MG
Contaminant Name	**GAC**	**GAC Source**	**Units**	**Total > LOD**	**Total > GAC**	**Min**	**Max**	**Saturation Value**	**Total > Saturation**							
LOI			%	No GAC	-	0.74	#VALUE!		0		3	4.3	4.1	4	7.8	4.3
Molybdenum			mg/kg	No GAC	-	<2	#VALUE!		0		<2	2.1	<2	<2	<2	<2
SVOC TIC			mg/kg	No GAC	-		#VALUE!		0		None Detected	None Detected	None Detected		None Detected	None Detected
Tetraethyl Lead			mg/kg	No GAC	-	<0.01	#VALUE!		0							
Tetramethyl Lead			mg/kg	No GAC	-	<0.01	#VALUE!		0							
Total Aliphatic Hydrocarbons			mg/kg	No GAC	-	<5	#VALUE!		0		<5	<5	<5	11	3100	38
Total Aromatic Hydrocarbons			mg/kg	No GAC	-	<5	#VALUE!		0		<5	<5	<5	77	780	710
Total PCBs (7 Congeners)			mg/kg	No GAC	-	<0.1	#VALUE!		0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Petroleum Hydrocarbons			mg/kg	No GAC	-	<10	#VALUE!		0		<10	<10	<10	87	3800	750
VOC TIC			mg/kg	No GAC	-		#VALUE!		0		0	0	0		0	0

Concentration exceeds GAC	100.00
Limit of Detection value exceeds GAC	<0.1
Concentration exceeds saturation value but not GAC	50

ARUP

											WS104&0.5&	WS104&1&	WS105&0.5&202	WS105&1&2021·	WS106&0.5&202	WS106&1&2021·
										Hole Ref	WS104	WS104	WS105	WS105	WS106	WS106
										Sample Ref	1	2	1	2	1	2
										Easting	530997.95	530997.95	530903.19	530903.19	530922.85	530922.85
										Northing	726165.53	726165.53	726025.43	726025.43	726032.93	726032.93
										Hole Elevation (mOD)	3.9	3.9	4.35	4.35	3.67	3.67
										Sample Depth (mbgl)	0.5	1	0.5	1	0.5	1
										Sample Date			30/11/21	30/11/21	30/11/21	30/11/21
										Investigation						
										Geology	MG	GG	MG	MG	MG	MG
Contaminant Name	**GAC**	**GAC Source**	**Units**	**Total > LOD**	**Total > GAC**	**Min**	**Max**	**Saturation Value**	**Total > Saturation**							
Antimony	1070	AGAC	mg/kg	2 of 18	0	<2	#VALUE!		0		<2	<2	<2	<2	<2	<2
Arsenic	79	;4SL/S4U	mg/kg	18 of 18	0	5.1	#VALUE!		0		12	5.1	10	12	8.4	8.4
Cadmium	106	AGAC	mg/kg	18 of 18	0	0.27	#VALUE!		0		0.39	0.37	0.47	0.94	0.52	0.47
Chromium (Hexavalent)	7.7	.GAC/S4U	mg/kg	0 of 18	0	<0.5	#VALUE!		0		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium (Trivalent)	1539	AGAC	mg/kg	18 of 18	0	5.7	#VALUE!		0		6.8	5.7	11	10	12	6.7
Copper	12000	.GAC/S4U	mg/kg	18 of 18	0	5.1	#VALUE!		0		6.1	15	5.1	18	30	7.2
Lead	630	C4SL	mg/kg	18 of 18	0	5.6	#VALUE!		0		15	12	5.6	250	89	20
Mercury Low Level	120	AC (inorga	mg/kg	13 of 18	0	<0.05	#VALUE!		0		<0.05	0.07	<0.05	0.13	0.25	0.05
Nickel	231	AGAC	mg/kg	18 of 18	0	3.8	#VALUE!		0		6.8	3.8	10	12	11	7.4
Selenium	1140	AGAC	mg/kg	5 of 18	0	<0.2	#VALUE!		0		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Zinc	80500	AGAC	mg/kg	18 of 18	0	8.2	#VALUE!		0		8.2	8.8	14	72	85	26
pH			-	No GAC	-	8.2	#VALUE!		0		9.3	8.6	8.5	8.2	8.2	8.4
Total Organic Carbon			%	No GAC	-	<0.2	#VALUE!		0		6.5	4.3	<0.2	0.6	2.6	0.3
Phenol	440	(direct co	mg/kg	1 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Aliphatic TPH >C10-C12	12600	AGAC	mg/kg	1 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aliphatic TPH >C12-C16	12600	AGAC	mg/kg	1 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aliphatic TPH >C16-C21	251000	C (Ali >C1	mg/kg	1 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aliphatic TPH >C21-C35	251000	C (Ali >C1	mg/kg	4 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aliphatic TPH >C35-C44	251000	C (Ali >C1	mg/kg	0 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aliphatic TPH >C5-C6	575000	AGAC	mg/kg	0 of 18	0	<1	#VALUE!	304.0	0		<1	<1	<1	<1	<1	<1
Aliphatic TPH >C6-C8	597000	AGAC	mg/kg	0 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aliphatic TPH >C8-C10	12500	AGAC	mg/kg	1 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aromatic TPH >C10-C12	5040	AGAC	mg/kg	1 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aromatic TPH >C12-C16	5050	AGAC	mg/kg	2 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aromatic TPH >C16-C21	3770	AGAC	mg/kg	3 of 18	0	<1	#VALUE!		0		<1	<1	6.8	<1	<1	<1
Aromatic TPH >C21-C35	3770	AGAC	mg/kg	5 of 18	0	<1	#VALUE!		0		<1	<1	52	<1	<1	<1
Aromatic TPH >C35-C44	3770	AGAC	mg/kg	0 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aromatic TPH >C7-C8	55800	;AC (tolue	mg/kg	0 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Aromatic TPH >C8-C10	5020	AGAC	mg/kg	0 of 18	0	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Acenaphthene	14800	AGAC	mg/kg	2 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	0.079	<0.05	<0.05
Dibenz(a,h)Anthracene	0.573	.GAC/S4U	mg/kg	8 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	0.1	0.13	<0.05	0.066
Fluoranthene	3080	AGAC	mg/kg	10 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	0.91	2.1	0.58	1.1
Fluorene	9870	AGAC	mg/kg	3 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	0.079	<0.05	<0.05
Indeno(1,2,3-c,d)Pyrene	81.7	.GAC/S4U	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	0.23	0.36	0.18	0.26
Phenanthrene	3070	AGAC	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	0.25	0.66	0.27	0.62
Pyrene	7410	AGAC	mg/kg	10 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	0.73	1.6	0.51	0.89
Naphthalene	4890	AGAC	mg/kg	1 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Of 17 PAH's			mg/kg	No GAC	-	<2	#VALUE!		0		<2	<2	<2	50	27	<2
Acenaphthylene	14800	AGAC	mg/kg	3 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anthracene	74100	AGAC	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	0.13	0.24	0.073	0.14
Benzo[a]anthracene	28.5	.GAC/S4U	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	0.48	0.96	0.35	0.48
Benzo[a]pyrene	5.72	.GAC/S4U	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	0.46	0.71	0.35	0.47
Benzo[g,h,i]perylene	636	.GAC/S4U	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	0.27	0.43	0.21	0.25
Benzo[b]fluoranthene	7.21	AGAC	mg/kg	10 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	0.58	1.1	0.48	0.64
Benzo[k]fluoranthene	190	AGAC	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	0.23	0.36	0.17	0.22
Chrysene	57	AGAC	mg/kg	9 of 18	0	<0.05	#VALUE!		0		<0.05	<0.05	0.45	0.87	0.32	0.52
Benzene	72	.GAC/S4U	mg/kg	1 of 18	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Toluene	55800	AGAC	mg/kg	4 of 18	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Ethylbenzene	23900	AGAC	mg/kg	1 of 18	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

Concentration exceeds GAC	100.00
Limit of Detection value exceeds GAC	<0.1
Concentration exceeds saturation value but not GAC	50

ARUP

Hole Ref	WS104	WS104	WS105	WS105	WS106	WS106
Sample Ref	1	2	1	2	1	2
Easting	530997.95	530997.95	530903.19	530903.19	530922.85	530922.85
Northing	726165.53	726165.53	726025.43	726025.43	726032.93	726032.93
Hole Elevation (mOD)	3.9	3.9	4.35	4.35	3.67	3.67
Sample Depth (mbgl)	0.5	1	0.5	1	0.5	1
Sample Date			30/11/21	30/11/21	30/11/21	30/11/21
Investigation						
Geology	MG	GG	MG	MG	MG	MG

Contaminant Name	GAC	GAC Source	Units	Total > LOD	Total > GAC	Min	Max	Saturation Value	Total > Saturation	WS104 1	WS104 2	WS105 1	WS105 2	WS106 1	WS106 2
m & p-Xylene	40700	AC (p-xyle	mg/kg	1 of 18	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
o-Xylene	41000	.GAC/S4U	mg/kg	1 of 18	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
PCB 118	0.000171	ı backgroı	mg/kg	0 of 18	0	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 138			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 153			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 180			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 28			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 52			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB 90+101			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,1,1,2-Tetrachloroethane	1410	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,1,1-Trichloroethane	137000	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,1,2-Trichloroethane	985	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,1-Dichloroethane	45900	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,1-Dichloroethene	10200	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!	2230.0	0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,1-Dichloropropene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,2,3-Trichlorobenzene	1780	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,2,3-Trichloropropane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,2,4-Trichlorobenzene	14900	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2,4-Trimethylbenzene	248	AGAC	mg/kg	1 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,2-Dibromo-3-Chloropropane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,2-Dibromoethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,2-Dichlorobenzene	89000	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2-Dichloroethane	28.9	.GAC/S4U	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,2-Dichloropropane	1720	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,3,5-Trimethylbenzene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,3-Dichlorobenzene	247	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,3-Dichloropropane			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
1,4-Dichlorobenzene	17200	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,4,5-Trichlorophenol	620	S4UL	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,4,6-Trichlorophenol	598	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,4-Dichlorophenol	597	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,4-Dimethylphenol	5020	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,4-Dinitrotoluene	501	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2,6-Dinitrotoluene	251	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Chloronaphthalene	7490	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Chlorophenol	597	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Chlorotoluene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
2-Methyl-4,6-Dinitrophenol			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Methylphenol	25080	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Nitroaniline			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Nitrophenol			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3-Nitroaniline			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Bromophenylphenyl Ether			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Chloro-3-Methylphenol			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Chloroaniline			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Chlorophenylphenylether			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Chlorotoluene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
4-Isopropyltoluene			mg/kg	No GAC	-	<0.0002	#VALUE!		0	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
4-Methylphenol	25080	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Nitroaniline			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Nitrophenol			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Azobenzene			mg/kg	No GAC	-	<0.05	#VALUE!		0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

1 3 4
2

Concentration exceeds GAC	100.00
Limit of Detection value exceeds GAC	<0.1
Concentration exceeds saturation value but not GAC	50

ARUP

Contaminant Name	GAC	GAC Source	Units	Total > LOD	Total > GAC	Min	Max	Saturation Value	Total > Saturation							
										Hole Ref	WS104	WS104	WS105	WS105	WS106	WS106
										Sample Ref	1	2				
										Easting	530997.95	530997.95	530903.19	530903.19	530922.85	530922.85
										Northing	726165.53	726165.53	726025.43	726025.43	726032.93	726032.93
										Hole Elevation (mOD)	3.9	3.9	4.35	4.35	3.67	3.67
										Sample Depth (mbgl)	0.5	1	0.5	1	0.5	1
										Sample Date			30/11/21	30/11/21	30/11/21	30/11/21
										Investigation						
										Geology	MG	GG	MG	MG	MG	MG
Bis(2-Chloroethoxy)Methane			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Bis(2-Chloroisopropyl)Ether			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Bis(2-Ethylhexyl)Phthalate	9688	AGAC	mg/kg	1 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Bis-(2-Chloroethyl)Ether			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Bromobenzene	5217	AGAC	mg/kg	1 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Bromochloromethane			mg/kg	No GAC	-	<0.0005	#VALUE!		0		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bromodichloromethane	72.5	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Bromomethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Butylbenzyl Phthalate	126000	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Carbazole			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	0.066
Chlorobenzene	11450	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Chloroethane	601000	AGAC	mg/kg	1 of 17	0	<0.0002	#VALUE!	2610.0	0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Chloromethane	543	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Di-N-Butyl Phthalate	1300	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Di-N-Octyl Phthalate	10700	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dibenzofuran			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dibromochloromethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Dibromomethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Diethyl Phthalate	49400	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dimethylphthalate			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene	15.6	.GAC/S4U	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobutadiene	25.2	.GAC/S4U	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorocyclopentadiene			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachloroethane	124	AGAC	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Isophorone			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Isopropylbenzene	24500	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Methyl Tert-Butyl Ether	74600	AGAC	mg/kg	0 of 18	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Butylbenzene			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Nitrosodi-n-propylamine			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-Nitrosodimethylamine			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-Propylbenzene	24900	AGAC	mg/kg	1 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Nitrobenzene			mg/kg	No GAC	-	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pentachlorophenol	59.8	.GAC/S4U	mg/kg	0 of 17	0	<0.05	#VALUE!		0		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sec-Butylbenzene			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Styrene	3016	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tert-Butylbenzene			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tetrachloroethene	1390	AGAC	mg/kg	3 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tetrachloromethane	886	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Trans 1,2-Dichloroethene	3866	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Trans-1,3-Dichloropropene			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tribromomethane	3930	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Trichloroethene	119	AGAC	mg/kg	2 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Trichlorofluoromethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Trichloromethane	2500	.GAC/S4U	mg/kg	4 of 17	0	<0.0002	#VALUE!		0		0.0053	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Vinyl Chloride	3.49	.GAC/S4U	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
cis 1,2-Dichloroethene	1320	AGAC	mg/kg	0 of 17	0	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
cis-1,3-Dichloropropene			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
ACM Type			-	No GAC	-		#VALUE!		0		-	-	-	-	-	-
Aromatic TPH >C5-C7			mg/kg	No GAC	-	<1	#VALUE!		0		<1	<1	<1	<1	<1	<1
Asbestos Identification			-	No GAC	-		#VALUE!		0		No Asbestos Detected	sbestos Detected	sbestos Detected	sbestos Detected	sbestos Detected	sbestos Detected
Barium			mg/kg	No GAC	-	12	#VALUE!		0		19	12	12	100	67	16
Coronene			mg/kg	No GAC	-	<0.1	#VALUE!		0		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dichlorodifluoromethane			mg/kg	No GAC	-	<0.0002	#VALUE!		0		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

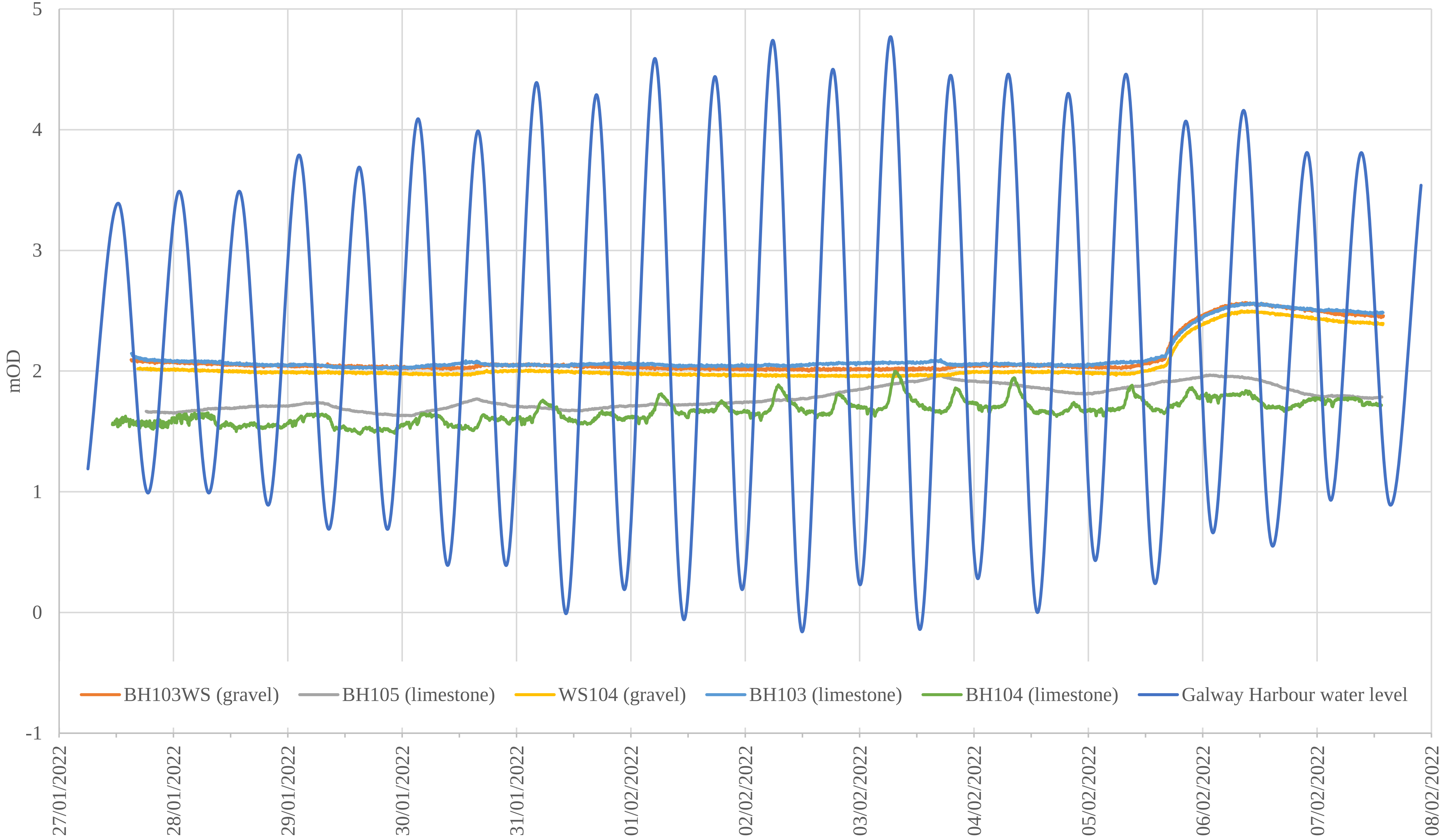
Concentration exceeds GAC	100.00
Limit of Detection value exceeds GAC	<0.1
Concentration exceeds saturation value but not GAC	50

ARUP

Hole Ref	WS104	WS104	WS105	WS105	WS106	WS106
Sample Ref	1	2				
Easting	530997.95	530997.95	530903.19	530903.19	530922.85	530922.85
Northing	726165.53	726165.53	726025.43	726025.43	726032.93	726032.93
Hole Elevation (mOD)	3.9	3.9	4.35	4.35	3.67	3.67
Sample Depth (mbgl)	0.5	1	0.5	1	0.5	1
Sample Date			30/11/21	30/11/21	30/11/21	30/11/21
Investigation						
Geology	MG	GG	MG	MG	MG	MG

Contaminant Name	GAC	GAC Source	Units	Total > LOD	Total > GAC	Min	Max	Saturation Value	Total > Saturation	WS104 (1)	WS104 (2)	WS105	WS105	WS106	WS106
LOI			%	No GAC	-	0.74	#VALUE!		0	0.93	2	2.9	4.9	4.7	3
Molybdenum			mg/kg	No GAC	-	<2	#VALUE!		0	<2	<2	<2	<2	<2	<2
SVOC TIC			mg/kg	No GAC	-		#VALUE!		0	None Detected	None Detected	None Detected	None Detected	None Detected	None Detected
Tetraethyl Lead			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01				
Tetramethyl Lead			mg/kg	No GAC	-	<0.01	#VALUE!		0	<0.01	<0.01				
Total Aliphatic Hydrocarbons			mg/kg	No GAC	-	<5	#VALUE!		0	<5	<5	<5	<5	<5	<5
Total Aromatic Hydrocarbons			mg/kg	No GAC	-	<5	#VALUE!		0	<5	<5	59	<5	<5	<5
Total PCBs (7 Congeners)			mg/kg	No GAC	-	<0.1	#VALUE!		0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Petroleum Hydrocarbons			mg/kg	No GAC	-	<10	#VALUE!		0	<10	<10	59	<10	<10	<10
VOC TIC			mg/kg	No GAC	-		#VALUE!		0	0	0	0	0	0	0

Appendix 14.4
Hydrograph showing groundwater levels recorded in the east of the proposed Galway Busconnects scheme



Galway City Council

BusConnects Galway: Cross-City Link (University Road to Dublin Road)

Appendix 14.5 - Land Contamination Remedial Strategy

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Contents

1 Introduction

Ove Arup & Partners Ireland (trading as Arup) have been appointed to provide multi-disciplinary engineering services for the proposed BusConnects Galway – Cross City Link Scheme (hereafter referred to as the Proposed Scheme) on behalf of Galway City Council. The Proposed Scheme is located from University Road to Dublin Road Galway City.

The Proposed Scheme redline boundary includes permanent acquisition of land within the footprint of the existing College Road Service Station (CRSS) operated by Circle K and temporary acquisition of the entire CRSS. Arup is providing technical guidance relating to the Land Contamination Remedial Strategy of the CRSS. This report comprises Appendix 14.5 of Volume 4 of the EIAR to Chapter 14 Land, Soils, Hydrogeology and Geology chapter of the EIAR (Volume 2).

The CRSS is located within the north-east of the Proposed Scheme. The area can be viewed on Diagram 1, the site is located 200m from Lough Atalia which is part of the Galway Bay Complex Special Area of Conservation (SAC).

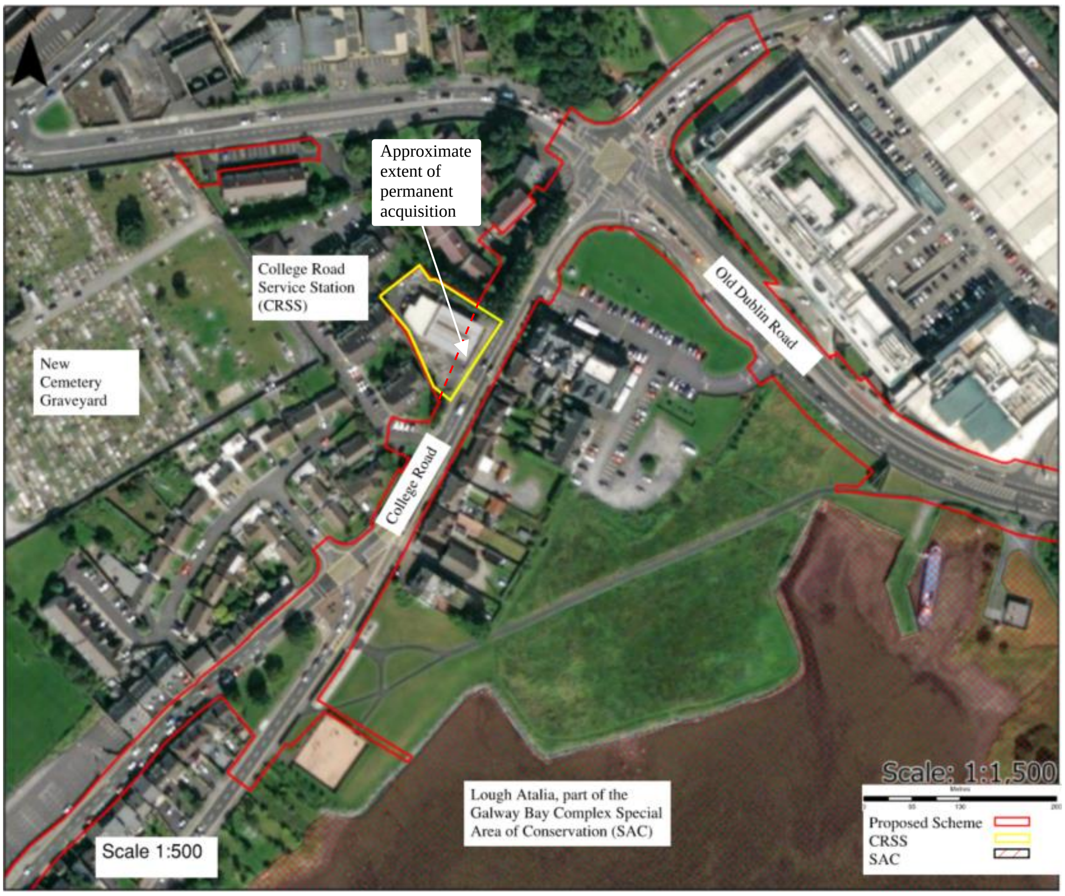

Diagram 1: Site layout and study area

1.1 Purpose of this report

The CRSS has been highlighted in the EIAR for the Proposed Scheme (refer to Chapter 14 Land, Soils, Geology and Hydrogeology) to be a potential soil and groundwater contamination source. As a result of this, the extent of the CRSS within the permanently acquired area is subject to a detailed assessment to determine the presence and extent of any contamination. The permanent acquisition includes the footpath and carriageway of the Proposed Scheme. The extent of the footpath and carriage way at the CRSS forecourt can be seen in Sheet 10 of the general arrangement drawings and Diagram 1 above. For the purpose of this report the area of the CRSS within the permanently acquisitioned land is referred to as 'the site'. The within the temporary acquisition and outside of the site in not considered in this assessment.

Ground investigations were carried out for the purpose of investigating the stability of the soils to inform the scheme design. The information obtained from the ground investigations were also used in the preparation of the NIS and EIAR.

1.2 Approach

The CRSS and study area has been assessed following the methodology presented in the following:

- Environmental Protection Agency (EPA) guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites.[1];

In accordance with the EPA's methodology a desk-top review has been carried out of the publicly available information on the site history, the ground conditions and local nearby sensitive receptors. This information has been combined with the results of a site walkover on 11 October 2021, to inform the design and the scope of an extensive ground investigation (GI) at the site between October 2021 and April 2022.

The results of the GI were used to describe the local geology and hydrogeology and develop a conceptual site model. The results are summarised under site geology (Section 6.1) and local hydrogeology sections (Section 6.2) of this report. The soil and water samples collected were compared to human health and environmental assessment criteria in a generic quantitative risk assessment (Section 7.0).

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[1] Environmental Protection Agency (EPA), 2013. Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites;

2 Sources of information

This report has been prepared alongside Chapter 14: Land, Soils, Hydrogeology and Geology of the Galway Cross Citylink EIAR (Volume 4). This report uses the same data sets as listed in Section 14.2.3 of Chapter 14 of the EIAR Volume 2 and are listed below for completeness.

2.1 Publicly available datasets

The publicly available datasets acquired and consulted are as listed in Section 14.2.3 of Chapter 14: Land, Soils, Hydrogeology and Geology. All datasets were accessed in 2021 and are listed in Table 1 below.

Table 1: Publicly Available datasets

Source	Name	Description
Ordnance Survey Ireland (OSI)	Current and historical ordnance survey maps	Current and historical survey maps produced by the OSI.
	Including OSI Galway Maps from 1949-1952, 1978 and 1991	Current and historical survey maps produced by the OSI.
OSI	Aerial photography	Current and historical survey maps produced by the OSI.
Google	Aerial photography	Current aerial imagery produced by Google
Bing	Aerial photography	Current aerial imagery produced by Bing (Bing 2019)
Teagasc	Teagasc Soils Data	Surface soils classification and description
Geological Survey Ireland (GSI)	Quaternary Mapping	Geological maps of the site area produced by the GSI and available on GSI online map viewer.
	Bedrock Mapping	
	Aggregate Potential Mapping	
	Mineral Localities	
	Geotechnical viewer	

Source	Name	Description
	Groundwater Mapping	
	Groundwater Levels	
	National Landslide Database	
	Karst Database	
	Active Quarries and pits	
	County Geological Sites (CGS) and Geological Heritage Areas	
EPA	Corine Land Cover 2018	These datasets are based on interpretation of satellite imagery and national in-situ vector data.
	Designated Natural Heritage Area (NHA). Special Protections Area (SPA), Special Area of Conservation (SAC) sites	
	River Network Map	
	EPA Hydro Net	Reports of groundwater level monitoring points.
National Parks and Wildlife Service (NPWS)	Mapping within the area of the Proposed Scheme	This dataset provides information on national parks, protected sites, and nature reserves
National Monuments Service (NMS)	Archaeological Monuments	This dataset provides all recorded archaeological monuments (NMS 2019)
Department of Communications, Energy and Natural Resources (DCENR)	State Mining and Prospecting Facilities	A booklet contains a list of all current and prospecting mining facilities.
	Historic Mine Sites – Inventory and Risk Classification	(DCENR 2019)

2.2 Scheme Walkover

A scheme walkover survey was carried out on 11 October 2021 to inform and verify the review of publicly available datasets.

The findings of the scheme walkover relevant to this Remedial Strategy are discussed in Section 3.3 of this report.

2.3 Ground Investigation

Both intrusive and non-intrusive (geophysical) ground investigations have been carried out as part of this project to inform the design of the Proposed Scheme. These ground investigations were carried out between October 2021 and April 2022. The reports from both investigations are presented in Appendix 14.1 of Volume 4 of the EIAR and are used in the assessment of the site specific conditions, these are further discussed in Section 5 of this report.

3 Site Use

3.1 Regional Geology and Hydrogeology

For a detailed description of the regional Geology and Hydrogeology refer to Section 14.3.2 of Chapter 14 of the EIAR (Volume 2). A summary of the findings relevant to the CRSS are listed below.

- The ground conditions are recorded to be made ground under and in vicinity of the site. Till derived from limestone is shown to be present to the north-east of the site and is likely to be present under the made ground;
- A drumlin is shown to be present to the west of the site;
- The site and area around the site are underlain by the Burren Formation which is recorded as a Regionally Important Aquifer;
- The aquifer is karstified and known to contain conduits transferring water from sink-holes to springs. The closest feature, a spring, is located 0.65km south-east of the site; and
- The site is located approximately 200m to the north-west of Lough Atalia which is part of the Galway Bay Complex Special Area of Conservation (SAC) an ecologically sensitive area that among other features includes habitats such as tidal mudflats and sand flats and coastal lagoons.

3.2 Current Site Use

The CRSS is located just south of the College Road - Lough Atalia intersection at Irish Transverse Mercator 531016E 726172N.

The site is bounded by College Road to the east and residential buildings/gardens/carparking to the north, west and south. The topography of the site is relatively flat at around 6mOD. The CRSS can be seen in Diagram 2.

Diagram 2: College Road Service Station

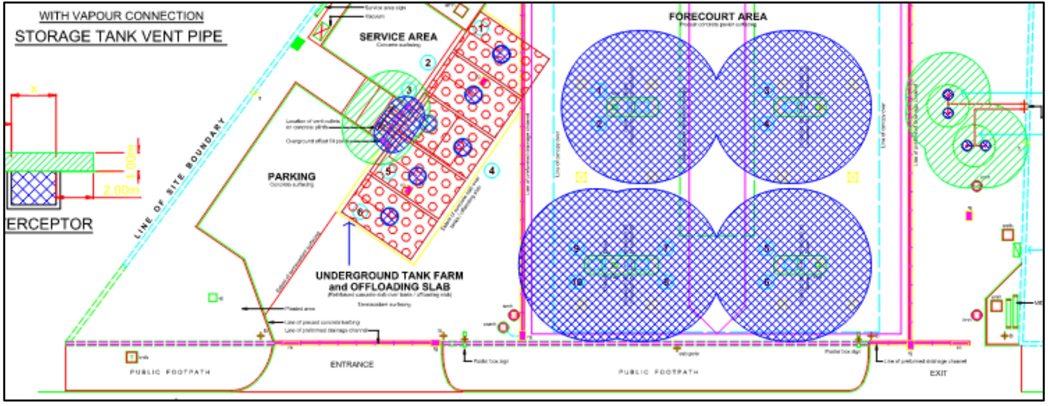
The site includes the following facilities:

- A working Service Station (Circle K) including;
  - A forecourt with working petrol and diesel fuel pumps;
  - Underground fuel tanks containing petrol and diesel;
  - Service area including air/water pumps and a vacuum;
  - Car wash facilities;
  - Retail and store area; and
  - Laundry facilities including pay as you go washing machines and tumble dryers.

An extract of a plan provided by Circle K showing the current position of the underground tanks at College Road Service Station is shown on

Diagram **3**. A full copy of the plan is provided at Appendix A1 of this report.

Diagram 3: College Road Service Station plan | Provided by Circle K



3.3 Site Walkover

A scheme walkover survey was carried out on 11 October 2021 to inform and verify the review of the publicly available datasets.

The findings relating to the site observed during the Proposed Scheme walkover are summarised below:

- The CRSS is on a reduced level, there are retaining walls surrounding the service station separating it from the higher ground level. The forecourt of the CRSS was in good order and appeared clean. The service station is shown in Diagram 2; and
- Lough Atalia is part of the Galway Bay Complex SAC lies approximately 200m south-east of the site. The Lough is tidal. Seepages were seen on the banks of the lough during low tide hence groundwater is likely to discharge into the lough from the surrounding area including under the site. No olfactory or visual evidence of contamination was observed on the bank or shore of the lough during low tide. Lough Atalia can be seen in Diagram 4.

Diagram 4: Lough Atalia viewed 1km southwest of the CRSS

4 Preliminary Assessment

4.1 Site History

This section describes the historical use of the site based on observations from the historical Ordnance Survey of Ireland (OSI) mapping and aerial photography. The site history of CRSS and associated figures are presented in Appendix A2 of this report. A summary of the site history is presented in Table 2.

Table 2: Summary of the site history

Date	Activities at the CRSS	Activities in Surrounding Area
1837 – 1842 (6" OSi first edition Map)	Small historical development probably residential along College Road and undeveloped fields or residential gardens.	There is a marsh area to the east of the site north of Lough Atalia which is described as 'Flooded at spring tides'.
1888 – 1913 (25" OSi Map)	The site is shown undeveloped and the small development along college road is not shown. It is likely this area was used as agricultural land during this time.	A watercourse is shown approximately 50m to the east of the site which drains form north to south into Lough Atalia. The marsh area is mapped to the east of the site north of Lough Atalia which is described as 'Liable to Floods'.
1913 – 1930s (last edition 6'' OSi Map)	No change	There are a number of housing developments marked to the east of College Road suggesting they had been built between the 1913 and 1930s. No notable change elsewhere
1945 – 1962 (OSi Mapping)	No change	No notable change
1977 – 1980 (OSi Mapping)	There is a footprint of a building underlying the west of the site. The footprint does not appear to be residential.	Additional development of housing east of College Road.
1991 – 1991 (Osi Mapping)	The service station outline is shown.	There has also been further development of buildings to the east of the site at the existing location of the Huntsman Inn, this development has taken place in the area previously shown to be liable to flooding. Watercourse 50m east of the site is not shown and instead is covered by the building which now include The Huntsman Inn.
1995 Aerial Photography	No change	There has been further residential development north-east of the CRSS
2000 Aerial Photography	The building footprints is smaller suggesting that	There has been residential development surrounding the north-eastern area of the site

Date	Activities at the CRSS	Activities in Surrounding Area
	construction of a new building is underway.	
2005 to present Aerial Photography	Show the site as it is presently.	No change

4.2 Discussions with the current site owner (Circle K)

Arup and Galway City Council staff met with Circle K management in November 2021 to discuss the ground investigations. During discussions with Circle K, it was noted by the manager of the CRSS that the site had originally been developed as a printworks. Subsequently the site was developed as a service station initially operated by Shell, then Statoil, Topaz and finally Circle K. It was reported that the site had operated as a filling station since the 1960s.

4.3 Potential Sources of Contamination

Based on the site history and observations noted in the Site Walkover, the following are considered to be the most pertinent potential sources of contamination for the site:

- The soil and groundwater under the site potentially impacted by historical industrial building which was reported to be a print works; and
- The soil and groundwater under the present day and historical use as a service/filling station and the underground services and tanks.

4.3.1 Potential Contaminants of Concern

The potential contaminants profile associated with the print works[2] is listed below. It should be noted that individual sites will not necessarily have all the characteristics described.

- Metals and metalloids;
- Inorganic compounds;
- Acids/bases;
- Asbestos;
- Organic compounds including:
    - Aliphatic/aromatic hydrocarbons and halogenated solvents;
- Fuels;
- Polychlorinated biphenyls (PCBs);
- Effluent treatment chemicals.

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[2] Department of Environment (DoE) Industry Profiles – Chemical works, coatings (paints and printing inks) manufacturing works (Accessed through CLAIRE: https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/198-doe-industry-profiles)

In addition, due to the presence of the working fuel pumps and underground fuel storage tanks within or directly adjacent to the site the following potential contaminants are also considered[3]. It should be noted that individual sites will not necessarily have all of the characteristics described

- Organic contaminants including;
    - Petroleum Spirit (including simple aromatics, such as benzene and additives, such as organo-lead compounds and ethers);
    - Diesel; and
    - Paraffin.

Other potential contaminants maybe present associated with the site use on the CRSS but are not considered as they are not relevant to the strip of land within the redline of the Proposed Scheme.

5 Ground Investigation

Both intrusive and non-intrusive geophysical ground investigations (GI) have been carried out to inform the design of the Proposed Scheme. The GIs were carried out between October 2021 and January 2022. The GIs comprised geotechnical, geophysical and geo-environmental investigations. The purpose of these ground investigations was to inform the Land, Soils, Geology and Hydrogeology Chapter of the EIAR (Volume 2). The reports from both investigations are presented in Appendix 14.1 of Volume 4 of the EIAR.

Considering the sensitive location of the GI the project ecologist (Moore Group) were consulted and confirmed that "*Given the level of urban activity in this area of Lough Atalia, it's unlikely that there would be an effect on Wintering Birds".*

5.1 Non-Intrusive Investigation

The non-intrusive geophysical ground investigation took place adjacent to the College Road-Lough Atalia Road junction Galway City, the layout of the investigation is shown in Diagram 5.

The non-intrusive geophysical investigation included the following works:

- 350m of Seismic Refraction Profiling geophysics across four designated locations to produce 2D geophysical profiles;
- 350m of Electrical Resistivity Tomography (ERT) across four designated locations to produce 2D geophysical profiles; and
- 2,000m^2 of Ground Penetrating Radar at the Service Station on College Road to identify any existing underground services.

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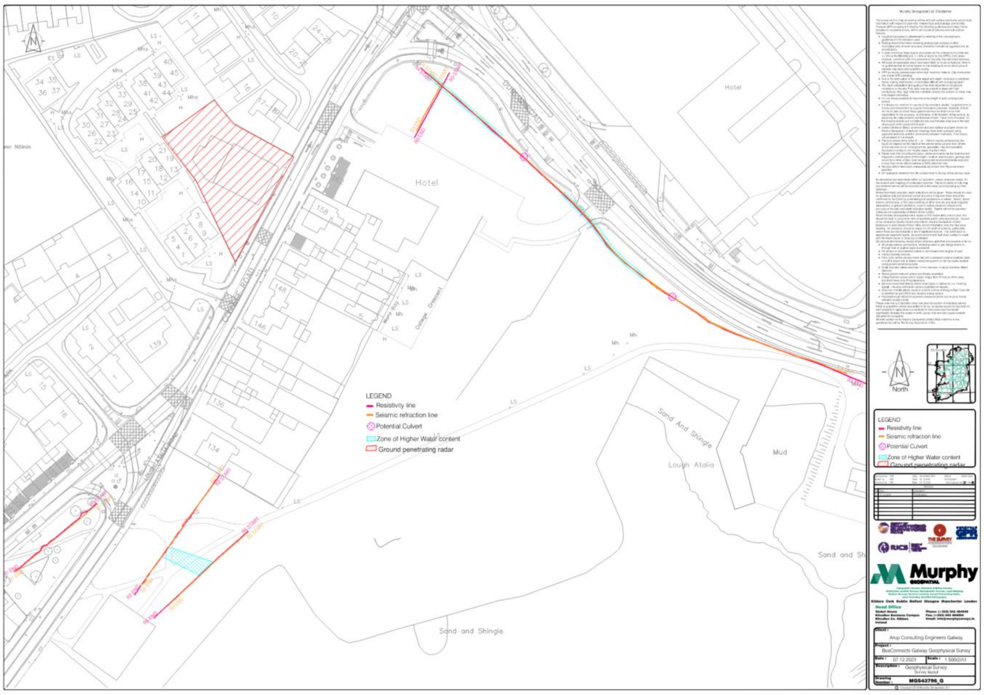
[3] Department of Environment (DoE) Industry Profiles – Road vehicle fuelling, service and repair – garages and filling stations (Accessed through CLAIRE: https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/198-doe-industry-profiles)

Diagram 5: Non-Intrusive Geophysical Survey plan



5.2 Intrusive Investigation

The intrusive ground investigation consisted of two locations in Galway City, one property of St. Brendan’s Avenue and the other on land adjacent to College Road (R339) between the junction with Lough Atalia Road and the junction with Old Dublin Road (R338) including the forecourt of the CRSS. The focus of this report will be on the ground investigation results from the College Road-Lough Atalia area, this layout of the investigation is shown in Diagram 6.

The intrusive ground investigation included the following works in the vicinity of the CRSS:

- Five (5) No. of cable percussion boreholes to refusal, with follow-on rotary.
- Five (5) No. of window samples of up to 5 mBGL;
- Five (5) No. of surface water sampling locations;
- Six (6) No. of standpipe monitoring locations (two of which were in window sample holes);
- Geotechnical and geo-environmental sampling and testing;
- Groundwater boreholes were developed and purged prior to sampling;
- Interface probe measurements;
- Datalogger installation in all installations for one week; and
- Monitoring on three occasions over four months of water quality in all boreholes and five surface water sampling points, at three locations in Lough Atalia (SW03, SW04 and SW05) and two seepage locations on the bank of Lough Atalia (SW01 and SW02).

Diagram 6: Intrusive Ground Investigation plan in the vicinity of CRSS

6 Conceptual Site Model

A Conceptual Site Model (CSM) has been developed for area surrounding the College Road-Old Dublin Road Junction. The CSM has been developed based on the 2021 GI.

6.1 Local Geology

The following assessment of the geology of the site and ground conditions has been inferred from available information. The geological conditions influence the CSM and will be discussed further in Section 6.4. The ground conditions are described in Table 3,

Table **4** and Diagram 7 below. These are based on the findings of ground investigation locations presented in Diagram 6 above.

These locations include the following:

- BH101, BH102, BH103, BH104 and BH105.
- WS101, BH103WS, WS104, WS105 and WS106.

Table 3: Ground conditions on the CRSS site

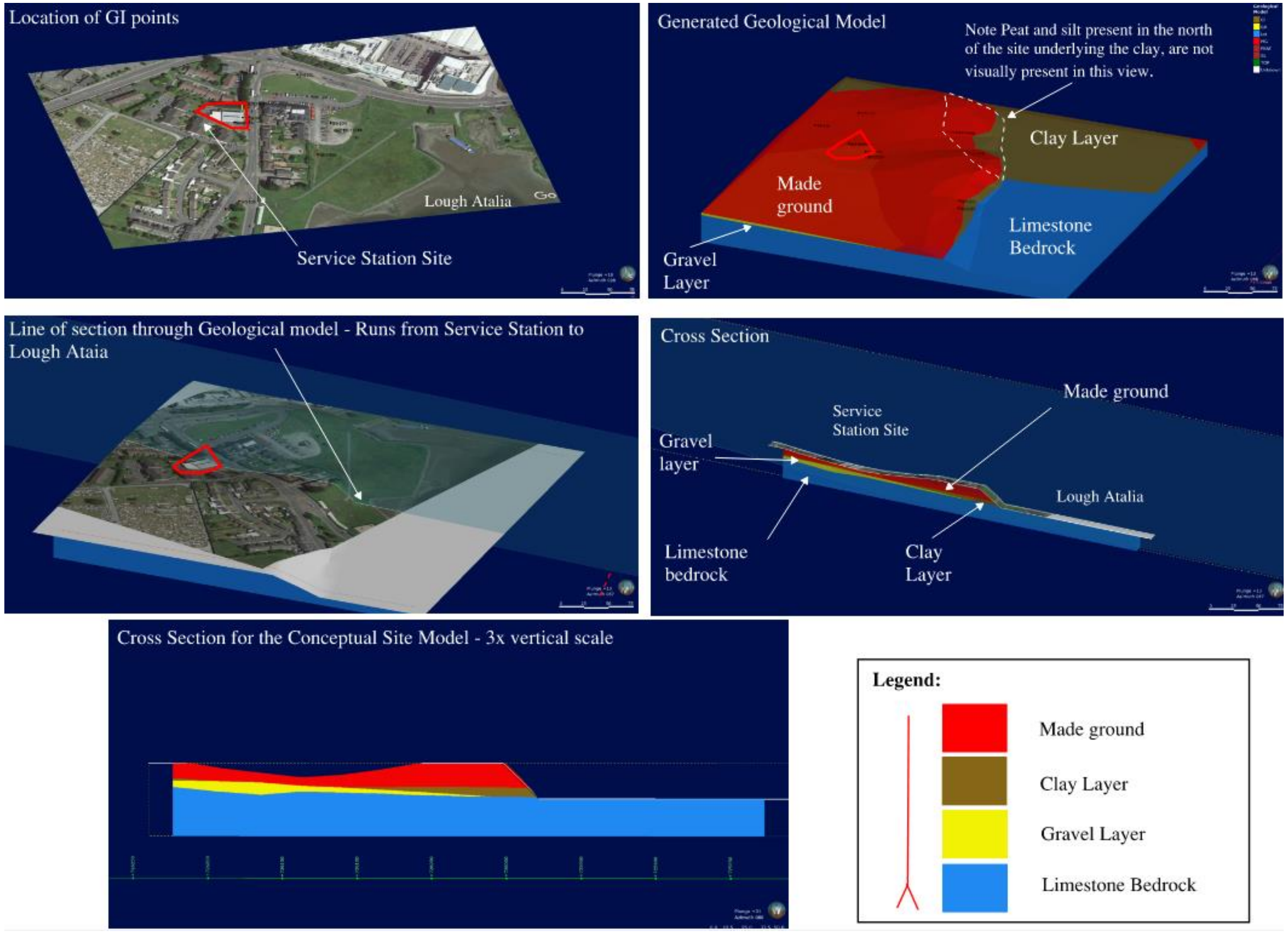
Stratum	Description	Ground Investigation location where present	Depth to Top of Stratum (m below ground level)	Thickness of Stratum (m)
Bitmac / Concrete	Tarmacadam and concrete hardstanding	BH102, BH102A BH103, BH103WS and WS104	0	0.05 – 0.3
Made Ground	Underlying Service Station forecourt – Brown to Grey silty sandy angular to subangular fine to coarse GRAVEL with high cobble content and fragments of plastic.	BH102, BH102A BH103, BH103WS, WS104	0 – 0.1	0.3 – 2.0
Subsoils	Grey to brown sandy silty subangular to subrounded fine to coarse GRAVEL with low to medium cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded.	BH101, BH103, BH103WS, BH104 and WS104	2.5 – 4.0	0.3 – 3.3
Bedrock	The Burren Formation –medium strong massive grey Limestone, with local areas of partial weathering and clay deposits along rare joint surfaces.	BH103 and BH104	2.3 – 6.7	Unknown

Table 4: Ground conditions surrounding site

Stratum	Description	Ground Investigation location where present	Depth to Top of Stratum (m below ground level)	Thickness of Stratum (m)
Topsoil	Topsoil with roots and fragments of plastic	BH105A, BH105, WS101, WS105 & WS106	0	0.1 - 0.4
Bitmac / Concrete	Tarmacadam and concrete hardstanding	BH101 and BH102	0	0.05 – 0.3
Made ground	Underlying the car park between the CRSS and Lough Atalia – Firm becoming stiff sandy gravelly Clay with low cobble content.	BH104, BH104A, BH105A and WS101	0 – 0.1	0.3 – 2.0
Sub-soils	Soft to stiff brown to grey sandy gravelly CLAY. Sand is fine to	BH101, BH104, BH105A, WS101, WS105 and WS106	0.6 – 1.0	0.7 – 1.9

Stratum	Description	Ground Investigation location where present	Depth to Top of Stratum (m below ground level)	Thickness of Stratum (m)
	coarse. Gravel is subangular to subrounded fine to coarse. 0.3m thick sand lens noted within WS106. Sand described as dark grey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse.			
	Grey to brown sandy silty subangular to subrounded fine to coarse GRAVEL with low to medium cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded.	BH101, BH103, BH103WS, BH104, BH105A, WS101 and WS104	2.5 – 4.0	0.3 – 3.3
	Very soft to soft grey to brown slightly clayey SILT with organic fibres.	WS101	1.65	0.45
	Very soft to soft dark brown-black fibrous Peat	WS101 and BH104	2.1	0.8 – 2.8
Bedrock	The Burren Formation –medium strong massive grey Limestone, with local areas of partial weathering and clay deposits along rare joint surfaces.	BH101, BH104 and BH105	2.3 – 6.7	Unknown

Diagram 7: Geological Model of the Site Study area.



6.2 Local Hydrogeology

During the 2021/2022 intrusive ground investigation, groundwater strikes were observed in both the gravel deposits and in the limestone bedrock beneath the site. Groundwater was monitored by hand and using loggers during the 2021/2022 ground investigation in six standpipes installed in either the gravel deposits or the limestone bedrock between the 27th of January 2022 and the 7th of February 2022. The groundwater conditions influence the CSM and is discussed further in Section 6.4.

6.2.1 Groundwater level monitoring

A summary of the groundwater monitoring data collected during the ground investigation period is presented in Table 5.

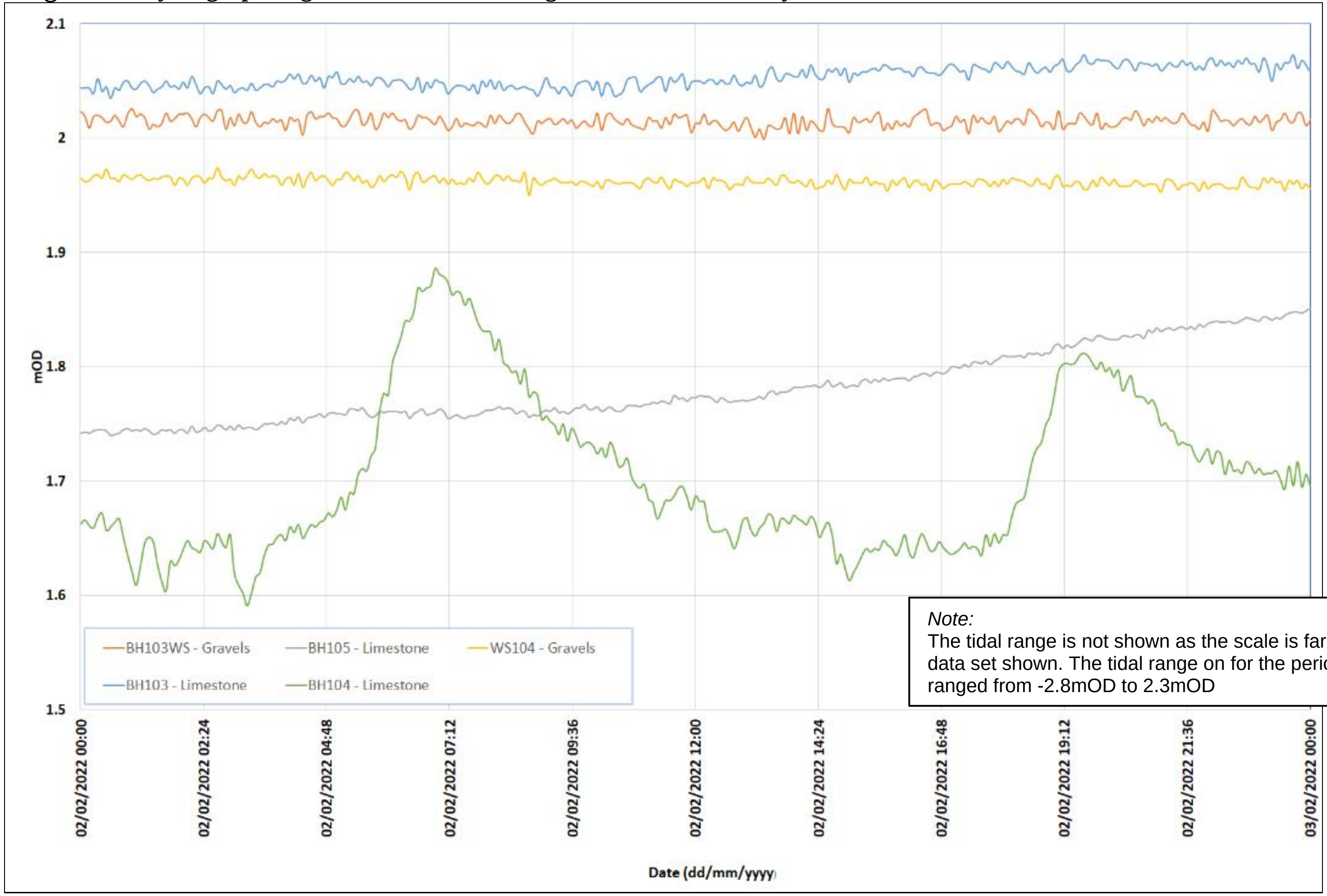
Table 5: Summary of Groundwater levels

Lithology monitored	Boreholes	Range of Groundwater Levels (mBGL)	Range of Groundwater Level (mOD)
Gravel	BH103WS	1.4 – 1.9	2.0 – 2.6
	WS104	1.4 – 1.9	1.95 – 2.5
The Burren Formation	BH102	1.6 – 2.2	1.9 – 2.5
	BH103	1.4 – 2.0	2.0 – 2.6
	BH104	1.6 – 2.2	1.5 – 2.0
	BH105	1.4 – 2.0	1.6 - 2.0

A hydrograph showing all the groundwater monitoring data collected on the 2nd of February 2022 during the ground investigation are presented in Diagram 8. Appendix A14.4 of Volume 4 of this EIAR shows a summary hydrograph of all groundwater monitoring data collected. Only BH104 was observed to respond to the tide.

Under the site the gravels directly overlie the bedrock hence the water observed in the gravel and the Burren Formation are in hydraulic connectivity. In some areas surrounding the site there is a low-permeability clay layer separating the made ground and the gravel deposits, this clay layer will act as an aquitard and restricts the movement of water from the made ground into the underlying gravels or limestone.

Diagram 8: Hydrograph of groundwater monitoring on the 2nd of February 2022



Note:
The tidal range is not shown as the scale is far larger than the data set shown. The tidal range on for the period shown ranged from -2.8mOD to 2.3mOD

6.2.2 Non-aqueous phase liquids

Non-aqueous phase liquid (e.g. unleaded or diesel) monitoring took place as part of the monitoring. No non-aqueous phase liquid was recorded during the monitoring.

Generally, there was no olfactory or visual evidence of non-aqueous phase liquids noted during the investigation or monitoring. The one exception to this was recorded during the drilling of BH102 when a sheen was noticed on the groundwater, but no odours were recorded.

6.2.3 Groundwater flow

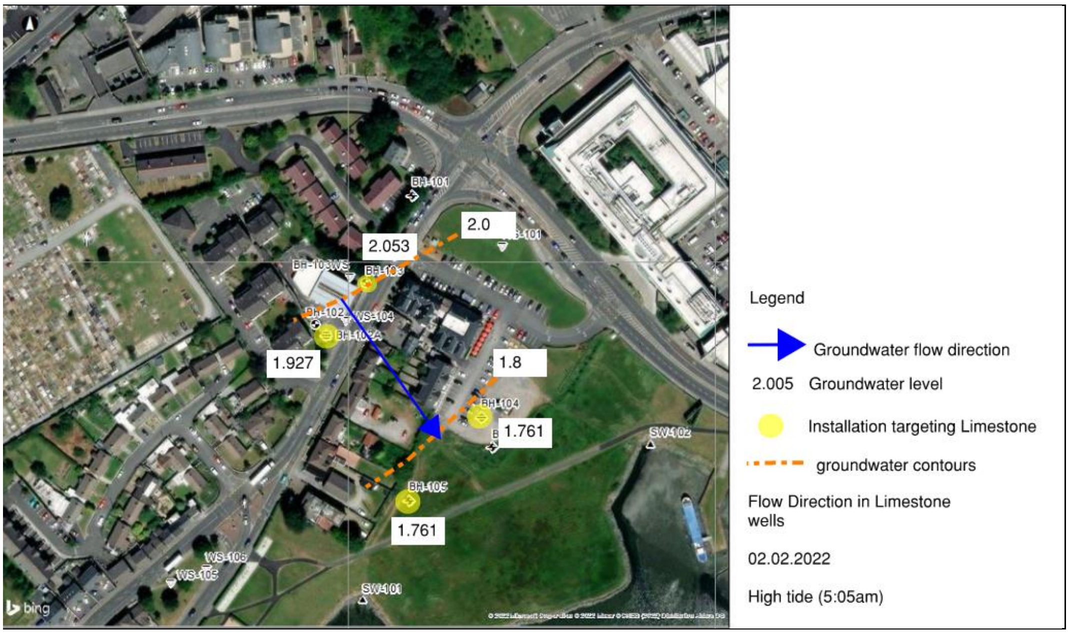
Based on the groundwater levels in the gravels and the limestone bedrock, the groundwater flow direction has inferred to be generally to the south-east towards Lough Atalia.

This suggests that the boreholes and window samples on the CRSS forecourt are up-hydraulic gradient (BH103WS, BH102, BH103, WS104) and that the boreholes between Old College Road and Lough Atalia are down-hydraulic gradient (BH104 and BH105). The groundwater in the gravel and limestone is in continuity under CRSS.

Considering the proximity of the former water channel identified in the 1913 OSi mapping, the shallow water table and the presence of shallow gravel under the site it is probable that groundwater in the gravels previously used to drain to the lough via the historic water channel. Seepages were noted on the bank of Lough Atalia in the vicinity of where the former water channel used to meet the Lough. Hence it is possible that the water that used to drain to the channel still drains to the Lough via these seepages. Consequently, is plausible that groundwater from WS104 and BH103WS could travel in the gravel and enter the Lough via seepages at the location of SW101.

The groundwater contours in the Limestone suggests that groundwater in the Limestone bedrock from BH102, BH103, BH104 and BH105 drains to the south-east to Lough Atalia. This drainage likely occurs through fracture pathways in the limestone bedrock and discharges diffusely into Lough Atalia during low tide. Considering that groundwater in the gravel and limestone is in continuity it is plausible that recharge from the CRSS could enter the limestone from the gravel and then discharge to the lough. This groundwater flow direction is presented in Diagram 9.

Diagram 9: Groundwater contour mapping of limestone bedrock on 2nd February 2022



Water levels in the gravels under the site appear to be unaffected by the tide (WS104 and BH103WS). Water levels in the limestone seem to be subject to influence of the tide. The boreholes on the forecourt (BH103 and BH102) seem to have minor influence with ranges between low and high tide limited to <0.05m. The boreholes at the Lough Atalia reclaimed area (BH104 and BH105) are influenced by the tide with ranges in water level between low and high tide of <0.1m. The fluctuations in the tide were not observed to change the groundwater flow direction.

On the 5th of February, 19.8mm of rain was recorded by Met Éireann in Athenry Co. Galway[4]. The water levels in both the gravels and bedrock rose on the 6th of February. This increase in groundwater measurements on the 6th of February suggests recharge was seeping down through the made ground and entering the underlying aquifer. Hence the gravel and limestone are very vulnerable to surface contamination.

6.3 Site Hydrology

The site is located 150m north-west of Lough Atalia, the extent of the Lough Atalia can be seen on Figure 14.5 of Volume 3 of this EIAR. Lough Atalia is located to the east of study area. Lough Atalia is an estuarine lagoon connected directly to the Corrib Estuary within Galway Bay. It is considered to be part of the Galway Bay Complex Special Area of Conservation (SAC), this is due to its biodiversity. As the Lough is tidal the water quality in the study area is likely to be influenced by the saline water quality in Lough Atalia.

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[4] Met Éireann historic daily data accessed March 2022. https://www.met.ie/climate/available-data/daily-data

There are no observed water features at the CRSS. Surface water drains from the site through surface water drainage system to a combined drainage system. The surface water from the CRSS drains into a foul system which is then pumped to a Wastewater Treatment Plant (WWTP) to undergo treatment. It is understood that there are no septic tank or soakaways on site.

6.4 Summary

A conceptual site model (CSM) has been developed from the ground information in the surrounding area. The site consists of made ground which overlies a gravel layer which sits on top of the Limestone Bedrock. Groundwater is present in the gravel and limestone and the groundwater in these layers is in continuity. The groundwater in both strata respond quickly to recharge. The groundwater in the gravel is likely to drain to the lough via seepages on the bank of Lough Atalia and via limestone into the base of the lough.

It must be noted that silt and peat deposits were observed in the north-east of the study area but are not underlying the site and do not affect the potential pathways to the lough so are not to be considered further.

Based on the preliminary assessment the CRSS has two potential sources of contamination within the site, the soils and groundwater under the filling areas affected by current and previous uses and the current underground services and tanks.

The receptors that have been highlighted are the Lough Atalia part of the Galway Bay Complex SAC and current and future site users.

Based on this CSM above three potential source-pathways-receptor linkages have been identified between the soils and groundwater under CRSS and Lough Atalia:

1. Between CRSS and Lough Atalia via the limestone. This potential contamination pathway is due to the presence of gravels directly underlying the made ground on the service station site. The gravels directly underlying the made ground provide a direct pathway for contaminants to access the underlying limestone aquifer, which drains to the Lough Atalia.
2. Between CRSS and the Lough Atalia via the gravels. The groundwater within the gravels is vulnerable to contamination from the made ground. These gravels have the potential to drain to the south directly to the banks of Lough Atalia during low tide (discussed in Section 6.2 and 6.3).
3. Between soils and future site users who could come into contact with soil.

The CSM and these potential pathways are highlighted on Diagram 10.

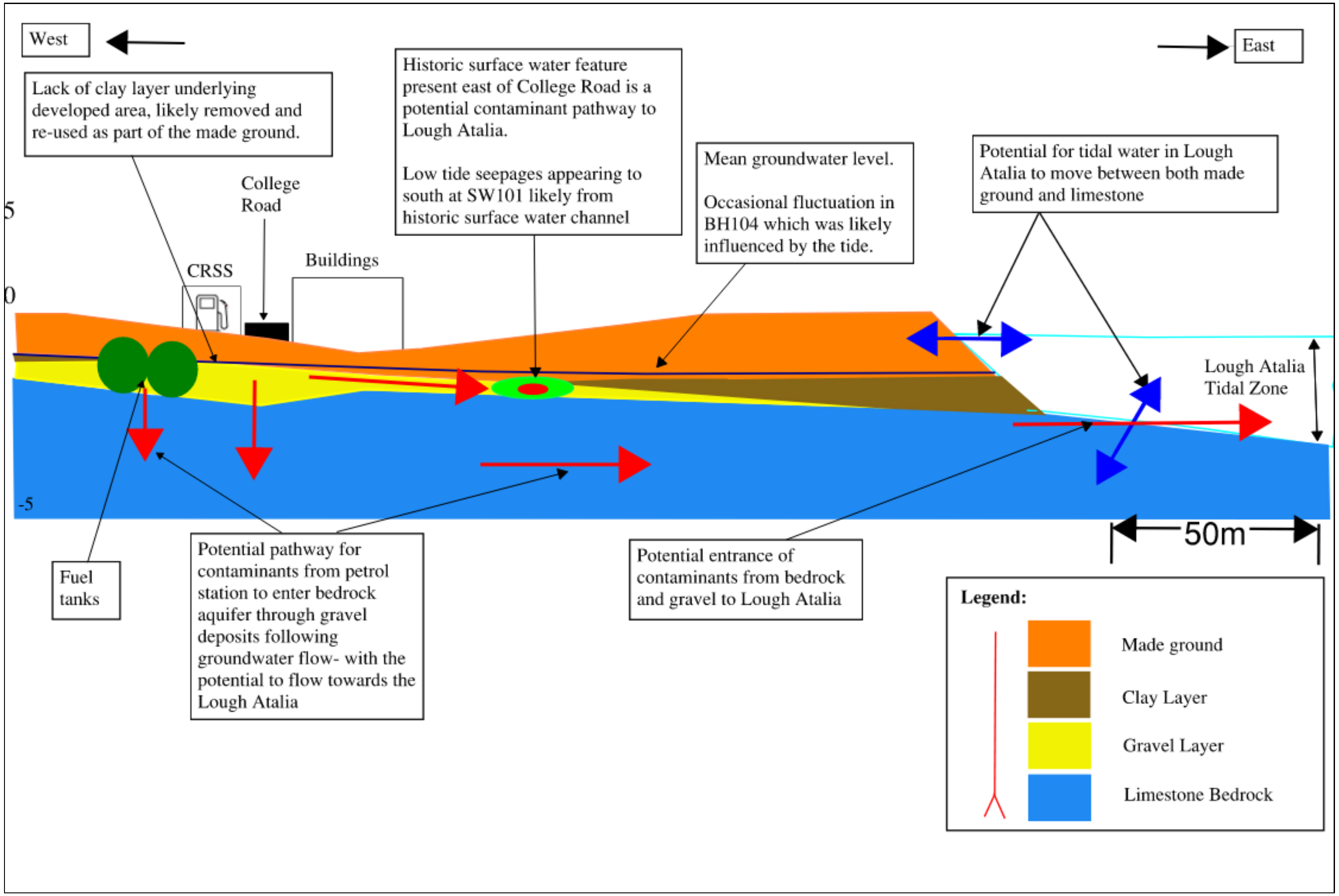

Diagram 11: Conceptual Site Model

7 Generic Quantitative Risk Assessment (GQRA)

7.1.1 Soil Analysis

The results of the soil analysis performed on the samples collected have been compared against soil criteria applicable to human health risk for long-term exposure to soil in a public open space close to a residential setting which is directly applicable to the Proposed Scheme. A copy of the assessment is presented in Appendix 14.3 of Volume 4 of this EIAR.

The results of this assessment show that there are no exceedances for these criteria measured in the soil analysis for the site. Based on these results it is considered that there is no significant risk of harm to the current or proposed future site users in relation to exposure to these soils. However, it must be considered that localised areas of contamination could still be present across the site.

7.1.2 Groundwater Analysis

As the most relevant receptor for the purposes of the assessment is the ecologically sensitive SAC, the water quality has been compared with the 2009 Surface Water Regulations[5] and the 2010 Groundwater Regulations[6] where suitable standards do not exist. In the rare exceptions that other parameters were noted without standards, the Environmental Protection Agency's 2003 Interim Guideline Values[7] and the United States Environmental Protection Agency's National Recommended water quality criteria[8] have been used. Drinking water standards were not used for the assessment as no groundwater abstractions were highlighted between the site and Lough Atalia.

The results of the water analysis are presented in Appendix 14.4 of Volume 4 of this EIAR and a comparison of the results with the water quality screening standard is presented in Appendix A14.6 of Volume 4 of this EIAR.

The results of the groundwater analysis are discussed below:

- There were two exceedances of total petroleum hydrocarbons (TPHs) or general hydrocarbon indicators recorded, these exceedances are presented on Diagram 12 below. One was recorded underlying the CRSS at BH102 on the 28th of March 2022. There was also exceedance of TPHs recorded in the seepage into the Lough at SW01 on the 13th of April 2022. The oil contamination appears to be localised and occurs sporadically.

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[5] S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended)

[6] S.I. No. 9/2010 - European Communities Environmental Objectives (Groundwater) Regulations 2010 (as amended)

[7] S.I. No. 722/2003 - European Communities (Water Policy) Regulations 2003

[8] Environmental Protection Agency (EPA) of USA - National Recommended Water Quality criteria under Section 302(a) of the Clean Water Act

This likely reflects drips or minor fuel spills at the CRSS that get flushed down to the gravel deposits and bedrock aquifer by surface water infiltration. This suggests that there are localised occurrences of contamination of TPH under the CRSS that is infiltrating into the bedrock aquifer on site and travelling downstream;

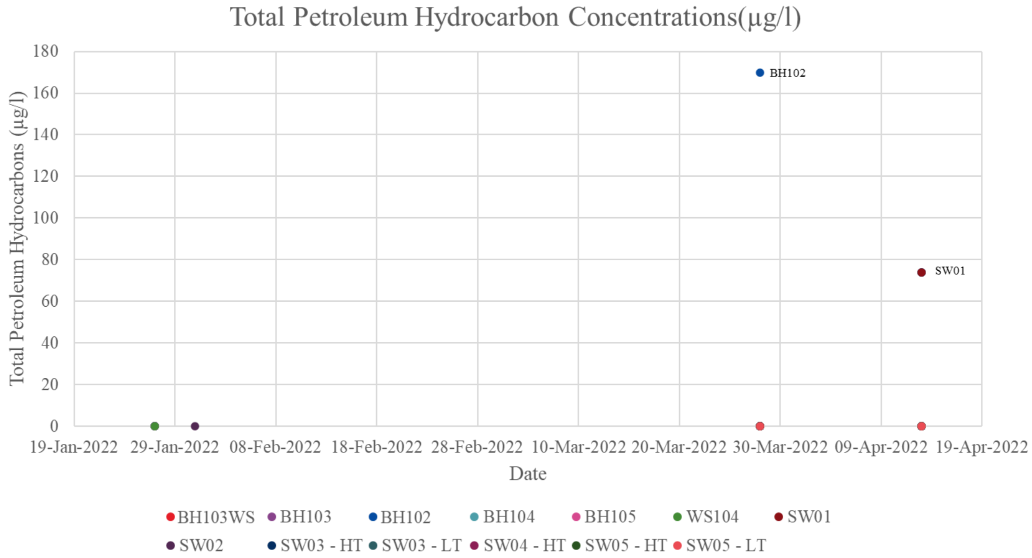

Diagram 12: TPH Concentrations (µg/l) [screening standard is 7.5µg/l]

- In addition to the TPH on the 28th of March 2022, the following compounds were seen in BH 102: 1,2,4-Trimethylbenzene and m-xylene and p-xylene. These are attributable to the presence of petroleum hydrocarbons in the groundwater. They are not recorded in Lough Atalia.
- There are exceedances of the iron and manganese screening standards observed in the gravel and limestone under the CRSS and downstream (See Diagram 12). The iron and manganese levels are likely to be as a result of the breakdown of hydrocarbons in the vicinity. Iron and manganese were recorded above the screening standard in the lough. On some occasions these recordings were greater than that observed at the CRSS, suggesting that the iron and manganese concentrations are also related to background contamination.
- There are exceedances of the ammoniacal nitrogen limit noted at all locations across the site. These exceedances are likely to be due to the site being down hydraulic gradient of the New Cemetery graveyard *and/or* the presence of a leaking septic tank in the vicinity of the site. The highest concentration of ammoniacal nitrogen is found in BH104 downstream of the CRSS and under some fill material suggesting that the fill could also be a source and one which is not on site.
- There is an exceedance of the arsenic limit noted underlying the site at BH103 on the 27th of January 2022 and underlying the reclaimed area at BH104 on all three occasions. The exceedances measured downstream at BH104 are higher than that measured at BH103. This suggests that the contamination is unlikely to be originating from the CRSS. Arsenic is not recorded above the screening limit in the Lough.

- There is an exceedance of the cadmium limit noted in all boreholes, the concentration of which fluctuates throughout the year. These exceedances are shown in Diagram 13 below. There are higher concentrations of cadmium noted in the gravel groundwater under the CRSS than the limestone bedrock. Cadmium was recorded in the seepage discharging into the Lough and in the Lough at low tide. Concentrations of cadmium in the bedrock decrease downstream of the CRSS. This suggests that contamination of cadmium under the CRSS and is infiltrating into the bedrock aquifer on site and travelling downstream. This could be present as a result of historic works at the CRSS or naturally elevated concentrations in the fill material.

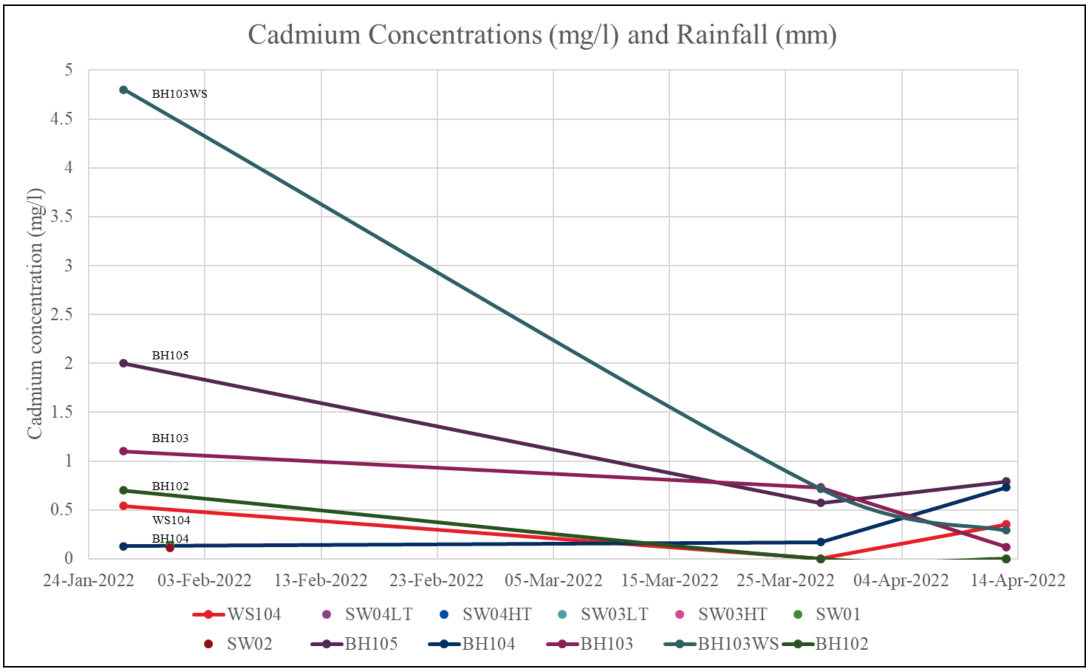

Diagram 13: Cadmium concentrations (µg /l) [screening standard is 0.08µg/l]

- There is an exceedance of the chloride, potassium, sodium, magnesium and sulphate limits measured in a number of locations including the Lough (See Diagram 13). These exceedances are likely due to the influence of seawater on the area.
- There are occasional exceedances of the lead limit on site in the bedrock groundwater at BH102, BH103 and BH104. Exceedances are not noted in the overlying gravel groundwater suggesting that the contamination source is polluting the bedrock upstream and is not related to the CRSS. No exceedances are recorded in the Lough.
- There is an exceedance of the nickel limit noted in BH104 only on the 27th of January 2022. As this contaminant is not present at the CRSS it is not related to the site.
- Finally, three exceedances of the zinc limit were measured in both BH103 and SW101 on 27 January 2022, BH104 on 28 March 2022 and in WS104 on the 28th March and 13th of April 2022. However, these exceedances are sporadic and not recorded in the Lough. Consequently, they are considered to represent localized contamination which is only having a small to negligible impact on water quality.

Based on these results it is considered that the cadmium and TPH concentrations recorded in the seepages on the banks of Lough Atalia above the screening standards could originate from the made ground under CRSS including the area within the permanently acquired part of the Proposed Scheme.

8 Remedial Strategy

The following text outlines the remedial strategy for the contamination observed and the requirements for decommissioning the area of the CRSS within the boundary of the Proposed Scheme.

8.1 Cadmium

Cadmium is recorded in the groundwater under the CRSS and downstream. This cadmium is likely to be derived from the made ground under CRSS including the permanently acquired part of the Proposed Scheme. Considering that some of the made ground will be removed as part of the construction of the Proposed Scheme it is considered the removal of the source within the permanently acquired part of the Proposed Scheme and replacement with clean fill is the most appropriate remedial option rather than treatment.

As part of the detailed design a quantitative groundwater risk and surface water risk assessment shall be carried out by a competent geoenvironmental expert to establish a concentration of cadmium in the soil that does not present a risk to the quality of water entering Lough Atalia. This may require additional ground investigation. The risk assessment shall be used to define the extent and depth of the area for excavation.

Conservatively if it is assumed that the entire footprint of the CRSS within the permanently acquired part of the Proposed Scheme will be removed to the full depth of the made ground (~1m), the estimated volume of disposal is approximately 200m^3. Based on the samples collected the top 0.7m of the forecourt within the Proposed Scheme the made ground is classified as suitable for disposal to a non-hazardous waste facility (approximately 170m^3). The rest of the made ground is suitable for disposal to an inert waste facility (approximately 30m^3). Within this volume, it is probable that there will be localised 'hot spots' around the tanks and the pumps that could be classified as hazardous, but this will be assessed during the excavation.

It is possible that made ground left under the remainder of CRSS outside of the permanently acquired part of the Proposed Scheme could also be a source. However, made ground outside of the permanently acquired part of the Proposed Scheme is not included in this assessment and not discussed further.

Following any excavation, the removal of the source shall be verified by testing of the soil under the made ground to demonstrate that the residual soil does not comprise a potential source.

In addition, groundwater and surface water testing should be carried to confirm the finding to the quantitative groundwater and surface water risk assessment.

8.2 Decommissioning of the filling station

The works at CRSS to accommodate the Proposed Scheme will involve temporary acquisition of the entire CRSS property and decommissioning of all fuel tanks for the duration of the works. The works will include the complete removal of two of the six existing underground fuel storage tanks, two existing pumping stations and removal or relocation of buried services (e.g. pipework and drainage). The primary purpose of this is to ensure that all potentially contaminative materials are removed in a safe manner.

During decommissioning, the information provided by the Association for Petroleum & Explosives Administration (APEA) and the Energy Institute in the 'Design, construction, modification, maintenance and decommissioning of filling stations 4th edition' will be followed[9]. A summary of the decommissioning process is presented below:

- Decommissioning process should take place as soon as is practicable after operation has ceased;
- Carrying out a full risk assessment taking into consideration all matters considering health and safety and environmental protection;
- Removal from site of the storage tanks and associated pipework or rendering tanks safe *(in situ)*;
- Removal of all dispensers within the area being permanently acquired;
- Cleaning and where appropriate, removal of oil/water separator and connected surface water drainage system; and
- Disconnection and, where appropriate, removal of the electrical installation.

8.2.1 Total petroleum hydrocarbons (TPHs)

TPH has been recorded in groundwater beneath the CRSS and downstream on the banks of Lough Atalia. This TPH is likely to reflect drips or minor fuel spills at the CRSS that get flushed down to the gravel deposits and bedrock aquifer by surface water infiltration. Ceasing operation of CRSS within the permanently acquired part of the Proposed Scheme is likely to improve the situation. In addition, during decommissioning should any contaminated soils be identified within the permanently acquired part of the Proposed Scheme, these shall be removed.

As part of the detailed design a quantitative groundwater risk and surface water risk assessment shall be carried out by a competent geoenvironmental expert to establish a concentration of TPH in the soil that does not present a risk to the

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[9] Energy Institute (EI) Design, construction, modification, maintenance and decommissioning of filling stations (known as the Blue Book) (EI 2018)

quality of water entering Lough Atalia. This may require additional ground investigation. The risk assessment shall be used to define the extent and depth of the area for excavation if required.

Following any excavation and the decommissioning of the CRSS, the removal of the source shall be verified by testing of the soil under the made ground to demonstrate that the residual soil does not comprise a potential source.

In addition, groundwater and surface water testing should be carried to confirm the finding to the quantitative groundwater and surface water risk assessment.

8.2.2 Underground tanks and services

All excavation and decommissioning will be supervised by a competent environmental engineer who is independent to the firm carrying out the works. During the excavation and removal, it should be assumed that the material in the surrounding area is contaminated with fuel. The contractor will arrange for any material that is suspected of being contaminated to be assessed by a competent person on site as soon as possible. Care and mitigation measures will be taken to ensure that any contaminated material is not permitted to become mobile and migrate to other areas. Any contaminated material present will be dealt with in accordance with the applicable waste legislation in Ireland.

For further guidance see BS 6187 Code of practice for demolition[10] (section 7.10 Excavation and removal of redundant petroleum tanks).

9 Conclusions

Ove Arup & Partners Ireland (trading as Arup) has been appointed to provide multi-disciplinary engineering services for the proposed BusConnects Galway – Cross City Link development (Proposed Scheme) on behalf of Galway City Council. The Proposed Scheme redline boundary includes land take within the footprint of the existing CRSS operated by Circle K. The CRSS within the permanently acquired part of the Proposed Scheme is subject to a detailed assessment to determine the presence and extent of any contamination.

The assessment found that the site has been previously a print works and a filling station has been operated on the site since the 1960s. A detailed ground investigation was carried out which did not prove any significant soil from the storage of fuels on the site.

Based on the results of the ground investigation, cadmium and occasional occurrences of TPH is present in groundwater under the site and downstream of the site. These exceedances are likely to originate from made ground under the CRSS.

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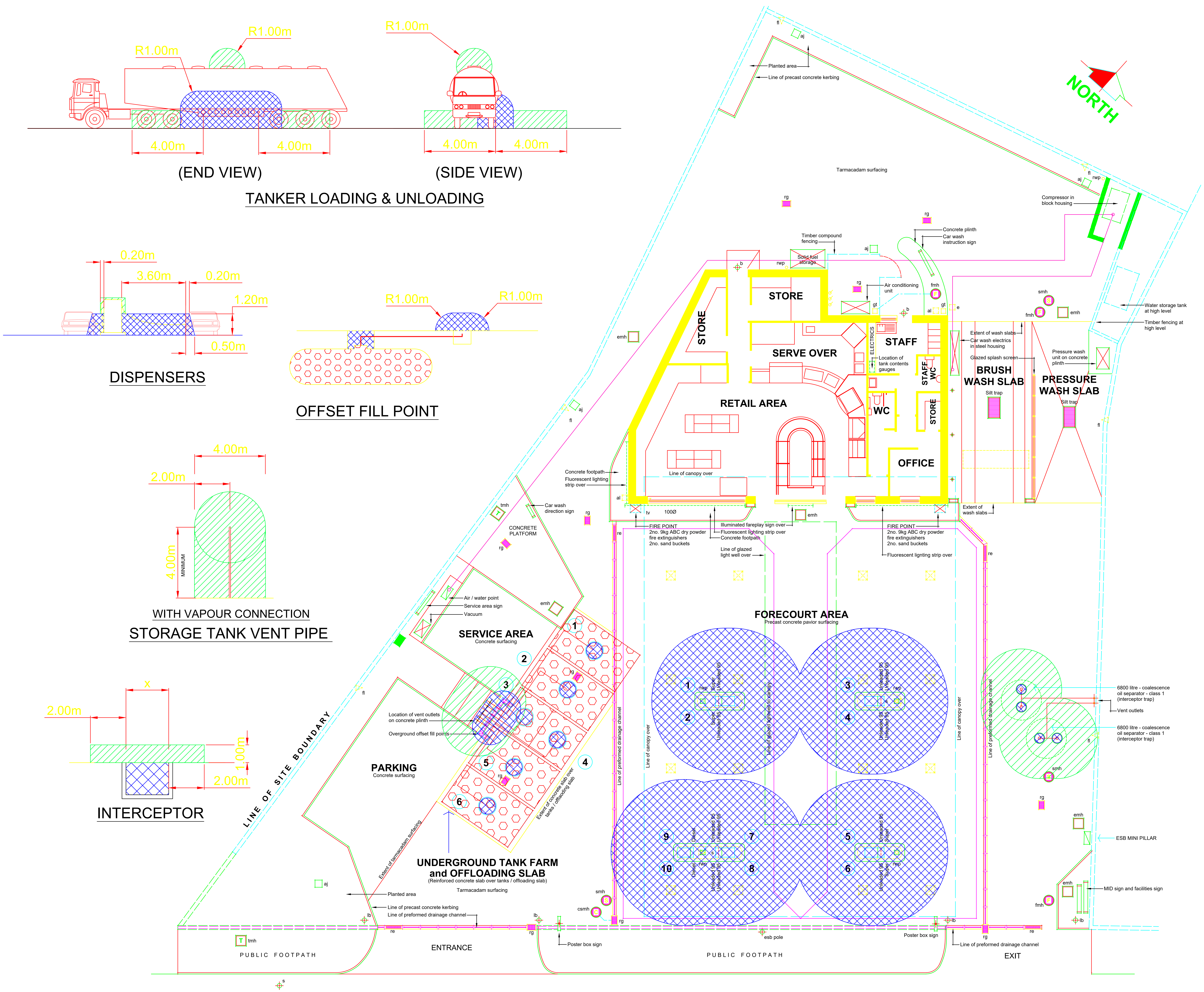
[10] BS 6187:2011 Code of practice for full and partial demolition

It is possible that cadmium originating from the made ground under the CRSS is also the source of elevated cadmium in the seepages on the banks of Lough Atalia. It is likely that the exceedances of TPH underlying the CRSS and observed in the seepages on the banks of Lough Atalia is related to localised fuel spills at the CRSS.

In respect of the cadmium and TPH recorded in the groundwater it is considered that subject to the finding of a risk assessment the removal of the sources of the contamination and disposal of them at an appropriately licenced facility is the most appropriate solution.

It will be necessary to decommission tanks and any buried services under the site to enable the Proposed Scheme in accordance with the 'Design, construction, modification, maintenance and decommissioning of filling stations' 4th edition[6].

The removal of the contaminated made ground and the decommissioning of the existing CRSS within the permanently acquired part of the Proposed Scheme will prevent the Proposed Scheme from impacting the water quality in the groundwater and the water quality entering Lough Atalia. Notwithstanding this it is possible that made ground left under the remainder of CRSS (outside of the permanently acquired part of the Proposed Scheme) could also be a source of cadmium and TPH and may continue to impact on the SAC.



1. Designed to:

(a) Hazardous Area Classification Code:
Part 15 of the IP Model Code of Safe Practice in the
Petroleum Industry in July 2005, 3rd Edition.

(b) Et105:2001, National Rules For Electrical
Installations in potentially Explosive Athospheres.

2. Prodict Gas Group
Gasoline: IIA T3
Derve: IIA T3
MGO: IIA T2
Kero: IIA T3
Ethanol: IIB T2

3. All dimensions in meters

HAZARDOUS AREA ZONES

▨	ZONE 0
▨	ZONE 1
▨	ZONE 2

TANK No.	CAPACITY	PRODUCT
1	19,400 LITRES	UNLEADED
2	19,400 LITRES	UNLEADED
3	9,500 LITRES	UNLEADED
4	9,800 LITRES	UNLEADED
5	19,700 LITRES	UNLEADED
6	19,700 LITRES	DERV

client
College Road, Galway,
Co. Galway

drawing title
EPD_AREA_CLASSIFICATION

TOPAZ

Topaz Energy Ltd.
Beech Hill,
Clonskeagh,
Dublin 4.
Tel : 01 202 8800

drawn	SB	scale	1:250
job no.	REV-1	date	27/6/17

drawing no.
EPD

Appendix

Site History

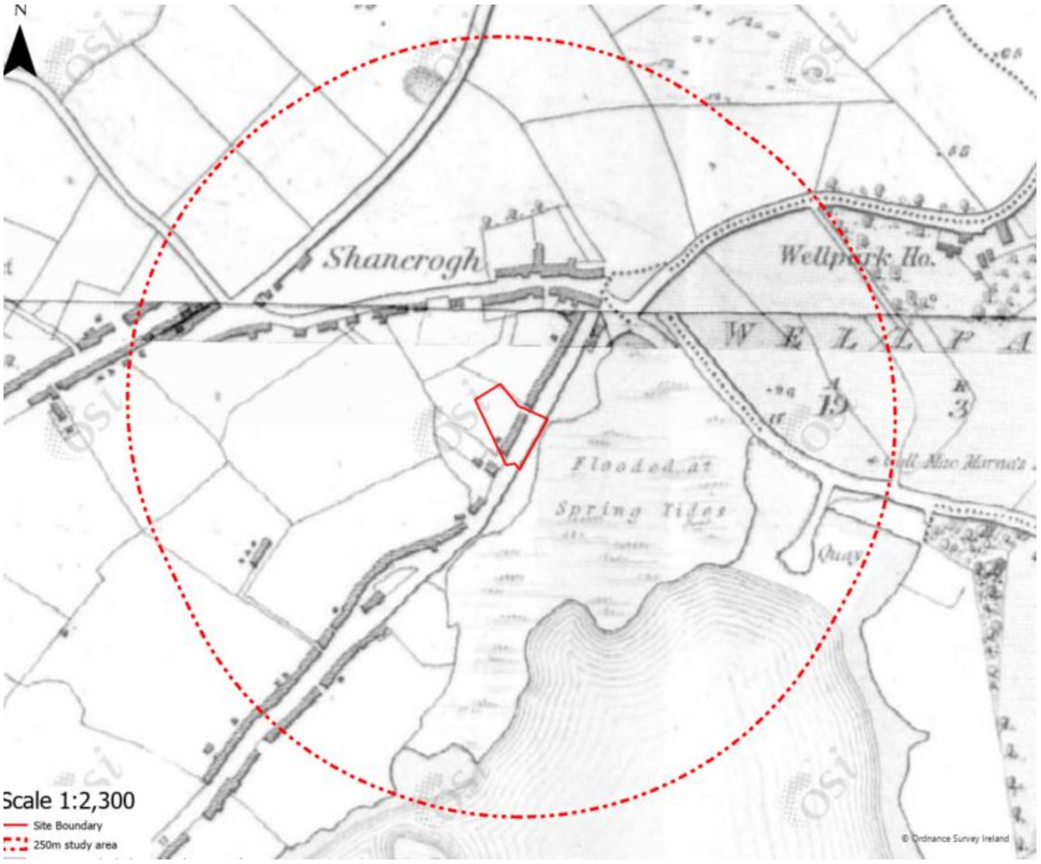
Contents

A2 Site History

A2.1 Site History from 1837 - 1842

The OSI first edition 6-inch mapping from 1837-1842 shows that the area underlying the site was comprised of some local historical development focused along College Road and the west of the site is underlain by fields. These fields are likely to be residential gardens at the back of the developments along College Road. There is a marsh area to the east of the site north of Lough Atalia which is described as ‘Flooded at spring tides’ suggesting that this area was an existing flood plain. This can be seen in Figure 1 below:

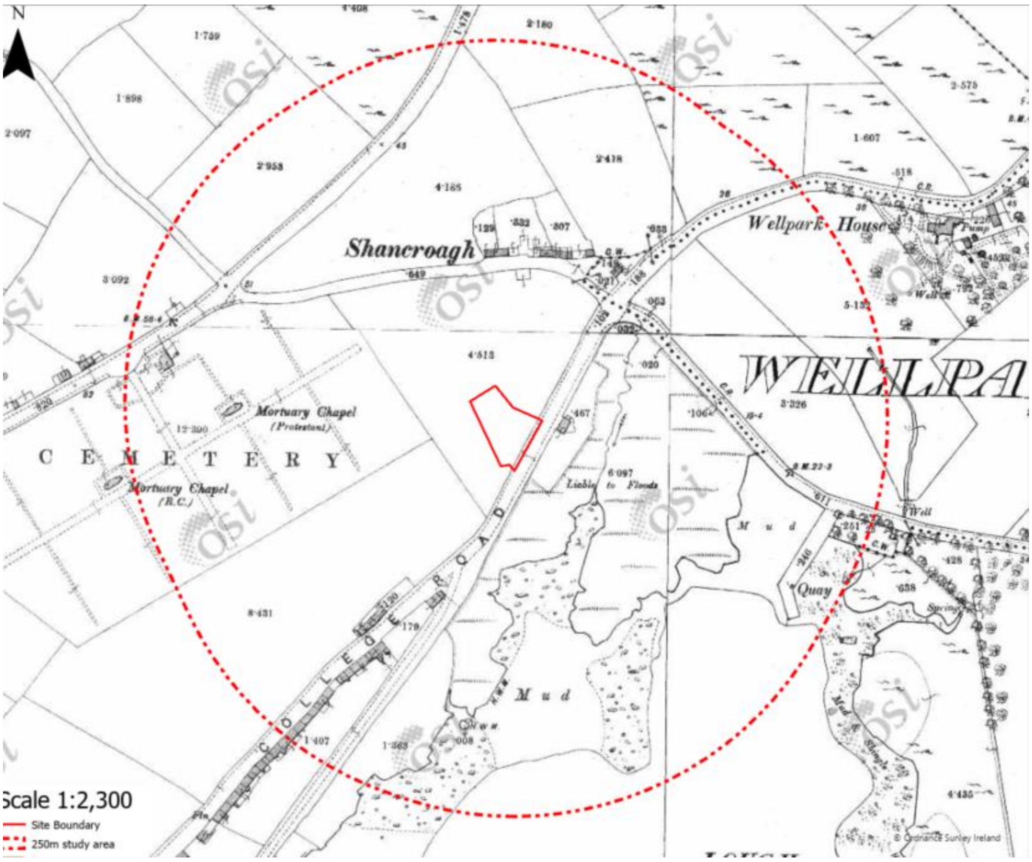
Figure 1: OSI historic 6 Inch black and white mapping



A2.2 Site History from 1888-1913

The OSI 25-inch mapping from 1888-1913 shows the site as part of a larger field, the historical developments along College Road seemed to have been removed. It is likely this area was used as agricultural land during this time. One housing development is noted to the east of College Road adjacent to Lough Atalia. The marsh area is mapped to the east of the site north of Lough Atalia which is described as ‘Liable to Floods’. A watercourse is shown approximately 50m to the east of the site which drains into Lough Atalia. This can be seen in Figure 2 below:

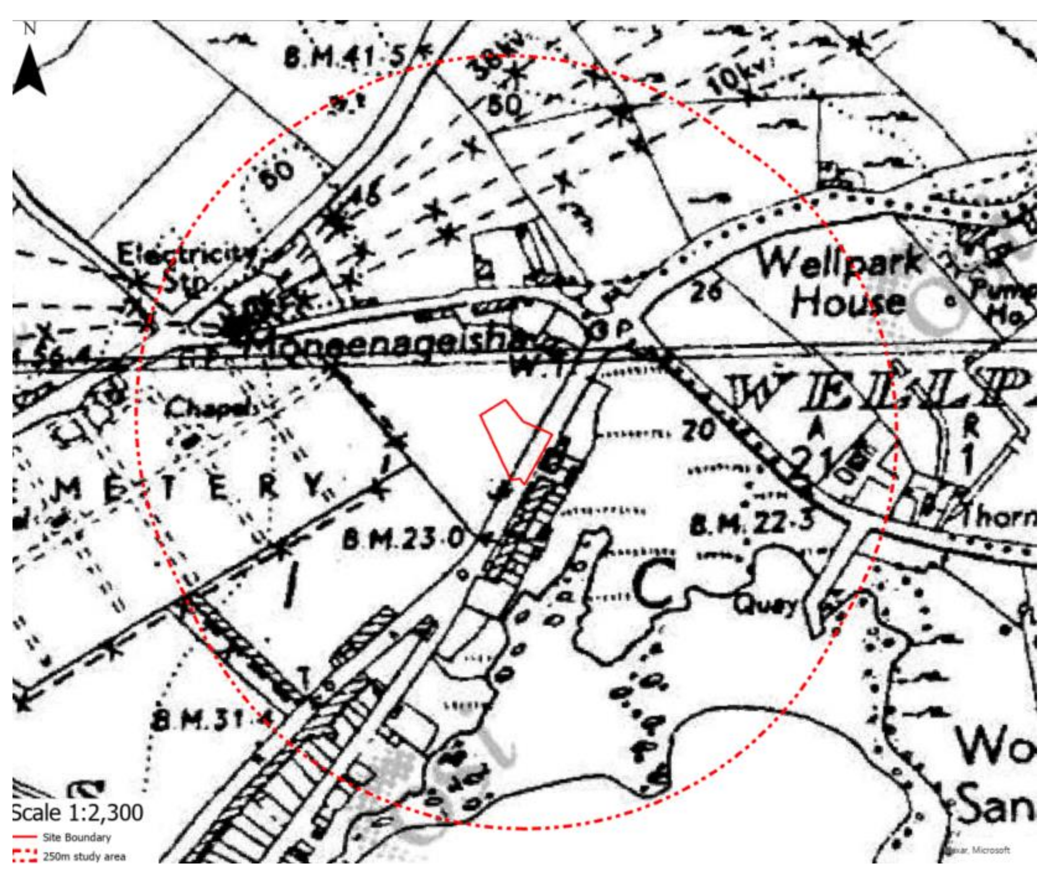
Figure 2: OSI 25-inch mapping (1888-1913)



A2.3 Site History from 1830s to 1930s

The OSI last edition historic 6-inch maps in this area were drawn from 1913-1930s. The maps show the SSCR as part of a larger field. There are a number of housing developments marked to the east of College Road suggesting they had been built between the 1913 and 1930s. The maps show the area east of the site as a marsh land. This can be seen in Figure 3 below:

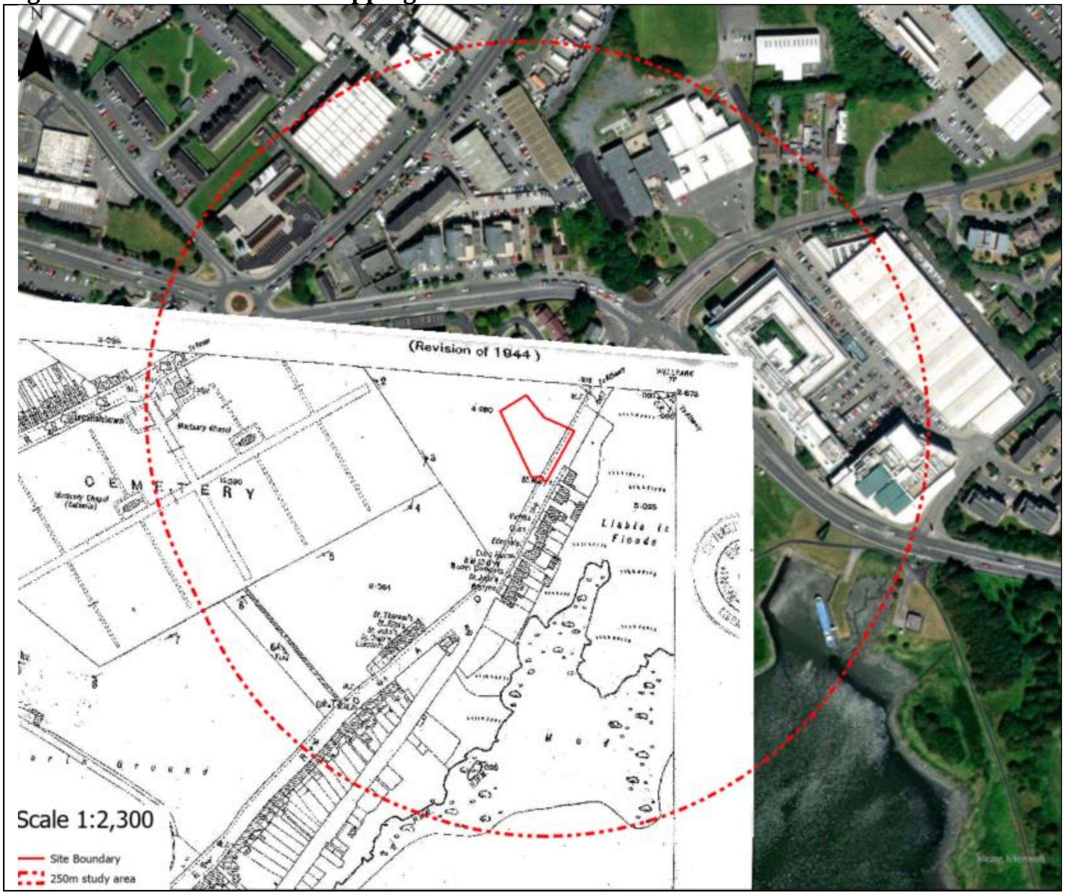
Figure 3: OSI last edition historic 6-inch maps



A2.4 Site History from 1945 to 1962

The OSI Galway City maps from 1945 to 1962 again shows the site similar to that of the last edition of the historic 6-inch maps, suggesting there has been no change on site between the 1930s and 1960s. These maps show the area east of the site as a marsh land at Lough Atalia, they included labelling the area as it as 'Liable to Floods', much of the coast here is described as 'Mud'.

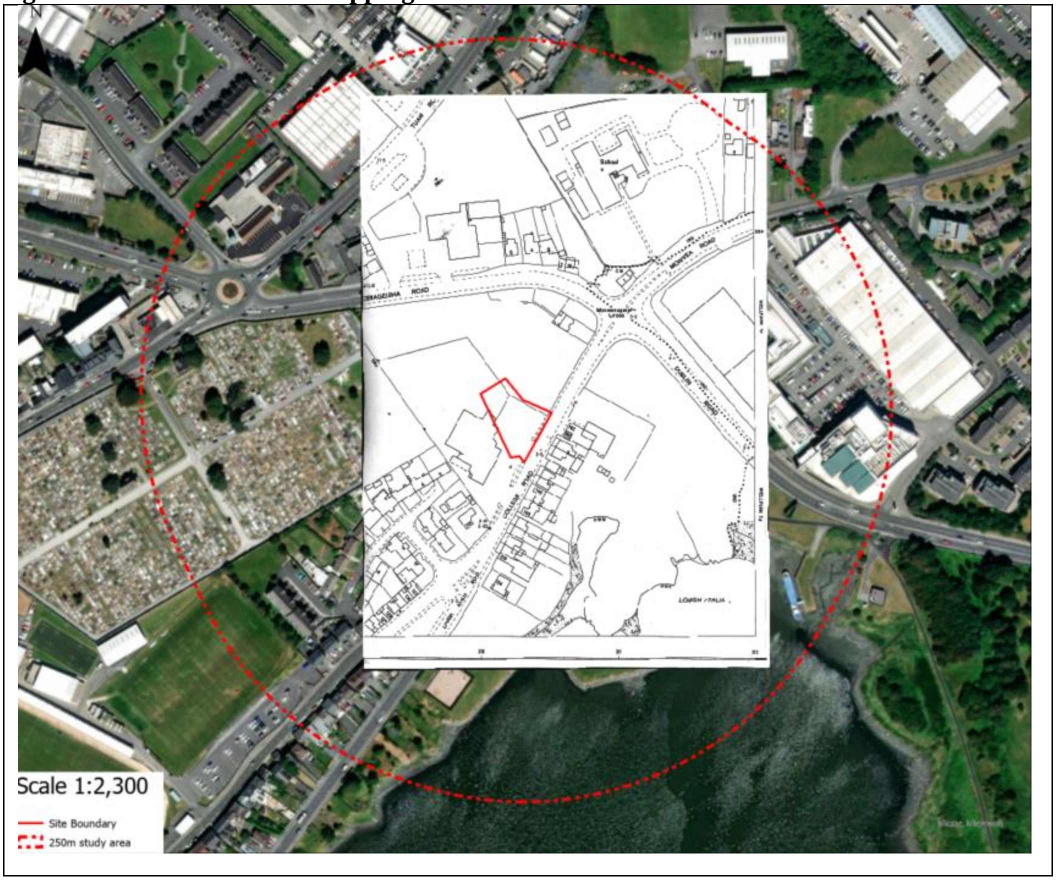
Figure 4: OSI 1945 to 1962 mapping



A2.5 Site History from 1977 to 1980

The 1977 to 1980 OSi mapping for this area show that the area has been developed, there is a footprint of a building underlying the west of the CRSS. The footprint does not appear to be residential but likely industrial. This suggests that development in these areas took place between 1962 and 1977. This can be seen on Figure 5 below:

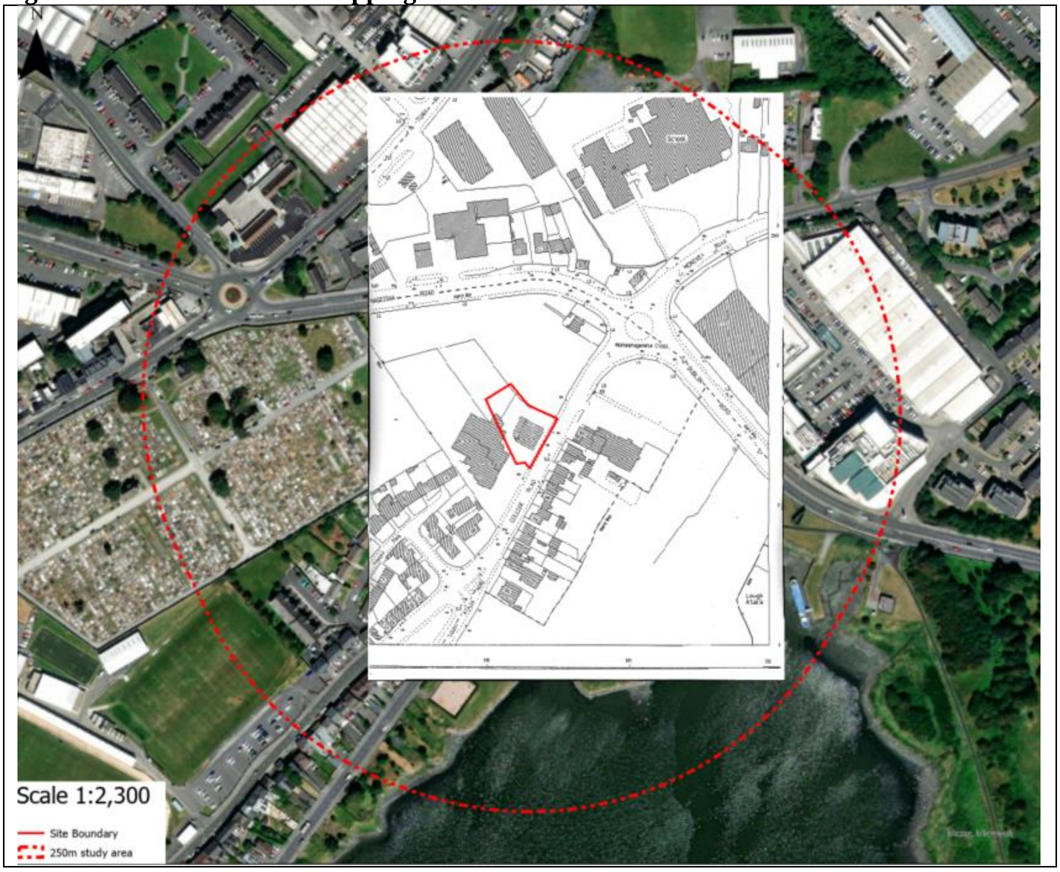
Figure 5: OSI 1997 to 1980 Mapping



A2.6 Site History from 1991 to 1992

The 1991 to 1992 OSi mapping shows that there are two large buildings within the site footprint. These buildings as mentioned above were reported as being a printworks. This suggests that there had been construction at the site between 1977 and 1991. There has also been further development of commercial buildings to the east of the site at the existing location of the Huntsman Inn, this development has taken place on reclaimed land. These observations are shown in Figure 6 below:

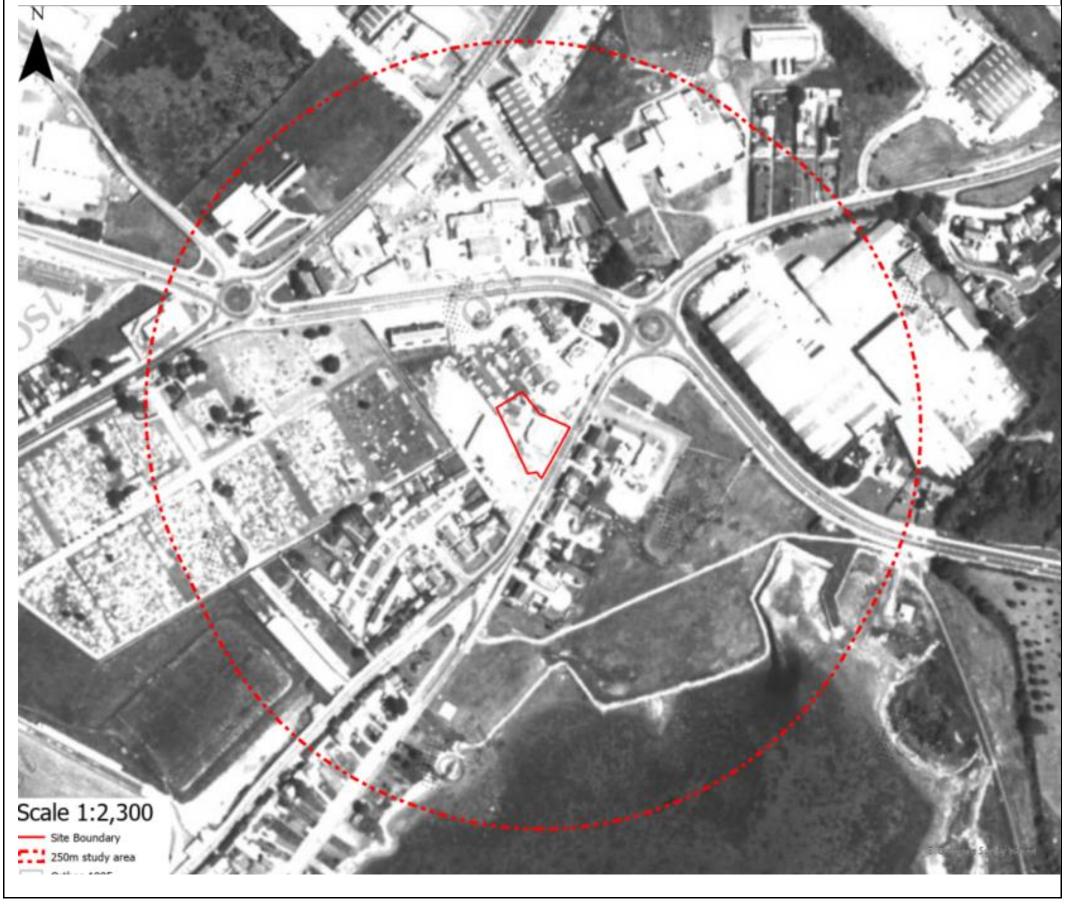
Figure 6: OSI 1991 to 1992 Mapping



A2.7 Site History 1995

The OSI 1995 Aerial photography exhibits no change at the CRSS but there has been further residential development surrounding the CRSS within the Study Area. This imagery suggests there was no development at the current CRSS between 1992 and 1995 at the site. This imagery can be seen below in Figure 7:

Figure 7: OSI 1995 Aerial Photography



A2.8 Site History 2000

The OSI Aerial from 2000 photography shows that there has been housing development surrounding the eastern area of the site, at this time it appears as though the site is vacant prior to construction of the Service Station. This suggests that there was demolition and construction on the site between 1995 and 2000. This can be seen in Figure 8 below:

Figure 8: OSI 2000 Aerial Photography

A2.9 Site History 2005 to 2018

The OSI Aerial photography from 2005 to 2018 and the 2019 Google Earth Aerial imagery show the site as it is presently. This suggests that construction of the Service Station took place between 2000 and 2005. This can be seen in Figure 9 below – showing the 2005 OSI Aerial photography.

Figure 9: OSI 2005 Aerial Photography

			Chemtest Sample ID	22-03384	22-03384	22-03384	22-03384	22-03384	22-03384	22-03745	22-03745	22-12073	22-12073	22-12073	22-12073	22-12073	22-12073	22-12073	22-12073	22-12073	22-12073
			Sample Location	BH103WS	WS104	BH102	BH103	BH104	BH105	SW1 - South	SW2 - West	SW1	SW3-LT	SW3-HT	SW4-LT	SW4-HT	SW5-LT	SW5-HT	BH105	BH104	BH103
			Sampling Round	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	2	2
			Approx. Location																		
			Installation Monitoring	Overburden	Overburden	Bedrock	Bedrock	Bedrock	Bedrock	Surface water	Surface water	Surface water	Surface water	Surface water	Surface water	Surface water	Surface water	Surface water	Bedrock	Bedrock	Bedrock
			Sample Type	GWATER	GWATER	GWATER	GWATER	GWATER	GWATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	GWATER	GWATER	GWATER
			Date Sampled	27-Jan-2022	27-Jan-2022	27-Jan-2022	27-Jan-2022	27-Jan-2022	27-Jan-2022	31-Jan-2022	31-Jan-2022	28-Mar-2022	28-Mar-2022	28-Mar-2022	28-Mar-2022	28-Mar-2022	28-Mar-2022	28-Mar-2022	28-Mar-2022	28-Mar-2022	28-Mar-2022
Parameters	**LOD**	**Groundwater Screening Standards**	**Units**																		
Aliphatic TPH >C10-C12	0.10	400	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	0.10	nv	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C5-C6	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Alkalinity (Total)	10	nv	mg/l	370	260	190	300	580	300	230	200	200	190	140	180	150	140	140	320	510	280
Ammoniacal Nitrogen as NH3	0.050	0.065	mg/l	0.078	0.12	0.093	0.47	2.6	0.12	0.44	0.14	0.1	0.58	0.3	0.061	0.1	0.086	0.47	0.058	1.7	0.063
Antimony	0.50	5.6	µg/l	0.79	0.72	4.8	1.2	9.2	1.3	1.8	0.65	0.54	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.56	1.2	< 0.50	0.68
Aromatic TPH >C10-C12	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	0.10	nv	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C5-C7	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Arsenic	0.20	7.5	µg/l	0.86	0.5	2.9	19	87	4.4	0.7	0.5	0.28	1.6	0.75	2.1	1	1.1	1	1.5	14	0.6
Barium	5.00	100	µg/l	40	27	53	50	60	35	20	18	19	21	20	27	26	29	41	53	43	34
Biochemical Oxygen Demand Low Level	1.0	nv	mg/l	1.1	3.4	< 1.0	< 1.0	1.1	< 1.0	18	4	< 1.0	1	< 1.0	2	< 1.0	< 1.0	< 1.0	< 1.0	2	3
Cadmium	0.11	0.08	µg/l	4.8	0.54	0.7	1.1	0.13	2	0.14	0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	0.57	0.17	0.73
Calcium	2.00	200	mg/l	49	97	130	160	170	93	84	120	88	130	120	130	120	130	130	150	130	65
Chemical Oxygen Demand	10	nv	mg/l	10	< 10	12	< 10	57	< 10	66	91	14	54	54	55	45	49	47	13	41	15
Chloride	1	187.5	mg/l	46	48	36	66	3200	54	50	2600	81	3400	3200	3300	3300	3700	3000	560	2000	54
Chromium (trivalent)	1	nv	µg/l	< 1	< 1	3	< 1	2	1	2	13	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	2	< 1
Copper	0.5	1500	µg/l	18	2.9	14	52	0.73	9.8	3.7	4.8	4.1	0.91	1.4	1.6	1	0.92	3.7	5.8	2	7.5
Iron	5	200	µg/l	340	6.7	2000	2800	110	180	42	5	17	260	15	420	96	100	13	5.6	270	23
Lead	0.5	7.5	µg/l	7.5	0.76	13	32	< 0.50	4.3	2.3	0.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.78	0.61
Low-Level Chromium (Hexavalent)	0.1	nv	µg/l	2.6	2.1	3.9	3.5	0.2	< 0.10	0.1	0.1	0.24	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.85
Magnesium	0.2	50	mg/l	7.1	5.5	5.7	10	200	14	5.3	160	6.4	220	210	220	230	240	210	34	130	7.5
Manganese	0.5	50	µg/l	27	180	250	1500	120	39	38	6.8	7	190	10	160	69	120	6	220	180	0.96
Mercury	0.01	0.75	µg/l	< 0.010	0.16	< 0.010	< 0.010	0.047	0.081	0.01	0.01	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Mineral Oil (TPH Calculation)	10	nv	µg/l	< 10	< 10	< 10	< 10	< 10	< 10	10	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Molybdenum	0.2	nv	µg/l	140	3	360	50	27	19	7.9	7.7	1.2	2.2	1.9	2	1.7	1.9	2.2	2.6	3.4	7
Nickel	0.5	15	µg/l	4.2	1.6	4.5	4.3	78	6.4	9.3	1.1	1.2	1.3	0.76	1.3	0.78	0.88	2.2	4.2	8.4	3
Nitrate	0.5	37.5	mg/l	7.2	4.4	4.5	< 0.50	< 0.50	5.1	5.4	1.7	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.53	< 0.50	1.3
Organolead Compounds	0.05	No match	ug/l	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	0.05	0.05	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Phosphate	0.2	nv	mg/l	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.2	0.4	0.2	0.27	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Potassium	0.5	5	mg/l	4.7	5.8	5	7	66	7.8	3.8	51	3.3	73	66	69	68	75	64	12	47	5
Selenium	0.50	170	µg/l	29	3	5.6	< 0.50	1.2	13	1.4	1.5	0.91	< 0.50	< 0.50	0.6	< 0.50	< 0.50	0.55	0.77	< 0.50	22
Sodium	1.50	150	mg/l	140	30	22	45	1900	140	32	1800	47	1900	1800	1900	1900	2200	1800	280	1100	110
Sulphate	1.0	187.5	mg/l	72	60	66	54	380	73	58	410	51	460	450	430	460	510	440	100	220	89
Suspended Solids At 105C	5.0	nv	mg/l	540	18	140	180	220	64	550	55	< 5.0	3100	170	1800	590	1300	610	420	84	47000
Total Aliphatic Hydrocarbons	5.0	nv	µg/l	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Aromatic Hydrocarbons	5.0	0.075	µg/l	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Dissolved Solids	1.0	1000	mg/l	530	470	380	530	7200	600	380	5500	980	7000	6600	6500	7000	7200	4900	1400	4200	510
Total Petroleum Hydrocarbons	10	10	µg/l		< 10		< 10	< 10	< 10			< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Total TPH >C10-C40	10	nv	µg/l	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Zinc	2.5	75	µg/l	55	7.5	41	150	7.1	41	190	14	14	< 2.5	4.7	< 2.5	< 2.5	< 2.5	19	24	5.7	7.1

ARUP

			Chemtest Sample ID	22-12073	22-12073	22-12073	22-14537	22-14537	22-14537	22-14537	22-14537	22-14537	22-14537	22-14537	22-14537	22-14537	22-14537	22-14537	22-14537
			Sample Location	BH102	BH103WS	WS104	BH103WS	WS104	BH102	BH103	BH104	BH105	SW01	SW03LT	SW03HT	SW04LT	SW04HT	SW05LT	SW05HT
			Sampling Round	2	2	2	3	3	3	3	3	3	3	2	2	2	2	2	2
			Approx. Location																
			Installation Monitoring	Bedrock	Overburden	Overburden	Overburden	Overburden	Bedrock	Bedrock	Bedrock	Bedrock	Surface water	Surface water	Surface water	Surface water	Surface water	Surface water	Surface water
			Sample Type	GWATER	GWATER	GWATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
			Date Sampled	28-Mar-2022	28-Mar-2022	28-Mar-2022	13-Apr-2022	13-Apr-2022	13-Apr-2022	13-Apr-2022	13-Apr-2022	13-Apr-2022	13-Apr-2022	13-Apr-2022	13-Apr-2022	13-Apr-2022	13-Apr-2022	13-Apr-2022	13-Apr-2022
Parameters	**LOD**	**Groundwater Screening Standards**	**Units**																
Aliphatic TPH >C10-C12	0.10	400	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Aliphatic TPH >C12-C16	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Aliphatic TPH >C16-C21	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Aliphatic TPH >C21-C35	0.10	7.5	µg/l	150	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Aliphatic TPH >C35-C44	0.10	nv	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Aliphatic TPH >C5-C6	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Aliphatic TPH >C8-C10	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Alkalinity (Total)	10	nv	mg/l	140	280	250	520	380	100	460	550	430	230	160	160	170	150	150	150
Ammoniacal Nitrogen as NH3	0.050	0.065	mg/l	0.24	< 0.050	0.12	0.23	0.23	0.55	0.24	1.2	0.44	0.5	1.6	1.3	1.4	1.2	1.1	1.2
Antimony	0.50	5.6	µg/l	0.68	0.74	4.1	0.61	0.97	0.86	0.52	0.52	1.1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0.73	< 0.50
Aromatic TPH >C10-C12	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	41	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Aromatic TPH >C12-C16	0.10	7.5	µg/l	19	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Aromatic TPH >C16-C21	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Aromatic TPH >C21-C35	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	33	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Aromatic TPH >C35-C44	0.10	nv	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Aromatic TPH >C5-C7	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Aromatic TPH >C7-C8	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Aromatic TPH >C8-C10	0.10	7.5	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	[C] < 0.10	< 0.10
Arsenic	0.20	7.5	µg/l	1.5	0.59	0.41	1.2	0.46	1.4	0.45	19	1.5	0.28	1.2	0.88	1.3	0.85	1	0.97
Barium	5.00	100	µg/l	13	32	34	46	52	11	43	39	140	16	26	24	26	24	25	22
Biochemical Oxygen Demand Low Level	1.0	nv	mg/l	2	< 1.0	< 1.0	[B] 3.0	[B] 3.0	[B] 5.0	[B] 1.0	[B] 4.0	[B] 3.0	[B] 16	[B] 5.0	[B] < 1.0	[B] 3.0	[B] < 1.0	[B] 4.0	[B] 5.0
Cadmium	0.11	0.08	µg/l	< 0.11	0.72	< 0.11	0.29	0.35	< 0.11	0.12	0.73	0.79	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	0.26	< 0.11
Calcium	2.00	200	mg/l	63	56	92	34	120	36	55	160	200	77	190	200	190	190	190	190
Chemical Oxygen Demand	10	nv	mg/l	21	12	17	[B] < 10	[B] < 10	[B] < 10	[B] < 10	[B] 20	[B] 26	[B] 27	[B] 110	[B] 41	[B] 110	[B] 37	[B] 100	[B] 110
Chloride	1	187.5	mg/l	47	43	47	54	90	140	53	1200	2900	80	8600	8800	8800	8300	8500	8500
Chromium (trivalent)	1	nv	µg/l	< 1	1	< 1	< 1	< 1	2	1	3	4	4	4	4	4	4	3	4
Copper	0.5	1500	µg/l	1.3	9.4	1.5	16	6.7	2.1	5.5	8.6	6.2	3.2	1.6	1.9	1.3	1.8	1.9	1.8
Iron	5	200	µg/l	< 5.0	33	< 5.0	270	390	19	21	2000	24	81	94	20	130	20	21	19
Lead	0.5	7.5	µg/l	< 0.50	0.64	< 0.50	3.7	5.6	< 0.50	< 0.50	15	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	1.3	< 0.50
Low-Level Chromium (Hexavalent)	0.1	nv	µg/l	0.66	0.73	0.99	[B] 3.9	[B] 4.3	[B] 3.3	[B] 4.1	[B] < 0.10	[B] < 0.10	[B] < 0.10	[B] < 0.10	[B] 0.48	[B] 0.28	[B] 0.50	[B] 0.48	[B] < 0.10
Magnesium	0.2	50	mg/l	3.4	6.4	4.2	6.7	14	5.5	8.9	74	160	6.2	460	480	470	470	450	470
Manganese	0.5	50	µg/l	0.87	< 0.50	0.75	13	45	14	1.5	290	330	9.2	53	2.6	69	3.1	5.6	1.7
Mercury	0.01	0.75	µg/l	< 0.010	< 0.010	< 0.010	0.04	0.039	0.06	0.039	0.039	0.038	0.041	0.052	0.042	0.048	0.044	0.038	0.042
Mineral Oil (TPH Calculation)	10	nv	µg/l	150	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Molybdenum	0.2	nv	µg/l	8	8.7	3.2	12	2.8	8.3	5.6	3.7	3.7	2.7	4.8	4.3	4.5	4.4	4.4	4.3
Nickel	0.5	15	µg/l	2.4	3.9	1	5.2	2.8	5.8	4.5	10	6.2	4.1	3.4	2.9	3.2	3	3	2.8
Nitrate	0.5	37.5	mg/l	1.1	0.94	1.7	2.1	9.2	1.8	2.9	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organolead Compounds	0.05	No match	ug/l	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Phosphate	0.2	nv	mg/l	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Potassium	0.5	5	mg/l	7.1	4.7	15	5.5	13	8.6	5.4	28	48	4.2	140	150	150	140	150	150
Selenium	0.50	170	µg/l	3	27	4.9	28	6.7	2.9	13	3.7	1	1.3	0.74	0.68	0.9	0.66	0.73	0.67
Sodium	1.50	150	mg/l	30	130	34	210	120	70	110	610	1800	44	4800	5100	5200	5400	5700	5300
Sulphate	1.0	187.5	mg/l	49	100	53	90	64	56	73	120	400	53	1100	1100	1100	1000	1100	1100
Suspended Solids At 105C	5.0	nv	mg/l	220	29000	2500	19000	20000	420	60000	2600	640	200	2400	210	4400	200	590	140
Total Aliphatic Hydrocarbons	5.0	nv	µg/l	150	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	[C] < 5.0	< 5.0
Total Aromatic Hydrocarbons	5.0	0.075	µg/l	19	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	74	< 5.0	< 5.0	< 5.0	< 5.0	[C] < 5.0	< 5.0
Total Dissolved Solids	1.0	1000	mg/l	310	520	420	600	700	260	550	2300	5400	490	14000	8200	14000	9200	14000	8800
Total Petroleum Hydrocarbons	10	10	µg/l	170	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	74	< 10	< 10	< 10	< 10	[C] < 10	< 10
Total TPH >C10-C40	10	nv	µg/l	150	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	[C] < 10	< 10
Zinc	2.5	75	µg/l	< 2.5	7	81	47	120	5.8	4.5	110	49	34	3.6	3.5	< 2.5	3.9	5.3	3.7

Chapter 15
(Archaeological Cultural Heritage and Architectural Heritage) Appendices

Galway City Council

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Appendix 15.1 - Legislation Protecting the Archaeological Resource

Chapter 15 Archaeology, Architecture, and Cultural Heritage

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Appendix 15.1 Legislation Protecting the Archaeological Resource

Appendix 15.1 Legislation Protecting the Archaeological Resource

Protection of Cultural Heritage

The cultural heritage in Ireland is safeguarded through national and international policy designed to secure the protection of the cultural heritage resource to the fullest possible extent (Department of Arts, Heritage, Gaeltacht and the Islands 1999, 35). This is undertaken in accordance with the provisions of the *European Convention on the Protection of the Archaeological Heritage* (Valletta Convention), ratified by Ireland in 1997.

The Archaeological Resource

The *National Monuments Act 1930 to 2014* and relevant provisions of the *National Cultural Institutions Act 1997* are the primary means of ensuring the satisfactory protection of archaeological remains, which includes all man-made structures of whatever form or date except buildings habitually used for ecclesiastical purposes. A National Monument is described as ‘a monument or the remains of a monument the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto’ (National Monuments Act 1930 Section 2). A number of mechanisms under the National Monuments Act are applied to secure the protection of archaeological monuments. These include the Register of Historic Monuments, the Record of Monuments and Places, and the placing of Preservation Orders and Temporary Preservation Orders on endangered sites.

Ownership and Guardianship of National Monuments

The Minister may acquire national monuments by agreement or by compulsory order. The state or local authority may assume guardianship of any national monument (other than dwellings). The owners of national monuments (other than dwellings) may also appoint the Minister or the local authority as guardian of that monument if the state or local authority agrees. Once the site is in ownership or guardianship of the state, it may not be interfered with without the written consent of the Minister.

Register of Historic Monuments

Section 5 of the 1987 Act requires the Minister to establish and maintain a Register of Historic Monuments. Historic monuments and archaeological areas present on the register are afforded statutory protection under the 1987 Act. Any interference with sites recorded on the register is illegal without the permission of the Minister. Two months’ notice in writing is required prior to any work being undertaken on or in the vicinity of a registered monument. The register also includes sites under Preservation Orders and Temporary Preservation Orders. All registered monuments are included in the Record of Monuments and Places.

Preservation Orders and Temporary Preservation Orders

Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act. Preservation Orders make any interference with the site illegal. Temporary Preservation Orders can be attached under the 1954 Act. These perform the same function as a Preservation Order but have a time limit of six months, after which the situation must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders with the written consent, and at the discretion, of the Minister.

Record of Monuments and Places

Section 12(1) of the 1994 Act requires the Minister for Arts, Heritage, Gaeltacht and the Islands (now the Minister for the Department of Culture, Heritage and the Gaeltacht) to establish and maintain a record of monuments and places where the Minister believes that such monuments exist. The record comprises a list of monuments and relevant places and a map/s showing each monument and relevant place in respect of each county in the state. All sites recorded on the Record of Monuments and Places receive statutory protection under the National Monuments Act 1994. All recorded monuments on the proposed development site are represented on the accompanying maps.

Section 12(3) of the 1994 Act provides that ‘where the owner or occupier (other than the Minister for Arts, Heritage, Gaeltacht and the Islands) of a monument or place included in the Record, or any other person, proposes to carry out, or to cause or permit the carrying out of, any work at or in relation to such a monument or place, he or she shall give notice in writing to the Minister of Arts, Heritage, Gaeltacht and the Islands to carry out work and shall not, except in case of urgent necessity and with the consent of the Minister, commence the work until two months after giving of notice’.

Under the National Monuments (Amendment) Act 2004, anyone who demolishes or in any way interferes with a recorded site is liable to a fine not exceeding €3,000 or imprisonment for up to 6 months. On summary conviction and on conviction of indictment, a fine not exceeding €10,000 or imprisonment for up to 5 years is the penalty. In addition, they are liable for costs for the repair of the damage caused.

In addition to this, under the *European Communities (Environmental Impact Assessment) Regulations 1989*, Environmental Impact Statements (EIS) are required for various classes and sizes of development project to assess the impact the proposed development will have on the existing environment, which includes the cultural, archaeological and built heritage resources. These document’s recommendations are typically incorporated into the conditions under which the proposed development must proceed, and thus offer an additional layer of protection for monuments which have not been listed on the RMP.

The Planning and Development Act 2000

Under planning legislation, each local authority is obliged to draw up a Development Plan setting out their aims and policies with regard to the growth of the area over a five-year period.

They cover a range of issues including archaeology and built heritage, setting out their policies and objectives with regard to the protection and enhancement of both. These policies can vary from county to county. The Planning and Development Act 2000 recognises that proper planning and sustainable development includes the protection of the archaeological heritage. Conditions relating to archaeology may be attached to individual planning permissions.

Galway City Council Development Plan, 2017-2023

It is a policy of the plan to:

Policy 8.5 Archaeology

- Protect the archaeological heritage of the city.
- Ensure that proposed development within the designated city centre Zone of Archaeological Potential is not detrimental to the character of an archaeological site or its setting.
- Have regard to the archaeological recommendations of the Department of Arts, Heritage, Rural, Regional and Gaeltacht Affairs on any planning applications.
- Endorse the sustainable use of archaeological heritage as an educational and cultural resource and promote public awareness of the archaeological heritage of the city.
- Require the surveying, recording or excavation of archaeological heritage during the development process where appropriate.
- Seek the preservation in-situ or, at a minimum, preservation by record of archaeological sites/monuments included in the Record of Monuments and Places.
- Ensure that any development proposal with potential to impact on archaeological heritage includes an archaeological assessment. This includes within terrestrial, riverine, inter-tidal and sub-tidal environments.
- Promote the protection of the varied industrial heritage of the city and encourage greater appreciation and public awareness of this heritage.

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Appendix 15.2 – SMR and RMP sites within the study area

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Appendix 15.2 SMR/RMP Sites Within the Study Area

AH No.	SMR No.	RMP Status	Townland	Parish	ITM	Classification	Dist. from scheme	Description	Reference
AH1	GA094-100	Yes	Townparks	St. Nicholas	529809, 725280 (centre)	Historic Town of Galway	0m	On E bank of the River Corrib at its outflow into Galway Bay. Its foundation dates from the 1230s when Richard de Burgh erected a castle on the site of the O'Flaherty stronghold of Bun Gaillimhe (Lynn 1986, 101). The construction of its defences dates from the 1270s and it was confirmed as a royal borough in 1396. The walled town covered an area of circa 60 hectares but an extra mural suburb also existed at the Claddagh, on W bank of the river (see GA094-091002-). Three friaries (GA094-091----, GA094-099003-, GA094-102----), a hospital, a (nunnery and an infirmary (GA094-105----, GA094-106----, GA094-113----) also stood outside the walls. The visible remains comprise	www.archaeology.ie/ SMR file

AH No.	SMR No.	RMP Status	Townland	Parish	ITM	Classification	Dist. from scheme	Description	Reference
								substantial portions of the town walls, the collegiate church of St Nicholas, and the remains of circa 20 late medieval houses (Higgins 1984-6). In the 17th century a series of artillery fortifications (GA094-032----, GA094-057----, GA082-083----, GA094-099002-, GA094-112----, GA094-022----) were erected around the town. (Killanin and Duignan 1967, 284-8; Hardiman 1820; Casey 1988b) The above description is derived from the published 'Archaeological Inventory of County Galway Vol. I - West Galway'. Compiled by Paul Gosling (Dublin: Stationery Office, 1993).	
AH2	GA094-103	Yes	Townparks	St. Nicholas	529479, 725480	Prison	0m	Description not yet uploaded to archaeology.ie	www.archaeology.ie/ SMR file
AH3	GA094-139	Yes	Townparks	St. Nicholas	529484, 725490	Stone sculpture (inside Cathedral)	24m W	In the chapel of St Nicholas in the Cathedral of Our Lady Assumed into Heaven and St Nicholas. The reredos above	www.archaeology.ie/ SMR file

AH No.	SMR No.	RMP Status	Townland	Parish	ITM	Classification	Dist. from scheme	Description	Reference
								the altar consists of four limestone panels arranged so as to represent the coronation of Our Lady by the Holy Trinity. Three of these date to the mid-seventeenth century (God the Father, God the Son, Blessed Virgin) and the fourth (Holy Ghost) is a modern carving. The older panels came from the Pro-Cathedral in Middle Street where they had been transferred from St Nicholas' church some time in the early 19th century. Richard Pococke, who visited Galway in 1752, records these as follows: ‘In the vestry on three large stones are cut as big as human life, Our Saviour, the Virgin Mary to the right, and to the right of that God the Father and over his head the Dove, they were dug up somewhere about the church’ (Pococke 1752, 105). Originally, they	

AH No.	SMR No.	RMP Status	Townland	Parish	ITM	Classification	Dist. from scheme	Description	Reference
								probably were intended to form part of an altar or tomb-surround that was never completed. The panel depicting God the Father formerly contained to the right of the figure the unfinished carvings of a dove and an angel with a censor. These were removed when the panels were re-erected in this chapel.	
AH4	GA094-100033	Yes	Townparks	St. Nicholas	529468, 725308	Causeway	34m SW	File unavailable	www.archaeology.ie/ SMR file
AH5	GA094-103001	Yes	Townparks	St. Nicholas	529522, 725410	Mill - unclassified	7m W	File unavailable	www.archaeology.ie/ SMR file
AH6	GA094-100056	Yes	Townparks	St. Nicholas	529599, 725380	Weir - regulating	50m SE	File unavailable	www.archaeology.ie/ SMR file
AH7	GA094-102002	Yes	Townparks	St. Nicholas	529663, 725498	Graveyard	12m E	File unavailable	www.archaeology.ie/ SMR file
	GA094-102008	Yes	Townparks	St. Nicholas	529659, 725506	Tomb – unclassified	c. 25m E	File unavailable	www.archaeology.ie/ SMR file
	GA094-102009	Yes	Townparks	St. Nicholas	529659, 725507	Memorial stone	c. 25m E	File unavailable	www.archaeology.ie/ SMR file
	GA094-102010	Yes	Townparks	St. Nicholas	529659, 725507	Tomb – unclassified	c. 25m E	File unavailable	www.archaeology.ie/ SMR file

AH No.	SMR No.	RMP Status	Townland	Parish	ITM	Classification	Dist. from scheme	Description	Reference
	GA094-102011	Yes	Townparks	St. Nicholas	529658, 725506	Tomb – unclassified	c. 25m E	File unavailable	www.archaeology.ie/ SMR file
	GA094-102012	Yes	Townparks	St. Nicholas	529659, 725506	Tomb – unclassified	c. 25m E	File unavailable	www.archaeology.ie/ SMR file
	GA094-102013	Yes	Townparks	St. Nicholas	529659, 725506	Tomb – unclassified	c. 25m E	File unavailable	www.archaeology.ie/ SMR file
	GA094-102014	Yes	Townparks	St. Nicholas	529659, 725506	Tomb – unclassified	c. 25m E	File unavailable	www.archaeology.ie/ SMR file
	GA094-102015	Yes	Townparks	St. Nicholas	529658, 725504	Graveslab	c. 25m E	File unavailable	www.archaeology.ie/ SMR file
	GA094-102016	Yes	Townparks	St. Nicholas	529655, 725503	Graveslab	c. 25m E	File unavailable	www.archaeology.ie/ SMR file
	GA094-102017	Yes	Townparks	St. Nicholas	529658, 725506	Graveslab	c. 25m E	File unavailable	www.archaeology.ie/ SMR file
	GA094-102018	Yes	Townparks	St. Nicholas	529656, 725506	Graveslab	c. 25m E	File unavailable	www.archaeology.ie/ SMR file
	GA094-102019	Yes	Townparks	St. Nicholas	529656, 725506	Tomb – unclassified	c. 25m E	File unavailable	www.archaeology.ie/ SMR file
AH8	GA094-102001	Yes	Townparks	St. Nicholas	529695, 725512	Church	14m W	File unavailable	www.archaeology.ie/ SMR file
AH9	GA094-102004	Yes	Townparks	St. Nicholas	529688, 725486	Wall monument	32m W	File unavailable	www.archaeology.ie/ SMR file
	GA094-102005	Yes	Townparks	St. Nicholas	529688, 725486	Wall monument	32m W	File unavailable	www.archaeology.ie/ SMR file

AH No.	SMR No.	RMP Status	Townland	Parish	ITM	Classification	Dist. from scheme	Description	Reference
	GA094-102006	Yes	Townparks	St. Nicholas	529688, 725486	Inscribed slab	32m W	File unavailable	www.archaeology.ie/ SMR file
	GA094-102007	Yes	Townparks	St. Nicholas	529688, 725486	Wall monument	32m W	File unavailable	www.archaeology.ie/ SMR file
AH10	GA094-100047	Yes	Townparks	St. Nicholas	529692, 725428	Water mill - unclassified	44m W	File unavailable	www.archaeology.ie/ SMR file
AH11	GA094-102	Yes	Townparks	St. Nicholas	529665, 725549	Religious house - Franciscan friars	0m	On the now-reclaimed St Stephen's Island on E side of the River Corrib just outside N gate of Galway town (GA094-100----). This Franciscan friary, founded by Wm. de Burgo in 1296, stood to N of the present Franciscan church in Francis St. The scale and layout of buildings is unclear but representations appear on a number of 16-17th-C maps. In 1657 'all the buildings...demolished' except the church which was reused as a court house. Reoccupied and repaired in 1689 and 1723-4, and completely rebuilt in 1781. Amongst its possessions was a watermill (GA094-	www.archaeology.ie/ SMR file

AH No.	SMR No.	RMP Status	Townland	Parish	ITM	Classification	Dist. from scheme	Description	Reference
								102003-). (Hardiman 1820, 264-73; Jennings 1947; Gwynn and Hadcock 1970, 250-1). The above description is derived from the published 'Archaeological Inventory of County Galway Vol. I - West Galway'. Compiled by Paul Gosling (Dublin: Stationery Office, 1993).	
AH12	GA094-100034	Yes	Townparks	St. Nicholas	529720, 725390	Bridge	42m SW	File unavailable	www.archaeology.ie/ SMR file
AH13	GA094-100001	Yes (Nat. Mon.)	Townparks	St. Nicholas	529832, 725410 and 529917, 725397	Galway Town Defences	0m	See AH1	www.archaeology.ie/ SMR file
AH14	GA094-100035	Yes	Townparks	St. Nicholas	529789, 725449	Bridge	0m	File unavailable	www.archaeology.ie/ SMR file
AH15	GA094-119	Yes	Townparks	St. Nicholas	529759, 725530	Structure	26m E	A curve in the wall at the junction of Court Lane and St Anthony's Place was identified as the remains of a possible dovecote. There is no dovecote shown in this location on the mid-17th century Pictorial Map of	www.archaeology.ie/ SMR file

AH No.	SMR No.	RMP Status	Townland	Parish	ITM	Classification	Dist. from scheme	Description	Reference
								Galway (TCD MS 1209.73) and the evidence is not sufficient to warrant accepting it as the remains of such. The construction of the curve at this corner appears to continue in a straight line along Court Lane rather than, as one would expect if it were a dovecote, to continue the line of the arc of such a structure. It is possible that the stonework might indicate the remnants of a building or structure of some antiquity but this cannot be certain: it is clearly earlier than the remainder of the wall above. On the W face of the corner stone, immediately above the curve, the faint carving of a cross is visible, which is reminiscent of those enigmatic early-19th century carvings associated with J. or I. Healy found at various locations in the city. A fragment from a 15th-17th century window (GA094-	

AH No.	SMR No.	RMP Status	Townland	Parish	ITM	Classification	Dist. from scheme	Description	Reference
								120----) has been incorporated in the wall to the N.	
	GA094-120	Yes	Townparks	St. Nicholas	529757, 725532	Architectural fragment	26m E	Incorporated in a wall on the east side of Court Lane near the junction with St Anthony's Place is a fragment of a probable window sill (H 0.14m; W 0.10m). The stone bears some punch dressing typical of 16th/17th century date and the residual base projection for a mullion.	www.archaeology.ie/ SMR file
AH16	GA094-138	Yes	Townparks	St. Nicholas	529988, 725449	Architectural fragment (Browne Doorway)	7m SE	This well-known landmark, known as the ‘Browne Doorway’, originally served as the elaborate entrance to a house on the west side of Abbeygate Street Lower at the junction with St. Augustine Street. It was removed from its original site in 1878 and re-erected as an entrance to the Eyre Square park in 1905 (see Trench 1905–6). In form it is a fine example of how the Classical style of	www.archaeology.ie/ SMR file

AH No.	SMR No.	RMP Status	Townland	Parish	ITM	Classification	Dist. from scheme	Description	Reference
								architecture found expression in the Jacobean world of early 17th-century Galway. It consists of a more-or-less elaborate entrance porch which is defined by Tuscan columns topped with Ionic capitals on tall pedestals.	
AH17	GA094-090	No	Townparks	St. Nicholas	529084, 725726	Redundant record	0m	This record was formerly classed as 'Earthwork possible' based on the interpretation of a feature represented on Sheet 10 of the OS 1:500 town plan of Galway (surveyed 1872). This feature, more likely a pond, formed part of the gardens attached to the then Queens College of Galway, now NUI Galway. It is no longer visible having been removed/filled in when this corner was redeveloped as part of a road realignment. It is not an archaeological monument.	www.archaeology.ie/ SMR file
AH18	GA094-030001	Yes	Milestone	St. Nicholas	531429, 726055	Boundary stone	38m E	This is the large erratic incorporated in a boundary	www.archaeology.ie/ SMR file

AH No.	SMR No.	RMP Status	Townland	Parish	ITM	Classification	Dist. from scheme	Description	Reference
								wall. The stone measures c. 2m by 1.20m and rises about 0.60m above the wall. Fr. McErlean (1905-6, 149-50) noted that nearly all Irish speakers then knew it under the name of Cloch an Linsig, though it was better known by all, even English speakers, as Cloch an mhíle or the mile-stone, from its being situated at the distance of an Irish mile from Galway.	

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Appendix 15.3 - Legislation Protecting the Architectural Resource

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Legislation Protecting the Architectural Resource

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Appendix 15.3 Legislation Protecting the Architectural Resource

The main laws protecting the built heritage are the *Architectural Heritage (National Inventory) and National Monuments (Miscellaneous Provisions) Act 1999* and the *Local Government (Planning and Development) Acts 1963–1999*, which has now been superseded by the *Planning and Development Act, 2000*. The Architectural Heritage Act requires the Minister to establish a survey to identify, record and assess the architectural heritage of the country. The background to this legislation derives from Article 2 of the 1985 Convention for the Protection of Architectural Heritage (Granada Convention). This states that:

For the purpose of precise identification of the monuments, groups of structures and sites to be protected, each member state will undertake to maintain inventories of that architectural heritage.

The National Inventory of Architectural Heritage (NIAH) was established in 1990 to fulfil Ireland's obligation under the Granada Convention, through the establishment and maintenance of a central record, documenting and evaluating the architecture of Ireland (NIAH Handbook 2005:2). As inclusion in the inventory does not provide statutory protection, the survey information is used in conjunction with the *Architectural Heritage Protection Guidelines for Planning Authorities* to advise local authorities on compilation of a Record of Protected Structures as required by the *Planning and Development Act, 2000*.

Protection Under the Record of Protected Structures and County Development Plan

Structures of architectural, cultural, social, scientific, historical, technical or archaeological interest can be protected under the Planning and Development Act, 2000, where the conditions relating to the protection of the architectural heritage are set out in Part IV of the act. This act superseded the Local Government (Planning and Development) Act, 1999, and came into force on 1st January 2000.

The act provides for the inclusion of Protected Structures into the planning authorities' development plans and sets out statutory regulations regarding works affecting such structures. Under new legislation, no distinction is made between buildings formerly classified under development plans as List 1 and List 2. Such buildings are now all regarded as 'Protected Structures' and enjoy equal statutory protection. Under the act the entire structure is protected, including a structure's interior, exterior, attendant grounds and also any structures within the attendant grounds.

The act defines a Protected Structure as (a) a structure, or (b) a specified part of a structure which is included in a Record of Protected Structures (RPS), and, where that record so indicates, includes any specified feature which is in the attendant grounds of the structure and which would not otherwise be included in this definition. Protection of the structure, or part thereof, includes conservation, preservation, and improvement compatible with maintaining its character and interest.

Part IV of the act deals with architectural heritage, and Section 57 deals specifically with works affecting the character of Protected Structures or proposed Protected Structures and states that no works should materially affect the character of the structure or any element of the structure that contributes to its special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest. The act does not provide specific criteria for assigning a special interest to a structure. However, the National Inventory of Architectural Heritage (NIAH) offers guidelines to its field workers as to how to designate a building with a special interest, which are not mutually exclusive. This offers guidance by example rather than by definition:

Archaeological

It is to be noted that the NIAH is biased towards post-1700 structures. Structures that have archaeological features may be recorded, providing the archaeological features are incorporated within post-1700 elements. Industrial fabric is considered to have technical significance and should only be attributed archaeological significance if the structure has pre-1700 features.

Architectural

A structure may be considered of special architectural interest under the following criteria:

- Good quality or well executed architectural design;
- The work of a known and distinguished architect, engineer, designer, craftsman;
- A structure that makes a positive contribution to a setting, such as a streetscape or rural setting;
- Modest or vernacular structures may be considered to be of architectural interest, as they are part of the history of the built heritage of Ireland;
- Well-designed decorative features, externally and/or internally.

Historical

A structure may be considered of special historical interest under the following criteria:

- A significant historical event associated with the structure;
- An association with a significant historical figure;
- Has a known interesting and/or unusual change of use, e.g. a former workhouse now in use as a hotel;
- A memorial to a historical event.

Technical

A structure may be considered of special technical interest under the following criteria:

- Incorporates building materials of particular interest, i.e. the materials or the technology used for construction.
- It is the work of a known or distinguished engineer.
- Incorporates innovative engineering design, e.g. bridges, canals or mill weirs.
- A structure which has an architectural interest may also merit a technical interest due to the structural techniques used in its construction, e.g. a curvilinear glasshouse, early use of concrete, cast-iron prefabrication.
- Mechanical fixtures relating to a structure may be considered of technical significance.

Cultural

A structure may be considered of special cultural interest under the following criteria:

- An association with a known fictitious character or event, e.g. Sandycove Martello Tower, which featured in Ulysses;
- Other structure that illustrates the development of society, such as early schoolhouses, swimming baths or printworks.

Scientific

A structure may be considered of special scientific interest under the following criteria:

- A structure or place which is considered to be an extraordinary or pioneering scientific or technical achievement in the Irish context, e.g. Mizen Head Bridge, Birr Telescope.

Social

A structure may be considered of special social interest under the following criteria:

- A focal point of spiritual, political, national or other cultural sentiment to a group of people, e.g. a place of worship, a meeting point, assembly rooms;
- Developed or constructed by a community or organisation, e.g. the construction of the railways or the building of a church through the patronage of the local community.
- Illustrates a particular lifestyle, philosophy, or social condition of the past, e.g. the hierarchical accommodation in a country house, philanthropic housing, vernacular structures.

Artistic

A structure may be considered of special artistic interest under the following criteria:

- Work of a skilled craftsman or artist, e.g. plasterwork, wrought-iron work, carved elements or details, stained glass, stations of the cross.

- Well-designed mass-produced structures or elements may also be considered of artistic interest.

(From the NIAH Handbook 2003 & 2005 pages 15–20)

The Local Authority has the power to order conservation and restoration works to be undertaken by the owner of the protected structure if it considers the building to need repair. Similarly, an owner or developer must make a written request to the Local Authority to carry out any works on a protected structure and its environs, which will be reviewed within three months of application. Failure to do so may result in prosecution.

Galway City Council Development Plan, 2017-2023

It is a policy of the plan to:

Policy 8.2 Built Heritage – Record of Protected Structures

- Encourage the protection and enhancement of structures listed in the Record of Protected Structures.
- Ensure new development enhances the character or setting of a protected structure.
- Avoid protected structures becoming endangered by neglect or otherwise by taking appropriate action in good time.
- Consider the inclusion in the Record of Protected Structure of buildings and structures of special interest.
- Consult with the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs regarding any planning applications relating to protected structures and national monuments.
- Implement proactive measures to encourage the conservation of protected structures.

Policy 8.3 Built Heritage – Architectural Conservation Area (ACA)

- Encourage the protection and enhancement of the character and special interest of designated Architectural Conservation Areas.
- Prepare and implement management plans for the conservation and enhancement of designated Architectural Conservation Areas.
- Complete the Eyre Square Architectural Conservation Area Management Plan.
- Ensure that developments within Architectural Conservation Areas enhance the character and special interest of the Architectural Conservation Areas.

Policy 8.4 Vernacular Heritage

- Encourage the rehabilitation, renovation and re-use of existing structures that contribute to the character of the city.
- Increase public awareness of the vernacular heritage of the city through publication of the Survey and Inventory of Galway City’s Thatched Buildings.

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Appendix 15.4 - RPS and NIAH Structures within the Study Area

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Appendix 15.4 RPS and NIAH Structures within the Study Area

Appendix 15.4 RPS and NIAH Structures within the Study Area

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
BH1.1	-	8501	Townparks	Rahoon	Rivers and Waterways	0m	Bridge over Eglington Canal	www.galwaycity.ie/heritage-conservation
BH1.2	-	8501	Townparks	St. Nicholas	Rivers and Waterways	0m	Beggards Bridge features extensions to increase the width of the bridge. It appears that original bridge survives underneath. Elevations of bridge feature a pecked appearance to mimic that of tooled stone	www.galwaycity.ie/heritage-conservation
BH1.3	-	8501	Townparks	St. Nicholas	Rivers and Waterways	0m	Distillery River. Mill race running along eastern side of Earls Island, feeding into River Corrib at southern end of the island, close to former Pearse Distillery. Sides of mill race are overgrown but mix of assumed bedrock, stone block walls and modern concrete and rendering.	www.galwaycity.ie/heritage-conservation

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
BH1.4	30319001/ 30314076	8501 /8601	Townparks	St. Nicholas	Rivers and Waterways (River Corrib)	0m	BH1 is the collective designation for river/waterway infrastructure falling under RPS 8501 and 8601, the latter being the River Corrib and its stone pillars and embankments specifically. BH1.4 refers to the mainstream of the River Corrib, the Friars River mill race and their infrastructure. (See also BH8/9)	www.buildingsofireland.ie
BH1.5	-	8501	Townparks	St. Nicholas	Rivers and Waterways		Commercial Dock	www.galwaycity.ie/heritage-conservation
BH2	30313012	-	Townparks	Rahoon	11 University Road	Adjacent	End of terrace three-bay two-storey house, built c.1840, having two-storey return to rear with lean-to slate roof. Pitched slate roof with rendered chimneystacks and replacement uPVC rainwater goods.	www.buildingsofireland.ie
	30313011	-	Townparks	Rahoon	12 University Road	Adjacent	Terraced three-bay two-storey house, built c.1840. Pitched artificial slate roof with rendered chimneystacks and	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							replacement uPVC rainwater goods.	
	30313010	-	Townparks	Rahoon	13 University Road	Adjacent	Terraced three-bay two-storey house, built c.1840, having two-storey return with lean-to roof to rear elevation. Pitched artificial slate roof with rendered chimneystacks and replacement uPVC rainwater goods.	www.buildingsofireland.ie
	30313009	-	Townparks	Rahoon	14 University Road	Adjacent	Terraced three-bay two-storey house built c.1840. Pitched slate roof with rendered chimneystacks and cast-iron rainwater goods.	www.buildingsofireland.ie
	30313008	-	Townparks	Rahoon	15 University Road	Adjacent	Terraced three-bay two-storey house, built c.1840, having two-storey return to rear. Pitched slate roof with rendered chimneystacks and replacement uPVC rainwater goods.	www.buildingsofireland.ie
	30313007	-	Townparks	Rahoon	16 University Road	Adjacent	Terraced three-bay two-storey house, built c.1840, having two-storey return to rear elevation.	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							Pitched slate roof with rendered chimneystacks and replacement uPVC rainwater goods.	
	30313006	-	Townparks	Rahoon	17 University Road	Adjacent	Terraced two-bay two-storey house, built c.1840, having two-storey with attic return and recent single-storey addition to rear. Pitched slate roof with red-brick chimneystacks and replacement uPVC rainwater goods.	www.buildingsofireland.ie
	30313005	-	Townparks	Rahoon	18 University Road	Adjacent	End of terrace two-bay two-storey house, built c.1840, having two-storey with attic return and recent single-storey addition to rear elevation. Pitched slate roof, rendered and brick chimneystacks and eaves course and replacement uPVC rainwater goods.	www.buildingsofireland.ie
BH3	30313002	10304	Townparks	Rahoon	Gate lodge	Adjacent	Detached three-bay single-storey gate lodge, built c.1845, having projecting gable-fronted porch to front elevation, additions	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							to rear elevation including recent hipped slate roof extension.	
BH4	30313014	3601	Townparks	St. Nicholas	House (Galway University Irish Centre for Human Rights)	18m N	Three-bay two storey L-plan faculty building, built c.1880, having canted front elevation, and varied rear elevation with lean-to additions and some recent flat-roofed additions. Hipped and pitched slate roofs having rendered chimneystacks, cast-iron and replacement uPVC rainwater goods.	www.buildingsofireland.ie
BH5	30313016	3602	Townparks	St. Nicholas	Galway Cathedral	5m E	Free-standing gable-fronted cruciform-plan Roman Catholic Cathedral, built 1965, facing north, comprising six-bay double-height nave with pair of three-stage bell towers recessed from façade corners, and with three-bay recessed entrance, five-bay side aisles, two-bay double-height transepts and chancel. Copper-roofed dome to crossing on	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							octagonal limestone drum and corbelled pendentive with limestone spired turrets to corners with cross finials.	
BH6	30313018	3605	Townparks	St. Nicholas	Store/warehouse	Adjacent	Detached former mill, built c.1840, now in use as office building. Comprises five-bay three-storey middle block with dormer floor, flanked by three-bay two-storey wings with single-bay three-storey projections to north and south elevations. Hipped and half-hipped slate roofs having pitched slate roofs to dormer-level loading doors to front and rear elevations of middle block, and cast-iron (replacement) rainwater goods.	www.buildingsofireland.ie
BH7	30313027	7409	Townparks	St. Nicholas	Water mill	14m S	Semi-detached seven-bay six-storey former flour mill, built c.1810, now in use as an educational laboratory by NUI Galway. Flat roof with recent corrugated-iron	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							monitor and replacement uPVC rainwater goods. Rubble limestone walls built to courses with roughcast render to top storey above render string course.	
BH8	30319001	3608/ 8501	Townparks	St. Nicholas	Harbour/dock /port	27m E	Banks of Lower Corrib River, canalised c.1750, following relatively straight course from Salmon Weir, southwards into Galway Bay. Three bridges cross this section of river, Salmon Weir Bridge, William O'Brien Bridge and Wolfe Tone Bridge. Banks consist of mixture of stone rubble and limestone blockwork lining with several tributaries to western bank from mill races and Eglinton Canal at southern end of river. Also mill races to eastern bank north of William O’Brien Bridge. Mill races feeding into river enter it either via stone block construction weirs with remains of cast-	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							iron fixings from now absent sluice mechanisms or through stone-lined channels (see also BH1)	
BH9	30313038	8501	Townparks	St. Nicholas	Mill Race	Adjacent	Distillery River. Limestone and rubble stone-lined mill race cutting, built c.1870, associated with now demolished marble works and lime kiln. Water source supplied from north by Eglinton Canal. Mill race follows curving path southwards before flowing into Corrib River. Race passes under four small pedestrian bridges and single-span section of Salmon Weir road bridge. Rusticated limestone to three of original bridges and Salmon Weir Bridge with rusticated voussoirs, soffit, parapets and coping stones. Concrete construction to recent additional bridge.	www.buildingsofireland.ie
BH10	30313015	3603/ 8501	Townparks	St. Nicholas	Bridge	0m	Seven-span limestone block road bridge, built	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							1818, comprising seven segmental arches having tooled limestone voussoirs, rendered soffits, springing from limestone block and rubble piers with bow-ended cutwaters, base of piers now encased in concrete. Moulded tooled limestone string course below parapet, latter of tooled limestone block construction with painted cast-iron balustrade with limestone coping over. Cast-iron lamp standards to parapet.	
BH11	30314048	3604/ 8501	Townparks	St. Nicholas	County Club House	Adjacent	Detached irregular-plan house, built c.1880, comprising L-plan six-bay two-storey block with canted bays to north-east, river elevation, presenting three-storey elevation to river and two-storey elevation to south-west, road, elevation, and having two-bay return to south-west with gables to each bay. Recent two-storey block to north-west with	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							half-hexagonal plan north-west end.	
BH12	30314014	7201	Townparks	St. Nicholas	Church/chapel	Adjacent	Attached Roman Catholic church, built c.1840, comprising surviving triple-gabled west elevation of nave and side aisles, with three-stage crenellated bell tower to north end. Original structure behind façade replaced by newer construction. Pitched slate roofs having cast-iron rainwater goods	www.buildingsofireland.ie
BH13	30314005	10504	Townparks	St. Nicholas	Corrib House Tearoom	42m NE	Detached three-bay two-storey house, built c.1810, having two windows to first floor, lower three-bay two-storey return to rear and two-storey lean-to to south elevation. Hipped artificial slate roofs having rendered chimneystacks, cast-iron and replacement uPVC rainwater goods and rendered eaves course.	www.buildingsofireland.ie
BH14	30314006	10505	Townparks	St. Nicholas	4 Waterside	35m NNW	Detached two-bay three-storey house, built c.1910, having flat-roofed full-	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							height canted bays to front elevation, and lower two-bay three-storey addition and recent conservatory to rear. Hipped artificial slate roof with rendered chimneystacks and cast-iron rainwater goods.	
BH15	30314007	2605	Townparks	St. Nicholas	3 Courthouse Sq	16m NW	Terraced two-bay four-storey house, built c.1800, east bay shared with neighbouring house to east. Pitched slate roof having rendered chimneystack and cast-iron rainwater goods**.**	www.buildingsofireland.ie
	30314008	2604	Townparks	St. Nicholas	2 Courthouse Sq	16m NW	Terraced two-bay four-storey house, built, c.1800, having recent gabled extension to rear. Pitched slate roofs having rendered chimneystack and cast-iron rainwater goods.	www.buildingsofireland.ie
	30314010	1050 6	Townparks	St. Nicholas	Lough Corrib House, 5 Waterside	16m NW	Attached corner-sited four-bay three-storey over basement double-pile house, built c.1810. M-profile hipped slate roof having rendered	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							chimneystacks and cast-iron rainwater goods.	
BH16	30314011	2601	Townparks	St. Nicholas	Galway Courthouse	Adjacent	Freestanding courthouse, built 1815, having five-bay single-storey front façade with slightly advanced end bays, and projecting Doric-style portico, with five-bay two-storey over half-basement side elevations, and slightly recessed lower three-bay two-storey over half-basement returns forming two-storey advanced pedimented end-bays of rear, flanking four-bay two-storey over basement pedimented recessed section. Main rear pediment has clock to tympanum with moulded render surround. Hipped slate roof with central roof-light, carved limestone parapet, rendered chimneystacks, cast-iron rainwater goods, and with moulded limestone cornice to front and side elevations of main block.	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
BH17	30314002	2606	Townparks	St. Nicholas	Post box	6m W	Freestanding cast-iron pillar post box, erected c.1915, on cylindrical base, with raised 'GR' royal cipher, having moulded neck and plinth with dentillation to shallow domed cap.	www.buildingsofireland.ie
BH18	30314012	2602	Townparks	St. Nicholas	Town Hall Theatre	Adjacent	Freestanding former courthouse, built 1825, formerly used as town hall, now in use as theatre. Single-storey entrance block with slightly advanced end bays and ashlar limestone facade with slightly projecting Doric portico to recessed three-bay middle unit. Five-bay three-storey rear block slightly recessed from side elevations of front block and having four-bay side and five-bay rear elevations, latter with projecting porticoed entrance. Hipped slate roof to rear block behind tooled limestone parapet concealing rainwater goods. Flat roof to front	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							block with tooled limestone parapet wall concealing rainwater goods and having rectangular panels to parapet of end bays and portico.	
BH19	30314015	9601	Townparks	St. Nicholas	Church/chapel (St Francis)	0m	Attached pedimented gable-fronted Franciscan church, dated 1849, having three-bay two-storey limestone front with ashlar tetrastyle Doric pedimented portico, four-bay nave with clerestory, having coffered dome to west and bell tower to south-west. Pitched slate roofs to nave and portico, with tooled limestone copings to gables, tooled limestone cross finials to pediment and bell tower, with copper ventilation ducts to ridge of nave. Snecked rusticated limestone walls to front elevation, with tooled limestone plinth and first-floor sill course, quoins and carved piscinae with	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							angel masks above, and ashlar parapet to front elevation. Rubble limestone to bell tower with quoin stones. Portico has tooled modillion motifs to frieze and moulded cornice with ornate underside.	
BH20	30314016	9606	Townparks	St. Nicholas	10 St. Francis Street	Adjacent	Terraced three-bay two-storey house, built c.1890, now in use as office. Pitched slate roof with bow-tell ridge tiles, rendered chimneystacks, and replacement metal and uPVC rainwater goods.	www.buildingsofireland.ie
BH21	30314017	-	Townparks	St. Nicholas	1 Eyre Street	Adjacent	Attached three-bay three-storey house and shop, built c.1860. Flat roofed having rendered chimneystack and rainwater goods concealed behind rendered parapet with moulded cornice and pediment with moulded copings and keystone.	www.buildingsofireland.ie
BH22	-	228	Townparks	St. Nicholas	52 Abbeygate Street Upper	33m S	House	www.galwaycity.ie/heritage-conservation

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
	-	227	Townparks	St. Nicholas	50 Abbeygate Street Upper	33m S	House	www.galwaycity.ie/heritage-conservation
	-	226	Townparks	St. Nicholas	48 Abbeygate Street Upper	40m S	House	www.galwaycity.ie/heritage-conservation
	-	225	Townparks	St. Nicholas	46 Abbeygate Street Upper	45m S	House	www.galwaycity.ie/heritage-conservation
	-	224	Townparks	St. Nicholas	42 Abbeygate Street Upper	52m S	House	www.galwaycity.ie/heritage-conservation
	-	223	Townparks	St. Nicholas	40 Abbeygate Street Upper	61m S	House	www.galwaycity.ie/heritage-conservation
	-	222	Townparks	St. Nicholas	38 Abbeygate Street Upper	65m S	House	www.galwaycity.ie/heritage-conservation
	-	221	Townparks	St. Nicholas	36 Abbeygate Street Upper	68m S	House	www.galwaycity.ie/heritage-conservation
	-	218	Townparks	St. Nicholas	29 Abbeygate Street Upper	72m S	House	www.galwaycity.ie/heritage-conservation
	-	216	Townparks	St. Nicholas	25 Abbeygate Street Upper	70m S	House	www.galwaycity.ie/heritage-conservation
	-	215	Townparks	St. Nicholas	23 Abbeygate Street Upper	65m S	House	www.galwaycity.ie/heritage-conservation
	-	213	Townparks	St. Nicholas	21 Abbeygate Street Upper	60m S	House	www.galwaycity.ie/heritage-conservation
BH23	30314030	-	Townparks	St. Nicholas	Eglinton Street post office	Adjacent	Corner-sited attached five-bay three-storey post office, built c.1860, having	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							arcaded ground floor to front, four-bay side elevation and multiple recent additions to rear. Flat roof with concealed rainwater goods and having oversailing eaves with render brackets. Front elevation has painted tiled walls to upper floors, and chamfered limestone plinth.	
BH24	30314031	3701	Townparks	St. Nicholas	1 Eglinton Street	Adjacent	Corner-sited attached three-storey department store, built c.1870, curving around junction of two streets, having five bays to south-east, William Street, elevation, single-bay to corner, and nine bays to north-east, Eglinton Street, elevation. Flat roof with oversailing rendered parapet having moulded cornice with rendered brackets to frieze and with moulded string course below, and concealed rainwater goods. Painted lined-and-ruled rendered walls having render	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							moulded sill course to top storey, channelled render quoin bands to ends of elevation and dividing Eglinton Street elevation into four- and five-bay sections.	
BH25	30314035	10809	Townparks	St. Nicholas	23, 25 William Street	Adjacent	Attached nine-bay three-storey limestone-fronted building with attic, built c.1750, now divided and refurbished in 2000. Pitched slate roof, with roof-lights to west-most two bays, coursed tooled stone chimneystacks, render copings to gables, carved cornice, and replacement uPVC rainwater goods.	www.buildingsofireland.ie
BH26	**Void**	**Void**	**Void**	**Void**	**Void**	**Void**	**Void**	**Void**
BH27	30314034	11002	Townparks	St. Nicholas	5, 7 Williamsgate Street	Adjacent	Attached seven-bay two-storey commercial premises, built c.1820. Pitched slate roof having rendered chimneystacks and cast-iron rainwater goods. Roughly coursed squared limestone walls	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							having moulded rendered eaves course.	
BH28	30314033	11003	Townparks	St. Nicholas	8 Williamsgate Street	Adjacent	Terraced three-storey shop, built c.1820, having canted oriel window through upper storeys. Flat roof having concealed rainwater goods behind painted render parapet with moulded cornice, frieze, moulded string course, and having decorative cast-iron railing to parapet at front. Painted lined-and-ruled rendered walls to upper floors having channelled quoin bands.	www.buildingsofireland.ie
BH29	30314074	5801	Townparks	St. Nicholas	5 Merchants Road	Adjacent	Attached three-bay two-storey Art Deco office building, built 1942, having central breakfront to front elevation, with later addition and recent extensions and car park to basement level of rear. Pitched roof concealed behind parapet walls to front and rear elevations, rendered chimneystack to south-west gable and large	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							battered red-brick chimneystack to rear addition with projecting concrete string-course and coping.	
	30314075	5801	Townparks	St. Nicholas	3 Merchants Road	Adjacent	Attached two-storey retail outlet, dated 1825, having six-bay ground floor and multiple-bay first floor, elevation somewhat reorganised c.1930 and three-bay Art Deco façade added to north-east end, and having recent two-storey extension to rear. Pitched roofs concealed behind parapet walls and flat roofs to recent extensions, having cast-iron rainwater goods. Painted rendered walls with roughcast rendered walling to rear and to extensions, decorative render fascia to main elevation with recent applied lettering.	www.buildingsofireland.ie
BH30	-	8202	Townparks	St. Nicholas	Cut Stone Stores, CIE	32m SE	Multi Bay 2 Storey Building, Cobbled Roadway, gateway and	www.galwaycity.ie/heritage-conservation

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
					Land, Queen Street		gatelodge to former gasworks	
BH31	30314059	-	Townparks	St. Nicholas	1 Merchant's Road		Terraced two-bay four-storey former house, built c.1810, with recent slightly recessed shopfront. Formerly in use as restaurant, now in use as shop. Double-pile pitched roof concealed behind parapet wall to front elevation and having ashlar cut-stone chimneystacks and cast-iron rainwater goods. Broken coursed dressed stone walling to front elevation, having projecting cut-stone coping to parapet.	www.buildingsofireland.ie
BH32	30314060	8201	Townparks	St. Nicholas	Methodist/Presbyterian Church, Queen Street, with burial ground to side and rear	2m SE	Corner-sited Methodist church and school, built c.1835, sharing same façade. Two-bay three-storey school to north-east end, having entrance door in first floor, and church to south-west end having three-bay gable-front and having projecting gabled porch to central bay.	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							Pitched slate and artificial slate roofs having cut limestone pediments to school and church, with modillions to sloping sides and to base, roof having cast-iron and replacement uPVC rainwater goods. Dressed limestone walling to front elevation with limestone plinth. Low buttresses to corners of porch, with ashlar quoins and kneelers. Blank raised plaques to above end windows of church and plaque between upper floors of school inscribed 'School House'.	
BH33	30314039	3804	Townparks	St. Nicholas	19 Eyre Square	Adjacent	Almost freestanding five-bay three-storey over basement bank, built 1863, with arcaded round floor. Offices to upper floors. Limestone front and gable walls. Entrances to slightly advanced end bays, having distyle Tuscan porticos to front. Building flanked by slightly recessed carriage entrances now converted to	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							window and doorway. Three-storey addition to rear. Tooled parapet with tooled coping stones concealing pitched roof and rainwater goods, and having tooled chimneystacks to gables.	
BH34	30314041	3802	Townparks	St. Nicholas	16 Eyre Square	Adjacent	End of terrace two-bay four-storey former house with basement, dated 1824, now in use as offices. Recent steel fire escape to rear, and single-storey addition to north-east. Double-pile pitched slate roof with cast-iron rainwater goods and rendered chimneystack. Tooled limestone front façade with plinth and having limestone plaque bearing date and initials.	www.buildingsofireland.ie
	30314040	3803	Townparks	St. Nicholas	17 Eyre Square	Adjacent	Terraced two-bay four-storey over basement former house, built 1824, currently in use as office and apartment. Recent two-storey lean-to extensions to rear. Canted	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							timber bay window to ground floor with metal-sheet roof. Double-pile pitched artificial slate roof with limestone eaves course, rendered chimneystack, and cast-iron and replacement aluminium and uPVC rainwater goods. Coursed tooled limestone walls to front, and rendered to rear and basement.	
BH35	30314038	-	Townparks	St. Nicholas	Eyre House, 21 Eyre Square	Adjacent	End of terrace three-bay three-storey former house over half-basement, built c.1810, now in use as clinic, and having recent three-storey extension to rear. Pitched slate roof with rendered chimneystacks, projecting rendered eaves course, and cast-iron rainwater goods. Lined-and-ruled rendered walls with channelled render quoin bands.	www.buildingsofireland.ie
BH36	30314037	-	Townparks	St. Nicholas	23 Eyre Square	Adjacent	Terraced three-bay three-storey over half-basement former house, built c.1810,	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							now in use as office. Pitched slate roof with rendered chimneystacks, projecting rendered stone eaves course, and cast-iron and replacement aluminium rainwater goods. Lined-and-ruled rendered walls.	
BH37	30314042	3801	Townparks	St. Nicholas	14, 15 Eyre Square	Adjacent	Almost freestanding thirteen-bay four-storey hotel, built c.1855, having basement, five-bay side elevations and limestone front and side elevations. Recently added flat-roof attic floor with slate-clad sides, five and six-storey extensions to rear, and recent flat-roof extensions to south-east elevation of basement. Front façade has three-bay entrance breakfront and two-bay advanced ends. Carved cornice with tooled supporting brackets, and cast-iron and replacement uPVC rainwater goods.	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							Limestone steps to basement entrance having replacement timber panelled door. Cut limestone plinth with ornate cast-iron railings to basement area, having cast-iron piers to corners.	
BH38	30314027	-	Townparks	St. Nicholas	The Galway Hooker, (fountain) Eyre Square	21m SE	Freestanding fountain, erected 1984, on a diagonal square plan with cut-limestone basin. Set in square on flagged platform, semi-abstract representation of the sails of a Galway Hooker	www.buildingsofireland.ie
BH39	30314026	3807	Townparks	St. Nicholas	Browne Doorway, Eyre Square	7m SE	Freestanding former entrance bay to Browne house of 1627, removed from original location in 1905 to form feature in Eyre Square. Structure comprises rendered wall incorporating limestone doorway and oriel window. Doorway has round-arch door opening in slightly recessed square-headed inset, with moulded imposts flanked	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							by engaged Tuscan columns with Ionic capitals on tall pedestals. Canted five-light oriel window has chamfered mullions and transom, apron between window and doorway having carved coats of arms of Martin Browne and Marie Lynch. (See also AH16).	
BH40	30314019	-	Townparks	St. Nicholas	41 Rosemary Avenue (Dunnes Stores)	Adjacent	Attached four-bay two-storey shop, built c.1930, also in use as restaurant. Oversailing flat concrete roof with cast-iron downpipes. Rendered wall to front with render canopy to eaves level. Render plat bands to first floor with recent lettering below eaves. Render shopfront to ground floor having channelled pilasters to supporting piers, tiled plinth and render fascia with recent lettering and shallow render canopy. Replacement timber and uPVC shopfront to restaurant part.	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
BH41	30314020		Townparks	St. Nicholas	40 Eyre Square (Golden Discs)	Adjacent	Attached three-bay single-storey shop with attic storey, built c.1910, formerly in use as filling station, with flat-roofed addition to rear. Pitched slate and bitumen roof behind elaborate stepped rendered parapet to front, concealing gutters, with cast-iron and replacement uPVC rainwater goods. Parapet has pilasters flanking the different levels, moulded copings, moulded panels to lower levels, scrolls flanking higher level. Painted rendered walls, lined-and-ruled to west side elevation. Render shopfront comprising channelled pilasters with architrave and frieze and moulded cornice behind recent timber fascia board having recent lettering. Diocletian window opening to middle of parapet.	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
BH42	30314021	3805	Townparks	St. Nicholas	43 Eyre Square	Adjacent	Attached seven-bay two-storey bank, built c.1810, second and second-last bays being recessed slightly to give undulating appearance to façade. Two-storey addition to rear with recent three-storey extension. Tooled limestone parapet to front elevation with raised central panel having iron clock above set into and flanked by decorative cast-iron details, parapet also concealing gutters. Pitched roof and tooled limestone chimneystacks with stepped rendered caps, and cast-iron rainwater goods	www.buildingsofireland.ie
BH43	30314022	3806	Townparks	St. Nicholas	45 Eyre Square	Adjacent	Attached seven-bay two-storey with attic storey former County Club, built c.1850, now in use as Revenue Commissioners office, and bank. Single-bay elevation to south-west. Recent five-storey addition to rear. Front and south-west side elevations of ashlar limestone.	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							Central entrance bay fronted by tetrastyle Tuscan portico and flanked by end bays grouped within square-headed recesses, latter flanked by plain Giant Order pilasters carried through cornice where topped by moulded caps. Similar detailing to south-west elevation. Recent mansard slate roof with round-headed uPVC dormer windows. Cut limestone chimneystack. Rainwater goods concealed behind limestone parapets and walls.	
BH44	30314023	3808	Townparks	St. Nicholas	Liam Mellows Statue, Eyre Square	0m	Freestanding limestone monument to Liam Mellows, erected 1957, comprising carved limestone statue, on block ashlar limestone pedestal with engraved text in Irish, set at centre of round platform with limestone steps and with granite benches to perimeter.	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
BH45	30314028	3809	Townparks	St. Nicholas	8 Eyre Square	Adjacent	Attached three-bay four-storey former house, built 1862, with shopfront to ground floor, now in use as public house, with recent two-storey and single-storey extensions to rear and south-east. Flat roofs having projecting rendered eaves to main block with rendered chimneystack, cast-iron gutters and replacement uPVC rainwater goods. Rendered walls with render quoins to front elevation and roughcast rendered to side and rear.	www.buildingsofireland.ie
BH46	30314043	10001	Townparks	St. Nicholas	Ceannt Station	9m S	Attached twenty-two-bay single-storey over basement railway station, built 1851, having ashlar limestone walls to front and sides. Symmetrical front façade comprises three-bay deeply recessed entrance flanked to each side by two-bay advanced section, four-bay recessed section, two-bay advanced section and three-bay	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							recessed section. Lower double-height two-bay block recessed to east end of façade and having single-bay single-storey lean-to structure recessed to latter block. Recent double-pile train shed. Five-bay single-storey former engine shed attached to south-west elevation with recent single-storey extension to north-west elevation, now in use as bus garage. Pitched roof and rainwater goods concealed behind high parapet to front façade of station having pilasters with plat band and moulded cornice. Rendered chimneystack.	
BH47	30314044		Townparks	St. Nicholas	Ceannt Station retaining wall	0m	L-plan retaining wall opposite Ceannt Station, erected c. 1860, comprising coursed roughly dressed snecked limestone, with rounded tooled limestone coping	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
BH48	30314045	10002	Townparks	St. Nicholas	Railway and Ancillary Buildings - train shed	50m SW	Detached single-storey railway buildings, built c. 1860, comprising former engine shed to north-east half and much-rebuilt part to south-west half now used as engine shed. Lower office attached to north-west corner with later addition to give L-plan. Pitched corrugated-asbestos roofs having recent metal-sheet to lower L-plan part, and dressed limestone copings. Red-brick and chamfered ashlar limestone chimneystack to north-west end of north-east part, with cast-iron rainwater goods.	www.buildingsofireland.ie
BH49	30314046	10002	Townparks	St. Nicholas	Railway and Ancillary Buildings - foot bridge	38m S	Single-span foot bridge built c.1860, located over now disused Galway-Clifden railway line. Rusticated snecked limestone abutments having margined string course and copings, supporting concrete span	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							of c.1970 with galvanised steel hand rails.	
BH50	30314047	10002	Townparks	St. Nicholas	Railway and Ancillary Buildings - signal box; water tower; turntable	48m S	Group of three detached railway structures, built c.1860-1920, sited to south-east of Ceannt Station; Two-storey signal cabin with attic, built c.1920, having pitched artificial slate roof with red-brick chimneystack and aluminium rainwater goods. Freestanding single-stage water tower to north-west of signal cabin, built c.1850, having rusticated limestone walls with plinth and surmounted by iron water tank. Circular turntable to north-west of water tower, built c.1920, with iron girder rotating table with timber boarding, iron tracks and metal handrails, set into circular hollow with	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							dressed limestone coping stones to brick retaining wall, surrounded by recent timber fence	
BH51	30314029		Townparks	St. Nicholas	19 Forster Street (Recently demolished)		**Prior to demolition;** Attached two-bay three-storey house, built c.1820. Pitched artificial slate roof with rendered chimneystack, stone eaves course and cast-iron rainwater goods. Lined-and-ruled rendered wall to front elevation, with channeled render quoins, and plinth.	www.buildingsofireland.ie
BH52	30314001	4301	Townparks	St. Nicholas	Water trough, Forster Street	**0m**	Freestanding rendered former horse trough, installed c.1900, now in use as flower bed. Rendered stone rectangular basin chamfered to base of long faces, engraved lettering to east face, supported by two rectangular rendered stone plinths with moulded corners attached to basin by wrought-iron riveted straps.	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
BH53	30314024	4308	Townparks	St. Nicholas	St. Patricks Hall, Forster Street	Adjacent	Freestanding gable-fronted former Roman Catholic Church, built 1842, now in use as parish hall. Three-bay nave, building interior divided into two storeys and former tall windows of side walls partly blocked to reflect division. Three-bay ashlar limestone gable-front, middle main entrance bay of latter being slightly advanced and doubling as bell tower, and having single-bay chancel to north-west end having single-storey porch and sacristy to south-west elevation. Replacement flat roof to nave and sacristy, pitched artificial slate roof to chancel having limestone copings to gables with cross finials. Enclosed to south-east street side by decorative cast and wrought-iron double-leaf gates and railings, latter atop snecked rock-faced	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							limestone plinth wall with chamfered cut-stone coping stones. Graveyard to front of church having carved limestone memorials.	
BH54	30314013	7803	Townparks	St. Nicholas	37 Prospect Hill	Adjacent	Terraced two-bay four-storey over basement house, built c.1810, now in use as offices with clinic to basement. Rendered parapet concealing roof and rainwater goods. Broached ashlar limestone to ground floor of front elevation, having lined-and-ruled render to other floors, and roughcast render to basement. Tooled limestone sill course to first floor and recent fascia board to ground floor.	www.buildingsofireland.ie
BH55	30314077	-	Townparks	St. Nicholas	County Hall, Prospect Hill	Adjacent	Snecked squared rubble limestone, constructed c.1999, incorporating features of former three-bay three-storey with attic façade of former infirmary building of c.1780 later used as Galway County	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							Council headquarters. Features window openings comprising cut limestone coping, square-headed window openings with recent timber sliding sash frames	
BH56	30314025	4306	Townparks	St. Nicholas	Magdalen Convent & Church, Forster Street	Adjacent	Attached former chapel of Magdalen convent, dated 1950, now in use as archive centre. Comprises six-bay nave with bowed south gable, shallow porch projection to north end, shallow transept-like projection to east, and recent porch addition to east side having lean-to roof. Pitched slate roof with limestone copings to gables with cross finials, overhanging rendered eaves on exposed timber rafters to nave side walls, and cast-iron rainwater goods. Snecked rusticated ashlar limestone walls with tooled limestone quoin stones and chamfered plinth. Enclosed graveyard to east having low	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							limestone enclosing wall with cast-iron railings and gate. Rubble limestone wall enclosing site.	
BH57	30315005	4305	Townparks	St. Nicholas	48 Forster Street	26m SE	Detached three-bay two-storey house over basement, built c.1850, having bowed entrance bay to front and bowed bays to south ends of three-bay side elevations. Hipped slate roofs with rendered chimneystacks and rendered eaves with cast-iron and replacement metal rainwater goods. Roughcast rendered walls with raised render quoins to corners and front bowed bay, and rendered plinth.	www.buildingsofireland.ie
BH58	30315003	2301	Townparks	St. Nicholas	Former Erasmus Smith Grammer School 1816, 3 College Road	19m NW	Freestanding H-plan five-bay three-storey school with basement, built 1815, having slightly advanced gable-fronted end bays to front, and having recent addition to rear. Pitched and hipped slate roofs having limestone copings to front gables, and cast-	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							iron rainwater goods. Roughcast rendered walls having tooled limestone plinth, and with tooled limestone eaves course and tooled limestone plat band doubling as sill course to first floor.	
BH59	30315002	-	Townparks	St. Nicholas	30 College Road	Adjacent	Detached three-bay two-storey house, built c.1820, having canted-bay windows to end bays of ground floor. Hipped slate roof having one red-brick chimneystack and one rendered chimneystack, and replacement metal rainwater goods. Garden to front bounded by rendered plinth wall with decorative cast-iron railings and garden gate.	www.buildingsofireland.ie
BH60	30313001	-	Townparks	Rahoon	Post box, University Road	Adjacent	Wall-mounted cast-iron post box, installed c.1860. Royal crest and insignia of Victoria with fluted decoration to door having maker's mark at base.	www.buildingsofireland.ie
BH61	30314032	3702	Townparks	St. Nicholas	2 Eglinton Street	Adjacent	Corner-sited attached eighteen-bay three-storey	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							former 'Colonial Buildings', built 1866, having arcaded ground floor to fourteen bays and curving around junction of Eglinton Street and Williamsgate Street. Former public house and restaurant to ground floor and other commercial units to upper storeys. Flat roof having cast-iron rainwater goods, and with hand-rail to rendered parapet. Painted rendered walls with moulded plinth, having render sill courses to upper storeys. Arcaded ground floor comprising round-headed openings flanked by vermiculated channelled pilasters with moulded imposts and supporting moulded archivolts with decorative scroll keystones.	
BH62	30313003	10305 & 10306	Townparks	Rahoon	19-20 University Road	Adjacent	Detached house, formerly pair of private houses, built c. 1900, each being two-bay and L-plan having gable-fronted single bay to	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							front, two storeys with attic and basement. Canted-bay windows to ground and first floors of single bay to front. Gabled bays to side returns having pitched roof single-bay two-storey additions with canted-bay window to rear of east addition, flat roof two-bay single storey porch (west) and recent half-hipped and flat-roofed additions to rear c.1940. Slate and artificial slate pitched and half-hipped roofs having central rendered chimneystack with render coping. Variety of rainwater goods including original cast-iron, replacement metal and replacement uPVC. Rendered rubble stone enclosing wall having cast-iron railings and gates with panelled rendered gate piers.	
BH63	30308006	6805	Townparks	Rahoon	Former nurses' home, UCHG	40m NW	Detached Art Deco former nurses' home, built 1933-38, in hospital complex.	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							Comprises twelve-bay three-storey wings flanking with rounded ends, flanking seven-bay four-storey central block, middle entrance bay of latter block projecting slightly outwards and upwards. Ten-bay four-storey return to west meets main block via stepped profile connecting bay. Multiple recent additions to rear of corrugated sheet metal construction. Flat roofs throughout having concrete coped parapets, concealed gutters and cast-iron rainwater goods (downpipes). Open concrete-roofed balconies to end bays of main block. Roughcast render to walls with exception of front block which is coursed rock-faced granite blockwork including plinth and pilasters, latter concrete-capped and separating ground floor of wings into seven bays and	

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							also flanking main bays of entrance block.	
BH64	-	7406	Townparks	St. Nicholas	Former Mill, Nuns Island Street	30m S		www.galwaycity.ie/heritage-conservation
BH65	-	3606	Townparks	St. Nicholas	Grave monument associated with Galway Gaol	0m	Memorial located within the cathedral carpark. Plaques commemorate all those who died or were executed at Galway Gaol and specifically one Myles Joyce, an innocent man executed at the gaol in 1882.	www.galwaycity.ie/heritage-conservation
BH66	-	3607	Townparks	St. Nicholas	Fisheries Offices, Earls Island	Adjacent	Multi Bay Single Storey with Dormer Commercial Buildings	www.galwaycity.ie/heritage-conservation
BH67	-	10507	Townparks	St. Nicholas	Sculpture	0m	Free standing elm-wood sculpture of a leaping salmon located at eastern end of Salmon Weir Bridge. Moderate weathering and some evidence of repair	www.galwaycity.ie/heritage-conservation
BH68	-	9602	Townparks	St. Nicholas	Church grounds with cemetery	11m E	Church grounds with cemetery, Medieval stone carvings, architectural fragments and tower	www.galwaycity.ie/heritage-conservation

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							building. Site of medieval waterway	
BH69	-	9604	Townparks	St. Nicholas	Medieval Doorway	25m W	1624 Medieval Doorway with Arms of D’Arcy and Marin Family Medieval hood mouldings. Plaque of Blake Arms	www.galwaycity.ie/heritage-conservation
BH70	-	9603	Townparks	St. Nicholas	Convent Grounds with Graves	1m S	Medieval fragments, doorway, site of medieval waterway, Convent Grounds with Graves	www.galwaycity.ie/heritage-conservation
BH71	-	7202	Townparks	St. Nicholas	Inscribed stone	43m S	Inscribed stone dated 1816, IHS Cross with name J. Healy	www.galwaycity.ie/heritage-conservation
BH72	-	5601	Townparks	St. Nicholas	18, 19 Mary Street	Adjacent	3 Bay 3 Storey with Dormer Building	www.galwaycity.ie/heritage-conservation
BH73	-	9605	Townparks	St. Nicholas	2 St. Francis Street	Adjacent	3 Bay 2 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
BH74	**Void**	**Void**	**Void**	**Void**	**Void**	**Void**	**Void**	**Void**
BH75	-	3703	Townparks	St. Nicholas	Town defenses	0m	Site of former C17th bastion, 2 no. Lions Tower Plaques 1. Arms of Galway 2. Arms of DeBathe. National Monument	www.galwaycity.ie/heritage-conservation

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
BH76	-	3901	Townparks	St. Nicholas	17 Eyre Street	23m E	House, Single storey thatched element. IHS Plaque	www.galwaycity.ie/heritage-conservation
BH77	-	3903	Townparks	St. Nicholas	Town defenses	35m NE	Site of gate and bastion wall, incorporated into modern building. National Monument	www.galwaycity.ie/heritage-conservation
BH78	-	10801	Townparks	St. Nicholas	16, 18, 18a William Street	5m W	Commercial building	www.galwaycity.ie/heritage-conservation
BH79	-	10803	Townparks	St. Nicholas	20 William Street	15m SW	5 Bay 3 Storey corner Commercial Building	www.galwaycity.ie/heritage-conservation
	-	10805	Townparks	St. Nicholas	22 William Street	19m SW	2 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
	-	10806	Townparks	St. Nicholas	24 William Street	24m SW	2 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
	-	10808	Townparks	St. Nicholas	26 William Street	28m SW	2 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
	-	10810	Townparks	St. Nicholas	28 William Street	32m SW	2 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
BH80	-	10807	Townparks	St. Nicholas	27, 29 William Street	6m S	Part of original 7 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
BH81	-	1903	Townparks	St. Nicholas	Section of medieval wall	14m SE	Medieval carved stone windows and cut stone fragments	www.galwaycity.ie/heritage-conservation

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
BH82	-	1902	Townparks	St. Nicholas	Section of medieval wall (x2)	32m SE	Section of late medieval house	www.galwaycity.ie/heritage-conservation
BH83	-	1901	Townparks	St. Nicholas	Town defenses	42m SE	Section of medieval town wall, National Monument	www.galwaycity.ie/heritage-conservation
BH84	-	10802	Townparks	St. Nicholas	19 William Street	Adjacent	4 Bay 3 Storey corner Commercial Building	www.galwaycity.ie/heritage-conservation
BH85	-	11006	Townparks	St. Nicholas	15 Williamsgate Street	Adjacent	2 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
BH86	-	11005	Townparks	St. Nicholas	10, 11 Williamsgate Street	Adjacent	5 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
BH87	-	11004	Townparks	St. Nicholas	9 Williamsgate Street	Adjacent	2 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
BH88	-	302	Townparks	St. Nicholas	Former artisan cottages	19m SE	Two Lime Rendered Rubble-Stone Houses	www.galwaycity.ie/heritage-conservation
BH89	-	11001	Townparks	St. Nicholas	1 Williamsgate Street	Adjacent	4 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
BH90	**Void**	**Void**	**Void**	**Void**	**Void**	**Void**	**Void**	**Void**
BH91	-	9901	Townparks	St. Nicholas	1 St. Nicholas Street	12m NW	2 Bay 2 Storey Residential Building	www.galwaycity.ie/heritage-conservation

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
	-	9902	Townparks	St. Nicholas	2 St. Nicholas Street	16m NW	2 Bay 2 Storey Residential Building	www.galwaycity.ie/heritage-conservation
	-	9903	Townparks	St. Nicholas	3 St. Nicholas Street	20m NW	2 Bay 2 Storey Residential Building	www.galwaycity.ie/heritage-conservation
	-	9904	Townparks	St. Nicholas	4 St. Nicholas Street	25m NW	2 Bay 2 Storey Residential Building	www.galwaycity.ie/heritage-conservation
	-	9905	Townparks	St. Nicholas	5 St. Nicholas Street	33m NW	2 Bay 2 Storey Residential Building	www.galwaycity.ie/heritage-conservation
	-	9906	Townparks	St. Nicholas	6 St. Nicholas Street	12m NW	2 Bay 2 Storey Residential Building	www.galwaycity.ie/heritage-conservation
	-	9907	Townparks	St. Nicholas	7 St. Nicholas Street	16m NW	2 Bay 2 Storey Residential Building	www.galwaycity.ie/heritage-conservation
	-	9908	Townparks	St. Nicholas	8 St. Nicholas Street	20m NW	2 Bay 2 Storey Residential Building	www.galwaycity.ie/heritage-conservation
	-	9909	Townparks	St. Nicholas	9 St. Nicholas Street	25m NW	2 Bay 2 Storey Residential Building	www.galwaycity.ie/heritage-conservation
	-	9910	Townparks	St. Nicholas	10 St. Nicholas Street	33m NW	2 Bay 2 Storey Residential Building	www.galwaycity.ie/heritage-conservation
BH92	-	10401	Townparks	St. Nicholas	Victoria Place	Adjacent	3 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
BH93	-	10002	Townparks	St. Nicholas	Railway and Ancillary Buildings (Footbridge)	16m SW	Stone Train Sheds, Stone Stables, Turntable, Bridges and Tracks	www.galwaycity.ie/heritage-conservation

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
BH94	-	4302	Townparks	St. Nicholas	12 Forster Street	Adjacent	2 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
	-	4303	Townparks	St. Nicholas	14 Forster Street	Adjacent	2 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
	-	4304	Townparks	St. Nicholas	16 Forster Street	Adjacent	2 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
	-	4309	Townparks	St. Nicholas	18 Forster Street	Adjacent	7 Bay 5 Storey with Dormer Commercial Building	www.galwaycity.ie/heritage-conservation
BH95	-	4307	Townparks	St. Nicholas	St. Patricks Church, Forster Street	26m W	1970s Church	www.galwaycity.ie/heritage-conservation
BH96	-	7801	Townparks	St. Nicholas	33 Prospect Hill	3m NW	3 Bay 4 Storey over basement Corner Commercial Building	www.galwaycity.ie/heritage-conservation
	-	7802	Townparks	St. Nicholas	35 Prospect Hill	3m NW	2 Bay 4 Storey over basement Commercial Building	www.galwaycity.ie/heritage-conservation
BH97	-	9501	Townparks	St. Nicholas	1 St. Brendans Road, Headford Road	Adjacent	2 Bay 3 Storey Residential Building	www.galwaycity.ie/heritage-conservation
	-	9502	Townparks	St. Nicholas	2 St. Brendans Road, Headford Road	Adjacent	2 Bay 3 Storey Residential Building	www.galwaycity.ie/heritage-conservation

BH No.	**NIAH No.**	**RPS No.**	**Townland**	**Parish**	**Classification**	**Dist. from scheme**	**Description**	**Reference**
	-	9503	Townparks	St. Nicholas	3 St. Brendans Road, Headford Road	Adjacent	2 Bay 3 Storey Residential Building	www.galwaycity.ie/heritage-conservation
	-	9504	Townparks	St. Nicholas	4 St. Brendans Road, Headford Road	Adjacent	2 Bay 3 Storey Residential Building	www.galwaycity.ie/heritage-conservation
	-	9505	Townparks	St. Nicholas	5 St. Brendans Road, Headford Road	Adjacent	2 Bay 3 Storey Residential Building	www.galwaycity.ie/heritage-conservation
	-	9506	Townparks	St. Nicholas	6 St. Brendans Road, Headford Road	Adjacent	2 Bay 3 Storey Commercial Building	www.galwaycity.ie/heritage-conservation
BH98	-	2302	Townparks	St. Nicholas	Carved Limestone block with blank shield in wall, 6 College Road	Adjacent	Carved Limestone block with blank shield in wall, 6 College Road	www.galwaycity.ie/heritage-conservation
BH99	-	10603	Townparks	St. Nicholas	1 Wellpark Road	Adjacent	2 Bay 2 Storey Residential Buildings	www.galwaycity.ie/heritage-conservation
BH100	-	5202	Townparks	St. Nicholas	Pier, Lough Atalia	23m S	C19th Relief Work Stone Ashlar Pier	www.galwaycity.ie/heritage-conservation

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
BH101	-	8406	Townparks	St. Nicholas	Boundary Stone	38m E	Cloch an Lionsigh (Lynchs Stone, see also AH18)	www.galwaycity.ie/heritage-conservation
BH102	30314009	2603	Townparks	St. Nicholas	1 Courthouse Sq	20m NW	Terraced two-bay four-storey house, built c.1800, now in use as office and having recent flat-roofed extensions to rear. Pitched slate roof having rendered chimneystack and cast-iron rainwater goods. Roughcast rendered walls with rendered eaves course.	www.buildingsofireland.ie
BH103	30314078	220	Townparks	St. Nicholas	33 Abbeygate Street Upper	49m S	End-of-terrace four-bay three-storey former house, built c.1820, with attic storey, now in use as public house, having recent additions to rear. Pitched slate roof having recent roof-lights, rendered chimneystacks and replacement uPVC rainwater goods. Exposed limestone rubble wall to front elevation, showing evidence of straight joints indicating alterations, having rendered eaves course, rendered wall to	www.buildingsofireland.ie

BH No.	NIAH No.	RPS No.	Townland	Parish	Classification	Dist. from scheme	Description	Reference
							north-west gable, and rendered walls to rear extension.	
BH104	-	10301	Townparks	Rahoon	Architectural fragments	5m NE	Remains of mullioned stone window from site of St. James Chapel c1510	www.galwaycity.ie/heritage-conservation

Galway City Council

BusConnects Galway - Cross City Link

Appendix 15.5 - Stray Finds within the Study Area

Chapter 15 Archaeological Cultural Heritage and Architecture Heritage

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Job number

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Appendix 15.5 Stray Finds within the Study Area

Museum No	IA/272/87
Townland	Middle Street, Townparks
Parish	St. Nicholas
Barony	Galway
Find	Various archaeological finds
Find place	Excavation at Middle Street
Description	Post-medieval dwelling houses fronting middle street. 17th century pot sherds and a clay pipe bowl (1660–1680). House probably shown on the 1651 map of Galway. A large quantity of domestic wares such as wine bottles and glasses, pottery etc, were found in pits. Glass tableware and wine bottles indicate Galways link with overseas trade in 17th and 18th centuries. Before c. 1780 most of the fine glass tableware was imported from England and the wine glasses discovered here were of English origin.
Reference	NMI Topographical Files

Museum No	IA/193/87
Townland	Townparks
Parish	St. Nicholas
Barony	Galway
Find	Two coins, one button and various archaeological finds
Find place	Found during excavation at Merchants Road, Galway
Description	Copper penny (Irish 1601) and a copper token (penny, c. 1660). The token is possibly a token of Dominic French (merchant of Galway). Excavations were undertaken in 1987 near a section of the town wall. The remains of 6 skulls were discovered during the excavation.
Reference	NMI Topographical Files

Museum No	2006:24
Townland	Townparks
Parish	St Nicholas
Barony	Galway
Find	Bann Flake
Find place	Corner of cross street and High Street
Description	None
Reference	NMI Topographical Files

Museum No	2004:106
Townland	Newcastle
Parish	St. Nicholas
Barony	Galway

Find	Human Remains
Find place	Near River Corrib
Description	Human skull found during a dive
Reference	NMI Topographical Files

Museum No	2002:63-65
Townland	Townparks
Parish	St. Nicholas
Barony	Galway
Find	Strike-a-light and two axeheads
Find place	At the Claddagh
Description	None
Reference	NMI Topographical Files

Museum No	1999: 137
Townland	Townparks
Parish	St. Nicholas
Barony	Galway
Find	Glass
Find place	Quay Street
Description	None
Reference	NMI Topographical Files

Museum No	1993:46-49
Townland	Townparks
Parish	St. Nicholas
Barony	Galway
Find	Earthenware pottery
Find place	Unknown
Description	4 sherds of earthenware pottery
Reference	NMI Topographical Files

Museum No	E269:1, 4-6
Townland	Townparks
Parish	St. Nicholas
Barony	Galway
Find	Knife, two iron swords and a stone axehead
Find place	River Corrib
Description	E269:1 Knife
Reference	E269:4 Iron Sword

Museum No	E269: 2, 3, 15-17
Townland	Newcastle
Parish	St. Nicholas
Barony	Galway
Find	Four iron swords and an iron spearhead
Find place	River Corrib
Description	E269:2 Iron Sword
Reference	E269:3 Iron Sword

Museum No	2002:63-65
Townland	-
Parish	-
Barony	-
Find	Strike-a-light and two axeheads
Find place	At the Claddagh
Description	None
Reference	NMI Topographical Files

Museum No	1999: 137
Townland	-
Parish	-
Barony	-
Find	Glass
Find place	Quay Street
Description	None
Reference	NMI Topographical Files

Museum No	1993:46-49
Townland	-
Parish	-
Barony	-
Find	Earthenware pottery
Find place	Unknown
Description	4 sherds of earthenware pottery
Reference	NMI Topographical Files

Museum No	N/A
Townland	-
Parish	-
Barony	-

Find	Stone Axehead
Find place	Found at Galway
Description	No further information
Reference	Cat. Coll. Crofton Croker (1854), p.10: lot 152

Museum No	1930:76-8
Townland	-
Parish	-
Barony	-
Find	Three polished stone axeheads
Find place	Galway
Description	No further information
Reference	NMI Topographical Files

Museum No	W.89
Townland	-
Parish	-
Barony	-
Find	N/A
Find place	Galway
Description	Flat bronze axehead
Reference	NMI Topographical Files

Museum No	W.33; F399 F400
Townland	-
Parish	-
Barony	-
Find	Two bronze axeheads
Find place	Galway
Description	No further information
Reference	NMI Topographical Files

Museum No	BM W.G.1603
Townland	-
Parish	-
Barony	-
Find	Spearhead (bronze)
Find place	Galway
Description	No further information
Reference	Cat. Coll. Crofton Croker (1854), p.12: lot 201

Museum No	1937:3673-4
Townland	-
Parish	-
Barony	-
Find	Two bronze socketed axeheads
Find place	Galway
Description	No further information
Reference	NMI Topographical Files

Museum No	Wk.21
Townland	-
Parish	-
Barony	-
Find	Iron axehead
Find place	From River Corrib near new bridge, Galway
Description	No further information
Reference	NMI Topographical File

Museum No	Wk.24; W.6; F502; W.6; F503; F501
Townland	-
Parish	-
Barony	-
Find	Two iron swords, spearhead and pike
Find place	From river Corrib, near new bridge, Galway
Description	No further information
Reference	NMI Topographical File

Museum No	Wk.37
Townland	-
Parish	-
Barony	-
Find	Iron pike-head
Find place	Found in the River Corrib, near new bridge, Galway
Description	No further information
Reference	NMI Topographical File

Museum No	Wk. 39
Townland	-
Parish	-
Barony	-

Find	Massive iron pike-head
Find place	Found in River Corrib, near new bridge, Galway
Description	No further information
Reference	NMI Topographical File

Museum No	2196-2203
Townland	-
Parish	-
Barony	-
Find	Coin hoard deposited after 1645
Find place	Courthouse, Galway
Description	No further information
Reference	NMI Topographical File

Galway City Council

BusConnects Galway - Cross City Link

Appendix 15.6 - Impact Assessment and the Cultural Heritage Resource

Chapter 15 Archaeological Cultural Heritage and Architecture Heritage

Issue | 12 August 2022

Job number

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A.15.6 Impact Assessment and the Cultural Heritage Resource

Potential Impacts on Archaeological and Historical Remains

Impacts are defined as ‘the degree of change in an environment resulting from a development’ (Environmental Protection Agency 2017). They are described as profound, significant or slight impacts on archaeological remains. They may be negative, positive or neutral, direct, indirect or cumulative, temporary or permanent.

Impacts can be identified from detailed information about a project, the nature of the area affected, and the range of archaeological and historical resources potentially affected. Development can affect the archaeological and historical resource of a given landscape in a number of ways.

- Permanent and temporary land-take, associated structures, landscape mounding, and their construction may result in damage to or loss of archaeological remains and deposits, or physical loss to the setting of historic monuments and to the physical coherence of the landscape;
- Archaeological sites can be affected adversely in a number of ways: disturbance by excavation, topsoil stripping and the passage of heavy machinery; disturbance by vehicles working in unsuitable conditions; or burial of sites, limiting accessibility for future archaeological investigation;
- Hydrological changes in groundwater or surface water levels can result from construction activities such as de-watering and spoil disposal, or longer-term changes in drainage patterns. These may desiccate archaeological remains and associated deposits;
- Visual impacts on the historic landscape sometimes arise from construction traffic and facilities, built earthworks and structures, landscape mounding and planting, noise, fences and associated works. These features can impinge directly on historic monuments and historic landscape elements as well as their visual amenity value;
- Landscape measures such as tree planting can damage sub-surface archaeological features, due to topsoil stripping and through the root action of trees and shrubs as they grow;
- Ground consolidation by construction activities or the weight of permanent embankments can cause damage to buried archaeological remains, especially in colluviums or peat deposits;
- Disruption due to construction also offers in general the potential for adversely affecting archaeological remains. This can include machinery, site offices, and service trenches.

Although not widely appreciated, positive impacts can accrue from developments. These can include positive resource management policies, improved maintenance and access to archaeological monuments, and the increased level of knowledge of a site or historic landscape as a result of archaeological assessment and fieldwork.

Predicted Impacts

The severity of a given level of land-take or visual intrusion varies with the type of monument, site or landscape features and its existing environment. Severity of impact can be judged taking the following into account:

- The proportion of the feature affected and how far physical characteristics fundamental to the understanding of the feature would be lost;
- Consideration of the type, date, survival/condition, fragility/vulnerability, rarity, potential and amenity value of the feature affected; and
- Assessment of the levels of noise, visual and hydrological impacts, either in general or site-specific terms, as may be provided by other specialists.

Galway City Council

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Appendix 15.7 - Mitigation Measures and the Cultural Heritage Resource

Chapter 15 Archaeological Cultural Heritage and Architecture Heritage

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Potential Mitigation Strategies for Cultural Heritage Remains

Mitigation is defined as features of the design or other measures of the proposed development that can be adopted to avoid, prevent, reduce or offset negative effects.

The best opportunities for avoiding damage to archaeological remains or intrusion on their setting and amenity arise when the site options for the development are being considered. Damage to the archaeological resource immediately adjacent to developments may be prevented by the selection of appropriate construction methods. Reducing adverse effects can be achieved by good design, for example by screening historic buildings or upstanding archaeological monuments or by burying archaeological sites undisturbed rather than destroying them. Offsetting adverse effects is probably best illustrated by the full investigation and recording of archaeological sites that cannot be preserved *in situ*.

Definition of Mitigation Strategies

Archaeological Resource

The ideal mitigation for all archaeological sites is preservation *in situ*. This is not always a practical solution, however. Therefore, a series of recommendations are offered to provide ameliorative measures where avoidance and preservation *in situ* are not possible.

Archaeological Test Trenching can be defined as ‘a limited programme of intrusive fieldwork which determines the presence or absence of archaeological features, structures, deposits, artefacts or ecofacts within a specified area or site on land, inter-tidal zone or underwater. If such archaeological remains are present field evaluation defines their character, extent, quality and preservation, and enables an assessment of their worth in a local, regional, national or international context as appropriate’ (CIfA 2014a).

Full Archaeological Excavation can be defined as ‘a programme of controlled, intrusive fieldwork with defined research objectives which examines, records and interprets archaeological deposits, features and structures and, as appropriate, retrieves artefacts, ecofacts and other remains within a specified area or site on land, inter-tidal zone or underwater. The records made and objects gathered during fieldwork are studied and the results of that study published in detail appropriate to the project design’ (CIfA 2014b).

Archaeological Monitoring can be defined as ‘a formal programme of observation and investigation conducted during any operation carried out for non-archaeological reasons.

This will be within a specified area or site on land, inter-tidal zone or underwater, where there is a possibility that archaeological deposits may be disturbed or destroyed. The programme will result in the preparation of a report and ordered archive (CIfA 2014c).

Underwater Archaeological Assessment consists of a programme of works carried out by a specialist underwater archaeologist, which can involve wade surveys, metal detection surveys and the excavation of test pits within the sea or riverbed. These assessments are able to access and assess the potential of an underwater environment to a much higher degree than terrestrial based assessments.

Architectural Resource

The architectural resource is generally subject to a greater degree of change than archaeological sites, as structures may survive for many years but their usage may change continually. This can be reflected in the fabric of the building, with the addition and removal of doors, windows and extensions. Due to their often more visible presence within the landscape than archaeological sites, the removal of such structures can sometimes leave a discernable ‘gap’ with the cultural identity of a population. However, a number of mitigation measures are available to ensure a record is made of any structure that is deemed to be of special interest, which may be removed or altered as part of a proposed development.

Conservation Assessment consists of a detailed study of the history of a building and can include the surveying of elevations to define the exact condition of the structure. These assessments are carried out by Conservation Architects and would commonly be carried out in association with proposed alterations or renovations on a Recorded Structure.

Building Survey may involve making an accurate record of elevations (internal and external), internal floor plans and external sections. This is carried out using an EDM (Electronic Distance Measurer) and GPS technology to create scaled drawings that provide a full record of the appearance of a building at the time of the survey.

Historic Building Assessment is generally specific to one building, which may have historic significance, but is not a Protected Structure or listed within the NIAH. A full historical background for the structure is researched and the site is visited to assess the standing remains and make a record of any architectural features of special interest. These assessments can also be carried out in conjunction with a building survey.

Written and Photographic record provides a basic record of features such as stone walls, which may have a small amount of cultural heritage importance and are recorded for prosperity. Dimensions of the feature are recorded with a written description and photographs as well as some cartographic reference, which may help to date a feature.

Chapter 16

(Landscape (Townscape) & Visual) Appendices

NOEL LANE

TREE CARE SERVICES

An Arboricultural Impact Assessment of the Site Area at Galway for the Cross City Link Scheme

Prepared for: ARUP Group

Prepared by: Noel Lane, Certified Arborist, MSIF National Dip in Science (Forestry)

Date: 04/07/2022

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1.0 Instructions

1.1 I have been instructed by ARUP Group to prepare an arboricultural Impact Assessment on the tree vegetation within the Cross City Link site area and to report the following:

A- To assess the present condition of the tree vegetation within the site area. See condition tree assessment schedule within ‘Appendix 4’ of this report and Drawing No.BCG-LA-01-01 to BCG-LA-01-12 which has been prepared as a constraint drawing for details.

B- To assess the impact of the proposed development layout on the surrounding tree vegetation located within the site area indicating those for removal and retention. See ‘Section 5.0’ of this report and Drawing No.BCG-LA-01-01 to BCG-LA-01-12 for detail.

C- To prepare this drawing as a tree protection plan to show the position of the line of protective fencing that needs to be erected around the trees to be retained at the very start of the works and be maintained until all construction works are complete. See ‘Section 6 of our report for detail.

2.0 Report Limitations

2.1 The inspection of the tree vegetation has been carried out from ground level only, is a preliminary report and does not include climbing inspections, internal investigations of the timber or below ground investigations. The assessment is based on what was visible at the time of the inspection and recommendations made are subject to the knowledge and expertise of the qualified Arboriculturist that carried out the above inspections.

2.2 Trees should be inspected on a regular basis as their health and condition can change rapidly due to biotic abiotic agents. The report only relates to factors apparent at the time of the inspection: as a result, further monitoring is imperative if potential problems/hazards are to be avoided. The recommendations within this report are valid for a 12-month period only, unless otherwise stated.

2.3 Before undertaking any work to these trees, it would be advisable to check whether any planning or tree preservation controls are in operation, if they are it will be necessary to obtain consent before undertaking any works (pruning or felling).

3.0 Survey Data Collection and Methodology

3.1 The Arboricultural data which is presented with the attached tree schedule (see appendix 4), has been recorded in line with BS 5837:2012. The tree survey was conducted by collecting and assessing the following information on all significant trees located on site and plotted on the land survey map provided.

- Tree number (mental tag attached to each tree).
- Tree species both common and botanical.
- Dimensions (Trunk diameter, height, crown spread and crown clearance if required).
- Age class
- Physiological Condition
- Structural Condition
- Preliminary recommendations
- Estimated remaining contribution within their present environment
- Retention category/category grade

3.2 Each tree within this assessment has been marked with a small aluminium tag with a reference number that relates to the main condition report.

3.3 The inspection of the trees involves a visual assessment from the ground level only and does not include any invasive means of assessing the trees internally, their below ground parts or the aerial parts that are not visible from the ground. Good, fair, and poor have been used to summarize the physiological and structural conditions of these trees with the comments giving more detail. Other items that may limit the assessment of a tree include Ivy cover, scrub vegetation and/or basal suckers.

3.4 Their retention category has been assessed and categorised according to their quality and value within the existing context (BS-4.5), and not in conjunction with any proposed Cross City Link development plans. In making this assessment, particular consideration was given to:
Arboricultural Value: An assessment of the trees health, structural form, life expectancy, species, and its physical contribution to or effects on other features located on site.
Landscape value: An assessment of a trees locality including its conditions to other features as well as to the site as a whole
Cultural Value: Additional contributions made such as conservation, historical or commemorative value.

3.5 The trees have been divided into one of the following categories, in accordance with the cascade chart illustrated in table 1 of BS 5837:2012. The classification process begins by determining whether the tree falls within the (U) category, if not then the process will continue by assuming that all trees are considered according to the criteria for inclusion in the high category (A). Trees that do not meet these strict criteria will then be considered in light of the criteria for inclusion in the moderate category (B) and failing this, they will be allocated in a low category (C).

The following summarizes each of the categories:

Category U Those trees in such a condition that any existing value would be lost within 10 years.

These would be seen as trees that have little or no potential either due to their physiological and/or structural condition and their removal would be seen as necessary either now or in the short-term as the most appropriate management option.

The category ‘U’ trees have been identified on our Drawing No.BCG-LA-01-01 to BCG-LA-01-12 with a ‘Red’ donut around their trunk positions. Due to the condition of these trees, they should not be considered a constraint on the design layout of the proposed development of this site area.

Category A- Trees of high quality/value with a minimum of 40 years life expectancy

These trees would be seen as trees that have the potential to contribute to the tree cover of these grounds for the ling-term and consists of trees of all age classes from semi-mature to mature.

The category ‘A’ trees have been identified on our Drawing No.BCG-LA-01-01 to BCG-LA-01-12 with a ‘Green’ donut around their trunk positions

Category B- Trees of moderate quality/value with a minimum of 20 years life expectancy.

These would be seen as trees that have the potential to contribute to the tree cover of these grounds for the medium term and consists of all age classes from semi-mature to mature.

The category ‘B’ trees have been identified on our Drawing No.BCG-LA-01-01 to BCG-LA-01-12 with a ‘Blue’ donut around their trunk positions

Category C- Trees of low quality/value with a minimum of 10 years life expectancy.

These trees would be seen as having the potential to provide tree cover for the short to medium term. As part of the future management, most of these trees would probably be removed for one reason or another. This category consists of trees of all age classes from young to mature. These trees should not be seen as a considerable constraint on the development of these lands but should be considered for retention where viable.
The category ‘C’ trees have been identified on our Drawing No.BCG-LA-01-01 to BCG-LA-01-12 with a ‘Brown’ donut around their trunk positions

3.6 The trees have been plotted onto the attached Drawing No.BCG-LA-01-01 to BCG-LA-01-12 by a land survey company and their positions are assumed accurate. This drawing has been developed as a constraint drawing to aid the design team in the layout of the Cross City Link development and the tag numbers referred to in the condition tree report have been shown on this drawing along with their crown spreads and their retention category colour coded as recommended by BS 5837 2012. The constraint (Minimum Root Protective Area) for each tree has been shown with an 'Orange Circle' and all proposed development should be planned to be positioned outside those trees proposed for retention allowing for additional space for construction activities.

The Root Protection Area (RPA) is the minimum area around individual trees to be protected from disturbance during construction works; RPA is usually expressed as a radius in metres measured from the tree stem

Any deviation in the RPA from the original circular plot takes account of the following factors whilst still providing adequate protection from the root system:

a) The morphology and disposition of the roots, when influences by past or existing site conditions (e.g. the presence of roads, structure, drainage ditches and underground apparatus);
b) Topography and drainage:
c) The soil type and structure:
d) The likely tolerance of the tree root disturbance or damage, based on factors such as species, age, condition and past management.

Explanation of Terms – Tree Survey Schedule Notes

Reference to Tree Nos:
Trees have metal tags attached and these correspond with the numbers on this report. (For group surveys only one tree is tagged).

Reference to Tree Species:
The genus and species of each tree is given

Height:
The approximate tree height to the nearest .5m above ground is given (where appropriate)

DBH:
This is the trunk diameter measured at a height of 1.2m above ground level (where appropriate)

Branch Spread:
This is the measurement taken from the base of the tree to the outer tip of the lateral branches. It records average branch spread (where appropriate)

Age:
The approximate age of the tree **- Referred to in generalized categories including:**

Young
A tree which has been planted in the last 10 years or is less than1/3 expected height of the species in question.

Semi-mature
A young tree, having attained dimensions that allow it to be regarded independently of its neighbours and approximately 50% of its ultimate size

Early Mature
A specimen 50 – 100% of its ultimate dimensions but with capacity for mass increase remaining.

Mature
A specimen having attained dimensions typical of a full-grown specimen of its species with potential for little if any dimensional increase.

Over- Mature
An old specimen of a species having already attained or exceeded its naturally expected longevity.

Senile
An extremely old specimen of a species, usually of low vigour and typically subject to rapid decline and deterioration - usually of very limited future longevity or approaching death

Condition:
Tree condition is based on a 3-tier rating system, and constitutes a general assessment of the physiological of the tree where the rating of:

Good = represents good health and vigour

Fair = Healthy and reasonable vigour, canopy slightly sparse, some defects and deadwood

Poor = Showing signs of decline, disease, or decay and at the point of being dangerous

Dead = A tree that is dead or showing signs of significant an irreversible overall decline

Retention Category: BS 5837:2012 determines four categories following assessment

(1) **Category A.** Trees whose retention is most desirable: Those of high quality and in such a condition to make a substantial contribution for up to 40 years

(2) **Category B.** Trees whose retention is desirable: Those of moderate quality and value so as to make a significant contribution for up to 20 years

(3) **Category C.** Trees which could be retained: Those of low quality and value, but can make a contribution until new planting is established

(4) **Category U.** Trees for removal. Trees that should be removed for reasons of sound arboricultural management

NWR: No Work required at this time

Comments - Typically, the comments provide a commentary relating to the reason a tree has been evaluated in such a way as to provide information relating to actions required for maintenance.

Note should be made of the fact that maintenance suggestions relate to the current site conditions and will require updating and reassessment with regard to environmental changes pertaining to the individual site.

Glossary of Arboricultural Terms:

Codominant stem: Forked branches or stems nearly the same size in diameter, arising from a common junction and lacking a normal branch union.

Crown: Upper part of a tree, measured from the lowest branch, including all the branches and foliage.

Crown cleaning: In pruning, the selective removal of dead, dying, diseased and broken branches from the tree crown

Crown raising/lifting: The removal of lower branches of trees to raise the crown to facilitate access and or avoid damage to structures such as walls

Crown Thinning: The systematic removal of living branches in a balanced manner/form throughout the tree crown, intending to reduce crown weight, wind resistance, to admit light and air circulation

Deadwooding/Remove Deadwood: The pruning out of all dead, disease affected limbs and branches throughout the canopy. All pruning involves removal back to a suitable pruning point i.e., nearest growing point. Deadwooding leads to good aesthetic, biological, pest control, economic and safety reasons for why the practice is undertaken, but some of those reasons are more compelling than others. Deadwooding can keep the plant health and mechanically safe.

Decline: Gradually diminishing health or condition of a tree

Crown Reduction: The shortening back of canopy limbs and branches to bring about a reduction in crown dimensions

Dieback: condition in which the branches in the tree crown die from the tips towards the centre

Failure: Breakage of stem, branch or roots, or loss of mechanical support in the root system.

Hanger: Broken branch hung up in the main crown

Lean: Angle of the trunk

Pruning: Removing branches from a tree using approved practices, to achieve a desired objective

Root Crown: Area where the main roots join the plant/tree stem

Root Protection Area (RPA): Area of tree root zone to be protected from construction damage, the size of which is based on the size of the tree to be protected

Stem: Woody structure bearing foliage and buds

Scope of Work: The defined project objective and requirements

Structural Defect: Feature, condition or deformity of a tree that indicates a weak structure or instability that could contribute to a tree failure

Target: Person, object, or structure that could be harmed (damaged or injured) by a tree or tree part in the event of failure.

4.0 Summary of Survey Findings

4.1 Site Location: The Cross City Link is a bus priority route through Galway City Centre, from the entrance to UCHG in the west as far as the brothers of Charity on the Dublin Road to the east, travelling along University Road, Salmon Weir Bridge, St. Vincent's Avenue, St Francis Street, Eglinton Street, Eyre Square, Forster St. College Road, and Dublin Road. There are also supplementary proposals along Fiargreen Road, Bothar Ui hEithir, Prospect Hill, Bothar na mBan, Headford Road, Woodquay and Newtownsmith.

4.2 This report presents a record of those trees existing within or adjacent to the site area that may be impacted by the proposed Cross City Link Scheme. Trees have been surveyed as individuals in accordance with BS 5837 (2012). The survey was undertaken over the course of 5 days carried out on 02/03/2022, 03/03/2022, 07/03/2022 and 08/03/2022 by Noel Lane Tree Care Services.

4.3 A full tree survey is presented in Appendix 4, together with accompanying Drawing No.BCG-LA-01-01 to BCG-LA-01-12

4.4 Every effort has been made to access all trees for inspection, however in some instances where site conditions prevent full access, some measurements may be visually estimated.

4.5 It is noted that the site contains several trees of significant maturity and size- every effort should be made to safely retain these trees as part of the development proposal.

4.6 The proposed Cross City Link development scheme will present an opportunity to implement additional new tree planting, both as part of a general landscape design scheme and as part of a tree management program aimed at maintaining high quality diverse long-term amenity tree cover, in keeping with the setting and proposed site use. The report concludes with recommendations for protection measures to ensure the conservation of retention trees during any development.

4.7 Within the site area 214 trees were tagged individually. The following table gives a breakdown of the category grading given to the trees as per the Cascade Chart BS 5837 2012.

4.8 There are 59 trees to be removed to facilitate the development. Two trees will be removed due to their condition and 153 trees will be retained

Category Grade Cross City Link

Species	**Cat. A**	**Cat. B**	**Cat. C**	**Cat. U**	Total
Lime	16	1			
Cherry	10				
Mt Ash	5	5	1		
Sycamore	26	1			
Alder	6				
Poplar		31			
Birch	16	1			
Maples	25	3			
Wing-nut	1				
Hornbeam	1	1			
Whitebeam	3			1	
London Plane	1				
Horse chestnut	2	1			
Fig	1				
Hawthorn	4				
Ash			3		
Oak	25		1		
Plum	2	1		1	
Dead					
Beech	16				
Crab Apple	1				
Silver Birch	1				
Total	162	45	5	2	214

5.0.0 Arboricultural Implication Study

5.1.0 Introduction

5.1.1 It is being proposed to develop this site area for a Cross City Link Scheme and it may also be necessary to allow for infrastructure works such as services. The Cross City Link is a bus priority route through Galway City Centre.

5.1.2 This section of the document is designed to assess the impact of the proposed Cross City Link development layout on the tree vegetation within and adjoining this site area and to look at the necessary measures that will need to be undertaken to help retain the trees shown for retention free from adverse impacts for the duration of the construction period.

5.1.3 On our Tree Constraints/Protection Plan and Drawing No.BCG-LA-01-01 to BCG-LA-01-12 we have identified the tree vegetation to be removed to facilitate the development or as part of management with 'Red' hatched crown spreads and those that it is proposed to retain with a 'Green Hatched' crown spread.

On Drawing No.BCG-LA-01-01 to BCG-LA-01-12 we have also shown the position of tree protection fencing using 'Orange Hatching' and this will need to be erected at the start of the works and be maintained in place until all works are completed. This fencing is to protect the root zone of the trees and to ensure their successful integration into the development of these grounds.

5.1.4 The comments made within this impact assessment study are based on my understanding of the proposed Cross City Link development layout and what is required to allow for its construction. Any errors or omissions in my understanding of this project should be brought to my attention by the project team.

5.2.0 Implications of Proposed Development

1. Direct Loss of Trees

To construct the proposed Cross City Link development, it will be necessary to remove 59 trees.

Label numbers: 2114, 2130, 2131, 2132, 2148, 2597, 2228, 2229, 2230, 2235, 2236, 2237, 2238, 2239, 2241, 2242, 2243, 2244, 2245, 2246, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2307, 2308, 2397 and 2398

2. **Indirect Impacts**

Two trees are to be removed due to their condition as per the condition tree survey – label numbers 2142 and 2174

5.2.1` Changes in Ground Level/Changes in Ground Surface within the Root Protection Area (RPA)

5.2.2 Roads, Footpaths and Parking Areas

If there is an encroachment with the RPAs of trees special measures will be taken to ensure the protection of those trees, which are set out in section six – Arboricultural Method Statement.

5.2.3 Boundaries:

N/A

5.3.0 Changes in Site Use and Tree Management Implications

5.3.1 Above Ground Constraints

The areas of retained trees will not have a significant change in use as most of them are presently on or near pedestrian footpaths and roads. There will be more pedestrian movements and necessary tree surgery will be carried out, and the trees will be maintained regularly.

5.3.2 Potential Root Damage to Infrastructure

There is potential of root damage to existing or proposed infrastructure. This must be observed when deciding on tree retention near the proposed development. Species such as poplar that have aggressive and invasive root systems should not be retained close to the development itself.

5.3.3 Potential Nuisance

All retained trees will have appropriate remedial tree surgery works and will be subject to normal ongoing arboricultural management. Shading and leaf drop is unavoidable given the location of the trees and proximity to the proposed development.

5.3.4 Construction Implications

All internal services will be routed outside the root protection zones. General precautions in storage or mixing materials that may be injurious to trees will need to be taken. All toxic materials will be stored at least 10m from RPA. No wash out facilities will be provided for ready mix concrete/mortar deliveries. All fuels stored on site will be bounded to prevent spillage or leakage.

5.3.5 Proposals for Tree Management

All retained trees will have the necessary tree surgery to ensure there are no hazard branches, deadwood, and weak limbs. All retained trees will be subject to regular inspections.

6.0.0 Arboricultural Method Statement

6.1.0 Introduction

This document sets out the methodology for all proposed works that affect trees on and adjacent to the proposed Cross City link site. Compliance with this method statement will be a requirement of all relevant contractors associated with the development proposals. Copies of this document will be available for inspection on site. The developer will inform local planning Authority within 24 hours if the arboricultural consultant is replaced.

The contractor shall take all precaution to ensure that any trees, which are to be retained, shall remain undisturbed and undamaged.

All works to trees and all operations adjacent to trees should be undertaken in accordance with the method statement. The contractor shall undertake no works to trees unless instructed by the Contract Administrator. All works within or close to the protected tree zones are to be supervised by the appointed Consultant Arborist. Two working days' notice or intention to undertake such works to be undertaken prior to any works commencing.

6.1.2 Root Protection Area

In accordance with the method statement and as per the issued drawings protective fencing shall be erected where appropriate before the commencement of building works or any works on site (other than remedial tree surgery works and erection of any boundary fences). The area within the tree protective fencing should be clearly identified with signage as the "Protected Tree Zone". The local planning authority will be notified in writing once the fencing is in place. Strictly no access should be permitted to this zone unless instructed by the Consultant Arborist. The appointed Consultant Arborist should be informed of any works or access to this zone. The fencing shall remain in place until completion of the main construction phase and then only removed with the consent of the local planning authority to permit completion of the scheme.

Other than works detailed within this method statement or approved in writing by the local planning authority, no works including storage or dumping of materials shall take place within the exclusion zones defined by the protective fencing. No fires shall be close or within 20m of the trunk of any tree/trees that is to be retained. No materials that are likely to have an adverse effect on the tree health such as oil, bitumen or cement will be stored or discharged within 10m of the trunk of a tree that is to be retained.

6.2.0 Code of Practice for the Preservation of Trees

The following code of practice is intended for the preservation of existing trees. These guidelines will help sustain vigour and minimise adverse growing conditions, for trees set out for retention.

This code will be brought to the attention of site personnel including the main contractor, sub-contractors and engineering specialist associated with the project. All operations are to be in accordance with BS 5837:2012*, trees in relation to design, demolition, and construction.* The main contractor should purchase and make available on site a copy of the above.

6.2.1 Prior Notice and Tree Removal

All necessary tree works are to be undertaken prior to the commencement of any other works on site. Trees must only be removed with the necessary licence, approval or permits. All necessary licences or permits should be inspected by the appointed Consultant Arborist prior to commencement of works.

Note: Note that under the Forestry Act 2014 – no felling licence will be required on receipt of planning permission.

6.2.2 The Arboricultural Consultant will:

- Liaise with the relevant authorities during the project
- Constantly monitor the project regarding tree health to ensure that no damage is caused to the subject trees during the operational works
- Report any negligent damage to trees, which will prejudice their health.
- Monitor works carried out by the Arboricultural Contractor and Main Contractor within the “Root Protection Area”

6.2.3 Guidelines for Demolition and Site Clearance

Demolition of existing footpaths or walls within the recommended RPA shall be undertaken inwards, within the footprint of the existing footpaths, removal of below ground elements should be undertaken with appropriate machinery, under supervision and with care. The area should be checked for possible root encroachment during operations. Any roots exposed should be treated in accordance with section 7.0 of BS 5837:2012. No stockpiling of soil will be allowed, and it will be removed off site as it is generated. Prior to and during all construction works on site, no spoil or construction materials etc. are to be stored within the tree protection zone, even if proposed development is an area outside the site.

6.2.4 Construction Access

In areas where there is site access, permanent car parking and access for construction of the boundary fence near trees, the ground shall be covered with Fibertex or similar geo textile fabric and a three-dimension cellular confinement system such as geoweb should be laid over the fabric.

Where access is required within the RPA of trees a cellular confinement system shall be put in place prior to use of the area. See construction details attached.

6.2.5 Construction of Roads Bays with the Root Protection Zone

The construction of several sections of the route is within the RPA of trees, the construction shall be undertaken using a no dig method, a minimum amount of topsoil shall be removed, and existing ground level shall be maintained. Once the soil is graded and lightly compacted it shall be overlaid with geo fabric and a 3-dimensional cellular confinement system. Paving within RPA shall be in accordance - Clause 7.4 of BS 5837:2012.

6.3.0 Soft Landscaping within Exclusion Zones

Preparation of ground in these areas will be carried out under the supervision of the Consultant Arborist.

6.3.1 Guidelines for Root Pruning

- Roots smaller than 25mm diameter may be pruned back, roots with a greater diameter should only be cut following consultation with the arborist
- Roots should be cut cleanly after excavation to promote callus formation and wound closure
- Exposed roots to be protected where an area of work is to be left open,
- In winter exposed roots are to be wrapped with dry sacking overnight.
- In summer, exposed roots are to be always covered with damp sacking. A suitable irrigation / drip feed system should be installed to keep sacking wet at all times
- Back filling material used around roots are to be of a fine granular material with no toxins and not susceptible to frost heave.

6.4.0 Offences and Penalties

Any damage whatsoever, caused to the protected trees shall be notified to the Consultant Arborist so that the damage can be assessed and rectified and the main contractor subject to financial penalty as per the conditions of contract. Value of damaged trees will be assessed using the “Helliwell System”

6.4.1 Supervision and Monitoring

The arboricultural consultant will be responsible for monitoring all arboricultural works and issuing a certificate of practical completion. In addition, the Consultant Arborist will inspect the protective fencing and monitor any work within exclusion zones.

A record of site visits will be maintained for inspection on site and copies forwarded to the developer/agent and to the local planning authority. The contractor shall not fell any trees under any circumstances. All works within the protected root zones are to be supervised by the Consultant Arborist (CA).

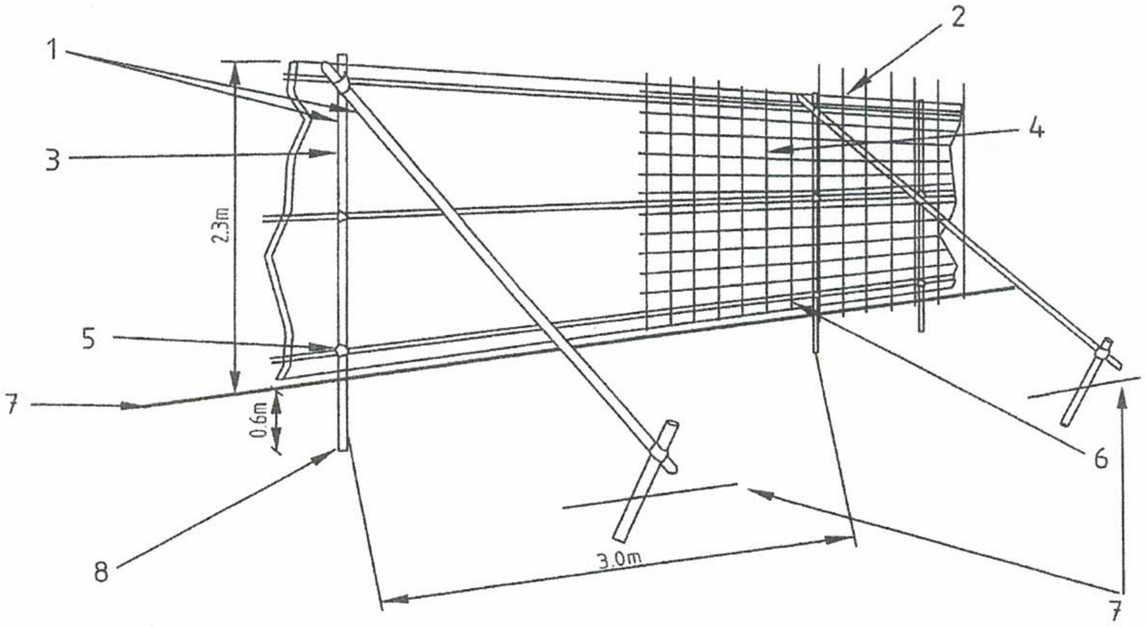
6.5.0 Tree Protection Barrier Fencing

Tree protection barriers are to be in accordance with BS 5837:2012, clause 6.2. Barrier fencing to be 2m high, comprising of “Herras” style fence, each panel to be secured to the adjoining panel fixed to scaffold poles with a minimum of 2 anti-tamper couplers, installed so that they can only be removed from inside the fence. The panels are to be supported by stabilizers struts on the inside. Barrier fencing is to be installed to an agreed alignment. The alignment is to be marked out on the site and approved by the CA prior to the erecting of the barrier fencing. “Construction Exclusion Zone” signage is to be securely attached to the fence. Barrier fencing is to be maintained by the main contractor for the duration of the contract. All damages to be reported immediately to the CA. Damaged fencing is to be repaired within 2 hours of the damage occurring to the satisfaction of the Consultant Arborist.

All site operations in the vicinity of the damaged fencing are to be suspended until the fencing is repaired. During site inspections the CA reserves the right to authorise the cessation of all works in proximity to the protected zones with immediate effect. A breach of such an instruction will be deemed to be a dismissible offence for the employee. As contract work progresses the protective barrier fence can only be adjusted under the supervision of the arboricultural consultant.

Appendix 1

Sample of Temporary Tree Protection Fencing Detail and Ground Protection



1 Standard scaffold poles
2 Uprights to be driven into the ground
3 Panels secured to uprights with wire ties and, where necessary, standard scaffold clamps
4 Weldmesh wired to the uprights and horizontals
5 Standard clamps
6 Wire twisted and secured on inside face of fencing to avoid easy dismantling
7 Ground level
8 Approx. 0.6m driven into the ground

Figure 2. – Protective fencing for RPA

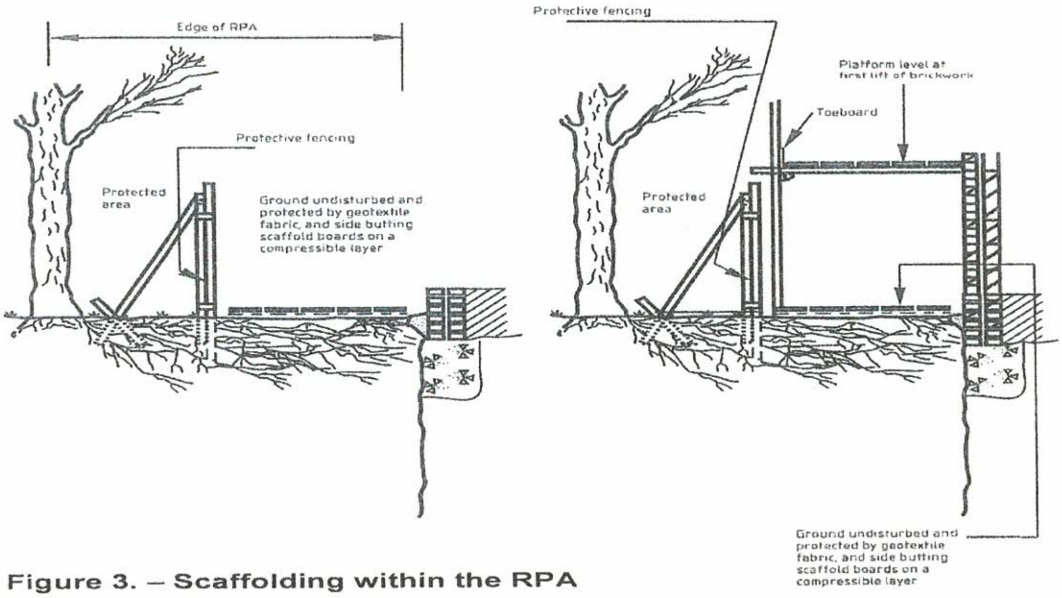


Figure 3. – Scaffolding within the RPA

Appendix 2

Photographs

Labels 2101 to 2105 - Line of trees at Cathedral area

Large poplar tree with aggressive and invasive root systems

Line of trees at Cathedral car parking area

Labels 2126 to 2129 - Trees at NUIG property

Label 2130 - Tree in paved area

Labels 2131 and 2132 - Trees in paved area

Labels 2133 to 2141 - Riverbank

Large Horse chestnut tree at salmon weir bridge – paved area

Fig tree to be retained and protected

Line of lime trees at Newtownsmith

Label 2142 - Hazardous tree at AXA buildings

Labels 2143 to 2145 - Three young Mt Ash trees at Woodquay area

Labels 2150 and 2151 - Trees across from dyke road

Labels 2182 to 2206 -

Labels 2180 and 2181 -

Label 2171 - Large high amenity value tree at Eyre Square

Dead tree at Eyre Square

Label 2175 - Large beech tree at Eyre Square

Labels 2153 to 2170 - Oak tree lines at Eyre Square – paved area

Damaged oak tree

Oak tree with dead top

Labels 2212 to 2227 - Tree line along College road close to City Hall

Labels 2228 to 2231 - Trees along College road – reduced to facilitate overhead powerlines

Trees reduced in the past

Labels 2232 to 2241 -

Labels 2242 to 2247 -

Labels 2253 to 2280 - Line of poplar trees opposite Huntsman

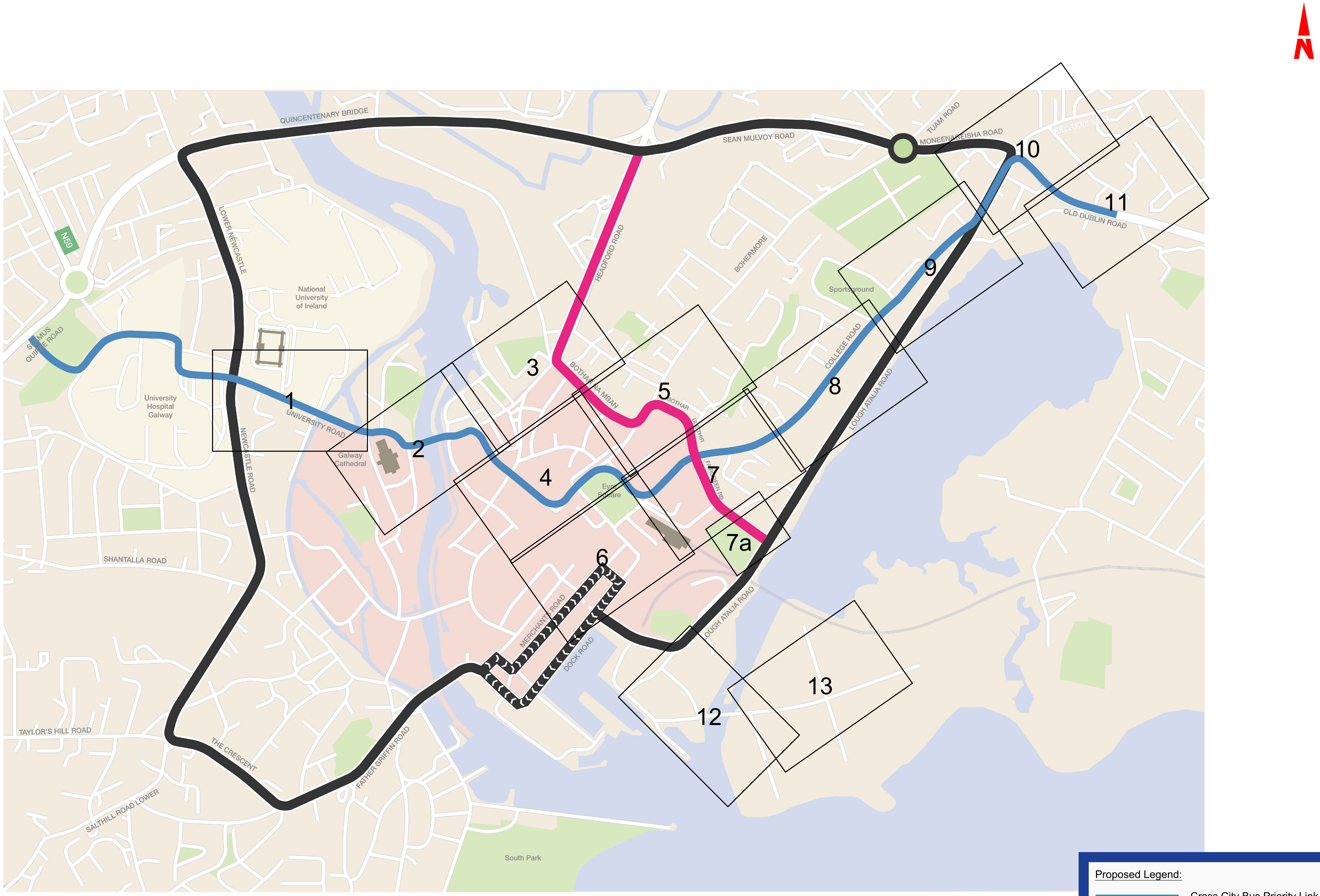
Labels 2281 to 2292 - Trees at G Hotel area

Labels 2293 to 2308 - Trees at Brothers of Charity area

Tree with heavy lean

Appendix 3

Drawings



Proposed Legend:

- Cross City Bus Priority Link
- City Centre Access Network
- Inner City Access Route

Figure 4.2 - Refer to Galway Transport Strategy Report

Údarás Náisiúnta Iompair
National Transport Authority

Rev	Date	By	Chkd	Appd
PL01	31/08/22	BM	BB	DMcD
Issue For Planning				

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Client
Galway City Council

Project Title
BusConnects Galway:
Cross-City Link
(University Road to Dublin Road)

Drawing Title
Tree Protection Plan
Keyplan

Scale at A1: NTS
Role: Transport Infrastructure
Suitability: Planning
Arup Job No: **253352-00**
Rev: **PL01**
Name: **BCG-LA-01-00**

Do not scale

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SCALE 1:500 @ A1; 1:1000 @ A3

GENERAL NOTES:

1. TREE SURVEY CARRIED OUT BY SUB CONSULTANT AS DETAILED IN ARBORICULTURAL REPORT.
2. TREE LOCATIONS BASED ON AVAILABLE TOPOGRAPHICAL SURVEY LOCATIONS WITH REFERENCE TO AERIAL IMAGERY AND ON SITE OBSERVATIONS.
3. DRAWINGS SHOULD BE READ IN CONJUNCTION WITH THE ARUP ARBORICULTURAL REPORT.
4. EXISTING TREE CANOPY BASED ON DIMENSIONS GATHERED ON SITE IN 4 DIRECTIONS, NORTH, SOUTH, EAST AND WEST.

LEGEND:

2301	TREE TAG NUMBER
RPA	ROOT PROTECTION AREA

LEGEND CONTINUED:

▨	EXISTING TREE TO BE RETAINED (FROM TOPOGRAPHICAL SURVEY)
▨	EXISTING TREE TO BE REMOVED (FROM TOPOGRAPHICAL SURVEY)
●	EXISTING TREE TO BE RETAINED (FROM AERIAL SURVEY)
●	EXISTING TREE TO BE REMOVED (FROM AERIAL SURVEY)

TREE CATEGORY BASED ON BS:5837 2012 CRITERIA

🟢	CATEGORY A
🔵	CATEGORY B
🟤	CATEGORY C
🔴	CATEGORY U
🟥	SITE BOUNDARY LINE

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Client
Galway City Council

Project Title
BusConnects Galway:
Cross-City Link
(University Road to Dublin Road)

BUS CONNECTS GALWAY
Project Ireland 2040

Drawing Title
Tree Protection Plan
Sheet 01 of 13

Scale at A1	1:500 @ A1 (1:1000 @ A3)
Role	Transport Infrastructure
Suitability	Planning
Arup Job No	**253352-00**
Rev	**PL01**
Name	**BCG-LA-01-01**

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LEGEND:

2301	TREE TAG NUMBER
RPA RPA	ROOT PROTECTION AREA

LEGEND CONTINUED:

▨	EXISTING TREE TO BE RETAINED (FROM TOPOGRAPHICAL SURVEY)
▨	EXISTING TREE TO BE REMOVED (FROM TOPOGRAPHICAL SURVEY)
🟢	EXISTING TREE TO BE RETAINED (FROM AERIAL SURVEY)
🔴	EXISTING TREE TO BE REMOVED (FROM AERIAL SURVEY)

TREE CATEGORY BASED ON BS:5837 2012 CRITERIA

🟢	CATEGORY A
🔵	CATEGORY B
🟤	CATEGORY C
🔴	CATEGORY U
—	SITE BOUNDARY LINE

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Client
Galway City Council

Project Title
BusConnects Galway:
Cross-City Link
(University Road to Dublin Road)

Drawing Title
Tree Protection Plan
Sheet 02 of 13

Scale at A1	1:500 @ A1 (1:1000 @ A3)
Role	Transport Infrastructure
Suitability	Planning
Arup Job No	253352-00
Rev	PL01
Name	BCG-LA-01-02

Do not scale

A1

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LEGEND:

2301	TREE TAG NUMBER
◠ RPA	ROOT PROTECTION AREA

LEGEND CONTINUED:

▨	EXISTING TREE TO BE RETAINED (FROM TOPOGRAPHICAL SURVEY)
▨	EXISTING TREE TO BE REMOVED (FROM TOPOGRAPHICAL SURVEY)
●	EXISTING TREE TO BE RETAINED (FROM AERIAL SURVEY)
●	EXISTING TREE TO BE REMOVED (FROM AERIAL SURVEY)

TREE CATEGORY BASED ON BS:5837 2012 CRITERIA

●	CATEGORY A
●	CATEGORY B
●	CATEGORY C
●	CATEGORY U
—	SITE BOUNDARY LINE

SCALE 1:500 @ A1; 1:1000 @ A3

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Galway City Council

Project Title
BusConnects Galway:
Cross-City Link
(University Road to Dublin Road)

Drawing Title
Tree Protection Plan
Sheet 03 of 13

Scale at A1: 1:500 @ A1 (1:1000 @ A3)
Role: Transport Infrastructure
Suitability: Planning
Arup Job No: **253352-00**
Rev: **PL01**
Name: **BCG-LA-01-03**

Do not scale

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LEGEND:

2301	TREE TAG NUMBER
RPA	ROOT PROTECTION AREA

LEGEND CONTINUED:

▨	EXISTING TREE TO BE RETAINED (FROM TOPOGRAPHICAL SURVEY)
▨	EXISTING TREE TO BE REMOVED (FROM TOPOGRAPHICAL SURVEY)
●	EXISTING TREE TO BE RETAINED (FROM AERIAL SURVEY)
●	EXISTING TREE TO BE REMOVED (FROM AERIAL SURVEY)

TREE CATEGORY BASED ON BS:5837 2012 CRITERIA

●	CATEGORY A
●	CATEGORY B
●	CATEGORY C
●	CATEGORY U
—	SITE BOUNDARY LINE

Do not scale

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Project Title
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Cross-City Link
(University Road to Dublin Road)

Drawing Title
Tree Protection Plan
Sheet 04 of 13

Scale at A1: 1:500 @ A1 (1:1000 @ A3)
Role: Transport Infrastructure
Suitability: Planning
Arup Job No: 253352-00
Rev: PL01
Name: BCG-LA-01-04

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LEGEND:

2301	TREE TAG NUMBER
RPA	ROOT PROTECTION AREA

LEGEND CONTINUED:

▨	EXISTING TREE TO BE RETAINED (FROM TOPOGRAPHICAL SURVEY)
▨	EXISTING TREE TO BE REMOVED (FROM TOPOGRAPHICAL SURVEY)
●	EXISTING TREE TO BE RETAINED (FROM AERIAL SURVEY)
●	EXISTING TREE TO BE REMOVED (FROM AERIAL SURVEY)

TREE CATEGORY BASED ON BS:5837 2012 CRITERIA

●	CATEGORY A
●	CATEGORY B
●	CATEGORY C
●	CATEGORY U
—	SITE BOUNDARY LINE

Údarás Náisiúnta Iompair
National Transport Authority

Rev	Date	By	Chkd	Appd
PL01	31/08/22	BM	BB	DMcD
Issue For Planning				

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www.arup.ie

Client
Galway City Council

Project Title
BusConnects Galway:
Cross-City Link
(University Road to Dublin Road)

Drawing Title
Tree Protection Plan
Sheet 05 of 13

Scale at A1: 1:500 @ A1 (1:1000 @ A3)
Role: Transport Infrastructure
Suitability: Planning
Arup Job No: **253352-00**
Rev: **PL01**
Name: **BCG-LA-01-05**

Do not scale

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GENERAL NOTES:

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2. TREE LOCATIONS BASED ON AVAILABLE TOPOGRAPHICAL SURVEY LOCATIONS WITH REFERENCE TO AERIAL IMAGERY AND ON SITE OBSERVATIONS.
3. DRAWINGS SHOULD BE READ IN CONJUNCTION WITH THE ARUP ARBORICULTURAL REPORT.
4. EXISTING TREE CANOPY BASED ON DIMENSIONS GATHERED ON SITE IN 4 DIRECTIONS, NORTH, SOUTH, EAST AND WEST.

LEGEND:

2301 TREE TAG NUMBER
RPA ROOT PROTECTION AREA

LEGEND CONTINUED:

▨ EXISTING TREE TO BE RETAINED (FROM TOPOGRAPHICAL SURVEY)
▨ EXISTING TREE TO BE REMOVED (FROM TOPOGRAPHICAL SURVEY)
● EXISTING TREE TO BE RETAINED (FROM AERIAL SURVEY)
● EXISTING TREE TO BE REMOVED (FROM AERIAL SURVEY)

TREE CATEGORY BASED ON BS:5837 2012 CRITERIA

● CATEGORY A
● CATEGORY B
● CATEGORY C
● CATEGORY U
— SITE BOUNDARY LINE

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Issue For Planning				
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Client
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Project Title
BusConnects Galway:
Cross-City Link
(University Road to Dublin Road)

Drawing Title
Tree Protection Plan
Sheet 06 of 13

Scale at A1
1:500 @ A1 (1:1000 @ A3)

Role
Transport Infrastructure

Suitability
Planning

Arup Job No
253352-00

Rev
PL01

Name
BCG-LA-01-06

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LEGEND:

2301	TREE TAG NUMBER
RPA	ROOT PROTECTION AREA

LEGEND CONTINUED:

▨	EXISTING TREE TO BE RETAINED (FROM TOPOGRAPHICAL SURVEY)
▨	EXISTING TREE TO BE REMOVED (FROM TOPOGRAPHICAL SURVEY)
●	EXISTING TREE TO BE RETAINED (FROM AERIAL SURVEY)
●	EXISTING TREE TO BE REMOVED (FROM AERIAL SURVEY)

TREE CATEGORY BASED ON BS:5837 2012 CRITERIA

●	CATEGORY A
●	CATEGORY B
●	CATEGORY C
●	CATEGORY U
—	SITE BOUNDARY LINE

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PL01	31/08/22	BM	BB	DMcD
Issue For Planning				
Rev	Date	By	Chkd	Appd

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Client
Galway City Council

Project Title
BusConnects Galway:
Cross-City Link
(University Road to Dublin Road)

Drawing Title
Tree Protection Plan
Sheet 07 of 13

Scale at A1: 1:500 @ A1 (1:1000 @ A3)
Role: Transport Infrastructure
Suitability: Planning
Arup Job No: 253352-00
Rev: PL01
Name: BCG-LA-01-07

Do not scale

SCALE 1:500 @ A1; 1:1000 @ A3

GENERAL NOTES:

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LEGEND:

2301	TREE TAG NUMBER
RPA	ROOT PROTECTION AREA

LEGEND CONTINUED:

▨	EXISTING TREE TO BE RETAINED (FROM TOPOGRAPHICAL SURVEY)
▨	EXISTING TREE TO BE REMOVED (FROM TOPOGRAPHICAL SURVEY)
●	EXISTING TREE TO BE RETAINED (FROM AERIAL SURVEY)
●	EXISTING TREE TO BE REMOVED (FROM AERIAL SURVEY)

TREE CATEGORY BASED ON BS:5837 2012 CRITERIA

●	CATEGORY A
●	CATEGORY B
●	CATEGORY C
●	CATEGORY U
—	SITE BOUNDARY LINE

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Project Title
BusConnects Galway:
Cross-City Link
(University Road to Dublin Road)

Drawing Title
Tree Protection Plan
Sheet 08 of 13

Scale at A1	1:500 @ A1 (1:1000 @ A3)
Role	Transport Infrastructure
Suitability	Planning
Arup Job No	253352-00
Rev	PL01
Name	BCG-LA-01-08

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LEGEND:

2301	TREE TAG NUMBER
RPA ◯	ROOT PROTECTION AREA

LEGEND CONTINUED:

▨	EXISTING TREE TO BE RETAINED (FROM TOPOGRAPHICAL SURVEY)
▨	EXISTING TREE TO BE REMOVED (FROM TOPOGRAPHICAL SURVEY)
●	EXISTING TREE TO BE RETAINED (FROM AERIAL SURVEY)
●	EXISTING TREE TO BE REMOVED (FROM AERIAL SURVEY)

TREE CATEGORY BASED ON BS:5837 2012 CRITERIA

●	CATEGORY A
●	CATEGORY B
●	CATEGORY C
●	CATEGORY U
—	SITE BOUNDARY LINE

SCALE 1:500 @ A1; 1:1000 @ A3

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Project Title
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Cross-City Link
(University Road to Dublin Road)

Drawing Title
Tree Protection Plan
Sheet 09 of 13

Scale at A1	1:500 @ A1 (1:1000 @ A3)
Role	Transport Infrastructure
Suitability	Planning
Arup Job No	253352-00
Rev	PL01
Name	BCG-LA-01-09

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LEGEND:

2301	TREE TAG NUMBER
RPA	ROOT PROTECTION AREA

LEGEND CONTINUED:

●	EXISTING TREE TO BE RETAINED (FROM TOPOGRAPHICAL SURVEY)
●	EXISTING TREE TO BE REMOVED (FROM TOPOGRAPHICAL SURVEY)
●	EXISTING TREE TO BE RETAINED (FROM AERIAL SURVEY)
●	EXISTING TREE TO BE REMOVED (FROM AERIAL SURVEY)

TREE CATEGORY BASED ON BS:5837 2012 CRITERIA

●	CATEGORY A
●	CATEGORY B
●	CATEGORY C
●	CATEGORY U
—	SITE BOUNDARY LINE

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Project Title
BusConnects Galway:
Cross-City Link
(University Road to Dublin Road)

Drawing Title
Tree Protection Plan
Sheet 10 of 13

Scale at A1: 1:500 @ A1 (1:1000 @ A3)
Role: Transport Infrastructure
Suitability: Planning
Arup Job No: **253352-00**
Rev: **PL01**
Name: **BCG-LA-01-10**

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LEGEND:

2301	TREE TAG NUMBER
RPA	ROOT PROTECTION AREA

LEGEND CONTINUED:

▨	EXISTING TREE TO BE RETAINED (FROM TOPOGRAPHICAL SURVEY)
▨	EXISTING TREE TO BE REMOVED (FROM TOPOGRAPHICAL SURVEY)
●	EXISTING TREE TO BE RETAINED (FROM AERIAL SURVEY)
●	EXISTING TREE TO BE REMOVED (FROM AERIAL SURVEY)

TREE CATEGORY BASED ON BS:5837 2012 CRITERIA

●	CATEGORY A
●	CATEGORY B
●	CATEGORY C
●	CATEGORY U
—	SITE BOUNDARY LINE

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Project Title
BusConnects Galway:
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Drawing Title
Tree Protection Plan
Sheet 11 of 13

Scale at A1 1:500 @ A1 (1:1000 @ A3)
Role Transport Infrastructure
Suitability Planning
Arup Job No 253352-00
Rev PL01
Name BCG-LA-01-11

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LEGEND:

2301	TREE TAG NUMBER
RPA	ROOT PROTECTION AREA

LEGEND CONTINUED:

🟢	EXISTING TREE TO BE RETAINED (FROM TOPOGRAPHICAL SURVEY)
🔴	EXISTING TREE TO BE REMOVED (FROM TOPOGRAPHICAL SURVEY)
🟢	EXISTING TREE TO BE RETAINED (FROM AERIAL SURVEY)
🔴	EXISTING TREE TO BE REMOVED (FROM AERIAL SURVEY)

TREE CATEGORY BASED ON BS:5837 2012 CRITERIA

🟢	CATEGORY A
🔵	CATEGORY B
🟤	CATEGORY C
🔴	CATEGORY U
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Project Title
BusConnects Galway:
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(University Road to Dublin Road)

Drawing Title
Tree Protection Plan
Sheet 12 of 13

Scale at A1: 1:500 @ A1 (1:1000 @ A3)
Role: Transport Infrastructure
Suitability: Planning
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Rev: **PL01**
Name: **BCG-LA-01-12**

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SCALE 1:500 @ A1; 1:1000 @ A3

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LEGEND:

2301	TREE TAG NUMBER
◯ RPA	ROOT PROTECTION AREA

LEGEND CONTINUED:

▨	EXISTING TREE TO BE RETAINED (FROM TOPOGRAPHICAL SURVEY)
▨	EXISTING TREE TO BE REMOVED (FROM TOPOGRAPHICAL SURVEY)
●	EXISTING TREE TO BE RETAINED (FROM AERIAL SURVEY)
●	EXISTING TREE TO BE REMOVED (FROM AERIAL SURVEY)

TREE CATEGORY BASED ON BS:5837 2012 CRITERIA

●	CATEGORY A
●	CATEGORY B
●	CATEGORY C
●	CATEGORY U
—	SITE BOUNDARY LINE

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Client

Galway City Council

Project Title

BusConnects Galway:
Cross-City Link
(University Road to Dublin Road)

Drawing Title

Tree Protection Plan
Sheet 13 of 13

Scale at A1: 1:500 @ A1 (1:1000 @ A3)

Role: Transport Infrastructure

Suitability: Planning

Arup Job No: **253352-00**

Rev: **PL01**

Name: **BCG-LA-01-13**

Do not scale

Appendix 4

A Condition Assessment of the Tree Vegetation within the site area at Galway Impacted by the Cross City Link Scheme

Tree condition analysis & preliminary recommendations

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2101	*Tilia cordata*	Lime	SM	30	10	N – 4 S – 3 E – 4 W - 3	Good	Good vigour and good form.	A >50 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.
2102	*Tilia cordata*	Lime	SM	30	10	N – 4 S – 2 E – 4 W - 3	Good	Good vigour and good form.	A >50 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.
2103	*Prunus*	Cherry	SM	42	8	N – 4 S – 3 E – 4 W - 4	Good	Good vigour and fair form.	A >30 years	
2104	*Tilia cordata*	Lime	SM	30	10	N – 4 S – 4 E – 4 W - 3	Good	Good vigour and good form.	A >50 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.
2105	*Tilia cordata*	Lime	SM	29	10	N – 4 S – 4 E – 4 W - 4	Good	Good vigour and good form.	A >50 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.
2106	*Tilia cordata*	Lime	SM	24	10	N – 3 S – 3 E – 4 W - 3	Good	Good vigour and good form.	A >50 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.

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2107	*Tilia cordata*	Lime	SM	26	10	N – 4 S – 2 E – 4 W - 3	Good	Good vigour and good form.	A >50 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.
2108	*Tilia cordata*	Lime	SM	26	10	N – 4 S – 2 E – 3 W - 4	Good	Good vigour and good form. Limb removed.	A >50 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.
2109	*Tilia cordata*	Lime	SM	28	10	N – 4 S – 4 E – 4 W - 4	Good	Good vigour and good form.	A >50 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.
2110	*Tilia cordata*	Lime	SM	29	10	N – 4 S – 3 E – 4 W - 4	Good	Good vigour and good form. Broken hanger.	A >50 years	Remove broken hanger.
2111	*Prunus*	Cherry	SM	20	9	N – 1 S – 1 E – 2 W - 1	Good	Good vigour and good form.	A >30 years	
2112	*Sorbus Aucuparia*	Mt. Ash	SM	16	7	N – 1 S – 1 E – 2 W - 1	Good	Good vigour and good form.	A >30 years	

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2113	*Acer pseudoplatanus*	Sycamore	M	63	15	N – 6 S – 5 E – 4 W - 6	Good	Good vigour and good form.	A >40 years	Thin and clean out the crown.
2114	*Populus*	Poplar	M	110	23	N – 6 S – 9 E – 7 W - 8	Fair	Good vigour and fair form. Open crown. Aggressive and invasive root systems!	B <20 years	To be removed due to proximity to proposed development and structural damage by roots.
2115	*Betula*	Birch	EM	35	10	N – 4 S – 2 E – 5 W - 1	Good	Good vigour and fair form.	A >30 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.
2116	*Betula*	Birch	SM	29	9	N – 2 S – 2 E – 5 W - 3	Good	Good vigour and fair form.	A >30 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.
2117	*Betula*	Birch	SM	23	10	N – 1 S – 2 E – 4 W - 3	Good	Good vigour and fair form.	A >30 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.
2118	*Sorbus Aucuparia*	Mt. Ash	SM	27	6	N – 1 S – 1 E – 4 W - 3	Good	Good vigour and fair form.	A >50 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.

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2119	*Sorbus aucuparia*	Mt. Ash	SM	23	7	N – 2 S – 0 E – 1 W - 0	Poor	Poor vigour and poor form. Suppressed. Broken stem.	C <10 years	In decline.
2120	*Betula*	Birch	SM	25	8	N – 3 S – 3 E – 5 W - 4	Good	Good vigour and fair form.	A >30 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.
2121	*Betula*	Birch	SM	29	9	N – 3 S – 3 E – 5 W - 4	Good	Good vigour and fair form.	A >30 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.
2122	*Sorbus aucuparia*	Mt. Ash	Y	9	4	N – 1 S – 1 E – 1 W - 1	Fair	Good vigour and fair form. Sucker growth at base.	A >30 years	Remove sucker growth.
2123	*Betula*	Birch	SM	27	7	N – 3 S – 3 E – 5 W - 4	Good	Good vigour and fair form.	A >30 years	Reduce limbs overhanging pedestrian footpaths and reshape the crowns.
2124	*Sorbus aucuparia*	Mt. Ash	SM	23 23 17	5	N – 0 S – 3 E – 3 W - 3	Fair	Fair vigour and fair form. Multistemed.	A >30 years	

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2125	*Acer pseudoplatanus*	Sycamore	M	35 37	12	N – 5 S – 5 E – 5 W - 5	Good	Good vigour and good form. Twin stems.	A >40 years	Clean the crown.
2126	*Acer platanoides*	Maple	EM	36	11	N – 4 S – 3 E – 2 W - 4	Good	Good vigour and fair form. Pruned in the past. Proximity to buildings and footpath.	A >30 years	Reduce and reshape by 25%.
2127	*Acer pseudoplatanus*	Sycamore	M	61	13	N – 6 S – 5 E – 6 W - 5	Good	Good vigour and fair form. Forked at 1.5m. Proximity to buildings and footpaths.	A >30 years	Reduce and reshape the crown by 25%.
2128	*Prunus*	Plum	SM	22	10	N – 3 S – 2 E – 2 W - 2	Fair	Good vigour and fair form. Ground compaction.	A >30 years	
2129	*Acer platanoides*	Maple	M	52	12	N – 5 S – 4 E – 4 W - 4	Good	Good vigour and fair form. Pruned in the past. Proximity to buildings and footpath.	A >30 years	Reduce the crown by 25% and reshape.
2130	*Carpinus*	Hornbeam	SM	28	6	N – 3 S – 3 E – 3 W - 3	Good	Good vigour and good form.	B >30 years	In paved car parking area. Tree to be removed to facilitate proposed scheme.

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2131	*Tilia cordata*	Lime	EM	33	6	N – 4 S – 4 E – 4 W - 3	Good	Good vigour and good form.	B >30 years	Paved car parking area. Tree to be removed to facilitate proposed scheme.
2132	*Tilia cordata*	Lime	EM	37	7	N – 4 S – 3 E – 5 W - 2	Good	Good vigour and fair form.	A >30 years	Paved car parking area. Tree to be removed to facilitate proposed scheme.
2133	*Sorbus aria*	Whitebeam	SM	22	7	N – 2 S – 2 E – 2 W - 2	Good	Good vigour and fair form. Close to streetlight.	A >30 years	Clear streetlight.
2134	*Acer platanoides*	Maple	EM	32	9	N – 3 S – 3 E – 3 W - 3	Good	Good vigour and fair form.	A >40 years	
2135	*Platanus Hispanica*	London plane	M	44	11	N – 4 S – 4 E – 6 W - 3	Good	Good vigour and fair form. Heavy limbs overhanging road.	A >40 years	Reduce heavy limbs overhanging road, thin and clean the crown.
2136	*Aesculus hippocastanum*	Horse chestnut	M	91	14	N – 6 S – 6 E – 6 W - 6	Fair	Good vigour and fair form. Cavities where limbs failed in the past. Roots lifting pedestrian footpath.	B >20 years	In paved area on restricted root development area. Monitor and consider impacts on proposed development. Monitor progress of decay at cavities!

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2137	*Ficus*	Fig	M	30	8	N – 6 S – 6 E – 2 W - 5	Good	Good vigour and good form. High amenity and specimen tree on riverbank.	A >50 years	Protect and retain this specimen.
2138	*Tilia cordata*	Lime	SM	21	8	N – 3 S – 3 E – 4 W - 4	Good	Good vigour and good form.	A >50 years	
2139	*Tilia cordata*	Lime	SM	21	8	N – 3 S – 3 E – 3 W - 4	Good	Good vigour and fair form.	A >30 years	
2140	*Tilia cordata*	Lime	SM	18	8	N – 3 S – 3 E – 3 W - 3	Good	Good vigour and good form.	A >50 years	
2141	*Tilia cordata*	Lime	SM	24	8	N – 3 S – 3 E – 4 W - 3	Good	Good vigour and good form.	A >50 years	
2142	*Sorbus aria*	Whitebeam	SM	23	7	N – 3 S – 0 E – 5 W - 0	Poor	Diseased with heavy lean.	U	Remove in the interest of safety to public and property.

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2143	*Sorbus aucuparia*	Mt. Ash	Y	13	6	N – 2 S – 0 E – 2 W - 2	Fair	Fair vigour and fair form. Near buildings.	B >20 years	
2144	*Sorbus aucuparia*	Mt. Ash	Y	13	6	N – 1 S – 1 E – 1 W - 2	Fair	Fair vigour and fair form. Near buildings.	B >20 years	
2145	*Sorbus aucuparia*	Mt. Ash	Y	12 10	5	N – 1 S – 1 E – 3 W - 3	Fair	Fair vigour and fair form. Forked at base.	B >20 years	
2146	*Crataegus*	Hawthorn	EM	33	5	N – 3 S – 2 E – 3 W - 2	Good	Good vigour and good form. In green area.	A >50 years	
2147	*Crataegus*	Hawthorn	EM	25	4	N – 3 S – 2 E – 3 W - 2	Good	Good vigour and good form. In green area.	A >50 years	
2148	*Acer platanoides*	Maple	SM	25 19	6	N – 4 S – 3 E – 4 W - 4	Fair	Regeneration on steep slope.	B <20 years	To be removed. This is due to possibly exposing roots due to excavation.

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2149	*Tilia*	Lime	EM	30	11	N – 3 S –3 E – 3 W - 3	Good	Good vigour and good form.	A >50 years	
2150	*Betula*	Birch	SM	22 28	11	N – 3 S – 6 E – 5 W - 3	Good	Good vigour and good form. On mound and restricted root development area.	B >20 years	
2151	*Fraxinus excelsior*	Ash	EM	34	12	N – 3 S – 4 E – 5 W - 3	Fair	Fair vigour and fair form. Early stages of ash dieback disease.	C <10 years	Clean the crown. Monitor progress of decline.
2153	*Quercus robur fastigiate*	Cypress oak	SM	24	10	N – 1 S – 1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	Tall slender common oak.
2154	*Quercus robur fastigiate*	Cypress oak	SM	26	10	N – 1 S – 1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	
2155	*Quercus robur fastigiate*	Cypress oak	SM	22	10	N – 1 S –1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	

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2156	*Quercus robur fastigiate*	Cypress oak	SM	24	10	N – 1 S – 1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	
2157	*Quercus robur fastigiate*	Cypress oak	SM	23	10	N – 1 S – 1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	
2597	*Quercus robur fastigiate*	Cypress oak	SM	23	10	N – 1 S – 1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	Tree to be removed to facilitate proposed scheme.
2158	*Quercus robur fastigiate*	Cypress oak	SM	24	10	N – 1 S – 1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	
2159	*Quercus robur fastigiate*	Cypress oak	SM	23	10	N – 1 S – 1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	
2160	*Quercus robur fastigiate*	Cypress oak	SM	25	10	N – 1 S – 1 E – 2 W - 1	Good	Good vigour and good form.	A >80 years	

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2161	*Quercus robur fastigiate*	Cypress oak	SM	22	10	N – 1 S –1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	
2162	*Quercus robur fastigiate*	Cypress oak	SM	16	9	N – 1 S – 1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	
2163	*Quercus robur fastigiate*	Cypress oak	SM	16	10	N – 1 S – 1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	
2164	*Quercus robur fastigiate*	Cypress oak	Y	13	8	N – 1 S – 1 E – 1 W - 1	Fair	Good vigour and fair form. Dead top.	A >80 years	Remove dead top back to live growth point.
2165	*Quercus robur fastigiate*	Cypress oak	SM	23	10	N – 1 S – 1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	
2166	*Quercus robur fastigiate*	Cypress oak	Y	14	9	N – 1 S – 1 E – 1 W - 1	Fair	Fair vigour and good form.	A >80 years	Clean out dead material.

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2167	*Quercus robur fastigiate*	Cypress oak	SM	18	9	N – 1 S –1 E – 1 W - 1	Poor	Poor vigour and fair form. Damage to bark at base of tree.	A >60 years	Monitor progress of decay – it could make a full recovery!
2168	*Quercus robur fastigiate*	Cypress oak	SM	21	10	N – 1 S – 1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	
2169	*Quercus robur fastigiate*	Cypress oak	SM	23	10	N – 1 S – 1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	
2170	*Quercus robur fastigiate*	Cypress oak	SM	23	10	N – 1 S – 1 E – 1 W - 1	Good	Good vigour and good form.	A >80 years	
2171	*Aesculus hippocastanum*	Horse chestnut	M	92	15	N – 7 S – 7 E – 7 W - 7	Good	Good vigour and good form. Specimen tree. Pruned and cleaned in the past.	A >30 years	High amenity tree of major significance to Eyre Square. Clean out the crown. Beech hedge in this area.
2172	*Acer*	Maple	SM	19	9	N – 2 S – 3 E – 2 W - 2	Good	Good vigour and fair form.	A >40 years	Slightly suppressed.

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2173	*Acer pseudoplatanus*	Sycamore	M	42	9	N – 4 S – 4 E – 4 W - 4	Good	Good vigour and good form. On raised bed.	A >40 years	Clean the crown.
2174			EM			N – S – E – W -	Dead		U	Remove this dead tree.
2175	*Fagus sylvatica*	Beech	M	91	15	N – 6 S – 6 E – 7 W - 6	Good	Good vigour and fair form. On raised bed.	A >40 years	High amenity tree of major significance to Eyre Square. Clean out the crown.
2176	*Acer*	Maple	Y	13	6	N – 1 S – 1 E – 2 W - 1	Fair	Good vigour and fair form. Wound at base of main stem.	A >30 years	Monitor progress of potential decay!
2177	*Quercus*	Oak	SM	18	8	N – 3 S – 4 E – 4 W - 3	Good	Good vigour and fair form.	A >80 years	Reduce the crown by 25% and reshape.
2178	*Aesculus hippocastanum*	Horse chestnut	M	80	15	N – 6 S – 6 E – 6 W - 6	Good	Good vigour and good form.	A >30 years	High amenity tree of major significance to Eyre Square. Clean out the crown.

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2179	*Carpinus*	Hornbeam	Y	8	5	N – 1 S – 1 E – 1 W -1	Good	Good vigour and good form.	A >50 years	
2180	*Acer platanoides*	Maple	EM	33 31	10	N – 4 S – 4 E – 3 W - 4	Good	Good vigour and fair form. Recently pruned. Proximity to buildings, road, and footpath.	A >40 years	
2181	*Acer Platanoides*	Maple	EM	24	9	N – 2 S – 3 E – 2 W - 3	Good	Good vigour and fair form. Recently pruned. Proximity to buildings, road, and footpaths.	A >40 years	
2182	*Acer pseudoplatanus*	Sycamore	M	30 57 30	16	N – 5 S – 4 E – 6 W - 3	Good	Good vigour and fair form. Close to buildings and overhanging road and pedestrian footpath.	A >30 years	Reduce heavy limbs overhanging the road and pedestrian footpath and reshape the crown.
2183	*Acer pseudoplatanus*	Sycamore	EM	38	15	N – 3 S – 3 E – 1 W - 5	fair	Good vigour and fair form. Pruned in the past. Proximity to buildings, road, and footpath. Suppressed.	A >30 years	

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2184	*Acer pseudoplatanus*	Sycamore	EM	38	16	N – 2 S – 3 E – 6 W - 2	Fair	Good vigour and fair form. Pruned in the past. Proximity to buildings, road, and footpath.	A >30 years	Reduce heavy limbs overhanging the road and pedestrian footpath and reshape the crown.
2185	*Acer pseudoplatanus*	Sycamore	M	43	16	N – 2 S – 2 E – 3 W -3	Good	Good vigour and good form.	A >40 years	
2186	*Acer pseudoplatanus*	Sycamore	M	49	16	N – 3 S – 3 E – 6 W - 4	Good	Good vigour and fair form. Pruned in the past. Proximity to buildings, road, and footpath.	A >40 years	Reduce heavy limbs overhanging the road and pedestrian footpath and reshape the crown.
2187	*Acer Pseudoplatanus*	Sycamore	M	49	16	N – 1 S – 4 E – 6 W - 4	Good	Good vigour and fair form. Pruned in the past. Proximity to buildings, road, and footpaths.	A >40 years	Reduce heavy limbs overhanging the road and pedestrian footpath and reshape the crown.
2188	*Acer platanoides*	Maple	EM	32	13	N – 3 S – 2 E – 5 W - 4	Good	Good vigour and fair form. Close to buildings and overhanging road and pedestrian footpath.	A >40 years	Reduce heavy limbs overhanging the road and pedestrian footpath and reshape the crown.

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2189	*Acer platanoides*	Maple	SM	20 16	12	N – 1 S – 1 E – 4 W - 2	Fair	Good vigour and fair form. Forked at 1.5m. Proximity to buildings, road, and footpath. Suppressed.	A >40 years	
2190	*Acer platanoides*	Maple	EM	38	13	N – 3 S – 3 E – 4 W - 4	Good	Good vigour and fair form. Proximity to buildings, road, and footpath.	A >40 years	
2191	*Acer platanoides*	Maple	EM	27	13	N – 2 S – 3 E – 3 W -3	Good	Good vigour and good form.	A >40 years	
2192	*Acer platanoides*	Maple	EM	37	13	N – 2 S – 4 E – 4 W - 1	Good	Good vigour and fair form.	A >40 years	
2193	*Fagus sylvatica*	Beech	EM	37	16	N – 4 S – 2 E – 4 W - 1	Good	Good vigour and fair form. Forked at 2m Ivy.	A >50 years	Sever ivy at base of main stem.
2194	*Fagus sylvatica*	Beech	EM	27	16	N – 2 S – 2 E – 3 W - 2	Good	Good vigour and fair form.	A >50 years	

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2195	*Fagus sylvatica*	Beech	EM	32 33	16	N – 2 S – 2 E – 3 W - 3	Good	Good vigour and fair form. Forked at 1m. Crossing limbs.	A >50 years	Remove crossing limbs.
2196	*Fraxinus excelsior*	Ash	SM	20	14	N – 1 S – 1 E – 1 W - 3	Fair	Fair vigour and fair form. Early stages of ash dieback disease. Ivy.	C <10 years	Sever ivy at base of main stem. Monitor progress of decline.
2197	*Fagus sylvatica*	Beech	EM	33	16	N – 3 S – 2 E – 4 W -2	Good	Good vigour and good form. Ivy.	A >50 years	Sever ivy at base of main stem.
2198	*Fraxinus excelsior*	Ash	EM	32	15	N – 2 S – 3 E – 2 W - 4	Good	Good vigour and fair form. Ivy.	A >50 years	Sever ivy at base of main stem.
2199	*Fagus sylvatica*	Beech	EM	27	16	N – 1 S – 2 E – 2 W - 2	Fair	Good vigour and fair form. Ivy.	A >50 years	Sever ivy at base of main stem.
2200	*Fagus sylvatica*	Beech	EM	22	16	N – 1 S – 4 E – 2 W - 3	Good	Good vigour and fair form.	A >50 years	

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2201	*Acer platanoides*	Maple	EM	33	12	N – 2 S – 3 E – 4 W - 2	Good	Good vigour and fair form. Ivy.	A >50 years	Sever ivy at base of main stem.
2202	*Acer platanoides*	Maple	EM	32	12	N – 3 S – 2 E – 2 W - 3	Good	Good vigour and fair form.	A >50 years	
2203	*Acer platanoides*	Maple	SM	20	12	N – 1 S – 1 E – 2 W -1	Fair	Fair vigour and good form..	A >40 years	
2204	*Acer platanoides*	Maple	EM	32	11	N – 2 S – 3 E – 3 W - 3	Good	Good vigour and fair form.	A >40 years	
2205	*Sorbus aucuparia*	Mt. Ash	SM	21	6	N – 1 S – 1 E – 2 W - 1	Fair	Fair vigour and fair form. Suppressed. Ivy.	B >20 years	Sever ivy at base of main stem.
2206	*Sorbus aucuparia*	Mt. Ash	SM	12	6	N – 1 S – 1 E – 1 W - 1	Fair	Fair vigour and fair form.	B >20 years	

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2207	*Betula*	Birch	SM	17	9	N – 2 S – 1 E – 2 W - 2	Good	Good vigour and fair form. Raised bed.	A >40 years	
2208	*Betula*	Birch	Y	12	9	N – 1 S – 1 E – 1 W - 1	Fair	Fair vigour and fair form. Raised bed.	A >40 years	
2209	*Betula jacquemontii*	Silver birch (White barked Himalayan)	SM	21	9	N – 3 S – 3 E – 4 W -2	Good	Good vigour and good form. Raised bed.	A >40 years	
2210	*Quercus*	Oak	EM	31	11	N – 3 S – 3 E – 3 W - 3	Good	Good vigour and fair form. Raised bed.	A >80 years	
2211	*Betula*	Birch	Y	11	7	N – 4 S – 2 E – 4 W - 1	Good	Good vigour and fair form. Forked at 2m Ivy.	A >50 years	Sever ivy at base of main stem.
2212	*Fagus sylvatica*	Beech	SM	20	9	N – 2 S – 2 E – 1 W - 2	Good	Good vigour and fair form.	A >60 years	

Tree No	**Species Botanical Name**	**Common Name**	**Age** **Y** **SM** **EM** **M** **OM** **V**	**DBH (cms)**	**Height (m)** **---------** **Height of clear stem**	**Crown Span (m)**	**Physiological Condition** **-Good** **-Fair** **-Poor** **-Dead**	**Comments Structural Observations**	**Retention Category** **A-High** **B-Moderate** **C-Low** **U-Fell** **-Lifespan**	**Preliminary Management Recommendations** **Priority** **A, B, C or U**
2213	*Fagus sylvatica*	Beech	M	59	12	N – 6 S – 5 E – 4 W - 5	Good	Good vigour and fair form.	A >60 years	
2214	*Fagus sylvatica*	Beech	M	49	13	N – 5 S – 3 E – 4 W - 2	Good	Good vigour and good form.	A >60 years	
2215	*Fagus sylvatica*	Beech	M	59	13	N – 6 S – 4 E – 4 W -4	Good	Good vigour and good form. Slight lean north.	A >60 years	
2216	*Acer pseudoplatanus*	Sycamore	EM	36	12	N – 0 S – 4 E – 1 W - 4	Fair	Fair vigour and fair form. Slightly suppressed.	A >40 years	
2217	*Fagus sylvatica*	Beech	M	39	12	N – 4 S – 2 E – 3 W - 3	Good	Good vigour and fair form.	A >60 years	
2218	*Fagus sylvatica*	Beech	M	53	14	N – 6 S – 5 E – 5 W - 4	Good	Good vigour and good form.	A >60 years	

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2219	*Acer pseudoplatanus*	Sycamore	EM	28	10	N – 2 S – 2 E – 3 W - 2	Fair	Good vigour and fair form.	A >40 years	
2220	*Acer pseudoplatanus*	Sycamore	M	42	10	N – 4 S – 3 E – 3 W - 4	Fair	Good vigour and fair form. Pruned and lowered in the past.	A >40 years	Reshape the crown.
2221	*Acer pseudoplatanus*	Sycamore	M	45	10	N – 4 S – 2 E – 4 W -3	Fair	Good vigour and fair form. Pruned and lowered in the past.	A >40 years	Reshape the crown.
2222	*Acer pseudoplatanus*	Sycamore	M	53	10	N – 5 S – 4 E – 4 W - 4	Fair	Fair vigour and fair form. Pruned and lowered in the past.	A >40 years	Reshape the crown.
2223	*Acer pseudoplatanus*	Sycamore	M	39	10	N – 4 S – 4 E – 4 W - 2	Good	Good vigour and fair form.	A >40 years	
2224	*Fagus sylvatica*	Beech	M	52 41 36 33	14	N – 6 S – 5 E – 7 W - 5	Fair	Good vigour and fair form. Multistemed. Pruned in the past.	A >60 years	Remove crossing limbs. Thin, clean and reshape the crown.

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2225	*Acer pseudoplatanus*	Sycamore	M	39 30 31	14	N – 4 S – 5 E – 4 W - 4	Fair	Good vigour and fair form. Multistemed. Ivy.	A >40 years	Clean the crown. Sever ivy at base of main stem.
2226	*Acer pseudoplatanus*	Sycamore	M	64	18	N – 7 S – 5 E – 6 W - 5	Fair	Good vigour and fair form. Pruned and lowered in the past.	A >40 years	Thin, clean and reshape the crown.
2227	*Fagus sylvatica*	Beech	M	82	20	N – 8 S – 6 E – 5 W -5	Good	Good vigour and good form. Pruned in the past.	A >50 years	Thin, clean and reshape the crown.
2228	*Acer platanoides*	Maple	EM	28	7	N – 2 S – 2 E – 3 W - 2	Fair	Fair vigour and fair form. Lowered and pruned in past to facilitate overhead powerlines.	B <20 years	Thin, clean and reshape the crown. Tree to be removed to facilitate proposed scheme.
2229	*Prunus*	Plum	EM	18 26 19	7	N – 2 S – 3 E – 3 W - 3	Fair	Fair vigour and fair form. Lowered and pruned in past to facilitate overhead powerlines.	B <20 years	Clean and reshape the crown Tree to be removed to facilitate proposed scheme.
2230	*Acer platanoides*	Maple	EM	37	7	N – 2 S – 3 E – 3 W - 3	Fair	Fair vigour and fair form. Lowered and pruned in. past to facilitate overhead powerlines.	B <20 years	Thin, clean and reshape the crown Tree to be removed to facilitate proposed scheme.

Tree No	**Species Botanical Name**	**Common Name**	**Age Y SM EM M OM V**	**DBH (cms)**	**Height (m) --------- Height of clear stem**	**Crown Span (m)**	**Physiological Condition -Good -Fair -Poor -Dead**	**Comments Structural Observations**	**Retention Category A-High B-Moderate C-Low U-Fell -Lifespan**	**Preliminary Management Recommendations Priority A, B, C or U**
2231	*Fagus sylvatica*	Beech	M	64	12	N – 6 S – 7 E – 6 W - 6	Good	Good vigour and good form.	A >60 years	
2232	*Tilia cordata*	Lime	M	45	14	N – 3 S – 2 E – 4 W - 2	Good	Good vigour and good form. Close to buildings.	A >40 years	Reduce by 20%, clean and reshape the crown.
2233	*Tilia cordata*	Lime	EM	32	10	N – 1 S – 2 E – 2 W -2	Good	Good vigour and good form.	A >50 years	
2234	*Sorbus aria*	Whitebeam	SM	20	5	N – 1 S – 1 E – 2 W - 1	Fair	Fair vigour and fair form.	A >30 years	
2235	*Acer pseudoplatanus*	Sycamore	EM	40	13	N – 4 S – 4 E – 4 W - 5	Good	Good vigour and good form.	A >40 years	Tree to be removed to facilitate proposed scheme.
2236	*Sorbus Aucuparia*	Mt Ash	EM	34	7	N – 4 S – 3 E – 3 W - 3	Good	Good vigour and good form.	A >40 years	Tree to be removed to facilitate proposed scheme.

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2237	*Sorbus Aucuparia*	Mt Ash	EM	23	6	N – 2 S – 2 E – 2 W - 2	Good	Good vigour and good form.	A >40 years	Tree to be removed to facilitate proposed scheme.
2238	*Fraxinus excelsior*	Ash	M	44	12	N – 3 S – 4 E – 4 W - 4	Fair	Fair vigour and good form. Early stages of ash dieback disease.	C <10 years	Clean and monitor decline. Tree to be removed to facilitate proposed scheme.
2239	*Sorbus Aucuparia*	Mt Ash	SM	16	7	N – 1 S – 2 E – 2 W -1	Good	Good vigour and good form.	A >50 years	Tree to be removed to facilitate proposed scheme.
2240	*Sorbus Aucuparia*	Mt Ash	SM	24	7	N – 2 S – 2 E – 1 W - 2	Good	Good vigour and good form.	A >50 years	
2241	*Sorbus Aucuparia*	Mt Ash	EM	27	7	N – 2 S – 2 E – 2 W - 2	Good	Good vigour and good form.	A >50 years	Tree to be removed to facilitate proposed scheme.
2242	*Acer platanoides*	Maple	Y	12 12 10 10	5	N – 2 S – 2 E – 2 W - 2	Fair	Good vigour and fair form. Multistemed.	A >40 years	Thin, clean and reshape the crown. Tree to be removed to facilitate proposed scheme.

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2243	*Acer platanoides*	Maple	SM	17	5	N – 2 S – 2 E – 2 W - 2	Fair	Fair vigour and fair form. Decay at base of main stem.	A >40 years	Clean and monitor Tree to be removed to facilitate proposed scheme.
2244	*Prunus avium*	Cherry	Y	12 12 12 13	5	N – 4 S – 1 E – 3 W - 3	Fair	Fair vigour and good form.	A <30 years	Tree to be removed to facilitate proposed scheme.
2245	*Acer platanoides*	Maple	SM	16	5	N – 2 S – 2 E – 2 W -2	Good	Good vigour and good form.	A >50 years	Tree to be removed to facilitate proposed scheme.
2246	*Acer platanoides*	Maple	SM	24	6	N – 3 S – 3 E – 3 W - 3	Good	Good vigour and good form.	A >50 years	Tree to be removed to facilitate proposed scheme.
2247	*Prunus avium*	Cherry	Y	14 12 11 10	4	N – 4 S – 3 E – 3 W - 3	Good	Good vigour and good form.	A >40 years	
2248	*Quercus ilex*	Holm oak	Y	9	4	N – 1 S – 1 E – 1 W - 1	Good	Pruned and shaped.	A >40 years	Maintain current shape. Remove stake.

Tree No	**Species Botanical Name**	**Common Name**	**Age** **Y** **SM** **EM** **M** **OM** **V**	**DBH (cms)**	**Height (m)** **---------** **Height of clear stem**	**Crown Span (m)**	**Physiological Condition** **-Good** **-Fair** **-Poor** **-Dead**	**Comments Structural Observations**	**Retention Category** **A-High** **B-Moderate** **C-Low** **U-Fell** **-Lifespan**	**Preliminary Management Recommendations** **Priority** **A, B, C or U**
2249	*Quercus ilex*	Holm oak	Y	10	4	N – 1 S – 1 E – 1 W - 1	Good	Pruned and shaped.	A >40 years	Maintain current shape Remove stake.
2250	*Quercus ilex*	Holm oak	Y	8	4	N – 1 S – 1 E – 1 W - 1	Good	Pruned and shaped.	A <40 years	Maintain current shape. Remove stake.
2251	*Quercus ilex*	Holm oak	Y	8	4	N – 1 S – 1 E – 1 W -1	Good	Pruned and shaped.	A >40 years	Maintain current shape. Remove stake.
2252	*Quercus ilex*	Holm oak	Y	8	4	N – 1 S – 1 E – 1 W - 1	Good	Prunes and shaped.	A >40 years	Maintain current shape. Remove stake.
2253	*Populus*	Poplar	EM	32	16	N – 1 S – 1 E – 3 W - 3	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2254	*Populus*	Poplar	EM	34	16	N – 1 S – 1 E – 4 W - 4	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.
2255	*Populus*	Poplar	EM	30	16	N – 1 S – 1 E – 4 W - 4	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.
2256	*Populus*	Poplar	EM	36	16	N – 1 S – 3 E – 3 W - 4	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2257	*Populus*	Poplar	EM	32	16	N – 2 S – 3 E – 2 W -1	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.
2258	*Populus*	Poplar	EM	27	16	N – 2 S – 2 E – 1 W - 1	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.
2259	*Populus*	Poplar	EM	25	16	N – 3 S – 3 E – 1 W - 1	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.

Tree No	**Species Botanical Name**	**Common Name**	**Age Y SM EM M OM V**	**DBH (cms)**	**Height (m) --------- Height of clear stem**	**Crown Span (m)**	**Physiological Condition -Good -Fair -Poor -Dead**	**Comments Structural Observations**	**Retention Category A-High B-Moderate C-Low U-Fell -Lifespan**	**Preliminary Management Recommendations Priority A, B, C or U**
2260	*Populus*	Poplar	EM	31	16	N – 3 S – 4 E – 1 W - 1	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments. Ivy.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. Sever ivy. To be removed to facilitate proposed scheme.
2261	*Populus*	Poplar	EM	36	16	N – 4 S – 4 E – 2 W - 1	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments. Ivy.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. Sever ivy. To be removed to facilitate proposed scheme.
2262	*Populus*	Poplar	EM	37	16	N – 4 S – 4 E – 2 W - 1	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments. Ivy.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. Sever ivy. To be removed to facilitate proposed scheme.

Tree No	**Species Botanical Name**	**Common Name**	**Age Y SM EM M OM V**	**DBH (cms)**	**Height (m) --------- Height of clear stem**	**Crown Span (m)**	**Physiological Condition -Good -Fair -Poor -Dead**	**Comments Structural Observations**	**Retention Category A-High B-Moderate C-Low U-Fell -Lifespan**	**Preliminary Management Recommendations Priority A, B, C or U**
2263	*Populus*	Poplar	EM	34	16	N – 4 S – 3 E – 2 W -2	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.
2264	*Populus*	Poplar	EM	32	16	N – 3 S – 3 E – 2 W - 1	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.
2265	*Populus*	Poplar	EM	35	16	N – 4 S – 3 E – 2 W - 1	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2266	*Populus*	Poplar	EM	39	16	N – 3 S – 4 E – 2 W - 2	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments. Ivy.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. Sever ivy. To be removed to facilitate proposed scheme.
2267	*Populus*	Poplar	EM	35	16	N – 3 S – 4 E – 3 W - 1	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments. Ivy.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. Sever ivy. To be removed to facilitate proposed scheme.
2268	*Populus*	Poplar	EM	38	16	N – 4 S – 4 E – 2 W - 1	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2269	*Populus*	Poplar	M	44	16	N – 4 S – 4 E – 2 W -2	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.
2270	*Populus*	Poplar	M	48	16	N – 4 S – 3 E – 3 W - 2	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.
2271	*Populus*	Poplar	EM	38	15	N – 3 S – 4 E – 1 W - 2	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments. Ivy.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. Sever ivy. To be removed to facilitate proposed scheme.

Tree No	**Species Botanical Name**	**Common Name**	**Age** **Y** **SM** **EM** **M** **OM** **V**	**DBH (cms)**	**Height (m)** **---------** **Height of clear stem**	**Crown Span (m)**	**Physiological Condition** **-Good** **-Fair** **-Poor** **-Dead**	**Comments Structural Observations**	**Retention Category** **A-High** **B-Moderate** **C-Low** **U-Fell** **-Lifespan**	**Preliminary Management Recommendations** **Priority** **A, B, C or U**
2272	*Populus*	Poplar	M	56	16	N – 4 S – 4 E – 2 W - 2	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments. Ivy.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. Sever ivy. To be removed to facilitate proposed scheme.
2273	*Populus*	Poplar	EM	37	16	N – 3 S – 4 E – 2 W - 2	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments. Ivy.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. Sever ivy. To be removed to facilitate proposed scheme.
2274	*Populus*	Poplar	EM	32	16	N – 3 S – 3 E – 1 W - 1	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments. Ivy.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. Sever ivy. To be removed to facilitate proposed scheme.

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2275	*Populus*	Poplar	EM	32	15	N – 3 S – 3 E – 1 W -1	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments. Ivy.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. Sever ivy. To be removed to facilitate proposed scheme.
2276	*Populus*	Poplar	EM	36	16	N – 3 S – 3 E – 2 W - 1	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments. Ivy.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. Sever ivy. To be removed to facilitate proposed scheme.
2277	*Populus*	Poplar	EM	31	14	N – 3 S – 3 E – 2 W - 2	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. To be removed to facilitate proposed scheme.

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2278	*Populus*	Poplar	EM	36 35	16	N – 4 S – 4 E – 2 W - 2	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments. Ivy.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. Sever ivy. To be removed to facilitate proposed scheme.
2279	*Populus*	Poplar	EM	56	16	N – 4 S – 4 E – 5 W - 2	Fair	Good vigour and fair form. Lowered in the past. New growth with weak attachments. Ivy.	B <20 years	Lower back to original cut in short term and repeat every 5 to 7 years to avoid limb and stem failure. Sever ivy. To be removed to facilitate proposed scheme.
2280	*Palmaceae*	Palm	Y	20	5	N – 1 S – 1 E – 1 W - 1	Fair	Good vigour and fair form.	A >30 years	To be removed to facilitate proposed scheme.
2281	*Alnus*	Alder	EM	32 26	10	N – 4 S – 2 E – 3 W -3	Fair	Good vigour and good form. Forked at .5m. Crown lowered in the past.	A >40 years	
2282	*Alnus*	Alder	EM	35	11	N – 5 S – 3 E – 3 W - 2	Fair	Fair vigour and fair form. Lean north.	A >40 years	Reshape the crown. Tree to be removed to facilitate proposed scheme.

Tree No	**Species Botanical Name**	**Common Name**	**Age** **Y** **SM** **EM** **M** **OM** **V**	**DBH (cms)**	**Height (m)** **---------** **Height of clear stem**	**Crown Span (m)**	**Physiological Condition** **-Good** **-Fair** **-Poor** **-Dead**	**Comments Structural Observations**	**Retention Category** **A-High** **B-Moderate** **C-Low** **U-Fell** **-Lifespan**	**Preliminary Management Recommendations** **Priority** **A, B, C or U**
2283	*Alnus*	Alder	SM	20	11	N – 2 S – 1 E – 1 W - 2	Good	Good vigour and fair form.	A >40 years	Tree to be removed to facilitate proposed scheme.
2284	*Betula*	Birch	Y	9	5	N – 1 S – 1 E – 1 W - 1	Fair	Fair vigour and fair form.	A >40 years	Tree to be removed to facilitate proposed scheme.
2285	*Betula*	Birch	Y	11	5	N – 0 S – 1 E – 1 W - 1	Fair	Fair vigour and fair form.	A >40 years	Tree to be removed to facilitate proposed scheme.
2286	*Alnus*	Alder	EM	29	11	N – 4 S – 1 E – 2 W - 2	Fair	Good vigour and fair form. Ivy.	A >40 years	Sever ivy. Tree to be removed to facilitate proposed scheme.
2287	*Alnus*	Alder	SM	18	10	N – 2 S – 1 E – 4 W -0	Fair	Good vigour and fair form. Lean east due to competition.	A >40 years	Monitor. Tree to be removed to facilitate proposed scheme.
2288	*Alnus*	Alder	EM	25 18	11	N – 3 S – 3 E – 3 W - 2	Good	Good vigour and fair form. Forked at 0.5m.	A >40 years	Tree to be removed to facilitate proposed scheme.

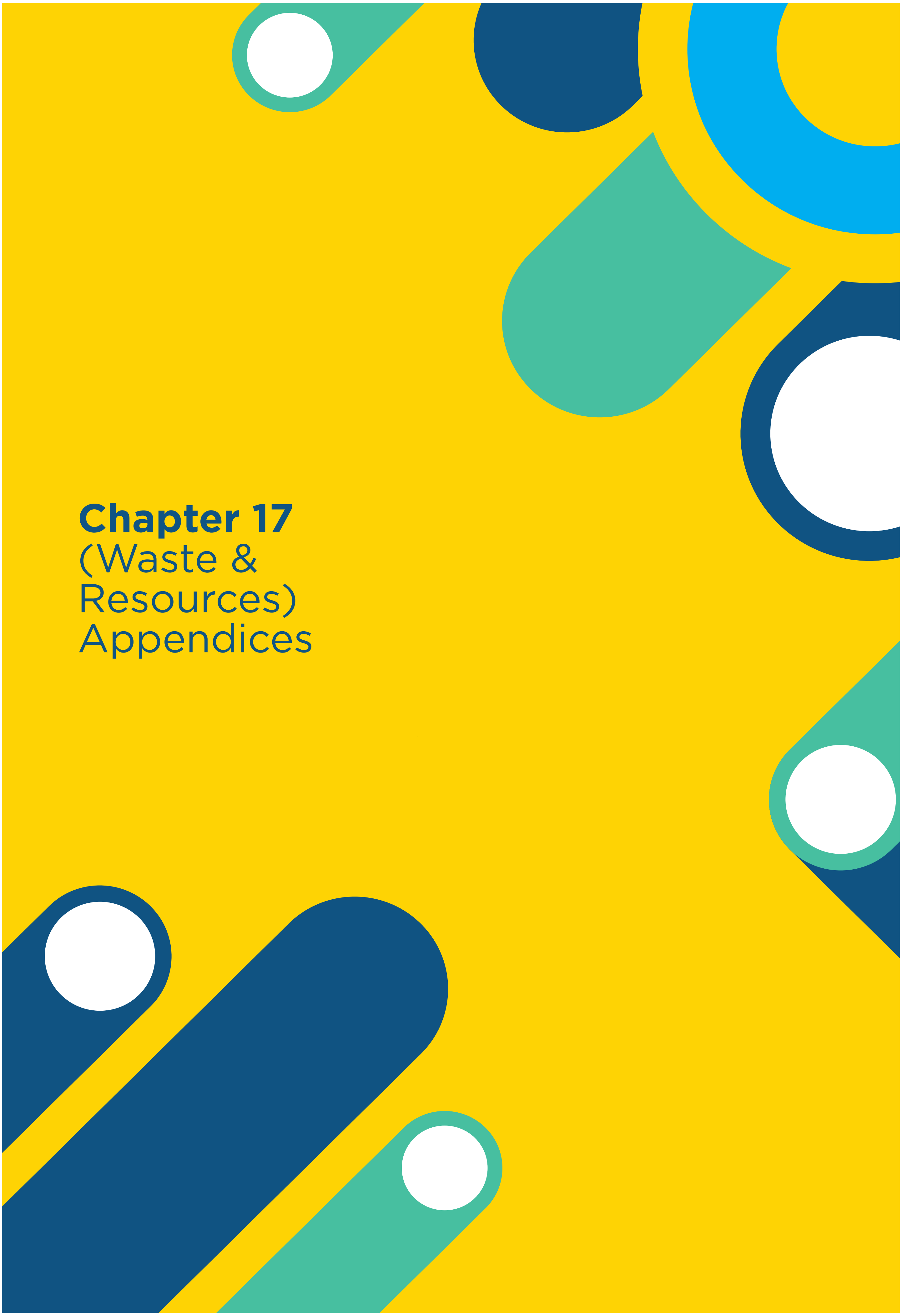
Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2289	*Betula*	Birch	SM	16	7	N – 2 S – 1 E – 1 W - 1	Good	Good vigour and fair form.	A >40 years	
2290	*Betula*	Birch	Y	11	6	N – 2 S – 1 E – 1 W - 1	Fair	Fair vigour and fair form.	A >40 years	
2291	*Betula*	Birch	SM	21	7	N – 1 S – 2 E – 1 W - 1	Fair	Fair vigour and fair form. Ivy.	A >40 years	Sever ivy at base of main stem.
2292	*Acer pseudoplatanus*	Sycamore	Y	10 10 8	4	N – 2 S – 2 E – 2 W - 2	Fair	Good vigour and fair form. Multistemed.	A >40 years	
2293	*Acer pseudoplatanus*	Sycamore	SM	18	7	N – 2 S – 2 E – 2 W -2	Good	Good vigour and good form.	A >40 years	
2294	*Prunus avium*	Cherry	M	48	8	N – 5 S – 5 E – 6 W - 5	Good	Good vigour and good form.	A >40 years	

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2295	*Prunus*	Plum	EM	38	7	N – 3 S – 2 E – 3 W - 3	Good	Good vigour and fair form.	A >40 years	
2296	*Sorbus aria*	Whitebeam	M	45	9	N – 4 S – 4 E – 5 W - 3	Good	Good vigour and good form.	A >40 years	
2297	*Acer pseudoplatanus*	Sycamore	M	80	15	N – 8 S – 9 E – 7 W - 6	Good	Good vigour and fair form. Open crown. Ivy.	A >40 years	Thin, clean and reshape the crown. Sever ivy at base of main stem.
2298	*Populus*	Poplar	M	90	17	N – 6 S – 5 E – 4 W - 4	Fair	Good vigour and fair form. Aggressive roots.	B <30 years	Removal was considered for the medium term. Final decision is to retain tree in the short term.
2299	*Populus*	Poplar	SM	21	10	N – 3 S – 2 E – 2 W -3	Fair	Good vigour and fair form.	B <30 years	
2300	*Betula*	Birch	EM	16	9	N – 2 S – 2 E – 2 W - 1	Good	Good vigour and fair form.	A >40 years	

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2301	*Pterocarya*	Wing-Nut	M	92	14	N – 5 S – 4 E – 7 W - 6	Good	Good vigour and fair form. Pruned and cleaned in the past. High amenity value tree.	A >50 years	Protect this significant specimen tree.
2302	*Sorbus aucuparia*	Mt. Ash	Y	12	4	N – 1 S – 1 E – 1 W - 1	Fair	Fair vigour and fair form.	A >40 years	
2303	*Crataegus*	Hawthorn	Y	12	3	N – 2 S – 2 E – 2 W - 2	Good	Good vigour and good form.	A >50 years	
2304	*Acer pseudoplatanus*	Sycamore	EM	38	11	N – 4 S – 2 E – 3 W - 3	Fair	Good vigour and fair form. Laden with ivy. Sucker growth at base.	A >40 years	Sever ivy at base of main stem. Remove sucker growth.
2305	*Acer pseudoplatanus*	Sycamore	M	46	11	N – 9 S – 1 E – 4 W -3	Fair	Good vigour and poor form. Heavy lean due to competition from neighbour. Laden with ivy.	B >20 years	Retain, clean, and reshape the crown. Reshape due to heavy lean. Sever ivy at base of main stem.
2306	*Acer pseudoplatanus*	Sycamore	M	112	17	N – 7 S – 7 E – 8 W - 6	Good	Good vigour and good form. Laden with ivy. Large open crown.	A >40 years	Thin, clean and reshape the crown. Sever ivy at base of main stem.

Tree No	Species Botanical Name	Common Name	Age Y SM EM M OM V	DBH (cms)	Height (m) --------- Height of clear stem	Crown Span (m)	Physiological Condition -Good -Fair -Poor -Dead	Comments Structural Observations	Retention Category A-High B-Moderate C-Low U-Fell -Lifespan	Preliminary Management Recommendations Priority A, B, C or U
2307	*Populus*	Poplar	EM	26	10	N – 3 S – 1 E – 1 W - 3	Fair	Good vigour and fair form.	B <30 years	Tree to be removed to facilitate proposed scheme.
2308	*Betula*	Birch	Y	11	8	N – 2 S – 1 E – 1 W - 0	Fair	Fair vigour and fair form.	A >40 years	Tree to be removed to facilitate proposed scheme.
0353	*Prunus*	Cherry	EM	46	6	N – 4 S – 5 E – 4 W -4	Good	Good vigour and good form.	A <30 years	
0397	*Acer platanoides*	Maple	EM	35	8	N – 4 S – 4 E – 4 W - 4	Good	Good vigour and good form.	A >40 years	
0398	*Prunus*	Cherry	EM	44	7	N – 5 S – 4 E – 4 W - 4	Good	Good vigour and good form.	A >40 years	Tree to be removed to facilitate proposed scheme.
0399	*Acer platanoides*	Maple	EM	34	7	N – 4 S – 4 E – 4 W - 4	Good	Good vigour and good form.	A >40 years	Tree to be removed to facilitate proposed scheme.

Tree No	**Species Botanical Name**	**Common Name**	**Age** **Y** **SM** **EM** **M** **OM** **V**	**DBH (cms)**	**Height (m)** **---------** **Height of clear stem**	**Crown Span (m)**	**Physiological Condition** **-Good** **-Fair** **-Poor** **-Dead**	**Comments Structural Observations**	**Retention Category** **A-High** **B-Moderate** **C-Low** **U-Fell** **-Lifespan**	**Preliminary Management Recommendations** **Priority** **A, B, C or U**
0400	*Prunus*	Cherry plum	EM	34	6	N – 2 S – 3 E – 3 W - 2	Good	Good vigour and good form.	A >40 years	
2397	*Malus sylvestris*	Crab Apple	SM	20	4	N – 1 S – 2 E – 3 W - 1	Good	Good vigour and good form	A >40 years	NWR
2398	*Prunus*	Bird cherry	Y	14	5	N – 2 S - 2 E – 2 W – 2	Good	Good vigour and good form	A >40 years	NWR



Chapter 17

(Waste & Resources) Appendices

Appendix

17.1 Legislation and Policy

Contents

A1 17.1: Legislation and Policy

A1.1 Legislation

European

Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (Text with EEA relevance)

Directive 2008/98/EC, known as the "Waste Framework Directive" came into force on 12th December 2008, and Ireland had two years from this date to implement it into national law. It provides for a general framework of waste management requirements and sets the basic waste management definitions for the EU.

The Directive lays down the five-step hierarchy of waste management options, with waste prevention as the preferred option, followed by re-use, recycling, recovery and safe disposal, in descending order. In addition, the Directive also deals with the issue of 'end of waste' and clarifies the definitions of recovery, disposal and by-product. The directive states that, 'The recovery of waste and the use of recovered material as raw materials should be encouraged in order to conserve natural resources.'

Directive 2008/98/EC amending Directive 2008/98/EC on waste

This Directive amends the Waste Framework Directive or Directive 2008/98/EC. It provides a number of updated waste management definitions. The Directive allows Member States to use economic instruments including taxes and levies as an incentive for the application of the waste hierarchy. The Directive was transposed into national law in August 2020 - S.I. No. 322 of 2020.

The Directive sets targets for the preparing for re-use and the recycling of municipal waste as follows:

- By 2025, at a minimum 55% (by weight) will be prepared for re-use or recycling
- By 2030, at a minimum 60% (by weight) will be prepared for re-use or recycling
- By 2035, at a minimum 65% (by weight) will be prepared for re-use or recycling

With regards construction and demolition waste, Member States must take measures to promote selective demolition in order to enable removal and safe handling of hazardous substances, facilitate re-use and high-quality recycling. It obligates Member States to take measures to prevent waste generation including reduction of waste generation in processes related to construction and demolition, taking into account best available techniques.

Commission Decision of 18 December 2014, amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European parliament and of the Council (2014/955/EEC) and Commission Regulation (EU) No 1357/2014 of 18 December 2014, replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives.

This decision and regulation consolidates the legislation relating to waste classification and allows the generators of waste to classify the waste as hazardous or non-hazardous and in the process assigning the correct List of Waste entry. Each list of waste entry is a three digit code which is closely linked to the list of the main characteristics which render waste hazardous contained in Annex III to the Waste Framework Directive. It is noted that Council Regulation (EU) 2017/997 of 8 June 2017 amending Annex 111 to Directive 2008/98/EC of the European parliament and of the Council as regards the hazardous property HP 14 'Ecotoxic' provides additional criteria in relation to determining whether ecotoxicity of wastes would result in a hazardous classification.

A1.2 National

Waste Management Acts, 1996, as amended and Regulations Made under the Acts

The Waste Management Act, 1996 was enacted in May 1996 and sets out the responsibilities and functions of various persons in relation to waste. This was subsequently amended by a number of subsequent acts including the Waste Management (Amendment) Act 2001 and the Protection of the Environment Act 2003. The Act:

- Prohibits any person from holding, transporting, recovering or disposing of waste in a manner which causes or is likely to cause environmental pollution.
- Requires any person who carries on activities of an agricultural, commercial or industrial nature to take all such reasonable steps as are necessary to prevent or minimise the production of waste.
- Prohibits the transfer of waste to any person other than an authorised person (i.e. a holder of a waste collection permit or a local authority).
- Requires the Environmental Protection Agency (EPA) to make a national plan in relation to hazardous waste.
- Requires local authorities to make waste management plans in relation to non-hazardous waste.
- Imposes certain obligations on local authorities to ensure that a service is provided for collection of household waste and to provide facilities for the recovery and disposal of such waste.
- Enables the Minister for the Environment and Local Government to make Regulations for various purposes to promote better waste management.
- Provides for substantial penalties for offences including fines, imprisonment and/or liability for clean-up measures.

Waste Management (Collection Permit) Regulations, 2007, S.I. No 820 of 2008, as amended

Waste from the proposed development may only be collected by the holder of a waste collection permit or a local authority. Waste collection permits are granted in accordance with the Waste Management (Collection Permit) Regulations, 2007 as amended. Waste storage and collection areas on site should be designed to prevent environmental pollution. These regulations were amended and updated in 2008, 2012 and 2019.

Waste Management (Shipments of Waste) Regulations 2007, S.I. No. 419 of 2007

Where waste from the Proposed Scheme is exported outside of Ireland for recovery or disposal the National Transfrontier Shipment (TFS) Office within Dublin City Council must be notified. Certain financial guarantees must be in place and a certificate issued by the National TFS Office prior to the waste movement taking place.

S.I. No. 323 of 2020 - European Union (Waste Directive) Regulations 2020 amending European Communities (Waste Directive) Regulations 2011, S.I. No. 126 of 2011

The amended regulations which were adopted in 2011 significantly changed the provisions of the Waste Management Acts, 1996 to 2008.

The 2011 regulations are now amended by S.I. No. 323 of 2020 - European Union (Waste Directive) Regulations 2020 giving effect to Directive 2018/851 of the European Parliament and of the Council of 30 May 2018 on waste as per the above. This amends definition of "waste" and "non-hazardous waste".

The Regulations define "waste disposal" and "waste recovery" as well as setting out tests which must be complied with in order for material to be described as a "by-product" or achieve "end of waste" status.

The Regulations formally set out the following waste hierarchy which shall apply as a priority order in waste prevention and management legislation and policy:

(a) prevention;

(b) preparation for re-use;

(c) recycling;

(d) other recovery (including energy recovery); and

(e) disposal.

The Regulations require that all waste management plans and hazardous waste management plans in existence at the commencement of the Regulations shall be evaluated by 31 December 2012 and where appropriate be revised to be brought into line with Directive 2006/12/EC on Waste.

The Regulations also require the Environment Agency to establish a waste prevention programme by December 2013.

European Union (Waste Directive) Regulations 2020 S.I. No. 323 of 2020

These regulations give effect to Directive 2018/851 of the European Parliament and of the Council of 30 May 2018 on waste as per the above.

This provides new definitions for a number of key terms including "waste" and "non-hazardous waste", "bio-waste", "waste management", "waste prevention", "backfilling" and "construction and demolition waste".

A1.2.1 European Policy

Europe 2020 Strategy, European Commission (2010)

Europe 2020 is the European Union's ten-year growth strategy published in 2010. A key focus of the strategy is to support the shift towards a resource-efficient, low-carbon economy by decoupling economic growth from resource use and reducing the resource intensity of what we use and consume.

Roadmap to a Resource Efficient Europe, European Commission (2011)

The Roadmap to a Resource Efficient Europe outlines a "roadmap" to transform Europe's economy into a sustainable one by 2050.

It proposes ways to increase resource productivity and decouple economic growth from resource use and its environmental impact. The roadmap aims to address resource inefficiency in the sectors that are responsible for the greatest share of environmental impacts – namely food, buildings and mobility, whose combined effects account for 70-80% of all environmental impacts.

Measures are set out aimed at transforming production and consumption, with incentives for investors to promote green innovation, and a greater role for eco-design, eco-labelling, and greener spending by public bodies. Governments are invited to shift taxation away from labour towards pollution and resources, and to provide fresh incentives to push consumers towards resource-efficient products. The roadmap also recommends adapting prices to reflect the real costs of resource use, especially on environment and health.

7th Environmental Action Programme, European Commission (2014)

The 7th Environmental Action Programme came into force in January 2014 and guided European environment policy until 2020. A key objective of the programme was to turn the Union into a resource-efficient, green and competitive low carbon economy. There was a special focus on turning waste into a resource, with more prevention, re-use and recycling, and phasing out wasteful and damaging practices like landfilling. By 2020 the European Union and member states were to ensure that:

- The environment and human health are protected by preventing or reducing the adverse impacts of the generation and management of waste;
  - Per capita waste generation and waste generation in absolute terms are reducing; and
  - Landfilling is phased out for recyclables and recoverable wastes and limiting energy recovery to non-recyclable materials.

European Commission Circular Economy Strategy (2015, 2018, 2020)

In December 2015 the European Commission adopted an ambitious Circular Economy Package, which includes revised legislative proposals on waste to stimulate Europe's transition towards a circular economy.

The Circular Economy Package consists of an EU Action Plan for the Circular Economy that establishes a programme of action, with measures covering the whole cycle: from production and consumption to waste management and the market for secondary raw materials. The annex to the action plan sets out the timeline when the actions will be completed.

The proposed actions will contribute to "closing the loop" of product lifecycles through greater recycling and re-use, and bring benefits for both the environment and the economy.

The revised legislative proposals on waste set clear targets for reduction of waste and establish an ambitious and credible long-term path for waste management and recycling. Key elements of the revised waste proposal include:

- An EU target for recycling 65% of municipal waste by 2030;
- An EU target for recycling 75% of packaging waste by 2030;
- A target to reduce landfill to maximum of 10% of all waste by 2030;
- A ban on landfilling of separately collected waste;
- Promotion of economic instruments to discourage landfilling;
- Simplified, improved definitions and harmonised calculation methods for recycling rates throughout the EU;
- Concrete measures to promote re-use and stimulate industrial symbiosis - turning one industry's by-product into another industry's raw material; and
- Economic incentives for producers to put greener products on the market and support recovery and recycling schemes (e.g. for packaging, batteries, electric and electronic equipment, vehicles).

The Circular Economy Package was updated in 2018 to comprise a new set of measures including:

- A Europe-wide EU Strategy for Plastics in the Circular Economy;
- A Communication on options to address the interface between chemical, product and waste legislation;
- A Monitoring Framework on progress towards a circular economy at EU and national level; and
- A Report on Critical Raw Materials and the circular economy.

It was subsequently further updated in 2020 (see below).

Key legislative measures adopted to date under the plan include:

- Directive (EU) 2018/851 amending Directive 2008/98/EC on waste;
- Directive (EU) 2018/850 amending Directive 1999/31/EC on the landfill of waste;
- Directive (EU) 2018/852 amending Directive 94/62/EC on packaging and packaging waste;
- Directive (EU) 2018/849 amending Directives 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment; and
- European Commission, 2020. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – A new Circular Economy Action Plan For a cleaner and more competitive Europe. COM (2020).

EU Circular Economy Action Plan 2020

In March 2020 the European Commission adopted the second EU Circular Economy Action Plan. The action plan adopted initiatives along the entire life cycle of products, targeting for example, their design, promoting circular economy processes, fostering consumption and aiming to ensure that resources used are kept in the EU economy for as long as possible.

Construction and Demolition is identified as a priority value chain in the plan and the Commission is drafting a Strategy for a Sustainable Built Environment which will promote circularity principles through the lifecycle of buildings by:

- Addressing the sustainability performance of construction products in the context of the revision of the Construction Product Regulation, including the possible introduction of recycled content requirements for certain construction products, taking into account their safety and functionality;
- Promoting measures to improve the durability and adaptability of built assets in line with the circular economy principles for buildings design and developing digital logbooks for buildings;
- Using Level(s) to integrate life cycle assessment in public procurement and the EU sustainable finance framework and exploring the appropriateness of setting of carbon reduction targets and the potential of carbon storage;
- Considering a revision of material recovery targets set in EU legislation for construction and demolition waste and its material-specific fractions; and
- Promoting initiatives to reduce soil sealing, rehabilitate abandoned or contaminated brownfields and increase the safe, sustainable and circular use of excavated soils.

Furthermore, the ‘Renovation Wave’ initiative announced in the European Green Deal to lead to significant improvements in energy efficiency in the EU will be implemented in line with circular economy principles, notably optimised lifecycle performance, and longer life expectancy of build assets. As part of the revision of the recovery targets for construction and demolition waste, the Commission will pay special attention to insulation materials, which generate a growing waste stream.

European Commission, 2020. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – A new Circular Economy Action Plan For a cleaner and more competitive Europe. COM (2020).

The European Commission has adopted a new Circular Economy Action Plan - one of the main blocks of the European Green Deal, Europe’s new agenda for sustainable growth.

The new Action Plan announces initiatives along the entire life cycle of products, targeting for example their design, promoting circular economy processes, fostering sustainable consumption, and aiming to ensure that the resources used are kept in the EU economy for as long as possible.

It introduces legislative and non-legislative measures targeting areas where action at the EU level brings real added value.

- The new Circular Economy Action Plan presents measures to:
- Make sustainable products the norm in the EU;
- Empower consumers and public buyers;
- Focus on the sectors that use most resources and where the potential for circularity is high such as: electronics and ICT; batteries and vehicles; packaging; plastics; textiles; construction and buildings; food; water and nutrients;
- Ensure less waste;
- Make circularity work for people, regions and cities; and
- Lead global efforts on circular economy.

European Commission (2019) European Green Deal

The European Green Deal, published by the European Commission in December 2019, provides an action plan to boost the efficient use of resources by moving to a clean, circular economy while cutting pollution and restoring biodiversity.

The plan outlines investments needed and financing tools available. It explains how to ensure a just and inclusive transition.

The EU aims to be climate neutral in 2050. A European Climate Law has been proposed by the European Commission to turn this political commitment into a legal obligation. Reaching this target will require action by all sectors of the Irish economy, including:

- Investing in environmentally friendly technologies;
- Supporting industry to innovate;
- Rolling out cleaner, cheaper and healthier forms of private and public transport;
- Decarbonising the energy sector;
- Ensuring buildings are more energy efficient; and
- Working with international partners to improve global environmental standards.

A1.3 National Policy

A1.3.1 Introduction

The first national waste policy statement was published by the Department of Environment and Local Government in 1998.

A number of statements have been published since, each of which builds on the objectives of the previous plans to improve how waste is managed in Ireland, move waste away from landfill and towards a more sustainable option. The statements published to date include:

- Department of the Environment and Local Government (1998). 'Waste Management - Changing Our Ways' – A Policy Statement.
- Department of the Environment and Local Government (2002). Preventing and Recycling Waste – Delivering Change – A Policy Statement.
- Department of the Environment, Heritage and Local Government (2004). Waste Management - Taking Stock and Moving Forward.
- Department of the Environment, Heritage and Local Government (2006). National Strategy on Biodegradable Waste Management.
- Department of the Environment, Heritage and Local Government (2012). A Resource Opportunity- Waste Management Policy in Ireland.

From 2012 a number of policy documents and reports have been published which are summarised in the sections below.

Department of the Environment, Heritage and Local Government (2012). A Resource Opportunity – Waste Management Policy in Ireland

This policy document sets out measures through which Ireland will increase recycling rates and reduce delivery of waste to landfill following coming into force of the EU Waste Framework Directive. Key measures set out in the report are as follows:

- Significant reduction of Planning Regions from ten to three. A review of regional waste management plans will be undertaken to comply with the requirements of the Waste Framework Directive.
- Timing and nature of the application of landfill bans will be considered taking into account the level of diversion being achieved and the development of viable beneficial uses for waste in support of the virtual elimination of our dependence on landfill.
- Ireland requires an adequate network of quality waste treatment facilities. The EPA will undertake a review of recovery infrastructure to advise on national requirements for managing municipal waste in accordance with the principles of proximity and self-sufficiency.
- All householders will be obliged to demonstrate that they are availing of an authorised waste collection service or are otherwise managing their waste in an environmentally acceptable manner.

- Through waste collection permits waste collectors will be required to manage waste in accordance with the waste hierarchy and operate pricing structures to incentivise environmentally sustainable behaviours by households in terms of waste reduction.
- Separate collection of organics will be a required waste permit condition for those collecting from households within population centres of a given size and will be introduced on a phased basis over a 4 year period, beginning with larger population centres.
- All current and future producer responsibility schemes will be required, as part of the conditions of their approval, to formulate, implement and demonstrate significant waste prevention and re-use initiatives for their particular waste streams.

EPA National Waste Statistics and Bulletins

The EPA publishes national statistics and bulletins relating to waste generation, management and disposal in Ireland. The published data provides information on key statistics and trends in waste as well as information on Ireland's progress in meeting EU waste collection, recovery and disposal targets. Key topics include: municipal waste generation and management; packaging waste; waste electronic and electrical equipment; end of life vehicles; tyres; hazardous waste; construction and demolition waste; and waste infrastructure. The data is available on the EPA website at *http://www.epa.ie/nationalwastestatistics/.*

EPA (2014) National Municipal Waste Recovery Capacity. An Assessment for the Department of the Environment, Community and Local Government

In 2012 the EPA were tasked by the Department of the Environment, Community and Local Government (DoECLG) to undertake an assessment of municipal waste recovery infrastructural capacities in the State. This report documents the outcome of that assessment. This task was articulated in the DoECLG publication 'A Resource Opportunity – Waste Management Policy in Ireland' (2012) (see above).

The EPA assessment, undertaken during 2013, has yielded an electronic register holding estimated municipal waste recovery capacity figures for authorised waste activities. The Capacity Register compromises different worksheets containing capacity data on:

- EPA waste licences;
- EPA IPPC licences;
- Sites authorised under an EPA Certificate of Registration;
- Local Authority issued Waste Facility Permits; and
- Local Authority issued Certificates of Registration.

The data in this study reflects a snapshot in time – May 2013 when there was an estimated 5,800 to 6,000 'live' waste facility authorisations in the state. This assessment report presents a synthesis of the Capacity Resister information.

Environmental Protection Agency (2014). National Hazardous Waste Management Plan, 2014-2020

The Third National Hazardous Waste Management Plan was published by the Environmental Protection Agency in 2014.

This Plan sets out priority actions to be taken over the six year life of the plan in relation to:

- Prevention of hazardous waste;
- Improved collection rates for certain categories of hazardous waste;
- Steps required to improve Ireland’s self-sufficiency in hazardous waste management; and
- Identification and management of certain legacy hazardous wastes such as historic unregulated waste disposal sites and contaminated soil.

The plan includes eight key environmental objectives which will be adopted for the plan including ‘To minimise the export of hazardous waste for treatment and/or disposal and reduce emissions due to transportation’.

The plan also includes a range of targets and indicators which provide a means of measuring progress towards the plan objectives. These include ‘minimise distance travelled by hazardous waste’ and *‘Minimise export of hazardous waste and move towards self-sufficiency’.*

EPA (2019) Waste Classification – List of Waste and Determining if Waste is hazardous or Non-Hazardous.

Waste classification is based on:

- Commission Decision of 18 December 2014, amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European parliament and of the Council (2014/955/EEC);
- Commission Regulation (EU) No 1357/2014 of 18 December 2014, replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives; and
- Council Regulation (EU) 2017/997 of 8 June 2017 amending Annex III to Directive 2008/98/EC of the European parliament and of the Council as regards the hazardous property HP 14 ‘Ecotoxic’.

This waste classification system applies across the EU and is the basis for all national and international waste reporting obligations. This document consolidates the Decision and Regulations and provides guidance on how to follow them.

There are two main elements:

- List of Waste (LoW) (Appendix 1); and
- Determining if waste is hazardous or non-hazardous (Appendix 2).

Government of Ireland (2020) A Waste Action Plan for a Circular Economy Ireland's National Waste Policy 2020-2025

The 'Waste Action Plan for a Circular Economy' is an action-focused plan that reflects the 2020 Circular Economy Action Plan 'For a cleaner and more competitive Europe' from the European Commission (see above).

The overarching objectives of this action plan are to:

- Shift the focus away from waste disposal and treatment to ensure that materials and products remain in productive use for longer thereby preventing waste and supporting reuse through a policy framework that discourages the wasting of resources and rewards circularity;
- Make producers who manufacture and sell disposable goods for profit environmentally accountable for the products they place on the market;
- Ensure that measures support sustainable economic models (for example by supporting the use of recycled over virgin materials);
- Harness the reach and influence of all sectors including the voluntary sector, R&D, producers / manufacturers, regulatory bodies, civic society; and
- Support clear and robust institutional arrangements for the waste sector, including through a strengthened role for Local Authorities (LAs).

The plan identifies opportunities for the application of circular economy principles across a range of areas in Ireland including:

- Municipal waste;
- Consumer Protection;
- Food waste;
- Plastic and packaging waste;
- Construction and demolition waste;
- Textiles; and
- Procurement.

Department of the Environment, Climate and Communications (2019) Climate Action Plan

The Government published its Climate Action Plan (to tackle Climate Breakdown) in 2019. The Plan sets out the actions the Government intends to take to address climate breakdown across sectors such as electricity, transport, built environment, industry and agriculture.

The Climate Action Plan provides that the Government will lead the transformation from waste management to circular economy practice through delivery of a new national policy. It is also intended that waste legislation will be revised to incorporate new circular economy requirements, including legally binding waste / recycling targets.

The implementation plan for actions by Government and other actors in relation to waste and the circular economy are as follows:

- Lead the transformation from waste management to circular economy practice through delivery of a new national policy;
- Revise waste legislation to incorporate new circular economy requirements, including legally binding waste / recycling targets;
- Develop a new National Waste Prevention Programme, and Regional Waste Management Plans that will guide our transition to a circular economy by EPA and Local Authorities;
- Support the development of eco-design and circular economy opportunities for Irish enterprises to reduce waste over the full lifecycle of products;
- Develop and implement a suite of measures to reduce the impact of single-use plastics Maintain Government leadership in taking responsibility for own resource consumption, particularly single use plastics, energy, waste and water;
- Identify opportunities to strengthen the regulatory and enforcement frameworks and structures for the waste collection and management system, to maximise the collection of clean, segregated materials for reuse and/or recycling from all households and businesses, and to incentivise consumers to reduce, reuse and recycle;
- Regulate and incentivise producers of waste, particularly packaging, to ensure the prevention of waste and the use of recycled materials in packaging products;
- Scope a number of possible environmental levies, including a possible levy on single use plastics, as part of the review of the Environment Fund. Further detailed research would be required prior to the introduction of any new levy; and
- Identify and commence delivery of measures to address the key regulatory barriers to the development of the bioeconomy, including exploring opportunities to establish “End of Waste” criteria for certain bio-wastes.
- ***Department of the Environment, Climate and Communications (2020) Waste Strategy for a Circular Economy***

The Waste Action Plan for a Circular Economy fulfils the commitment in the Programme for Government (2020) to publish and start implementing a new National Waste Action Plan. This new national waste policy will inform and give direction to waste planning and management in Ireland over the coming years. It was followed by an All of Government Circular Economy Strategy (see below).

The previous national waste policy, A Resource Opportunity – Waste management policy in Ireland, drove delivery on national targets under EU legislation, but the Irish and international waste context has changed in the years since its launch. The need to embed climate action in all strands of public policy aligns with the goals of the European Green Deal.

The policy document shifts focus away from waste disposal and moves it back up the production chain. To support the policy, regulation is already being used (Circular Economy Legislative Package and Single Use Plastics Directive). The policy document contains over 200 measures across various waste areas including Circular Economy, Municipal Waste, Consumer Protection and Citizen Engagement, Plastics and Packaging, Construction and Demolition, Textiles, Green Public Procurement and Waste Enforcement.

Whole of Government Circular Economy Strategy 2022 – 2023: Living more, Using Less (Government of Ireland 2021)

The Government of Ireland released a Whole Government Circular Economy Strategy 2022-2023 (Government of Ireland 2021), setting out a policy framework for transitioning to a circular economy. The strategy will address a policy gap that exists in Ireland's national policy framework. It sets out a vision for Ireland's transition to circularity; explaining the concept of the circular economy, describing what initiatives are being undertaken, what opportunities are available and how Government will drive the changes required. The strategy estimates Ireland's current circular material use at 1.6% and aims to exceed the EU average by 2030, currently 12.8%. The strategy will:

- Showcase public sector leadership, using policy tools such as green public procurement as well as supporting circular economy practices across the entire public sector;
- Establish and implement an education and awareness campaign – for individuals, households, communities, and the public and private sectors;
- Recognise priority sectors for the development of sectoral circular economy roadmaps;
- Assemble a consultative advisory group, from amongst stakeholders, to input into policy development and implementation; and
- Develop an interdepartmental working group to oversee the integration of circular economy policies and practices across public policy.

The strategy sets out draft roadmaps for the transport and construction sectors, including the following objectives:

- Construction:
    - Increased use of offsite design and manufacture;
    - Modular building design;
    - Refurbishment and retrofitting of existing stock;
    - Tackling dereliction and bringing stock back into occupancy; and
    - Increased use of Construction & Demolition Waste as a secondary construction material.
- Transport:
    - Increased use of telecommuting, as well as of local and regional hubs;
    - Prioritising resource efficient personal mobility, e.g. walking and cycling;
    - Expanding public transport capacity and promoting shared mobility schemes; and

  - Efficient end-of-life vehicle waste management schemes.

A1.3.2 Regional Policy

The Connacht – Ulster Region Waste Management Plan 2015-2021

For the purposes of waste management planning, Ireland is now divided into three regions: Southern, Eastern-Midlands, and Connacht-Ulster. The Connacht-Ulster Region includes the Galway City Council and Galway, Mayo, Roscommon, Roscommon, Sligo, Leitrim, Donegal, Cavan and Monaghan County Council areas.

The Connacht-Ulster Region Waste Management Plan 2015-2021 was launched in 2015. The strategic approach of the plan places a stronger emphasis on preventing wastes and material reuse activities. Three strategic targets have been set in the plan which include:

- 1% reduction per annum in the quantity of household waste generated per capita over the period of the plan;
- Achieve a recycling rate of 50% of managed municipal waste by 2020; and
- Reduce to 0% the direct disposal of unprocessed residual municipal waste to landfill in favour of higher value pre-treatment processes and indigenous recovery practices.

The plan looks to 2030 and includes a long term goal of reaching a recycling rate of 60%.

Construction and Demolition Waste Soil and Stone Recovery / Disposal Capacity – Eastern Midlands Region / Connacht Ulster Region / Southern Region and RPS (2020)

This report was undertaken on behalf of the Irish regional waste management offices to analyse the national waste capacity market for safe treatment of waste soils. A review was undertaken of soil waste generation and available capacity to accept soil waste in authorised facilities within the three waste regions. The report identifies that the future authorised capacity available to recover soil and stones is an issue in each waste region in the context of likely strong construction activity. Possible options recommended include existing capacities at existing sites and the use of Article 27 By Product notifications.

Galway City Development Plan 2017-2023

The Galway City Development Plan 2017-2023 sets out Galway City Council’s policies and objectives for the development of the city over the Plan period.

The Plan sets out the waste management priorities for the city for a 6-year period from 2017 to 2023. The Plan seeks to ensure that measures will be adopted to ensure sustainable waste management while it also aims to support initiatives that will develop the circular economy through implementation of the Regional Waste Management Plan for the Connacht Ulster Region 2015-2021 and its successor.

A1.3.3 Guidance

EPA (2021) Best Practice Guidelines for the Preparation of Resource Management Plans for Construction and Demolition Projects – 2021.

These guidelines supersede the 'Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects' which were published by the Government in July 2006. The replacement guidelines reflect current waste legislation and policy including 'A Waste Action Plan for a Circular Economy Ireland's National Waste Policy 2020-2025' published in September 2020. Since the publication of the 2006 guidelines, waste management legislation and policy have evolved towards prioritising waste prevention and life-cycle thinking as follows:

- An increased emphasis on waste prevention, in line with the waste hierarchy, through established principles such as designing out waste and the use of green procurement.
- The guidelines have also been prepared to promote more circular design and construction principles in line with the EU Circular Economy Action Plan under the EU Green Deal. The circular economy model tries to avoid using unnecessary resources in the first place and keep resources 'in flow' by means of effective and smart reuse and recycling strategies reducing the use of virgin materials.

The guidelines provide a practical and informed mechanism to document the prevention and management of C&D wastes and resources from design to construction or demolition of a project. They provide clients, developers, designers, practitioners, contractors, sub-contractors and competent authorities with a common approach to preparing and determining Resource and Waste Management Plans (RWMP) for the construction and demolition sector in Ireland.

The guidelines address the best practice approach for the following phases of a project:

- Prior to Construction – including the stages of design, planning and procurement in advance of works on site; and
- During Construction – relating to the effective management of resources and wastes during construction or demolition operations.

EPA (2019) Guidance on Soil and Stone By-products in the context of Article 27 of the European Communities (Waste Directive) Regulations 2011

Article 27 of the European Communities (Waste Directive) Regulations, 2011, as substituted by Reg. 15 S.I. No. 323 of 2020, states the following:

> *'Economic operators may decide, in accordance with the following conditions of article 27, that their substance or object is a by-product:*
>
> > *(a) further use of the substance or object is certain;*
> >
> > *(b) the substance or object can be used directly without any further processing other than normal industrial practice;*

> *(c) the substance or object is produced as an integral part of a production process; and*
>
> *(d) further use is lawful in that the substance or object fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts.'*

Decisions made by economic operators under Article 27 must be notified to the Environmental Protection Agency. Conditions a) to d) must be satisfied for an Article 27 notification to be successful.

The purpose of the guidance is to inform economic operators how to prevent waste soil and stone by classifying it as a by-product in accordance with the legislation and the EPA's regulatory approach to determinations on soil and stone by-products. This guidance document covers soil and stone only.

It is aimed at local authorities, developers, the construction sector, the waste management sector and consultants.

Its environmental objective is by making certain that excess uncontaminated soil and stone is beneficially used with no overall adverse impacts on the environment or human health, a material producer will ensure that the material is regarded as a by-product rather than a waste.

EPA By Product- Guidance Note. A guide to by-products and submitting a by-product notification under Article 27 of the European Communities (Waste Directive) Regulations, 2011

This guidance note published in June 2019 applies to all other sectors and materials apart from soil and stones. It aims to inform economic operators how to prevent waste by classifying it as a by-product in accordance with the applicable Regulations.

Environmental Protection Agency (2020) Draft End of Waste Guidance Part 1 and Part 2

Part 1: describes the context and benefits and introducing the end-of-waste test to potential under Article 28. Part 2: provides guidance for applicants on how to address the requirements of the end-of-waste test under Article 28 of the European Communities (Waste Directive) Regulations, 2011.

Appendix A

17.2 List of Waste Codes for Construction and Demolition Wastes

Contents

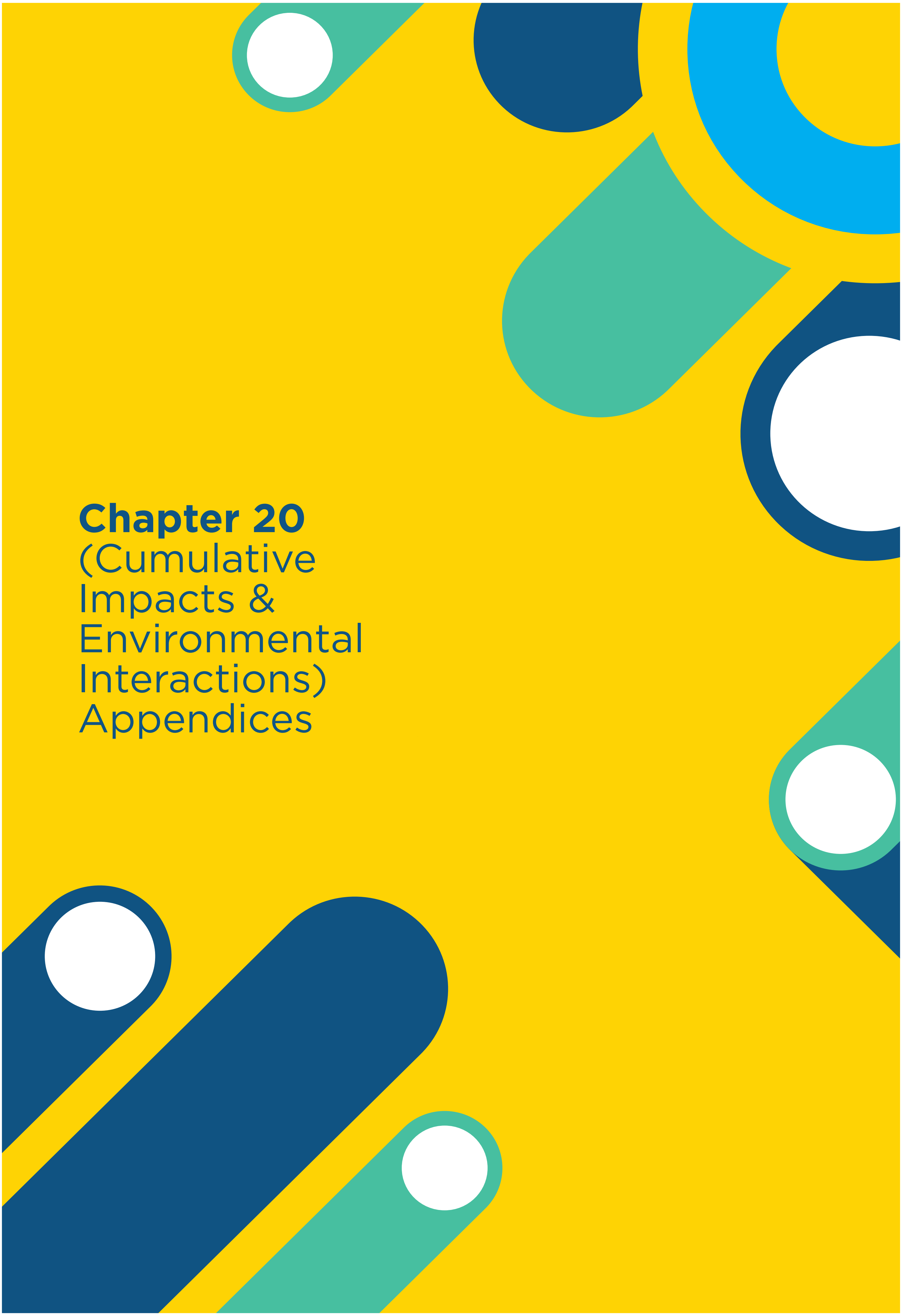
A1 17.2: List of Waste Codes for Construction and Demolition Wastes

03 02	**wastes from wood preservation**
03 02 01*	non-halogenated organic wood preservatives
03 02 02*	organochlorinated wood preservatives
03 02 03*	organometallic wood preservatives
03 02 04*	inorganic wood preservatives
03 02 05*	other wood preservatives containing hazardous substances
03 02 99	wood preservatives not otherwise specified
13 07	**wastes of liquid fuels**
13 07 01*	fuel oil and diesel
13 07 02*	petrol
13 07 03*	other fuels (including mixtures)
16 02	**wastes from electrical and electronic equipment**
16 02 09*	transformers and capacitors containing PCBs
16 02 10*	discarded equipment containing or contaminated by PCBs other than those mentioned in 16 02 09
16 02 11*	discarded equipment containing chlorofluorocarbons, HCFC, HFC
16 02 12*	discarded equipment containing free asbestos
16 02 13*	discarded equipment containing hazardous components[1] other than those mentioned in 16 02 09 to 16 02 12
16 02 14	discarded equipment other than those mentioned in 16 02 09 to 16 02 13
16 02 15*	hazardous components removed from discarded equipment
16 02 16	components removed from discarded equipment other than those mentioned in 16 02 15
16 06	**batteries and accumulators**
16 06 01*	lead batteries
16 06 02*	Ni-Cd batteries
16 06 03*	mercury-containing batteries
16 06 04	alkaline batteries (except 16 06 03)
16 06 05	other batteries and accumulators
16 06 06*	separately collected electrolyte from batteries and accumulators

17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**
17 01	**concrete, bricks, tiles and ceramics**
17 01 01	concrete
17 01 02	bricks
17 01 03	tiles and ceramics
17 01 06*	mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing hazardous substances
17 01 07	mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06
17 02	**wood, glass and plastic**
17 02 01	wood
17 02 02	glass
17 02 03	plastic
17 02 04*	glass, plastic and wood containing or contaminated with hazardous substances
17 03	**bituminous mixtures, coal tar and tarred products**
17 03 01*	bituminous mixtures containing coal tar
17 03 02	bituminous mixtures other than those mentioned in 17 03 01
17 03 03*	coal tar and tarred products

17 04	**metals (including their alloys)**
17 04 01	copper, bronze, brass
17 04 02	aluminium
17 04 03	lead
17 04 04	zinc
17 04 05	iron and steel
17 04 06	tin
17 04 07	mixed metals
17 04 09*	metal waste contaminated with hazardous substances
17 04 10*	cables containing oil, coal tar and other hazardous substances
17 04 11	cables other than those mentioned in 17 04 10

17 05	**soil (including excavated soil from contaminated sites), stones and dredging spoil**
17 05 03*	soil and stones containing hazardous substances
17 05 04	soil and stones other than those mentioned in 17 05 03
17 05 05*	dredging spoil containing hazardous substances
17 05 06	dredging spoil other than those mentioned in 17 05 05
17 05 07*	track ballast containing hazardous substances
17 05 08	track ballast other than those mentioned in 17 05 07
17 06	**insulation materials and asbestos-containing construction materials**
17 06 01*	insulation materials containing asbestos
17 06 03*	other insulation materials consisting of or containing hazardous substances
17 06 04	insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05*	construction materials containing asbestos
17 08	**gypsum-based construction material**
17 08 01*	gypsum-based construction materials contaminated with hazardous substances
17 08 02	gypsum-based construction materials other than those mentioned in 17 08 01
17 09	**other construction and demolition wastes**
17 09 01*	construction and demolition wastes containing mercury
17 09 02*	construction and demolition wastes containing PCB (for example PCB-containing sealants, PCB-containing resin-based floorings, PCB-containing sealed glazing units, PCB-containing capacitors)
17 09 03*	other construction and demolition wastes (including mixed wastes) containing hazardous substances
17 09 04	mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03



Chapter 20

(Cumulative Impacts & Environmental Interactions) Appendices

Galway City Council

BusConnects Galway: Cross-City Link

Appendix 20.1 Planning History

235532-04-03-02

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Job number 235532

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1. Locations of other Projects

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
1	Iarnród Eireann	Permission for development which will consist of changes to previously approved planning permission ref no. 14/18 (extended under 19/175). Ceannt Railway Station is a protected structure (RPS 10001). The changes include: 1. Partial removal of three no. internal walls in the northern buildings to increase visibility and thus assist with both passenger flow and wayfinding and accessibility. 2. The partial removal of some of the existing concrete floor on the eastern side of the station building and the subsequent lowering of same by approx. 180 mm to be at the same level throughout and thus assist with passenger accessibility	LA: 22/87	Granted: 30/06/2022	No	No
2	CBK Developments Limited	Permission for retention which will consist of retention of first floor level rear extension	LA: 22/66	Granted: 21/06/2022	No	No
3	Frank O' Connell	Permission for retention which will consist of retention of demolition to rear wall of house and existing rear extension. Construction of new rear single and two storey extension. Modifications to existing house and all associated site works to house	LA: 22/67	Granted: 21/06/2022	No	No
4	Fergus & Emer Whelan	Permission for development which will consist of the construction of a new two storey dwelling and associated site works	LA: 22/60	Granted: 14/06/2022	No	No
5	Advanced Vision Ltd.	Permission for retention which will consist of revisions to the development permitted under Pl. Ref. No. 17/41. No.86 Bohermore is a protected structure (RPS No. 1201). The	LA: 22/19	Granted: 16/05/2022	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		development consists of (1) Retention of relocation of ESB sub-station towards the southern boundary of the site (to the rear of the Hotel) together with associated revisions to landscaping to provide screening (2) Retention of revised surface layout to the rear of the Hotel including revised turning area arrangements and a reduction in the number of on-site car parking spaces from 13 to 8 (3) Retention of high level Hotel signage to the front and side elevations, together with all associated site works and services				
6	Three Ireland (Hutchison) Limited	Permission for development which will consist of (1) the removal of the existing retail fit out and the installation of a new retail fit out to the ground floor retail area only (2) the replacement of the existing shopfront fascias and signage with new armourcoat fascia details and internally illuminated fascia signage to the Shop Street and Abbeygate Street Lower elevations and (3) all associated site works. The building is a Protected Structure and within an Architectural Conservation Area	LA: 22/22	Granted: 06/05/2022	No	No
7	Kevin Keady	Permission for development which will consist of: 1.Construct a new porch to front elevation of terrace house (3.02m2) 2.Demolish the existing rear extension (2.93m2) 3. Construct a new extension to ground floor and first floor levels to rear of dwelling (81.95m2) 4. And all associated site works	LA: 21/366	Granted: 26/04/2022	No	No
8	Barry Murphy	Permission for retention which will consist of retaining 2 no bedroom attic conversion and to retain and complete a dormer window to the front first floor bedroom and also to retain and complete an addition to the rooflight to the rear first floor bedroom both to act as fire escape windows	LA: 22/11	Granted: 26/04/2022	No	No
9	Vanda Luddy	Permission for retention which will consist of retaining a 2 storey rear extension	LA: 22/10	26/04/2022	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
10	Galway Harbour Company	Permission for retention which will consist of retention for 2 no. security roller gates located at the Eastern and Western Ends of Mulvoy Quay, Galway Harbour. Previously permitted and constructed under Pl. Ref. No. 16/29. The security gates are located between Dock Road and the commercial dock. The commercial dock is a protected structure	LA: 21/424	Granted: 24/03/2022	No	No
11	Breda Peters	Permission for retention and development which will consist of retaining and completing the addition of 2 no. ground floor level side elevation windows to the side of existing dwelling house				No
12	John Curley	Permission for development which will consist of (1) Permission to demolish existing 2 storey building (2) Permission to construct a new 3 storey dwelling house with private open space to include roof garden and (3) All associated site works and services	LA: 21/305	Gtanted: 31/01/2022	No	No
13	Allied Irish Banks PLC	Permission for development which will consist of works to a protected structure (RPS 9313) including installation of 2 no security cameras on the Shop Street Elevation & 2 no new security cameras to the Abbeygate Street Elevation & 5 no new or replacement security cameras to the rear elevation at roof level	LA: 21/54	Granted: 26/01/2022	No	No
14	Liam Dilleen	Permission for development which will consist of construction of a vehicle entrance to the back of site accessing from The Plots Road	LA: 21/334	Granted: 11/11/2021	No	No
15	Galway Harbour Company	Galway Harbour extension, including land reclamation.	ABP PA61.PA0033	Pending	Yes	Yes
16	Dwelling Application	Permission for development which will consist of construction of two and a half storey dwelling (407.0 m2); all associated ancillary site works.	LA: 22/5	Pending: 20/03/2022	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
17	Threshold Western Region Services	Permission for retention which will consist of retaining change of use of former betting shop to offices at Ground Floor Level	LA: 22/4	Pending: 14/03/2022	No	No
18	Hanoview Ltd	Permission for development which will consist of a) demolition of existing derelict buildings including a habitable house on site (327 sqm) b) three storey over part-basement boutique hotel of 1239 sqm containing 34 bedrooms and ancillary spaces and a balcony at first floor level to the rear (west) façade accessed off Nun's Island Street with secondary, pedestrian-only, access off the waterside laneway to rear (southwest) and with associated landscaping to including an internal courtyard.	LA: 21/418	Outline Grant: 22/02/2022	Yes	No
19	Tirvana Property Limited	Permission for development which will consist of the construction of a dwelling house on an infill site. Permission is also sought to connect to public services and for a new vehicular entrance	LA: 21/401	Pending: FI Request	No	No
20	Primark Ltd	Permission for retention and permission for development which will consist of: retaining previous amalgamation of unit 225 first floor, unit 226 at second floor, additional mezzanine floor area and to amalgamate existing 4,105 sq .m retail unit at first and second floor level with existing 1,721 sq.m retail unit at ground floor level including making necessary structural alteration to install escalators and lifts with associated pits, new mall shopfront at ground floor level. altering existing windows and ventilation louvres at ground floor level, erecting new external signage on Merchants Road and Ballalley Lane and all associated works.	LA: 21/331	Granted: 24/01/2022	No	No
21	Best Drive Paddy Murphy & Brendan Smith	Permission for development which will consist of construction of a new car wash and office units, including new advertisement signage to ground floor fascia at Side	LA: 21/219	Granted: 17/01/2022	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		Elevation (West) and Front Elevation (South) including site and ancillary works				
22	Galway County Council	N6 Galway City Ring Road	ABP:MA07.302885 ABP:HA07.302848	Granted 06/12/2021	Yes	Yes
23	Micheal & Mary O'Reilly	Permission for development which will consist of partial change of use of ground floor from café to guesthouse	LA: 21/287	Granted: 24/11/2021	No	No
24	Iarnród Éireann	Permission for the development at Former Engine Shed (Protected Structure RPS N0. 10002) which will consist of 1. removal of the existing metal roofing and asbestos roof covering to the existing structure 2. partial demolition of the front entrance wall to the southwest of the building to allow for a new recessed entrance to facilitate accessible access to this development and the adjacent development adjoined to the south (ref: 19347). 3. Other works to the existing fabric which will include the removal of masonry to openings currently blocked up, replacement of the roof finishes, windows and floors and insulation of the structure as necessary. 4. Localised openings within the building as necessary to facilitate safe and accessible use of the building. Proposed use of the building is to be welfare and administration facilities for station staff. Existing building is listed on the record of protected structures (10002).	LA: 21/278	Granted: 24/11/2021	No	No
25	Harbour Office Galway Harbour Company	Permission for development which will consist of: Temporary planning permission for the use of an area for outdoor dining with pitches for adapted vehicles/food stalls, outdoor seating area, temporary portable toilets and all necessary associated site works at the site	LA: 21/83	Granted: 13/09/2021	No	No
26	O'Malley Group (Homes and	Permission for development which will consist of; a three to six storey building (total gross floor area 7768 sqm). (1) The demolition of the existing building in the northeast corner of	LA: 20/346	Granted: 01/09/2021	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
	Developments) Ltd.	the site known as St. Clare's Walk Building and construction of a new 6 storey building with a new junior library and office reception at ground floor and office use to all upper floors. (2) The construction of an additional 2 no. floors over part of the Hynes building for office use. (3) A single storey extension to the existing library at ground floor of the Hynes Building on Augustine Street. (4) Alterations to the elevations on Augustine Street and Merchants Road. (5) All other associated site development and servicing works.				
27	Ali Disz Kebude	Permission for retention which will consist of retaining the use of a ground floor unit	LA: 21/170	Granted: 17/08/2021	No	No
28	Seagullpoint Limited	Large scale development, details of which are laid out in Planning Application Details online and site notice	LA: 20/47 ABP: PL61.310568	Partially Granted: 17/08/2021	Yes	Yes
29	Galway City Council	Salmon Weir Pedestrian and Cycle Bridge.	ABP:JP61.308783	Granted: 16/08/2021	Yes	No
30	Cleverson Ltd	Demolition of an ESB enclosure and construction of a seven/eight storey development comprising 4 retail units, a gymnasium and student accommodation (254 beds). A Natura Impact Statement (NIS) was submitted as part of this application.	LA:20/184 ABP:PL61.309673	Granted: 12/07/2021	Yes	No
31	Connacht Hospitality Forster Street Ltd	Permission for development which will consist of 1) internal alterations/revisions to amalgamate Forster Court Hotel & the adjoining building formally known as 'Aras Failte Tourist Information Office' at basement, ground and first floor levels 2) Change of use of the adjoining building formally known as 'Aras Failte Tourist Information Office' from Tourist information centre including ancillary offices and retail space to a Hotel / Conference centre. Changes to include - a) 11 no. hotel sites at first floor level, b) Alterations at ground floor level to facilitate the enlargement of the existing Forster	LA: 21/12	Granted: 26/04/2021	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		Court Hotel restaurant bar area and new conference centre reception with ancillary refreshment area, meeting room & toilet facilities, c) New stairs & lift to conference centre at basement level to include conference/function room(s), meeting rooms, kitchen and toilets. 3) Associated external signage, together with all associated site works.				
32	Roshin Limited	Permission for development which will consist of the change of use from Burger Restaurant to general retail	LA: 21/1	Granted: 06/04/2021	No	No
33	Bonham Dock Limited	Permission for development which will consist of amending a previously permitted (currently under construction) mixed use office development (Galway City Council Reg. Ref. 17/83; An Bord Pleanála Ref. 300275 - 17 - the 'parent permission'). The development proposed comprises of an amendment to the permitted basement (now partially constructed) involving the omission of part of the previously permitted basement that has not yet been constructed, completion of the partially constructed basement area, including alterations to the internal layout of the basement car park and ancillary accommodation, together with an extension of the now partially constructed basement to link to previously permitted cores serving permitted buildings above that have not yet been constructed. The development proposed results in the reduction in the footprint / floor space and associated internal re-configuration of the permitted single level basement level -1, including : Reduction in the floor area of basement level by c.3505 sqm GFA (c. 7060 sqm GFA permitted to c.3555 sqm GFA proposed) ; Re-configuration of the permitted car parking spaces ; Reduction in car parking to provide 51 no. car park spaces at Level -1 in lieu of 131 no. permitted spaces. Exterior amendments to the permitted development at ground floor level to facilitate the	LA: 20/367	Granted: 06/04/2021	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		basement reduction, including : Alterations to the design of landscape features in the public realm at surface level; Provision of 1 no. accessible surface car parking space.				
34	GCID - Galway City Innovation District Company Ltd	Permission is sought for the development which will consist of Change of Use of Paper Store (ground and first floor level) area to Co-Working Office Space use; Reconfiguration of internal layout of existing two storey office area as a Co-Working Office Space; Partial demolition of two storey projection to rear and side, and replacement with new enlarged projection over four floors; Construction of additional (second floor) flat roofed floor above part of the existing two storey building; Construction of roof garden/deck area above part of second floor area; Alteration of front and side elevations including replacement façade along Market Street; Installation of external plant and equipment, revised boundary treatments, hard and soft landscaping, cycle parking, signage and branding, connections to services and utilities; Consequential superseding of Reg. Ref: 18/337 relating to provision of a Food Market, insofar as it relates to the ground level Paper Store, and associated and ancillary revisions to northern and southern laneway serving the printworks/permitted Food Market area; and All associated and ancillary work and development above and below ground level. All part of a protected structure	LA: 20/108	Granted: 23/03/2021	No	No
35	English by Design Ltd C/o Dr V.Hennessy and Ms M Grennan	Planning permission is sought for the development which will consist of (a) retention of change of use of Office/Retail to a Language School (b) permission for window signage at protected structures reference: 3804	LA: 20/62	Granted: 09/03/2021	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
36	GCID - Galway City Innovation District Company Ltd	Permission for development which will consist of the change of use of existing two storey warehouse to co-working office space use, associated two storey extension, demolition of existing arched concrete gateway, internal reconfiguration, alteration of elevations, roof replacement (and removal of chimney), installation of external plant and equipment, revised boundary treatments, hard and soft landscaping, cycle parking, signage and branding, connections to services and utilities, creation of pedestrian and cycle access to Market Street (through Market Street car park, a protected structure), and all associated and ancillary works and development above and below ground level.	LA: 20/89	Granted: 17/02/2021	No	No
37	Galway Leisure Investments Ltd	Permission is sought for the development which will consist of a) demolition of 2 no. hotel bedrooms at second and third floor of the east wing (area c.53 sqm), b) link extension at second floor to the north and east wing, (area c.20.1 sqm) c) bedroom and link extension at third and fourth floor, which includes 14 no. hotel bedrooms to the north and east wing, (area c.573.6 sqm), d) associated elevational changes and e) all necessary site works and services	LA: 20/89	Granted: 29/01/2021	No	No
38	Dwelling Application	Permission for development which will consist of dwelling house, garden shed and all associated services	LA: 20/256	Granted: 14/01/2021	No	No
39	Galway Harbour Company	Permission for development which will consist of the demolition of an existing single storey office building (140.7 sqm), the demolition of two ancillary buildings (17.4 sqm & 19.2 sqm) along with all associated works.	LA: 20/253	Granted: 14/01/2021	No	No
40	Better Value Unlimited Company	Permission for development which will consist of change of use of the existing shop (vacant) to a Café/Restaurant with an ancillary take-away delivery offer at ground floor level, associated storage and office space at first floor, replacement signage to front elevation and all other associated ancillary	LA: 20/131	Granted: 14/01/2021	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		site service works. The proposed development is located within Eyre Square Architectural Conservation area				
41	K. King Construction Claregalway Ltd.	Permission for revisions to previously granted residential development under Pl. Ref 18/47 and An Bord Pleanála number ABP 301960-18 at this site. The new proposal will consist of: (A) An increase in unit numbers from 19 no. granted units to a total of 27 no. Residential units. (B) Previously approved 3 storey Duplex block to Saint Brendan's Avenue containing: 1 no. 3 bedroom duplex; 4 no. 2 bedroom duplex; 1 no. 2 bedroom own door apartment and 3 no. 1 bedroom own door apartments with amendments to rear to allow for lift and communal stairs to first floor. (C) Replacement of the previously approved 4 storey duplex block to the rear of the site (containing 4 no. 1 bedroom apartments & 4 no. 3 bedroom Duplexes) and 2 storey block to the courtyard (containing 2 no. 2 bed apartments) with a new 6 storey apartment block and larger communal courtyard. New apartment block to contain: 12 no. 2 bedroom apartments and 6 no. 1 bedroom apartments with revised access onto rear laneway. (D) This application also includes revisions to cycle store, bin stores and landscaping including larger shared communal courtyard, provision of all associated surface water and foul drainage services and connections, ancillary to the residential development as well as all associated site development works and services	LA: 20/235	Granted: 14/12/2020	No	No
42	Skeffington Arms Limited	Permission for the development which will consist of the following: Permission for the refurbishment of two no. cottages including the reconstruction of partially collapsed chimney and external wall, internal alterations including the provision of a mezzanine floor and associated stairs and all other restoration works necessary to refurbish the cottages.	LA: 20/237	Granted: 14/12/2020	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		This planning application relates to work to a protected structure (RPS 302)				
43	Ross News Ltd T/a Café Roscoe's	Permission is sought for the retention of a change of use of a retail unit to a restaurant (known as café Roscoe's) and all associated works	LA: 20/67	Granted: 20/10/2020	No	No
44	Paddy McDonald Tribal Restaurant ltd	Permission is sought for the development of a protected structure (RPS No 5801 NIAH Reference 30314075) and which will consist of change of use of ground floor level vacant area (612sqm) and first floor level restaurant (573sqm), to provide 1185sqm of office use over ground and first floor levels; the erection of a new entrance to Merchants Road, as per previous grant permission (Ref 16/150); the replacing of an existing door to the south east end of the Merchants Road elevation with a door of similar appearance; internal alterations comprised of the careful removal of non-original partition walls, bar, kitchen fit-out, and miscellaneous non-original elements and redundant services. All works to be in accordance with conservation principles	LA: 20/145	Granted: 01/09/2020	No	No
45	DVMD Property Ltd	Planning permission is sought for the retention of the rear balcony terrace with guard railings at the first floor of the existing development and for the change of use from offices to 2 no dwellings (2 No. 1 Bedroom units) and all associated external works at the first floor of the existing development	LA: 20/86	Granted: 01/09/2020	No	No
46	The Poor Clare's Community	Permission for development at a protected structure RPS no. 7404, which will consist of the installation of a ground mounted PV solar panel array and associated inverter enclosure in the field to the rear of the convent	LA: 20/95	Granted: 24/08/2020	No	No
47	Iarnród Éireann	Planning permission for development to the former Engine Shed(Protected Structures RPS No. 10002) The development will consist of: 1. The renovation and alterations to the former engine shed (Protected Structure RPS No.10002)	LA: 19/347	Granted: 29/07/2020	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		Galway City. 2. Undertaking conservation work to the structure to include the re- pointing and repair of all walls internal and external, repair to all rainwater goods, and to remove existing roof covering and install a new roof finish. 3. The installation of a new entrance door on the west elevation. 4. The installation of new windows on the south elevations. 5. The redesign of the internal layout to accommodate office space including meeting rooms, changing facilities, canteens etc and remove the current office space. 6 The provision of a fire escape lobby and internal stairwell between ground and first floor. 7. Undertaking all associated site works and provision of services				
48	Niche Hotels Unlimited Company	Planning permission is sought for development which will comprise the following: Construction of a 136.4 sq.m, extension to the 1st floor mezzanine level in Unit 7b of Wellpark Retail Park; Subdivision of Unit 7b to comprise : 1 no. ground floor retail unit (308 sq.m), and the change of use of the 1st floor of Unit 7b (523.6 sq.m) of Wellpark Retail Park from retail warehouse use to hotel use, including the provision of 9 no. hotel bedrooms, 2 no. meeting rooms, 4 no. administrative offices and all ancillary stores and breakout spaces ; Addition of 6 no. windows to the 1st floor of the western elevation of Unit 7b of Wellpark Retail Park; Installation of a spandrel glass section to the southern elevation of Unit 7b Wellpark Retail Park; All ancillary works to facilitate the proposed development including creation of links the existing G Hotel Premises and the 1st floor of Unit 7b of Wellpark Retail Park	LA: 20/48	Granted: 09/07/2020	No	No
49	Sonia Sweeney	Planning permission is sought for the change of use of ground floor shop unit to restaurant, the erection of 1 no. internally	LA: 19/363	Granted: 24/06/2020	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		illuminated double sided projecting sign, 2 no. fascia signs, associated elevational changes and minor internal alterations				
50	Eyre Square Hotel Ltd	Retention permission is being sought for the development which will consists of the following 1) Store room and ground floor extension at rear of number 12. 2) Fire- escape flat roof area and fire-escape stairs from rear of number 12. 3) Change of use from restaurant area to four double bedrooms with en-suites to existing Mezzanine level. 4) Five double bedrooms with en-suites at first floor level. 5) Four double bedrooms with en-suites at second floor level. 6) Five double bedrooms at third floor level. 7) Change of use of existing fourth floor from offices and storage to fourteen double bedrooms with en-suites. 8) Two double bedrooms with en-suites including rooflights and flat roof access at attic level. Lift-room over main flat-roof and associated works . 9) This submission includes works to a protected structure	LA: 19/287	Granted: 24/06/2020	No	No
51	Niche Hotel	Retention Permission for the development which will consist of a private commercial well which serves non-potable water applications	LA: 19/337	Granted: 04/06/2020	No	No
52	Floris Wagemakers	Planning permission of the development which consists of (1) Permission to demolish existing Guesthouse at No 3 Newtownsmith along with existing outbuildings. (2) Permission to construct a new 3 Storey Mixed use building at 3 Newtownsmith incorporating; (a) A restaurant on ground floor with ancillary kitchen/toilets/ bin store and dining area (b) Revised ducting/ ventilation arrangements and (c) A new Guesthouse over first and second floor levels, incorporating the first and second level of No. 11 Mary street. (D) Amalgamation of existing restaurant on the ground floor of No.11 Mary street into the new proposed restaurant. (e) Amalgamation & change of use of first floor of No.11 Mary	LA: 19/157	Granted: 24/02/2020	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		Street from restaurant dining area to part of new guesthouse. (F) Amalgamation & change of use of second floor of No. 11 Mary street from bedroom to part of new guesthouse. (3) Proposed new signage, outdoor seating area and canopy along No.3 Newtownsmith (4) All associated site works and services				
53	Dwelling Application	Planning permission is sought for refurbishment and partial change of use from office to residential of an existing three-storey terraced house, including all associated site works	LA: 19/141	Granted: 11/12/2019	No	No
54	SLK Management Services Ltd	Permission for development which will consist of a change of use of an existing commercial/office unit, to residential use to accommodate a 1 bed apartment, together with all associated alterations and site works	LA: 18/374	Granted: 26/07/2019	No	No
55	The Brothers of Charity Services	Permission for development which will consist of a) Construction of a new 3,640 sq. m. single storey special school; b) construction of a 39 sq. m. single storey ancillary storage shed; c) all associated site development works including works to the existing Woodlands campus entrance, revised access road, staff and visitor car parking, bus drop-off areas, new perimeter boundary walls and fences, removal of selected trees and new ancillary site signage; d) all associated site services including surface and foul water drainage rainwater harvesting system, underground rainwater tanks and site lighting	LA: 18/398	Granted: 11/06/2019	No	No
56	Ortamount Limited	Permission at the former Connacht Tribune site (part of a protected structure) consisting of change of use of former printworks, paper store and associated areas to indoor licenced food hall/market and dining space, with associated ancillary outdoor space/use with ancillary use as an occasional event space, along with all associated and ancillary works and development	LA: 18/337	Granted: 15/05/2019	No	No

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57	Dr Abdul Rashid	Permission for (a) change of use of the existing banking hall to the provision of doctors surgery (b)all associated elevation changes and (c) all associated works	LA: 19/6	Granted: 17/04/2019	No	No
58	Liam Mulryan	Permission for change of use from office to retail use of 107 Sq.m	LA: 18/330	Granted: 24/01/2019	No	No
59	Radical Properties	Permission for development which comprises of the following: a) Removal of part of mezzanine level in unit 7 b) Subdivision of Unit 7 to form Unit 7a and Unit 7b c) Addition of new signage to external façade of Unit 7 d) All ancillary works to facilitate the proposed development	LA: 18/217	Granted: 04/10/2018	No	No
60	Tony Brannelly	Permission for, a) a new partial change of use of ground floor from dwelling to shop, b) an attic level extension to existing dwelling with a new roof terrace, c) a new shop front and external alterations, d) internal alterations, and e) all associated site works	LA: 18/84	Granted: 05/09/2018	No	No
61	Bonham Dock Ltd	Student Accommodation Development	LA:17/121 ABP:PL61.300613	Granted: 31/08/2018	No	No
62	Bonham Dock Ltd	Permission for a 10year permission development at this site (c.0.93ha). The proposed development consists of a mixed use office development (c. 34,765 sq.m GIA excluding basement, external terraces and open roof plant) provided in 4 no. block.	LA: 17/83 ABP:PL61.300275	Granted: 31/08/2018	No	No
63	Eugene Keville	Permission for (a) retention of change of use and associated amalgamation of apartment 1 & 2 to hotel use, (b) minor alterations to the front elevation, (c) change of use of basement and ground floor accommodation of No. 35 from existing commercial use to hotel use, (d) provision of single storey enclosure of existing deck yard for use as hotel foyer, and (e) provision of 4 No. additional bedrooms on existing	LA: 17/201	Granted: 13/06/2018	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		roof deck at third floor level. These are protected structures- RPS 7801 7802 & 7803				
64	Eyre St. SBH Ltd.	Permission for development to consist of change of use of existing first floor space from office use to residential use and associated works for conversion to apartment	LA: 17/339	Granted: 18/05/2018	No	No
65	Dwelling Application	Permission for development which will consist of Demolition of the existing workshop/garage and construction of a new single storey 2 bed dwelling house along with all associated site works and services	LA: 17/198	Granted: 01/05/2018	No	No
66	The National University of Ireland Galway	Permission for the replacement of steel pedestrian access bridge with a pre-cast concrete bridge spanning a mill race off Eglinton Canal. The bridge gives access to Tribesman Rowing Club clubhouse and slip. Eglinton Canal and the Distillery Channel are protected structures under River/Waterways Ref. No. 8501	LA: 17/374	Granted: 28/03/2018	No	No
67	M. McGrath	Permission for changes and alterations. Proposed changes to consist of extension of Bunk Hostel as follows: 1) Change of use of part of existing retail unit on ground floor at front of Kiltartan House to provide extended catered dining area. 2) Provision of new fire escape hallway and external door from main stairwell to front of Kiltartan House. 3) Provision of disabled toilet and lobby at main entrance. 4) Relocation of Hostel reception to main entrance lobby. 5) Change of use of existing retail unit on ground floor at rear of Kiltartan House to Self-Catering Kitchen, dining and common room. 6) Provide seven new en-suite bedrooms at first floor. 7) Provide two new en-suite bedrooms at second floor. 8) Change of use of existing third floor office space to hostel accommodation providing an extra sixteen en-suite bedrooms, common room, and management offices	LA: 17/239	Granted: 12/01/2018	No	No

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68	Square Medical Clinic Ltd.	Permission for a change of use from office to dental practice	LA: 17/221	Granted: 14/12/2017	No	No
69	Doug Leddin & Ciaran O'Malley	Permission for the proposed change of use from vacant internet café on ground floor and commercial use of upper floors to restaurant with ancillary take away on ground and first floor and use of second floor for storage, provision of new shopfront, reinstatement of the sliding sash windows on the upper floors and ancillary works	LA: 16/356 ABP: PL61.248870	Granted: 12/12/2017	No	No
70	Mollydale Limited	Permission for development on a site of c0.26 ha. The development will consist of: (i) the change of use of the permitted wholesale and ancillary retail uses (currently vacant) at basement and ground floor levels to hotel use; (ii) the change of use of the permitted bank and office uses (currently vacant) at basement and ground floor levels to hotel use; and, (iii) the internal reconfiguration of the existing hotel use at ground floor level. The development will include ancillary staff areas, kitchen, office, toilet and storage facilities at basement level; 17 no. additional hotel bedrooms, the enlargement of 2 no. existing bedrooms, a new hotel restaurant and revised lobby and entrance spaces at ground floor level (c.1,146m2 gross floor area). The proposed development includes external alterations to the northern (front) elevation of the building at ground floor level including a new entrance with associated canopy and hotel signage, together with minor alterations to the southern (rear) and western (side) elevations at ground floor level. The development will also include all associated site development works above and below ground	LA: 17/128	Granted: 16/11/2017	No	No
71	Boojum 3 Ltd.	Permission for a change of use of existing shop to use as a restaurant with ancillary take away. The proposed development comprises a new ground floor restaurant,	LA: 17/59	Granted: 16/11/2017	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		associated storage space and customer facilities at basement level, external signage to front elevation and ventilation openings to rear elevation onto Ballalley Lane. The proposed development is located within Eyre Square Architectural Conservation Area				
72	Connacht Branch IRFU	Permission for the provision of a hospitality marquee for a period of 5 years	LA: 17/200	Granted: 29/09/2017	No	No
73	Foxfield Inns Limited	Permission for the change of use of a ground floor commercial unit from bakery to restaurant including alterations to façade and all associated works	LA: 17/69	Granted: 26/07/2017	No	No
74	Snap Fitness	Permission for a change of use of existing permitted retail space and circulation space at basement and ground floor level to a 24-hour gymnasium use. The proposed development comprises a new reception and waiting area at ground floor level and new external signage onto Prospect Hill and at basement level a new gymnasium including free weights area, cardio area, pin loading area and fitness on demand area, associated changing rooms and showers and all associated works	LA: 17/62	Granted: 26/07/2017	No	No
75	Cwc Fairgreen Ltd.	Permission for development for change of use of part of ground floor unit from (permitted) retail use to co-working office space use and installation of mezzanine level. The proposed development also includes signage and branding, and all associated and ancillary works and development	LA: 17/90	Granted: 05/07/2017	No	No
76	Cwc Fairgreen Ltd.	Permission for development for change of use of basement unit and part of ground floor unit from (permitted) retail use to multifunctional sports, arts and events space use, with café and incidental retailing. The proposed development also includes creation of new fire exit doorway and completion of ground floor façade to Bothar Pairc An Aonaigh, along with	LA: 17/91	Granted: 05/07/2017	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		signage and branding, and all associated ancillary works and development				
77	Brian Lynch	Permission for a change of use at ground floor level from office use to use as a hyperbaric oxygen centre. The proposed development includes the provision of a barochamber (oxygen treatment unit), associated public / staff facilities, alterations to the front elevation, signage and all associated site development works and services	LA: 16/363	Granted: 10/04/2017	No	No
78	Tribal Restaurant Limited	Permission which will consist of a new pedestrian entrance from Merchants Road, new pedestrian entrances from Forthill Street, repositioning of existing escape door to stairs at rear of building, internal alternations including new partitions to accommodate new toilets and storage areas all at ground floor level and ductwork from ground floor to roof level. Extension of the existing restaurant use at first floor to ground floor which will result in a change from retail, storage and cookery class use to retail, storage, restaurant use. All at ground floor level, gross area of building is 1215.0 sq.m. This building is a protected structure	LA: 16/150	Granted: 09/12/2016	No	No
79	Bradley Motor Works	Permission is sought for the demolition of an existing single storey, split-level showroom building facing Dublin Road and for the construction of a replacement showroom building, with a mezzanine level. The proposed finished floor level of the new showroom building will be lowered to street level. Permission is also sought for the demolition of associated, single storey out-buildings to the rear of the showroom and for the provision of hard landscaping for the display of cars in lieu of same and for all other associated site works, services, landscaping and the relocation of an existing totem sign	LA: 16/227	Granted: 02/11/2016	No	No

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80	Tony Dervan	Permission for the development of a site to the rear of 82 College Road consisting of construction of a single dwelling house fronting onto Lough Atalia Road. The development will be comprised of a two storey house over a semi-basement garage with vehicular access onto Lough Atalia road and all ancillary site works	LA: 16/155	Granted: 20/10/2016	No	No
81	PJ Lavelle Chemists Ltd.	Permission to change the use of part of the ground floor of an existing building from office use to use as a pharmacy. Permission is also sought for a second entrance door to the building foyer	LA: 16/16	Granted: 10/10/2016	No	No
82	GoBus	Permission for : 1) Subdivision of existing Restaurant into two units 2) Change of use of one of these units from Restaurant to Offices/Retail ticket outlet 3) Removal of front porch 4) Relocation of position of main entrance 5) Modifications to elevation and layout including provision of new window opening and new access doors	LA: 15/370	Granted: 08/09/2016	No	No
83	Cope Galway	Permission for a change of use of the Convent building (which is a protected structure, Galway City Council ref no 4306) for use as a domestic violence refuge. The application includes demolition of the existing boiler house, stores & rear corridor and other elements within the existing building & site, new extensions alterations and renovation of the building internally and externally, to provide nine self-contained residential units, staff accommodation, offices, outreach facilities, meeting rooms and childcare facility and general alterations to the site works including some new security fences and alteration to entrance gate	LA: 15/342	Granted: 15/06/2016	No	No
84	The PAS Fund	Permission for change of use of existing basement as office use to residential use as two number two bedroom apartments and permission to demolish existing rear toilet blocks to facilitate new external stairs to open space area	LA: 16/356 ABP: PL61.246109	Granted: 02/06/2016	No	No

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85	Gerry & Ann O'Gorman	Permission for change of use from shop to restaurant and will include: new fascia signage, internal layout changes including new seating areas, stairs, commercial kitchen, toilets and storage areas	LA: 15/333	Granted: 19/04/2016	No	No
86	Michael Molloy	Permission for change of use from retail (previously approved under (05/716)) to restaurant use, for new shop front including bay window, signage & lighting and associated external works at existing ground floor premises	LA: 15/236	Granted: 03/02/2016	No	No
87	Peadar Monaghan	Permission for (1) The demolition of existing building containing 6 no. existing apartments and (2) The construction of a three storey apartment development. The development will consist of: A) 1 no. ground floor 2 bedroom apartment, with rear garden and storage building B) 1 no. 4 bedroom apartment at first and second floor levels, with rear garden and storage building and roof terrace. C) All associated site works	LA: 15/196	Granted: 31/12/2015	No	No
88	Niche Hotels	Permission for the retention of the change of use from retail (108m2) to hotel use	LA: 15/230	Granted: 16/11/2015	No	No
89	Mr. Stephen Francis	Permission for the retention of well and associated plant	LA: 14/148	Granted: 27/10/2015	No	No
90	BECOCO Ltd.	Permission for (1) change of use from licensed premises approved under Pl. Ref. No. 06/934 to restaurant (2) permission for new signage along front elevation, together with all associated site works and services	LA: 15/54	Granted: 18/08/2015	No	No
91	National University of Ireland, Galway	Permission for development which will consist of the proposed external works to existing access road and adjacent landscaped area to include; provision of shared pedestrian and cyclist route; upgrade and resurfacing of existing road and footpaths; relocation of existing and provision of new signage, pedestrian crossing, balustrading and bollards;	LA: 14/214	Granted: 29/06/2015	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		relocation of existing services and access gates and designated overspill boat storage area. Associated works to include demolition of existing low level wall, removal of 2 No trees, and all remedial landscaping and associated site works. The works are adjacent to an existing protected structure, reference 3609 (Lime Kiln)				
92	Anna O'Donnellan	Permission to change use of ground floor from retail to coffee shop/sandwich bar (which is a protected structure)	LA: 14/312	Granted: 17/06/2015	No	No
93	Connacht Rugby Limited	Permission for (1) retention of a prefabricated ticket office, merchandise shop, advertisement structure and signage; and (2) permission for new signage (including replacement signage) and associated works	LA: 15/44	Granted: 26/05/2015	No	No
94	Mr. Michael McGrath	Permission for change of use of existing first floor office space to hostel accommodation. Proposed new hostel accommodation to provide an extra twelve en-suite bedrooms, common room, kitchen and dining area to existing hostel granted under Pl. Ref. 12/148. Development will also provide one new fire escape stairs/exit at ground floor and alterations to existing external fire escape stairs	LA: 14/293	Granted: 07/04/2015	No	No
95	Michael & Rita Burke	Permission for change of use of existing non-retail space at ground floor level (Planning Ref. No. 12/333 refers), to a cafe/restaurant, alterations to existing front facade at ground floor level, including signage and lighting and all ancillary works and services	LA: 14/198	Granted: 29/01/2015	No	No
96	Carrizozo Limited	Permission for (1) retention of (a) change of use of building at base of large triangular advertisement structure serving the Retail Park (former ATM fronting onto Headford Road) to a coffee kiosk shop and (b) associated retractable awning and signage; and (2) permission for new signage	LA: 14/237	Granted: 05/01/2015	No	No

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97	Daniel Sajfert	Permission for change of use of a derelict building into a premises that will form part of an existing cafe. The proposed works will consist of a seating area, cold food preparation area, toilets and all associated site works	LA: 14/103	Granted: 10/12/2014	No	No
98	Commissioners of Public Works in Ireland	Permission for development which will consist of the change of permitted use at mezzanine level from restaurant (associated with the Coach Station) to public office use (390sqm); minor amendments to main entrance door from Forster Street, and new external signage (approx. 20sqm) to Forster Street and Fairgreen Road elevations	LA: 14/137	Granted: 08/10/2014	No	No
99	Maura Keaveney	Permission to (1) retain change of use of ground floor from office to commercial (2) the construction of a separate entrance to ground floor unit	LA: 14/130	Granted: 13/08/2014	No	No
100	Iarnród Éireann, Structures & Architects Dept.	Permission for development at (a protected structure). Northern Elevation: The construction of a new 95 square metres single storey fully accessible glazed entrance building, the extension of the existing North Eastern bay platform, new 2m high boundary treatment to enclose this platform extension. Demolition of the existing lean too single storey building at the North eastern end of station, internal alterations and removal of walls within the train station to provide additional ticket purchase facilities, enlarged concourse areas, new toilet facilities, new ticket inspector accommodation North Eastern side of the station. The removal of the existing steel ramped access to the main station entrance after completion of the level access pedestrian entrances to the southern elevation. The reinstatement of the original step arrangement to the station building. Southern Elevation; CIE Stores and Maintenance Area (a protected structure). The refurbishment of the existing stores and maintenance area to provide 2336 square	LA: 14/18	Granted: 13/08/2014	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		metres of extended train concourse and platform, new pedestrian entrances, new curved partially glazed roof single span structure to replace existing roof, new openings within the existing South Western facade of the building to create new glazed entrances and fenestration. The proposed construction of new sloped approach routes, entrance plazas, street lighting and furniture, new glazed canopies to entrance plazas. New glazed entrances and fenestration to existing openings to South West, South East and North West elevations. The construction of new glazed retail pods and new toilet block within the station. New glazed doors and screens to be created to existing arches to both North Western and South eastern elevations of building. The removal of the existing internal mezzanine floor, removal of the existing ramped access, demolition of the existing lean to buildings at the North Western side of the building, demolition of the shed to the South Eastern gable of the building. Site works to include, inter alia, demolition of existing single storey industrial storage building and associated fuel silos to existing car park, reinstatement of car park paving, provision of 5no. disabled car parking spaces, new footpaths to both South Western elevations of station, removal of existing footpath to South Western gable of Meyrick Hotel and the construction of a new pedestrian walkway from the South East corner of Eyre Square to the new etc				
101	John C. O'Donnell & Sons	Permission for change of use of two apartments from residential to office and associated works	LA: 13/370	Granted: 08/08/2014	No	No
102	Peter Mernagh	Permission for change of use from shop unit (granted planning permission under Pl. Ref. No. 10/86) to coffee	LA: 14/2	Granted: 17/07/2014	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		shop/café, associated signage and all associated site works at the ground floor unit				
103	Connacht Branch Irish Rugby Football Union	Permission for a ground floor extension to the existing Sports Pavilion Administration facility	LA: 14/93	Granted: 02/07/2014	No	No
104	John Daly Atlantic Language Galway Limited	Permission for change of use of permitted retail floor area at ground floor and permitted office area at mezzanine level to educational use as a language school and a café. The proposed use includes teaching classrooms at mezzanine level and ancillary reception, staff and student facilities at ground floor level. The proposed café is at ground floor level.	LA: 14/62	Granted: 23/06/2014	No	No
105	Michael McAteer & Paul McCann (Receivers) of Shancar Developments (in Receivership)	Permission for a change of use (which is a protected structure), from Banking Hall to Cafe/Coffee Shop/Restaurant use. The proposed development encompasses a change of use at ground floor level, the removal of internal partitions to create a servery, minor internal alterations and the addition of plant to a flat roof at the rear of the structure, and all associated works	LA: 13/320	Granted: 16/04/2014	No	No
106	Workcast Limited (in Receivership)	Permission for development to consist of the construction of 5 no. coach bays and 33 no. apartments (5 no. one bedroom; 23 no. two bedroom; 5 no. three bedroom) on first, second, third, fourth and fifth floors and all other site development works above and below ground is required to facilitate the completion of a mixed use development substantially granted permission under Reference Number 04/872: An Bord Pleanála Reference Number: PL 61.210830 that amended the planning permission granted under Reference Number: 448/02, for a coach station and associated and ancillary facilities on ground floor; facilities associated with and	LA: 13/306	Granted: 01/04/2014	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		ancillary to the coach station at mezzanine level; office accommodation and apartments on first, second and third floors; and a basement car park and access ramp to the access road to Radisson SAS Hotel from Fairgreen Road.				
107	Galway County Council	Permission sought for the construction of a single storey extension to the existing Council Chamber	LA: 14/3	Granted: 25/03/2014	No	No
108	Enda McEvoy	Permission to consist of a change of use of 440m2 of retail space at ground floor to restaurant premises. The works will comprise a kitchen, dining room, toilets, signage and all associated services	LA: 13/317	Granted: 25/03/2014	No	No
109	Mr Daniel Sajfert	Retention Permission of (1) a cafe premises (2) seating area to the side of the cafe (3) roof covering over seating area to the side of the cafe (4) canopy/advertising sign along with associated works	LA: 13/253	Granted: 12/03/2014	No	No
110	Talebury Properties	Permission for alterations and change of use at no 1 to 3 Merchants Road, Galway, gross area 1215.0sqm, this building is a protected structure and is located at the junction of Merchants Road and Forthill Street. The alterations include installing 4 no retractable canopies over the existing ground floor windows to Merchants Road, New signage to existing shopfront to Merchants Road, the construction of a new food preparation area and two hoists at ground floor serving a new kitchen at first floor, double doors in existing courtyard at ground floor, a new kitchen at first floor level, remodelling of the existing toilets and staff areas at first floor, the construction of two new extracts to the rear elevation at first floor level to serve the kitchen and the removal of existing retail fixtures and fittings. The change of use comprises of change from 573.1sqm of retail use and staff areas to restaurant/kitchen use and staff areas at first floor level, 19.3sqm of retail use to food preparation area at ground	LA: 13/273	Granted: 23/12/2013	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		floor, 59.4sqm of retail use to cookery class use at ground floor, together with all associated site works all				
111	Mr. Eamon Doyle	Permission is sought to change the use of the existing Park House Office building into hotel bedrooms and associated rooms to be incorporated into and to form part of the existing Park House Hotel premises (The Park House Hotel is a protected structure), and for alterations to external elevations, including all associated services	LA: 13/115	Granted: 26/11/2013	No	No
112	Michael J. Fitzgerald Ltd.	Permission for retention and completion of a restaurant area to ground floor with ancillary sanitary facilities to first floor (a larger restaurant use in the building had previously been granted under Pl. Ref. No. 11/250)	LA: 13/115	Granted: 26/11/2013	No	No
113	Sisters of Mercy Western Province	Permission is sought for the provision of a new pedestrian entrance in the southern boundary wall (on to Forster Street) of the Magdalene Convent, a protected structure (Galway City reference 4306)	LA: 13/213	Granted: 15/10/2013	No	No
114	St. Joseph's Patrician College Board of Management	Permission is sought for a 3 storey front extension to their school at Nun's Island, incorporating a double fire escape stairs, relocation of oil tank to enclosed compound at front corner of site, elevation changes including provision of 2 new fire exit doors at the front of the building, all as part of required Fire Safety measures	LA: 13/207	Granted: 07/10/2013	No	No
115	National University of Ireland, Galway	Permission for a change to pedestrian footpath access to Quadrangle Building from University Road Main entrance, rearrangement of low level boundary wall at same entrance point, provision for safe pedestrian crossing at traffic entrance from University Road, speed ramp, lighting, relocation of NUIG sign and associated landscaping, all located at main entrance to NUIG Campus, University Road, Galway within the curtilage of NUIG Quadrangle Building a	LA: 13/59	Granted: 23/05/2013	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
		protected structure, unique identity no. 10303 and adjacent NUIG Gate Lodge Building a protected structure unique identity no. 10304				
116	Paddy Power PLC.	Permission for the change of use from retail to betting office use of the existing small retail unit (62m2) to the front of the former Permanent TSB bank premises to allow for the expansion of the existing Paddy Power betting office into the unit, replacing the existing shop fronts of both the existing Paddy Power unit and the adjoining unit at ground floor level with a new shop front, new external fascia level signage and associated site works at Paddy Power Bookmakers and adjoining unit to the front of the former Permanent TSB bank premises	LA: 12/356	Granted: 27/03/2013	No	No
117	Galway Bay Medical Centre Ltd.	Permission for a) provision of external signage and b) retention of the change of use from office to medical centre	LA: 12/320	Granted: 05/03/2013	No	No
118	N.U.I. Galway	Permission to: 1) carry out external works to include on-site set-down area/reconfigure public path. Provide accessible ramp/steps. 2) Provide external steps/fire exit to rear from internal stairs landing. 3) Construct machine room on roof to serve new internal lift. 4) Provide replacement windows and external doors/cladding panels/flashings and new automatic opening vent to stairwell	LA: 12/265	Granted: 11/01/2013	No	No
119	Radical Properties	Permission for works to amalgamate the existing ground level cafe/restaurant and retail units. The change of use from existing retail use to cafe/restaurant use at unit 13, modifications and extension to the existing canopy and signage to both units and alterations to the existing shopfronts	LA: 12/222	Granted: 20/11/2012	No	No
120	Connacht Branch Irish	Permission for the following: Provision of new changing room facilities and associated site works; Provision of new sports equipment storage facilities and associated site works;	LA: 12/122	Granted: 20/11/2012	No	No

No.	Applicant	Brief Description of Proposed Development	Reg. No.	Decision Date	NIS	EIAR
	Rugby Football Union	Provision of an extension to an existing hospitality facility. 1st floor extension to existing sports pavillion/administration facility. Provision of 2 no. promotional signs. Retention of an existing commercial marketing office facility				
121	Breege Lyons	Permission for development. The development will consist of permission for change of use from off License to Retail Unit	LA: 12/85	Granted: 16/07/2012	No	No

Údarás Náisiúnta Iompair
National Transport Authority

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Comhairle Cathrach na Gaillimhe
Galway City Council

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