Client:

Cork County GAA Board

Project:

Proposed Residential Development at Kilbarry, Cork.

Report:

Services Infrastructure Report

BARRY & PARTNERS

Document Control Sheet

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SECTION 1: INTRODUCTION

1.1 Scope of the Report

This Services Infrastructure Report outlines the proposed means of servicing the development with wastewater collection and disposal, stormwater management and disposal and water supply infrastructure. A Flood Risk Assessment is provided with this submission under a separate cover. Roads and traffic issues are dealt with separately by MHL Consulting Engineers on behalf of the Applicant and their submission should be consulted for such details.

The following should be read in conjunction with the engineering drawings which illustrate the servicing proposals and with the submissions by other members of the Applicant's design team

1.2 Site Location

The proposed development is located at Cork GAA Lands, Old Whitechurch Road, Kilbarry, Cork City on a circa 14.8-hectare site, approximately 3.3km to the north of Cork city centre, see Figure 1.1. The Old Whitechurch Road forms the western boundary of the site, the IDA City North Business Park is located to the south and Delaney's GAA Club to the east, with the Glenamought River/River Bride forming the northern boundary.

Figure 1-1: Location of Made Ground

The site topography is steep in some areas, particularly the northern portion of the site. The highest point of the site is approximately 88.70 m OD located near the eastern boundary. The lowest point is approximately 43.60 m OD at the northwest of the site. The proposed development is cognisant of these level issues and is designed to respect the existing topography. The developable area falls from approximately 88.70 m OD to 68.00 m OD, east to west.

1.3 Proposed Development Brief

This report is prepared in support of a Strategic Housing Development (SHD) planning application by Cork County GAA Board. The proposed development will consist of a strategic housing development of 319no. residential dwellings comprising of 85no. semi-detached units (comprising of 17no. 4-bed units and 68no. 3-bed units), 118no. terraced units (comprising of 8no. 4-bed units, 60no. 3-bed units and 50no. 2-bed units), 53no. duplex units (comprising of 30no. 1-bed units, 21no. 2-bed units and 2no. 3-bed units) and 63no. apartments (in 3no. part 4 storey and part 5-storey blocks and comprising 15no. 1-bed units and 48no. 2-bed units). The development also includes the provision of a crèche facility (519sqm) and a riverside amenity park to the north and northeast of the site. The proposed total gross floor area is 33,718.35sqm.

The proposed development will also consist of the demolition of a disused hurley manufacturing factory and associated out buildings, the removal and replacement of the southern and eastern boundary treatments, as well the creation of formalised and informal walking paths to replace the informal walking paths located to the north of the site, a new through road from the proposed site access on the Old Whitechurch Road to Delaney's GAA Grounds and accessing the Upper Dublin Hill Road, with associated new boundary treatments at Delaney's GAA club, all associated ancillary site development and hard and soft landscaping works, to include the provision of private, communal and public open space, waste storage areas, bicycle, motorcycle and car parking, including EV and disabled parking, esb substations, groundworks, foul drainage works, stormwater drainage proposals including directional drilling for the stormwater outfall, water supply proposals, public lighting, and all new boundary treatments for a proposed development of 319 dwellings together with a creche and associated ancillary site works, the proposed site layout is included in Appendix 1.

SECTION 2: EARTHWORKS & GROUNDWORKS

Proposed roads, houses, apartments and the creche will be developed as close to existing ground levels as is possible. However, given the relatively steep existing topography and the need to achieve reasonable longitudinal gradients along roads and Part M access into residential units and the creche, it will be necessary to excavate and fill across the site to achieve acceptable levels. The design of the development will balance the extent of cut and fill, in so far as practically achievable, to ensure that there is not a significant surplus or deficit of material required.

Priority Geotechnical were appointed to undertake a detailed Site Investigation and Interpretive Report (SI) of the proposed site, to assess subsoil and bedrock conditions (the full SI report is included in Appendix 2). 2 No. Cable percussive boreholes and 25 No. trial pits were conducted. Some made ground was discovered at the east of the site, up to 4.0m in depth, see Figure 2.1. In addition, some shallow bedrock was discovered on the west of the site, between 0.6m to 2.3m in depth, see Figure 2.2. The SI report advises that foundations should not be constructed in the made ground. Special site-specific foundations will be designed in these areas of fill to ensure the stability of the proposed construction. Piled foundation solutions will be implemented to transfer the structural loads to the natural ground beneath the fill. The report also advises that in areas where bedrock is shallow, the foundations shall be over excavated to the weathered bedrock.

No groundwater was encountered during the investigative works.

The made ground area comprises fill that was illegally dumped by others in 1999 without the knowledge or permission of Cork County Board. Cork County GAA Board employed Malachy Walsh and Partners Consulting Engineers to address and resolve this matter with Cork County Council and the Applicant has recently employed Verde Environmental Consultants to assess the available SI information and confirm the status of this made ground area. The relevant correspondence and reports are attached in Appendix 3 confirming these interactions.

The material in this filled area has been sampled and tested and confirmed as being non-hazardous and inert.

Given that this material has been in place for over 20 years it is intended to leave this material in place and while it will require specialised foundation solutions to be employed for structures developed in this area it would not be sensible or practical to remove this material from the site at this stage.

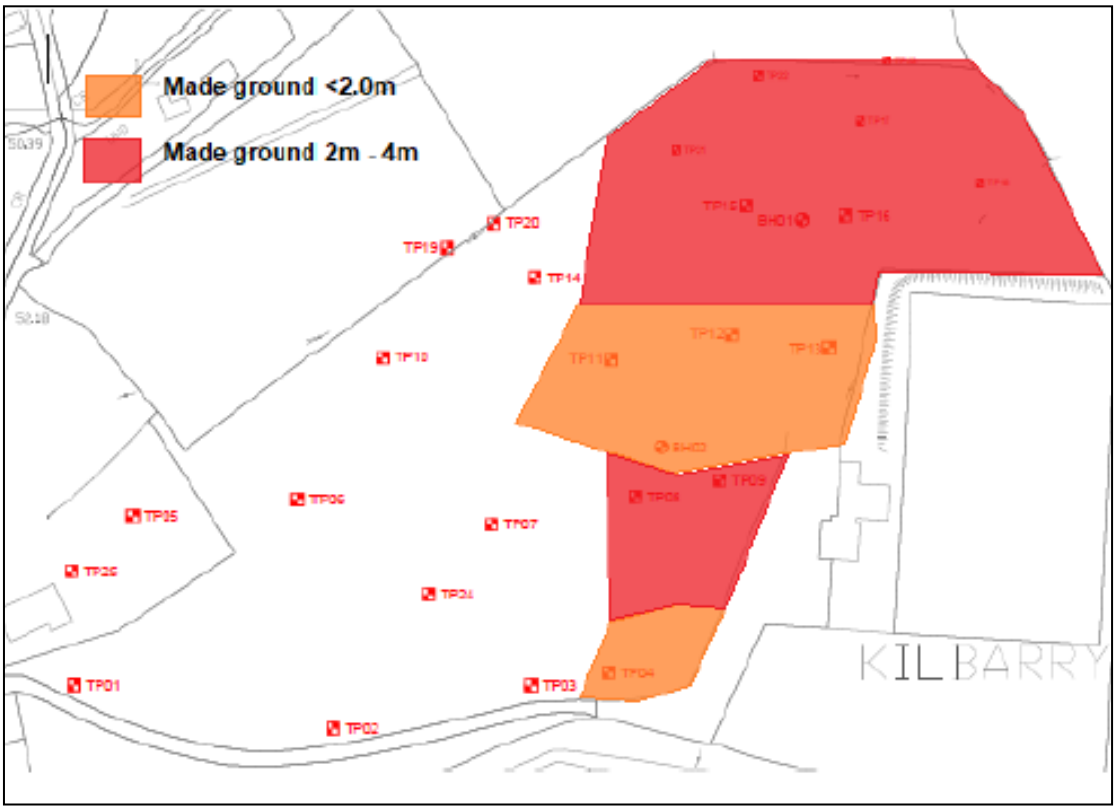

Figure 2-1: Location of Made Ground

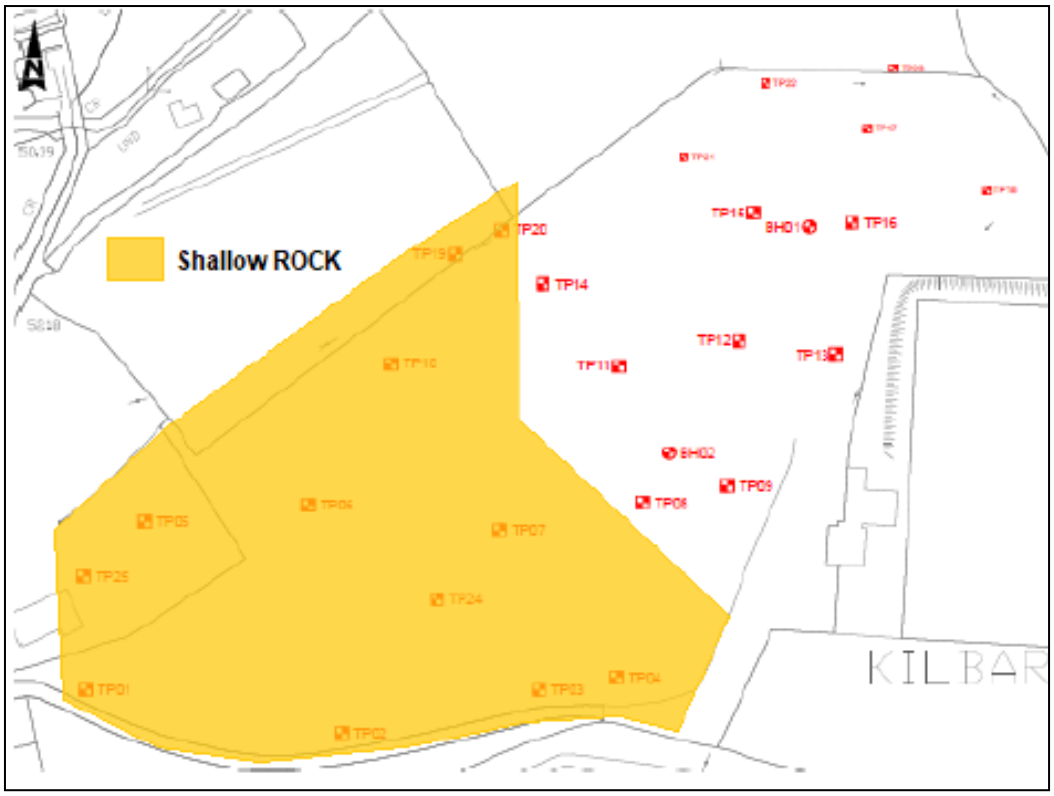

Figure 2-2: Location of Shallow Bedrock

SECTION 3: ROADS AND ACCESS

See EIAR for full details of roads and transportation issues. Access will be from Old Whitechurch Road and via the existing road serving the IDA and GAA club which connects to Upper Dublin Hill.

Sightlines at the Old Whitechurch Road entrance will be provided in accordance with DMURS. The Old Whitechurch Road in this area is within a 50kmh speed limit and therefore a design speed of 60kmh applies.

In accordance with section 4.4.4 of DMURS, table 4.2 sightlines of 59 meters are required. Sightlines at the junction with Upper Dublin Road are also in accordance with this requirement. See Drawing No. 19215-JBB-00-XX-DR-C-05001 for sightlines at both junctions.

See DMURS Statement submitted as part of this application for full details of internal roads, cycleways and footpaths.

SECTION 4: WASTEWATER COLLECTION & DISPOSAL

4.1 Existing Wastewater Network

Irish Water drainage records show that there is an existing 225mmØ foul sewer located in the Whitechurch Road, west of the site, see Appendix 4

4.2 Pre-Connection Enquiry Stage

Following a Pre-Connection Enquiry, Irish Water (IW) issued a Confirmation of Feasibility (COF) stating that the site can be serviced by its wastewater infrastructure network. This COF is included in Appendix 5.

The COF states that a connection to the existing 225mm foul sewer in the Whitechurch Road can be made to serve the first 100 houses of this proposed development. In order to facilitate the connection of the remaining proposed units, approximately 150m of upgrades are required to the existing Whitechurch Road foul sewer and it is likely that further sewer network upgrades will be required downstream. Irish Water currently have a project underway to assess the necessary upgrades to the existing foul sewer network, which in due time will inform the required upsizing of the Old Whitechurch Road sewer.

IW have been consulted in order to agree a high-level solution to the necessary upgrade works. IW have confirmed that the upgrade works required are to pipe sizes only, can be carried out on public roads and do not involve provision of infrastructure that would require planning approval. Agreement on the optimum procurement methods for the provision of this infrastructure can be a matter for later detailed agreement with Irish Water.

4.3 Design Acceptance Stage

The proposed designs were progressed in accordance with Irish Water's Code of Practice for Wastewater Infrastructure and were submitted to Irish Water for review and consideration for design acceptance as per the requirement of the SHD process. A Statement of Design Acceptance was issued by Irish Water and is included in Appendix 5.

The wastewater collection system is designed to ensure self-cleansing velocities will be achieved on all pipe runs. The pipes proposed as part of this design have been sized in accordance with Table 3.1, an extract from IW-CDS-5030-03 (Revision 2 2020).

Manholes will be constructed on all pipe-runs at changes in sewer direction, changes in gradients, at significant sewer connections and at a maximum spacing of 90m on all straight sections of pipework. The gravity wastewater sewers have been designed using MicroDrainage design software and the outputs are included in Appendix 6 of this report. The foul sewer layout plans are attached on Drawing No's. 19215-JBB-00-XX-DR-C-04000, 04001, 04002 & 04003.

Table 4-1: Foul Sewer Size/Gradient Criteria

No. of Dwellings	Pipe Diameter	Minimum Gradient
2 to 9	150mm (or 225mm)	1:60
10 to 20		1:150
21 to 210	225mm	1:300
211 to 250		1:200
351 to 330		1:100
331 to 450	300mm	1:300

No. of Dwellings	Pipe Diameter	Minimum Gradient
451 to 565		1:200
566 to 655		1:150
656 to 830		1:100

SECTION 5: STORMWATER COLLECTION & DISPOSAL

5.1 Existing Hydrology

The main hydrological feature of the area is the Glenamought River/River Bride. The River Bride is a tributary to the River Lee and flows in a south westerly direction forming the northern boundary of the site. Figure 4.1 below illustrates the main hydrological features associated with the site.

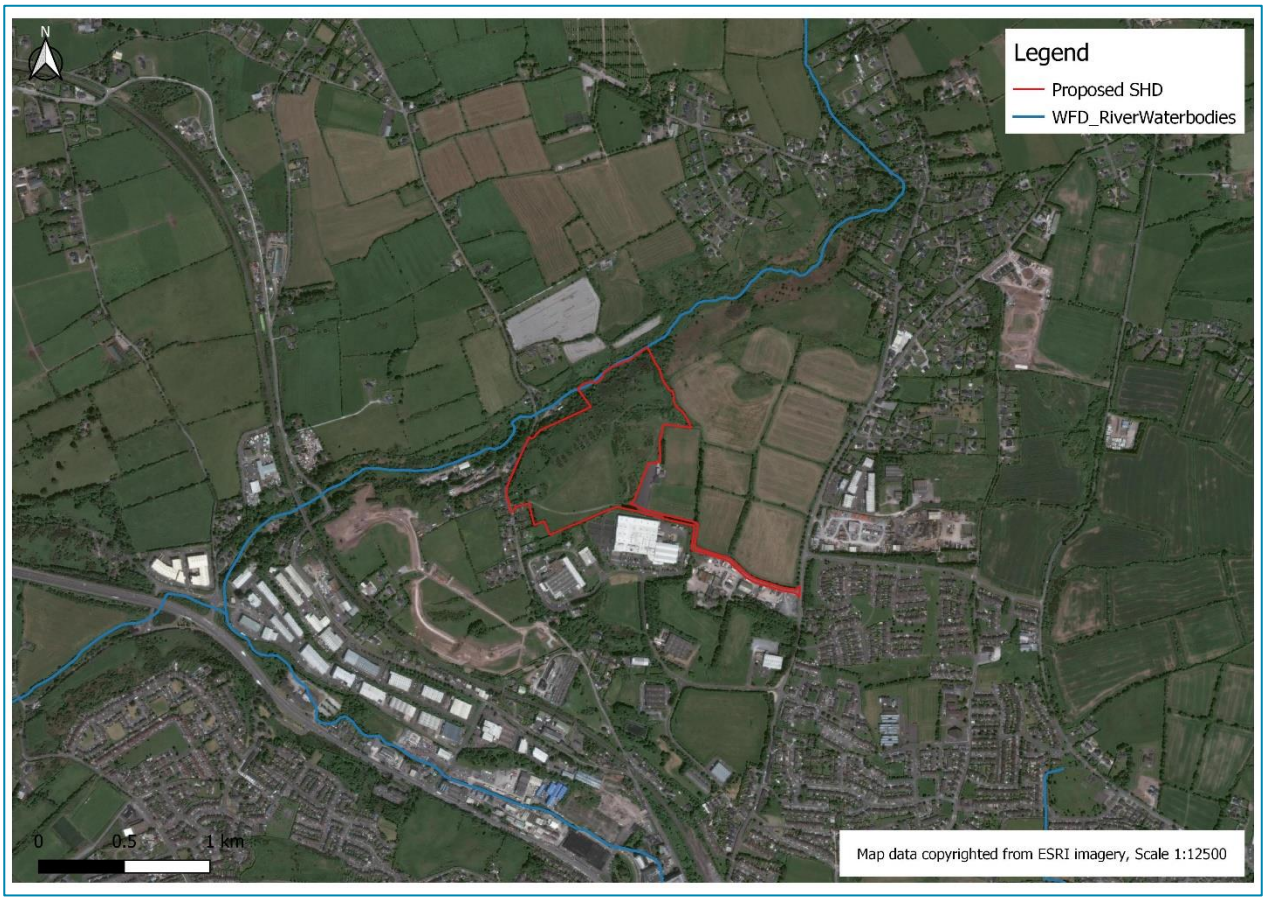

Figure 5-1: Hydrological Features of the Area

Priority Geotechnical Ltd were appointed to complete a ground investigation to determine the infiltration capacity of the exiting ground. 7 No. soakaway tests were conducted in accordance with BRE Digest 365 which resulted in a range of infiltration rates from $3.04x10^{-4}$ m/s to $7.43x10^{-6}$ m/s. The full Ground Investigation, Infiltration test report is included in Appendix 7.

5.2 Greenfield Runoff

The total site area for planning purposes is 14.8ha, however this includes the northern area of the site which falls steeply to the river and which will remain largely unaltered. As this area is not positively drained to the developments surface water drainage system, it is excluded from the surface water calculations of Qbar and a figure of 8.07ha is used as the catchment area.

The greenfield runoff rate has been estimated using the HR Wallingford Greenfield runoff estimation online tool (report attached in Appendix 8). The online tool calculated a Qbar figure of 26.26 l/s (equivalent to 3.25 l/sec/ha). A summary of the design values output by the HR Wallingford Greenfield runoff estimation online tool is shown below:

Table 5-1: HR Wallingford Design Value Outputs

Design Criteria	Value
Catchment Area (ha)	8.07
Soil Type	2
SPR	0.3
SAAR (mm)	1149
1-year factor	0.85
30-year factor	1.65
100-year factor	1.95

5.3 Proposed Development Surface Water Management System

The proposed surface water management system will, as much as is feasible, be designed in accordance with the principles of Sustainable Drainage Systems (SuDS) as embodied in the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS).

The GDSDS addresses the issue of sustainability by requiring designs to comply with a set of drainage criteria which aim to minimise the impact of urbanisation by replicating the runoff characteristics of a greenfield site. The criteria provide a consistent approach to addressing both rate and volume of runoff as well as ensuring the environment is protected from pollution that is washed off roads and buildings. These drainage design criteria are as follows:

- Criterion 1 - River Water Quality Protection
- Criterion 2 - River Regime Protection
- Criterion 3 - Flood Risk Assessment
- Criterion 4 - River Flood Protection

The requirements of SuDS are typically addressed by provision of the following:

- Interception storage
- Treatment storage (not required if interception storage is provided)
- Attenuation storage
- Long term storage (not required if growth factors are not applied to QBAR when designing attenuation storage, i.e., extended attenuation storage design)

5.3.1 Layout of the Proposed Network

The proposed surface water network will include a storm drainage pipe network, attenuation storage structures and several SuDS features which will aid the reduction of runoff volumes by slowing surface water flows, providing the opportunity for evapotranspiration and providing the opportunity for infiltration to ground. Both the interception and attenuation storage requirements of GDSDS will be sufficiently met.

An assessment of the potential SuDS measures that could be incorporated within the site was conducted using the SuDS Manual, CIRIA 753 as guidance. The following SuDS features have been identified as applicable and will be provided within the proposed scheme:

- Green Roof: will be provided on the creche building. The green roof will be an extensive type with sedum planting at the surface with a drainage layer beneath. The drainage layer will convey flows to discharge locations. It is not proposed to restrict the discharges from the roof.
- Permeable Paving: will be provided for all parking spaces. Permeable paving will be a Type B as per SuDS Manual, CIRIA 753, a combination of infiltration and piped drainage.

- Tree Pits/Bioretention Planters: will be provided in every feasible location where there is a proposed tree or planter. The tree pits will contain engineered soil filled tree boxes with drainage pipes beneath to link trees together and tie in with the proposed surface water sewer. The bioretention planters will consist of a shallow landscaped depression at the surface with a drainage layer beneath.
- StormTech Attenuation Tank: will be provided at the natural low points for final storage of runoff volumes before discharging to the existing river at a controlled rate.

The SuDS features will be designed to work in sequence thereby creating a treatment train. The proposed SuDS layout is shown on see Drawing No. 19215-JBB-00-XX-DR-C-04004 and the overall drainage arrangement is shown on Drawing No. 19215-JBB-00-XX-DR-C-04000, both included with this submission.

Manholes will be constructed on all pipe-runs at changes in sewer direction, changes in gradients, at significant sewer connections and at a maximum spacing of 90m on all straight sections of pipework The gravity surface water sewers have been designed using MicroDrainage design software and the outputs are included in Appendix 9 of this report.

The contributing surface areas of the development has been split up and tabulated below:

Table 5-2: Breakdown of Contributing Surface Areas

Design Criteria	Area (ha)
Catchment Area (ha)	8.07
Green Roof	0.04
Permeable Paving, Tree Pits and Bioretention Areas	0.90
Impermeable Area (Roofs, Roads)	4.36
Positively Drained Area	5.30
Area Without Formal Drainage	2.77

5.3.2 Interception Storage

In accordance with the requirements of GDSGS, at least 5mm, and preferably 10mm, of interception storage should be provided on site, where runoff to the receiving water can be prevented. It has been assumed that where the rainfall falls on green areas there will be no runoff occurring for the first 5mm - 10mm.

For this development the total catchment area for interception purposes (green roof, permeable paving, tree pits/bioretention area & impermeable area) is 5.30ha (53,000m²) as per Table 4.2 above. This results in a required interception storage volume of 265m³ (53,000 X 0.005) The proposed interception storage will be provided by green roofs, permeable paving and within the base of the StormTech attenuation tanks.

A green roof is proposed for the creche building, which covers a total area of 400m². The green roof will include a drainage mat which will provide a minimum of 5mm of interception storage per 1m², allowing for a total interception storage volume of 2m³.

Permeable paving is proposed throughout the development, for a total area of 6,500m². The drainage pipe within the gravel bed for these areas will be set at 50mm above the bed formation giving (assumed 30% voids) interception stage equivalent to 15mm storage depth. Total interception volume provided in the permeable paving equals 97.5m³.

Tree pits/bioretention areas are proposed throughout the development, for a total area of 2,500m². The drainage pipe within the gravel bed for these areas will be set at 50mm above the bed formation giving (assumed 30% voids) interception stage equivalent to 15mm storage depth. The total interception volume provided is 37.5m³.

The proposed StormTech attention tank has a surface area of 1,597m². Interception storage will be provided within the base of the tanks for a depth of 230mm depth of stone below the StormTech Chambers. Assuming the stone has a void ratio of 43%, the total interception storage volume provided is 158 m³

The overall interception storage volume provided is therefore 295m³ which represents approximately 5.6mm of interception storage which is above the required minimum provision as detailed above.

5.3.3 Attenuation Storage

The proposed rate of surface water discharge from the development will be limited to Qbar, as described in Section 4.2. Attenuation storage will be provided by StormTech attenuation chambers which will cater for the 100-year storm event with a 10% climate change allowance added. The proposed surface water network has been split into two catchments, A and B, see Figure 4.2.

These catchments will work together in series where the controlled discharge from upstream system connects to the downstream system, so the downstream system receives the flow from the upstream hydrobrake as well as flow from the surface water runoff generated within its own catchment. The discharge rate from the downstream hydrobrake is the sum of the rates calculated for the contributing catchments.

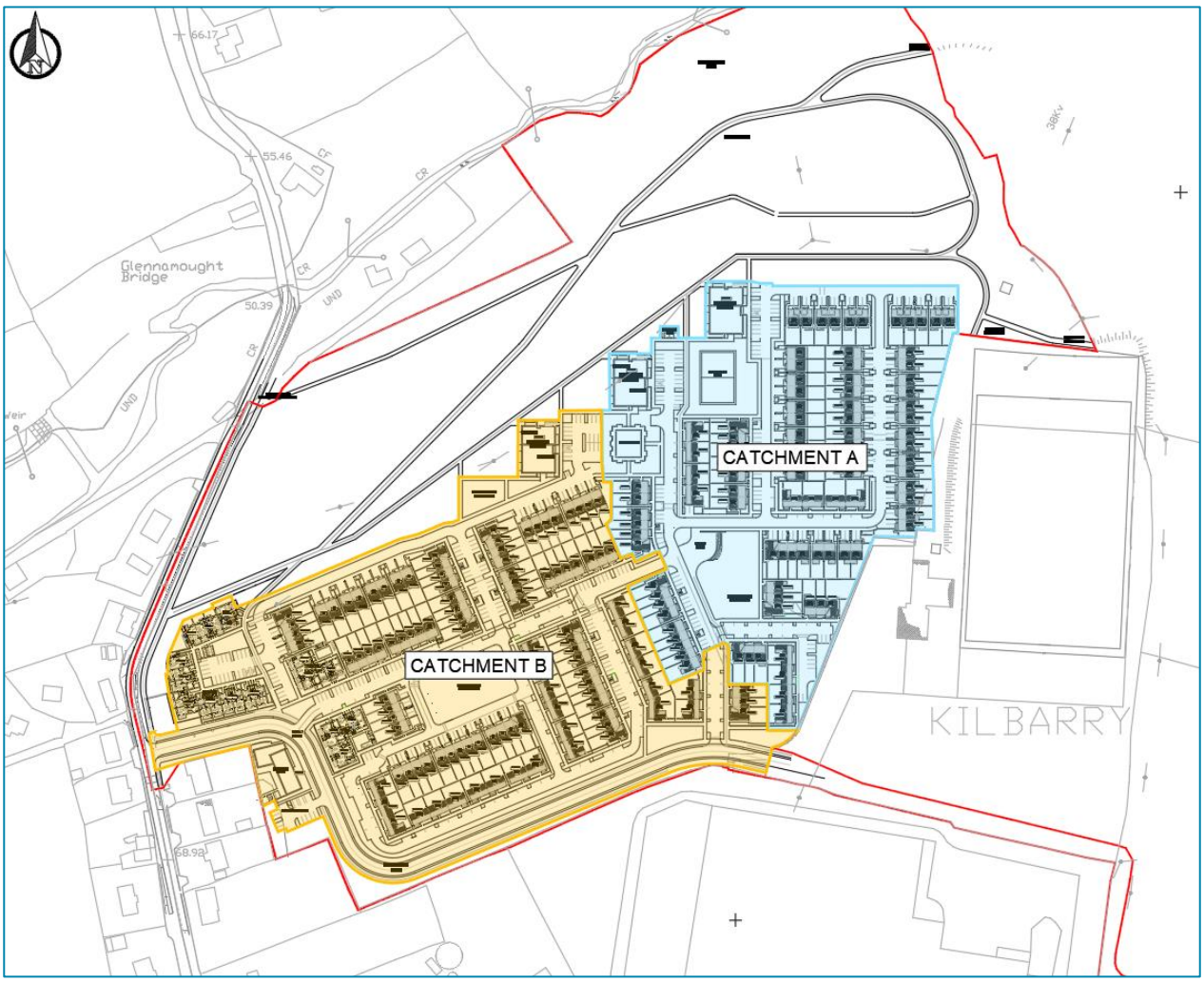

Figure 5-2: Surface Water Catchments

The various SuDS components being proposed as part of the development will provide some attenuation, reduce flow rates and will disperse surface water runoff via evapotranspiration and infiltration. To account for these contributions, we have assumed a reduction in runoff volume from the various contributing surfaces based on runoff coefficients (Cv). The following Cv decisions have been informed by South Dublin County Council's – "Sustainable Drainage Explanatory Design & Evaluation Guide".

Table 5-3: Coefficients of Volumetric Runoff

Contributing Surface	Runoff coefficient (Cv)
Roads	0.90
Roofs	0.95
Permeable Surfaces	0.10
Green Roof	0.30

Due to the positive infiltration rate of the existing ground at the location of Attenuation Tank B, $1.19x10^{-4}$ m/s (See Appendix 7), the proposed design has utilised discharge to ground in addition to a restricted piped outfall. As a conservative measure we have assumed that infiltration will occur in only half of the base of the tank and with no infiltration at the sides. The same design method has not been used for Attenuation Tank B as no infiltration testing was conducted at the proposed location. However, infiltration capacity it will be explored in due course subject to a granted planning permission.

Preliminary attenuation volume calculations, based on the above criteria, are summarised in Table 3.3. (See Appendix 10 for detailed calculations)

Table 5-4: Summary of Attenuation Requirements and Proposals

Ref.	Catchment Area (ha)	QBar (l/s)	Max. Outfall Rate (l/s)	Max. Discharge to Ground (m/hr)	Required Storage Volume 100yr +10% C.C. (m^3)	Provided Attenuation Volume (m^3)
A	3.35	10.9	10.9	-	841	881
B	4.72	15.3	26.2	0.2142	918	933

5.3.4 Water Quality

The proposed development is residential and therefore is considered a low-level pollution hazard. Where possible surface water runoff will be directed to the SuDS features as mentioned above and will therefore benefit from their pollutant removal qualities. However, to ensure water quality standards are met, we are proposing a hydrocarbon interceptor upstream of the StormTech attenuation tank.

Simple Index Approach

The effectiveness of the chosen SuDS components to achieve water quality can be assessed using the 'simple index approach' as described in CIRIA C753.

The simple index approach designates risk indices to the various areas of development to determine their possible pollutant contribution. Similarly, the SuDS features are designated mitigation indices and if the mitigation indices are larger than the risk indices the water quality objectives are considered satisfied.

Table 5-5: Pollution Hazard Indices for Different Land Uses

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very Low	0.2	0.2	0.05

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Driveways, car parks, low traffic roads	Low	0.5	0.4	0.4

As can be seen in Table 3.5 below the total mitigation potential of the SuDS features far outweigh the contamination risks. Secondary (or further) stages in the treatment train are assigned 50% of the stated treatment indices value.

Table 5-6: Indicative SuDS Mitigation Indices for Discharges to Surface Waters

SuDS Component	TSS	Metals	Hydrocarbons
Permeable paving	0.7	0.6	0.6
Bioretention/Tree pits	0.8	0.8	0.8
Petrol Interceptor	0.4	0.4	0.4

5.3.5 Amenity and Biodiversity

Meeting amenity and biodiversity standards is all about creating attractive, pleasant, and liveable urban areas for both people and for nature.

The proposed SuDS features within this development will not only be aesthetically pleasing, but they will also assist the creation of liveable habitats for nature by retaining rainfall at the source. The final details of these features will be drawn-up in consultation with the landscape design and ecological consultants on the design team.

5.4 Conveyance of Surface Water Outflow to Final Discharge Location

The route from the final storage area to the final discharge location at the Glenamought River/River Bride must pass a protected butterfly habitat and navigate a steep decline to the river edge.

To combat these issues, it is proposed to utilise directional drilling along the outfall route beneath the butterfly habitat at a depth of approximately 3.4m – 4.2m below existing ground. The underground drilling will be continued beyond the habitat area, as far as the transition from underground to open channel at manhole S77. From this point it is proposed, due to steepness of the gradient to the discharge location, to create a meandering open drain. The open drain has been designed in consultation with the landscape architect and ecologists to ensure that the open drain is considerate of the existing landscape and will ensure that flows are managed, and erosion of the open drain does not occur, their submissions should be referred to for further detail.

It is proposed to discharge surface water from the final storage area at a maximum rate of Qbar (26.2 l/s).

SECTION 6: WATER SUPPLY

6.1 Existing Watermain Network

Irish Water water distribution records show that there is an existing 150mmØ ductile iron watermain located in the Whitechurch Road, west of the site, see Appendix 11

6.2 Pre-Connection Enquiry Stage

Following a Pre-Connection Enquiry, Irish Water have issued a Confirmation of Feasibility (COF) that the site can be serviced by its water infrastructure network. This COF is included in Appendix 5.

The COF confirms that a connection to the existing 150mm ductile iron watermain in the Whitechurch Road can be made to serve the first 100 houses of this proposed development. In order to facilitate the connection of the remaining units, approximately 750mm of upgrades are required to the existing Whitechurch Road watermain. These upgrades include upgrading the existing 150mm watermain to 250mm as far as the existing 300mm watermain in the Killarney Business Park.

IW have been consulted with in order to agree a high-level solution to the necessary upgrade works. IW have confirmed that the upgrade works can be carried out on public roads and do not involve provision of infrastructure that would require planning approval. Agreement on the optimum procurement methods for the provision of this infrastructure can be a matter for later detailed agreement with Irish Water.

6.3 Design Acceptance Stage

The proposed design for water supply infrastructure within the development was progressed in accordance with Irish Water's Code of Practice for Water Infrastructure and was submitted to Irish Water for review and consideration for design acceptance as per the requirement of the SHD process. A Statement of Design Acceptance was issued by Irish Water and is included in Appendix 5.

To serve the developments 319 units a short length of 200mmØ watermain is required for the initial connection. The remainder of the development will be served by 150mmØ and 100mmØ diameter watermains. If the proposed development progresses in advance of the upgrade works to the existing Irish Water network, a concentric taper reducer will be installed at the connection point to reduce the proposed 200mmØ watermain to the existing 150mmØ watermain.

Fire hydrants will be provided such that each residential unit will be within 46m of a hydrant and these hydrants will be provided to be fully accessible to the fire service. Apartment buildings and the creche will be subject to later Fire Safety Certificate applications and the provision of appropriate water supply for firefighting at these buildings will be addressed in these applications.

Appendix 1:

PROPOSED SITE LAYOUT

Rev	DETAIL	DATE	BY
1	ISSUED FOR PLANNING APPLICATION	29.06.22	SD

Stage Abbreviations:
SU-Survey, SK-Sketch, PP-Preplanning, PA-Planning Application, FI-Further Information, AP-Appeal, RC-Response To Conditions, TE-Tender, FC-Fire Cert/, LE-Contract / Legal, CO-Construction, AB-As Built.

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CLIENT:
CORK COUNTY GAA BOARD

JOB TITLE:
RESIDENTIAL DEVELOPMENT AT KILBARRY, CORK

DRG. TITLE:
OVERALL LANDSCAPE MASTERPLAN

Drawn By:	Checked By:	Job No:	Drawing Number:	Revision:	Stage:
SD	KMCD	19012	4000	1	PA

SCALE: 1:1000@A1

Appendix 2:

SITE INVESTIGATION INTERPRETIVE REPORT

Our Ref: JMcS/Rp/P19129 + attachments (*.pdf)

09th April, 2020

Messrs. JB Barry & Partners
3 Eastgate Road,
Eastgate Business Park,
Little Island,
Co. Cork.

Re: Kilbarry Lands, Cork– Site Investigation, Interpretive report.

Introduction

In October 2019, Priority Geotechnical were requested by JB Barry & Partners acting on behalf on behalf of the Client, Páirc Uí Chaoimh Ctr, to undertake a site investigation as part of the proposed residential housing development on lands at Kilbarry, Co. Cork. The proposed scheme is located on a mix of agricultural, residential and industrial land.

Objectives

This site investigation contract is required to assess subsoil and bedrock conditions in order to inform the engineering design solutions of the proposed residential development at Kilbarry, Co. Cork.

Scope

The scope of the ground investigation, which was specified by JB Barry & Partners, comprised of:

- 02Nr. Cable percussive boreholes to a scheduled depth 8.0m;
- 25Nr. Trial pits to a scheduled depth 4.5m;
- *In-situ* tests including standard penetration tests;
- All associated sampling;
- Associated lab testing and
- Associated reporting.

The final site works as completed is outlined, herein**.**

This geotechnical interpretive report; GIR presents a summary of the fieldworks records and geotechnical data obtained with regard to the site investigation at Kilbarry lands, Co. Cork and should be read in conjunction with the exploratory and photographic records and laboratory test data accompanying the separate factual reporting.

Site Works

This investigation was carried out under the supervision of PGL, Engineering Geologist(s between the 07th August and the 13th September, 2019 in accordance with I.S. EN 19972:2007 Eurocode 7 - Geotechnical design, Part 2, Ground investigation and testing and BS 5930:1999+A2:2010 and the relevant British Standards (BS 5930 (2015) Code of Practice for Site Investigation and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests Parts 1 to 9) and the Specification and Related Documents for Ground Investigations in Ireland (IEI, 2nd Ed., 2016).Details of the plant and equipment used are detailed on the relevant exploratory records, accompanying the factual reporting.

Cable percussion boreholes

Two (2) number cable percussion boreholes were drilled to depths 4.0m below existing ground level (bgl) to 4.9m bgl using PGL's Dando 2000 percussion rig and 200mm diameter casing. Boreholes terminated after one (1) hour chiselling without progress. The nature of the obstruction was not determined. The exploratory records accompany the separate factual report and are discussed, herein.

Location	Depth (m bgl)	Date (dd/mm/yyyy)
BH01	4.9	13/09/2019
BH02	4.0	13/09/2019

Location	Chiselling (m bgl)		Duration, hh:mm
	from	to	
BH01	4.8	4.9	01:00
BH02	3.9	4.0	01:00

Trial pit excavations

Twenty five (25) trial pit excavations were dug to depths 0.7m bgl to 4.2m bgl using an 8t tracked excavator. The exploratory records accompany the separate factual report and are discussed herein.

Location	Depth, m bgl	Stability remarks	Groundwater remarks
TP01	1.4	Good.	None encountered.
TP02	2.3	Good	None encountered.
TP03	2.7	Good	None encountered.
TP04	2.0	Good	None encountered.
TP05	0.7	Good.	None encountered.
TP06	1.8	Good.	None encountered.
TP07	1.6	Good	None encountered.
TP08	3.9	Good	None encountered.
TP09	2.8	Good	None encountered.
TP10	2.2	Good	None encountered.
TP11	3.1	Good	None encountered.
TP12	2.4	Good	None encountered.
TP13	2.4	Good	None encountered.
TP14	2.6	Good	None encountered.
TP15	4.2	Moderate	None encountered.
TP16	3.4	Good	None encountered.
TP17	4.1	Good	None encountered.
TP18	4.2	Moderate	None encountered.
TP19	1.6	Good	None encountered.
TP20	0.9	Good	None encountered.
TP21	3.9	Moderate	None encountered.
TP22	1.9	Good	None encountered.
TP23	4.1	Good	None encountered.
TP24	1.2	Good	None encountered.
TP25	0.7	Good	None encountered.

Sampling

A total of fifty seven (57) bulk disturbed samples (B) and five (5) environmental soil samples (ENV, ES) were recovered from the exploratory holes in accordance with Geotechnical Investigation and Sampling– Sampling Methods and Groundwater Measurements (EN ISO 22475-1:2006).

In-situ testing

Standard Penetration Test

Nine (9) number Standard Penetration Tests, N values, were carried out in the boreholes using the 60º solid cone (CPT) in place of the standard split barrel sampler; in accordance with Geotechnical Investigation and Testing, Part 3 Standard penetration test, BS EN ISO 22476-3:2005+A1:2011. The data is presented on the exploratory logs accompanying this report; discussed and presented graphically herein.

Hand Vane Tests

Ten (10) number hand vane tests were undertaken in trial pit excavations. The shear strength was measured in kPa and presented on the exploratory logs accompanying the factual report and discussed, herein.

Survey and Drawings

Upon completion of the fieldworks, the 'as built' exploration locations were surveyed using Trimble 5700/5800 GPS equipment to the Ordinance Survey Irish Transverse Mercator system of co-ordinates (ITM) and elevations to Malin Head datum. The exploratory locations are shown on the Exploratory Location Plans (P19129_SI_A and P19129_SI_01) attached for reference.

Laboratory Testing

Laboratory testing was scheduled by JB Barry & Partners and carried out by PGL in accordance with BS1377 (1990), Methods of test for soils for civil engineering purposes and the ISRM suggested methods for rock characterisation, testing and monitoring. Specialist environmental testing was carried out by Chemtest Ltd. UK on behalf of PGL. The laboratory data accompanies the separate factual report and was summarised as follows;

SUMMARY OF LABORATORY TESTING

Type	Quantity, Nr.	Remarks
Natural Moisture Content	17	13% to 28%
Atterberg Limits	04	Liquid Limit, LL 33% to 49% Plastic Limit, PL 21% to 35% Plasticity Index, PI 11 to 15

Type	Quantity, Nr.	Remarks
Particle Size Distribution	15	No hydrometer analysis on fine soils
Moisture condition value, MCV moisture content relationship	01	TP12 0.6m, see attached
California bearing ratio, CBR moisture content relationship	03	TP06 0.8m; TP07 1.5m and TP11 0.5m, see attached
Proctor compaction, dry density moisture content relationship	03	TP06 0.8m; TP07 1.5m and TP11 0.5m Maximum dry density 1.90Mgm^{-3} to 2.00Mgm^{-3} Optimum moisture content 9.5% to 13.3%
pH	10	5.7 to 8.5
Sulphate (2:1 water soluble) as SO_4	10	<0.010g/l to 0.027g/l
Total Sulphur	07	<0.010% to 0.026%
Sulphate (acid soluble)	10	<0.010% to 0.042%
Organic matter	02	<0.40% (LOD, limit of detection)
Loss on ignition (LOI)	06	2.3% to 4.8%
Environmental analysis absolute values and leachate	05	TP04, TP12, TP17, TP19 and TP24,see attached results

Ground and Groundwater Conditions

The full details of the ground conditions encountered are provided for on the exploratory records accompanying this report. The records provide descriptions, in accordance with BS 5930 (2015) and Eurocode 7, Geotechnical Investigation and Testing, Identification and classification of soils, Part 1, Identification and description (EN ISO 14688-1: 2002),– Identification and Classification of Soil, Part 2: Classification Principles (EN ISO 14688-2:2004) and Identification and Classification of Rock, Part 1: Identification & Description (EN ISO 14689-1:2004) of the materials encountered, in situ testing and details of the samples taken, together with any observations made during the ground investigation.

No groundwater was encountered during the period of works. Groundwater levels may be subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc. The groundwater regime should be assessed from standpipe well installations, where available. Exploratory holes were backfilled with arisings upon completion of the works. Backfill details are shown below and presented graphically on the exploratory logs accompanying the factual report.

Geotechnical Review

The following geotechnical review provides an overview of the ground conditions identified within the site along with the general characterisation of the deposits encountered. The following sections should be read in conjunction with the exploratory records, laboratory data, photographic records and the proposed construction details/ plans.

Published Geology

A search of the Geological Survey data base and 1:100,000 mapping (Sheet 25) indicates the immediate site is defined by the Ballytrasna Formation (BS, purple Mudstone and Sandstone). The Gyleen Formation (GY, Sandstone with Mudstone and Siltstone) lies the north and south. The national groundwater vulnerability mapping indicates the area is of high to extreme vulnerability. Teagasc subsoil mapping indicated the site is underlain by glacial tills derived from Devonian Sandstones. Outcropping bedrock is mapped extensively to the north. Historic well ID's: 1407SEW106 and 1407SEW108 indicated a depth to rock 6.0m.

Ground model

The ground model was such that Topsoil, slightly sandy SILT where encountered was 100mm to 600mm thick. Made Ground, medium dense, brown, very sandy very clayey GRAVEL with low cobble content and stiff brown, slightly sandy gravelly SILT with C& D waste inclusions: PVC ducting, plastics, Boulders, concrete, re-bar, glass, metal, wire, concrete blocks, timber, red bricks, clay pipe and bituminous materials; where encountered, was described persisting to depths 0.3m bgl up to 4.9m bgl (BH01). This was underlain by mixed glacial deposits of brown, slightly sandy gravelly SILT with low cobble content to depths 0.7m bgl to 1.3m bgl overlying medium dense purple brown, silty sandy GRAVEL with medium cobble content and low boulder content to a depth 1.6m bgl to 3.1m bgl. Depth to bedrock was varied within the site.

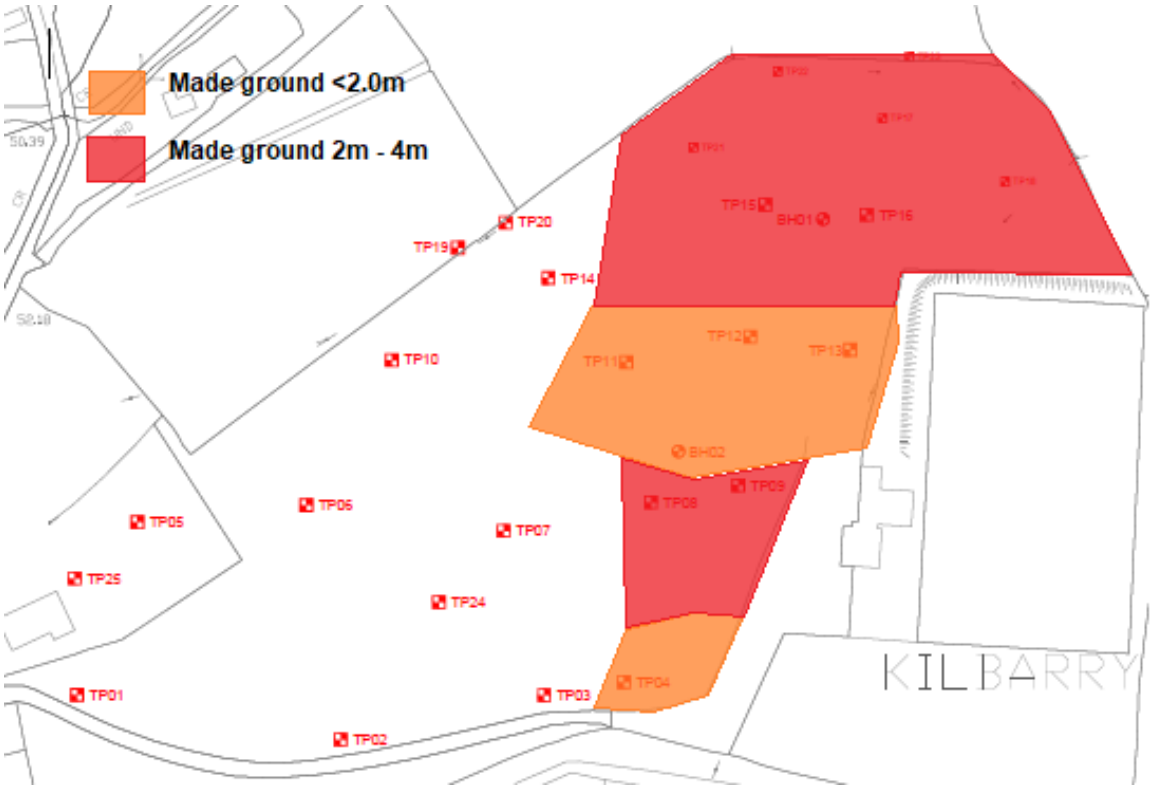
No groundwater was encountered, seasonal fluctuations may occur.

Geotechnical Risk Register

The following non-exhaustive list of geotechnical risks are presented; the exact extents identified may be subject to change where further information becomes available and are presented for reference only:

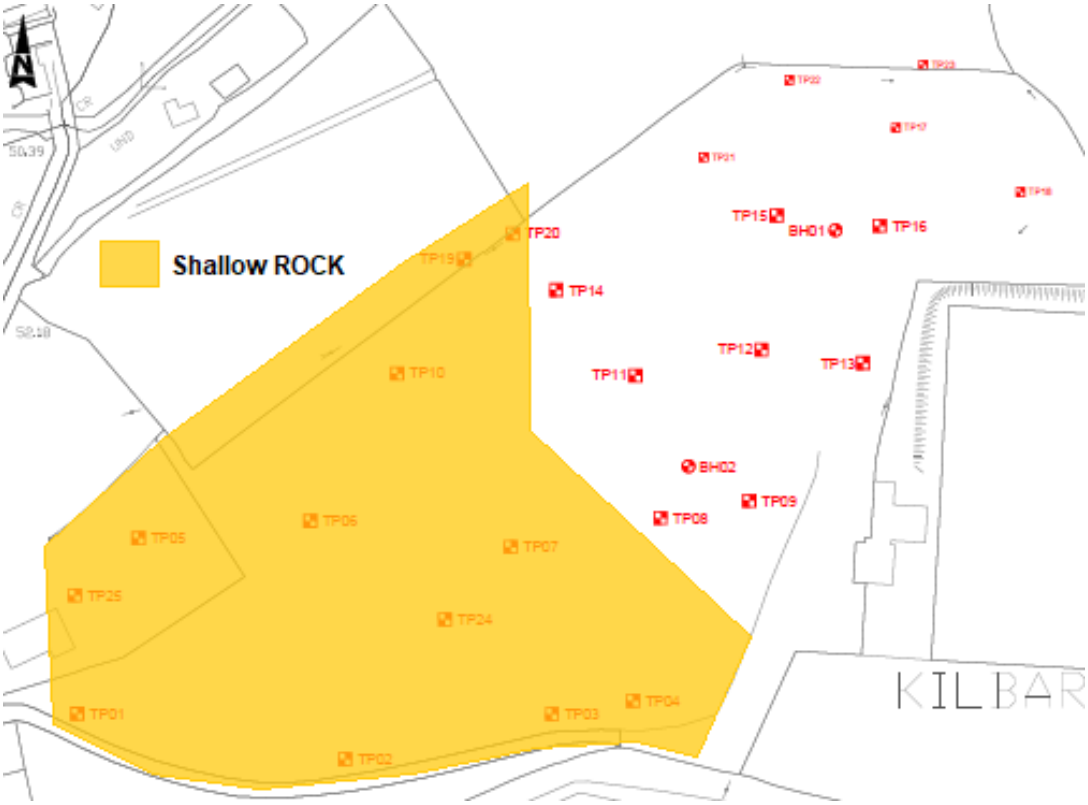
1. Made ground (C&D waste streams) has been identified as a particular risk (BH01, BH02, TP04, TP08, TP09, TP11, TP12, TP13, TP15, TP16, TP17, TP18, TP21 and TP23);

   at locations TP04, TP11, TP12 and TP13 the Made ground was <2.0m thick: At locations: TP08, TP09, TP15, TP16, TP17, TP18, TP21 and TP23 made ground exceeded 2.0m thick up to 4.0m thick;



2. Hydrocarbon contamination, TP12 noting a basic screening was undertaken further areas of unidentified contamination may exist within the site and

3. Shallow bedrock, SHALE 0.6m bgl to 2.3m bgl (TP01, TP02, TP04, TP05, TP06, TP07, TP10, TP19, TP20, TP24 and TP25).

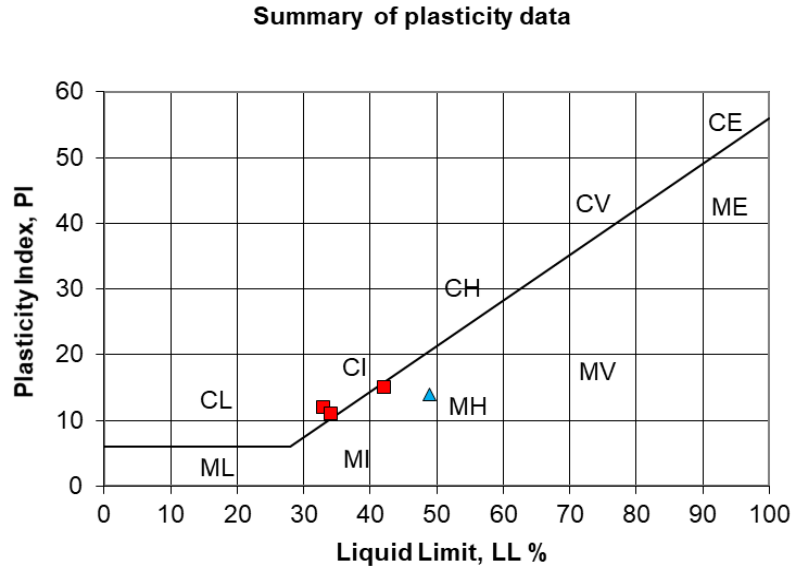


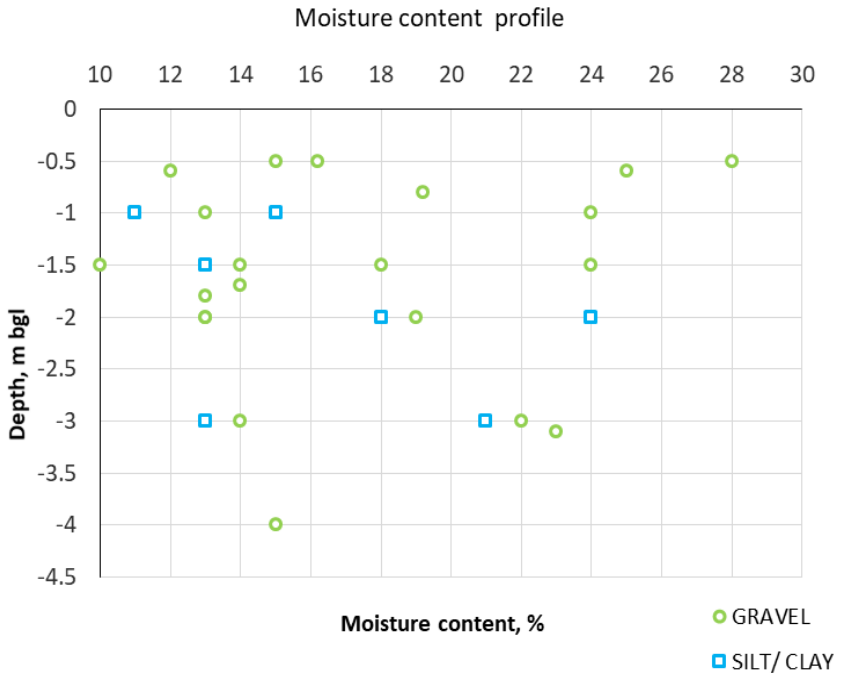
The site was characterized as geotechnical category GC-1.

> *Category 1 contains only small and simple structures with maximum design column load 250kN and maximum design wall load of 100kN, retaining walls and excavation which does not exceed the 2m and small excavations for pipes and drainage (Orr and Farrell, 1999).*

Characteristic properties

The mixed glacial deposits were of low to intermediate plasticity(CL/ MI) with natural moisture contents ranging from 10% to 28% with low organic contents (<6%). Grading analysis indicated Gravel fraction(s) 45% to 67%; Sand fraction(s) 14% to 26%, Clay/ Silt fraction(s) 15% to 28%, and with low Cobble contents (0% to 10%).





The more elevated moisture content >20% were associated with higher fines fractions.

A review of the moisture content, *w* data indicated natural moisture content, *w* to plastic limit, PL ratio; *w*/PL median 0.6. This was indicative of stiff deposits (C504 Engineering in glacial tills, figure 5.19). Undrained shear strength of the order 75kPa to 150kPa are expected. This correlated with *in-situ* tactile assessment of deposits, characterised as stiff deposits and *in situ* hand vane measurements.

Taking a range of N_{SPT}= 18 - 30, a factor f_1= 5.5 such that undrained shear strength,

Cu (kPa) = Nspt x f_1 (Stroud, 1975),

f_1 being function of plasticity, PI=<20;

An undrained shear strength of the order 99kPa to 165kPa is expected for the mixed glacial deposits describing stiff gravelly SILT/CLAY deposits. In situ hand vanes measured a median value of 77kPa in the upper 1.0m bgl. Stiffness/ relative density was noted to increase marginally with depth.

Friction ϕ in the assumed gravel deposits was assessed where;

$\phi^o = (N_{SPT} \times 12)^{0.5} + 15$;

value sof 30^o to 33^o are recommended. A median value of 32^o is prposed for foundation design.

Bulk density was determined as follows;

Soil Unit Weight(s)

Granular: $\gamma_{sat} = 16.0 + 0.1N \ (kN/m^3)$

Cohesive: $\gamma_{sat} = 16.8 + 0.15N_{60} \ (kN/m^3)$

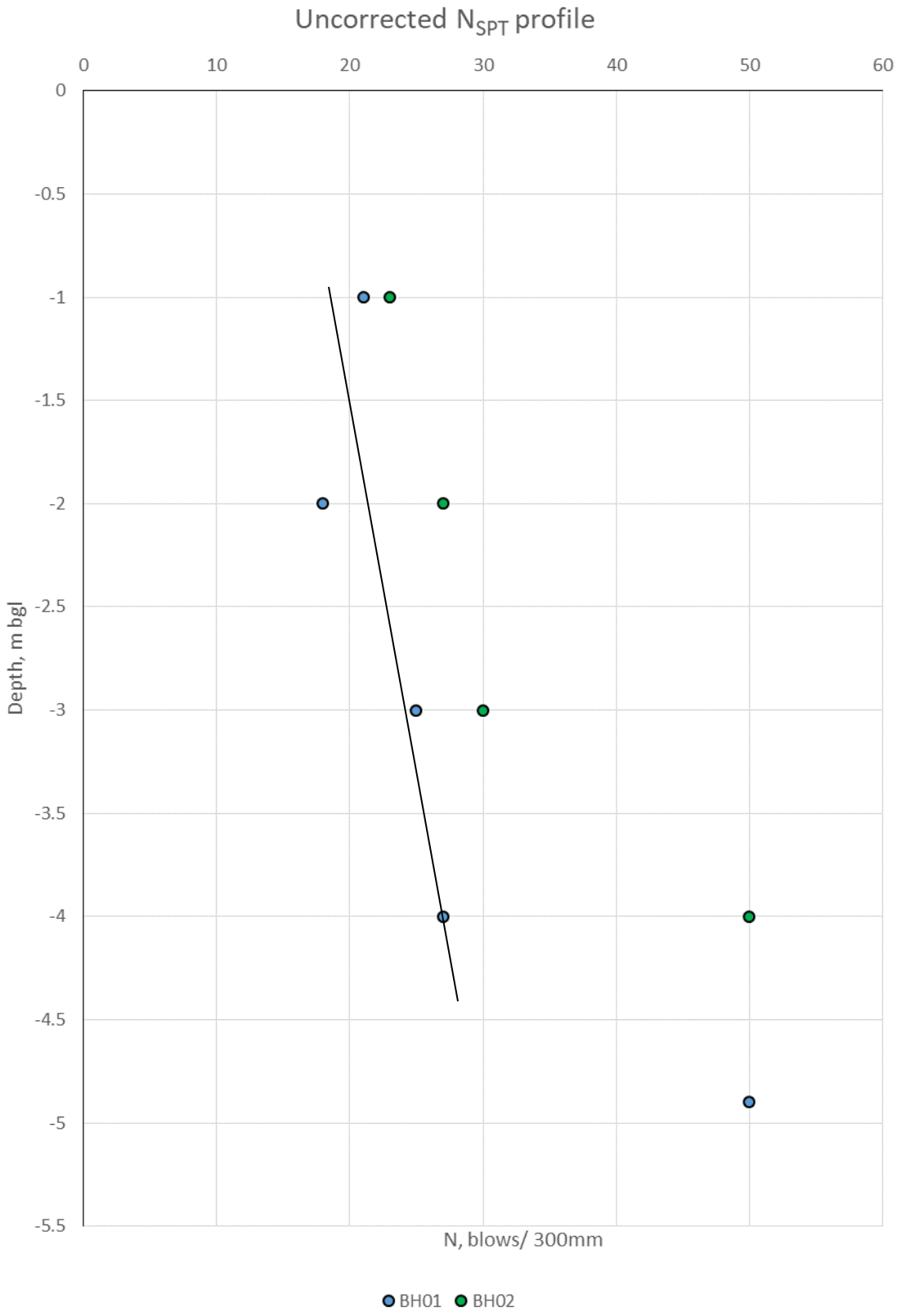
The unit weight has been adjusted for bulk density and dry density based on moisture content data.

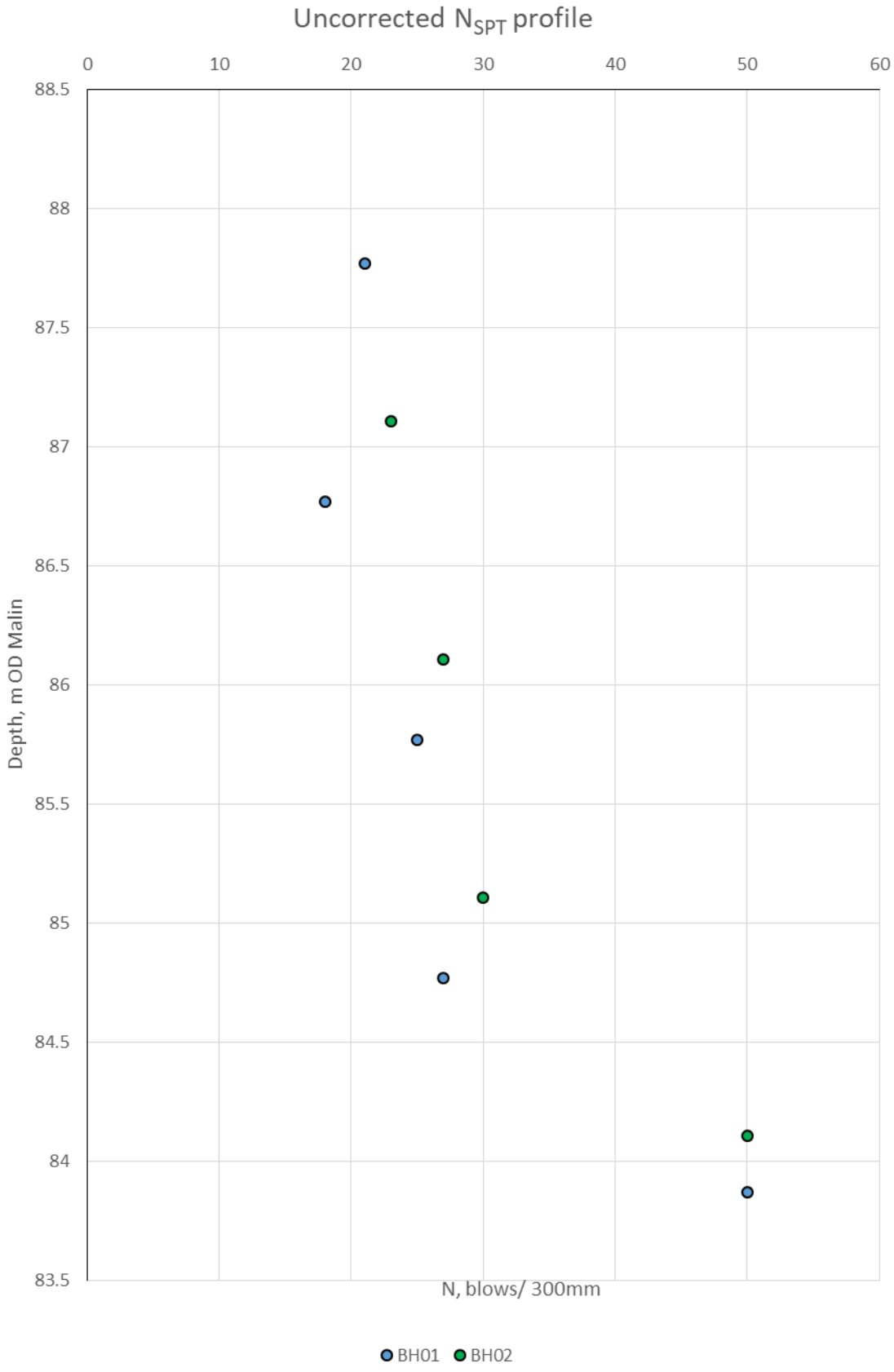
Depth, m bgl	Unit weight, kPa		Moisture content, %		Bulk density, Mgm^{-3}		Dry density, Mgm^{-3}	
1.0	18.1	18.3	11	25	1.85	1.87	1.66	1.49
2.0	19.5	20.85	13	24	1.99	2.13	1.88	1.60
3.0	20.55	21.3	13	23	2.09	2.17	1.92	1.70
4.0	20.85	24.3	15	-	2.13	2.48	1.85	2.15
4.9	24.3	-	-	-	2.48	-	2.48	-

Elastic modulus, E was assessed as follows:

E (MPa) = Cu (kPa) x 600 (PI<20, Bowles, 1997)

E (MPa) = N_{SPT} (Gravels)


Uncorrected N_{SPT} profile
0
10
20
30
40
50
60
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
-5.5
Depth, m bgl
N, blows/ 300mm
BH01
BH02


Uncorrected N_{SPT} profile
0
10
20
30
40
50
60
88.5
88
87.5
87
86.5
86
85.5
85
84.5
84
83.5
Depth, m OD Malin
N, blows/ 300mm
BH01
BH02

Foundations

It is not recommended to found in the Made ground where such deposits are known to be variable and identified a containing deleterious inclusions. Over excavation of shallow Made ground may be consider at locations TP04, TP11, TP12 and TP13.

It has been assumed that groundwater where present has influenced the *in situ* test and so no adjustment is provided. A partial factor of safety 1.25 shall be applied to ϕ. A partial factor of safety 1.4 shall be applied to c_u, kPa.

A presumed allowable bearing value of 150kNm^{-2} (kPa) to 300kPa is expect of stiff CLAY/ SILT superficial deposits (BS8004, Code of practice for foundations, 1986, Table 1). A presumed allowable bearing value of 200kNm^{-2} (kPa) to 600kPa is expect of medium dense GRAVEL deposits (BS8004, 1986) noting 'remarks' relating to groundwater.

Table 1 — Presumed allowable bearing values under static loading

NOTE These values are for preliminary design purposes only, and may need alteration upwards or downwards. No addition has been made for the depth of embedment of the foundation (see 2.1.2.3.2 and 2.1.2.3.3).

Category	Types of rocks and soils	Presumed allowable bearing value		Remarks
		kN/m^2 [a]	kgf/cm^2 [a] tonf/ft^2	
Rocks	Strong igneous and gneissic rocks in sound condition	10 000	100	These values are based on the assumption that the foundations are taken down to unweathered rock. For weak, weathered and broken rock,
	Strong limestones and strong sandstones	4 000	40	
	Schists and slates	3 000	30	
	Strong shales, strong mudstones and strong siltstones	2 000	20	
Non-cohesive soils	Dense gravel, or dense sand and gravel	> 600	> 6	Width of foundation not less than 1 m. Groundwater level assumed to be a depth not less than below the base of the foundation. For effect of relative density and groundwater level, .
	Medium dense gravel, or medium dense sand and gravel	< 200 to 600	< 2 to 6	
	Loose gravel, or loose sand and gravel	< 200	< 2	
	Compact sand	> 300	> 3	
	Medium dense sand	100 to 300	1 to 3	
	Loose sand	< 100	< 1	
		Value depending on degree of looseness		
Cohesive soils	Very stiff boulder clays and hard clays	300 to 600	3 to 6	Group 3 is susceptible to long-term consolidation settlement (see 2.1.2.3.3). For consistencies of clays, see Table 5
	Stiff clays	150 to 300	1.5 to 3	
	Firm clays	75 to 150	0.75 to 1.5	
	Soft clays and silts	<75	<0.75	
	Very soft clays and silts	Not applicable		
Peat and organic soils		Not applicable		
Made ground or fill		Not applicable		

[a] 107.25 kN/m^2 = 1.094 kgf/cm^2 = 1 tonf/ft^2.

A presumed allowable bearing value of 2000kNm^{-2} (kPa) is expect of strong sedimentary bedrock (BS8004, Code of practice for foundations, 1986, Table 1). It should be assumed that where present any rock mass is weathered in the upper layers and a bearing pressure of 250kPa should be considered for a class 3/4 weak rock mass with assumed fracture spacing 60mm - 200mm (BS8004; Code of practice for foundations, 1986, Figure 1). The bedrock was not characterised where the scope of works did not investigate this hard strata; solid geology.

For a design undrained shear strength of 77kPa allowing for a partial factor of safety an ultimate bearing pressure of 282kPa is recommended (bearing capacity factor N_C 5.14, Skempton, 1951). Taking a design friction 32^o allowing for a partial factor of safety an ultimate bearing pressure of 260kPa is recommended (bearing capacity factors N_C 20.1, Ng 8.11 , Nq 10.7 Terzaghi, 1943 for a foundation of minimum width B=0.9m and depth D = 1.0m. Based on N_{SPT} 21, a unit weight of 18.1kPa is provided for foundation assessment).

Taking the following empirical relationship for allowable bearing capacity;

Qall (kPa) = N_{SPT} x 10 (Terzaghi and Peck, 1967)

for settlement up to a maximum of 25mm;

A basic settlement analysis base don N_{SPT} and compression index I_C yielded a predicted and adjusted for foundation geometry B/L strip foundations, settlement of 10.0mm.

An allowable bearing pressures up to 200kPa is provided for the stiff CLAY/ SILT, medium dense GRAVEL deposits or shallow bedrock below a depth 1.0m bgl for shallow strip foundations.

Where bedrock is shallow it is recommended to over excavate to the weathered bedrock for foundations.

To better assess the settlement in the GRAVEL it is recommended that plate loading tests are carried out.

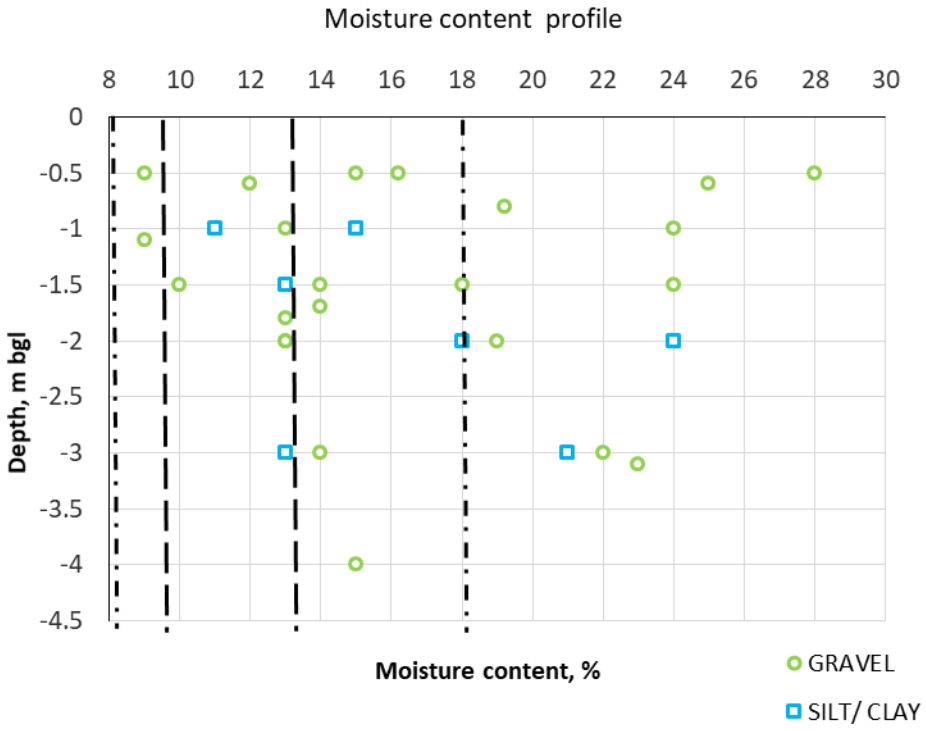
It is recommended to undertaken dynamic probing to better asses the bedrock profile and strength of the superficial deposits when the proposed housing layout is available.

Further assessment of the Made ground is recommended using dynamic probing and plate loading tests where the descriptions and field observations did not identify any deleterious inclusions.

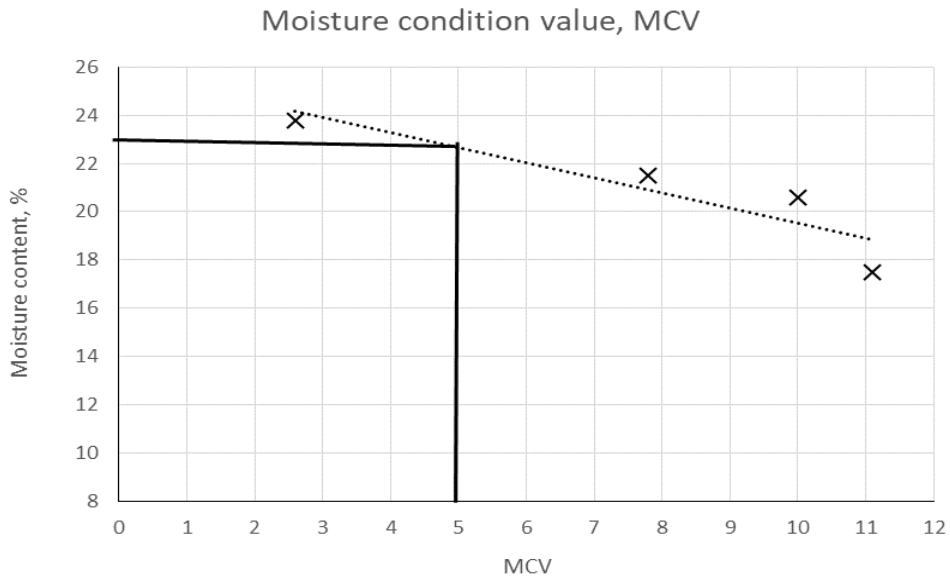
Re-use of deposits

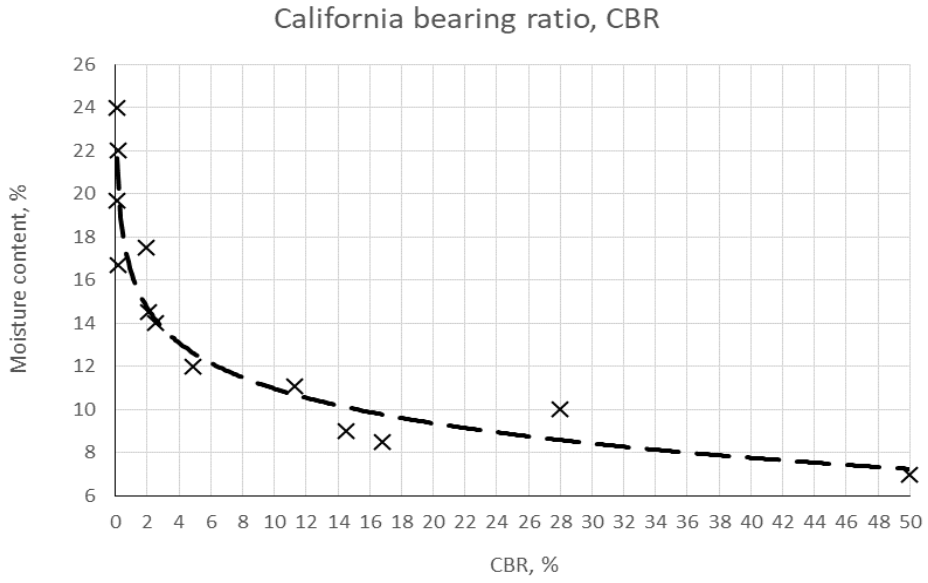
For Madeground deposits al deleterious material inclusion may be screened and removed. Subject to a further more detailed review, such deposits may be assessed for re-use.

With maximum dry density 9.5% to 13.3% natural moisture content typically lies 'wet' of the optimum for maximum dry densities 1.90Mgm^{-3} to 2.00Mgm^{-3}.Compaction levels of 95% maximum dry density can be achieved at moisture content 7% to 18%. Deposits are expected to be suitable for re-compaction at natural moisture content(s).



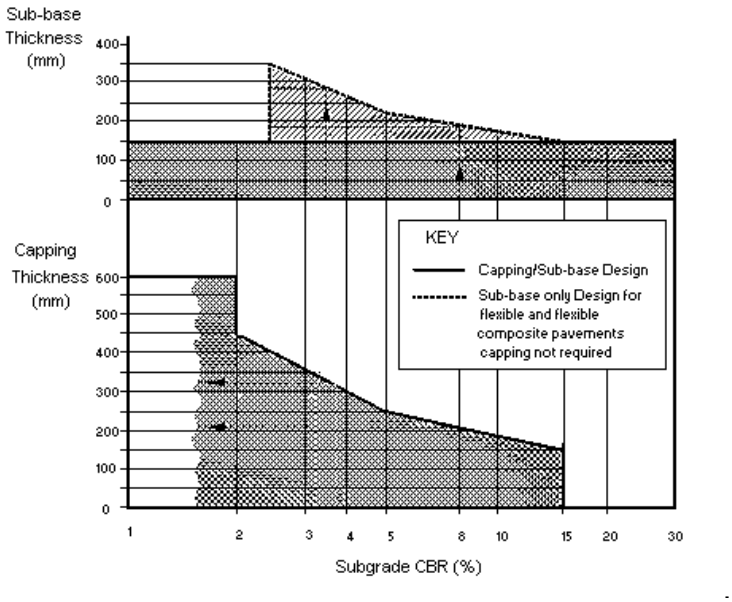
At mositure content <23% a MCV5 is expected identifying deposits as suitable for re-use as general landscaping fill. Some drying -1% to -5% is requried fo the upper 1.0m of SILT deposits.





Plasticity data suggested a design equilibrium CBR4% to CBR5% (TRRL 889, Road note 29, Black and Lister 1979).

A CBR5% is achieved at natural moisture content <12%. With natural mositure contents ranging from 9% to 28% in the upper 1.0m bgl, varied CBR values of CBR0.2% to CBR16% are expected. At natural mositure content CBR02% was measured; capping 6F1/ 6F2 600mm thick with 150mm sub base is recommended for pavement construction in accordance with Tii DMRB Vol 7 Pt 2A, TD25-26/1- Figure 4.1.



A drainage system shall be provided a minimum of 600mm below formation (underside of capping).

Chemical

pH (5.7 – 8.3) and sulphate (<0.010g/l 0.012g/l; <0.010% to 0.042%; <0.010% to 0.026%) data indicate a design class DS-1z in accordance with BRE digest for concrete in aggressive ground. The pH values <6.5 indicated an acidic environment, *suffix z*.

Location		TP01	TP03	TP09	TP14	TP17	TP20	TP21
Depth	m bgl	1.1	1.5	1.8	1.5	1.5	0.6	2.0
Moisture	%	9.4	10	13	14	13	12	13
pH		**6.6**	7.3	7.1	7.0	8.0	**5.7**	7.0
Sulphate (2:1 Water Soluble) as SO_4	g/l	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Sulphur	%	< 0.010	< 0.010	< 0.010	< 0.010	-	0.026	0.018
Sulphate (Acid Soluble)	%	0.012	< 0.010	0.010	< 0.010	0.019	0.036	0.023
Organic Matter/Loss on ignition	%	<0.40	<0.40	-	-	3.1	4.8	-

Location		TP22	BH01	BH02	BH02	BH02
Depth	m bgl	0.5	1.0	1.0	2.0	3.0
Moisture	%	9.1	13	11	18	13
pH		**6.5**	8.3	8.3	-	-
Sulphate (2:1 Water Soluble) as SO_4	g/l	< 0.010	0.012	< 0.010	-	-
Total Sulphur	%	< 0.010	-	-	-	-
Sulphate (Acid Soluble)	%	0.042	0.019	< 0.010	-	
Organic Matter	%	-	3.2	2.3	4.7	3.0

Environmental

A basic environmental screening was undertaken at five (5) locations at shallow depths, 0.5m bgl to 2.0m bgl. The soil analysis was screened against Soil Guideline Values (Contaminated Land Exposure Assessment, CLEA Model UK) for residential usage (with plant uptake), DRAFT Guidance for Soil Recovery Facility WAC, EPA December, 2017 and the Dutch N-List (2000, 2006) for public open space. This report presents the results of the environmental screening undertaken by PGL. This basic assessment/ screening does not constitute an environmental risk assessment.

Location	**Unit**	TP04	TP12	TP17	TP19	TP24	**N-List 2000/ 2006**	
Sample top depth	m bgl	0.5	0.6	2.0	0.6	0.5	**Target/ Trigger (2017)**	**Target/ Trigger (2017)**
Determinand								
Asbestos Identification	%	No Asbestos Detected					-	-
Moisture	%	6.8	8.7	13	6.1	6.7	-	-
pH	-	8.3	8.0	8.2	6.3	7.1	-	-
Arsenic	mg/kg	4.2	4.0	5.6	3.1	2.9	29/ 16[1]	55
Boron		< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	-	-
Barium	mg/kg	48	38	41	25	38	160	625
Cadmium	mg/kg	< 0.10	< 0.10	0.11	< 0.10	< 0.10	0.8/ 1.3[1]	12
Molybdenum	mg/kg	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	3	200
Antimony	mg/kg	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	3	55
Copper	mg/kg	10	8.8	11	4.7	5.6	36/ 35 [1]	190
Mercury	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.3/ 0.2 [1]	10
Nickel	mg/kg	39	29	30	32	31	35/ 42 [1]	210
Lead	mg/kg	18	14	20	8.8	7.4	85/ 48 [1]	530
Selenium	mg/kg	< 0.20	< 0.20	< 0.20	0.23	< 0.20	0.7	100
Zinc	mg/kg	58	42	51	41	42	140/ 126 [1]	720
Chromium (Trivalent)	mg/kg	27	19	20	25	21	-	-

[1] EPA soil trigger levels, 2017

Location	Unit	TP04	TP12	TP17	TP19	TP24	N-List 2000/ 2006	
Sample top depth	m bgl	0.5	0.6	2.0	0.6	0.5	**Target/ Trigger (2017)**	**Target/ Trigger (2017)**
Determinand								
Chromium (Hexavalent)	mg/kg	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	100/ 75[1]	380
Total Organic Carbon	%	0.61	0.56	0.68	0.99	0.30	-	-
Mineral Oil	mg/kg	< 10	< 10	< 10	< 10	< 10	500/ 190[2]	5000
Total Aliphatic Hydrocarbons	mg/kg	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	-	-
Total Aromatic Hydrocarbons	mg/kg	< 5.0	18	< 5.0	< 5.0	< 5.0	-	-
Total Petroleum Hydrocarbons	mg/kg	< 10	18	< 10	< 10	< 10	-	-
Naphthalene	mg/kg	< 0.10	0.45	< 0.10	< 0.10	< 0.10	-	-
BTEX	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0		
Acenaphthylene	mg/kg	< 0.10	0.46	< 0.10	< 0.10	< 0.10	-	-
Acenaphthene	mg/kg	< 0.10	0.43	< 0.10	< 0.10	< 0.10	-	-
Fluorene	mg/kg	< 0.10	0.34	< 0.10	< 0.10	< 0.10	-	-
Phenanthrene	mg/kg	< 0.10	0.60	< 0.10	< 0.10	< 0.10	-	-
Anthracene	mg/kg	< 0.10	0.45	< 0.10	< 0.10	< 0.10	-	-
Fluoranthene	mg/kg	< 0.10	0.52	< 0.10	< 0.10	< 0.10	-	-
Pyrene	mg/kg	< 0.10	0.47	< 0.10	< 0.10	< 0.10	-	-
Benzo[a] anthracene	mg/kg	< 0.10	0.29	< 0.10	< 0.10	< 0.10	-	-
Chrysene	mg/kg	< 0.10	0.32	< 0.10	< 0.10	< 0.10	-	-
Benzo[b] fluoranthene	mg/kg	< 0.10	0.34	< 0.10	< 0.10	< 0.10	-	-
Benzo[k] fluoranthene	mg/kg	< 0.10	0.30	< 0.10	< 0.10	< 0.10	-	-
Benzo[a]pyrene	mg/kg	< 0.10	0.24	< 0.10	< 0.10	< 0.10	-	-
Indeno(1,2,3-c,d)Pyrene	mg/kg	< 0.10	0.32	< 0.10	< 0.10	< 0.10	-	-
Dibenz(a,h)-Anthracene	mg/kg	< 0.10	0.18	< 0.10	< 0.10	< 0.10	-	-
Benzo[g,h,i] perylene	mg/kg	< 0.10	0.39	< 0.10	< 0.10	< 0.10	-	-
Coronene	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	-	-
Total Of 17 PAH's	mg/kg	< 2.0	6.1	< 2.0	< 2.0	< 2.0	6.8/ 1.0[1]	40
Total PCBs (7 Congeners)	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.5	1
Total Phenols	mg/kg	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30		

With the exception of; Nickel, all other heavy metals were within all acceptable levels:

[2] The Dutch N list industrial usage residential usage target level is noted as 190mg/kg.

Nickel; TP04, 39mg/kg exceeded the Dutch target value 35mg/kg, but was within EPA trigger limit 42mg/kg.

Total Aliphatic Hydrocarbons; TP12, 0.6m, 18mg/kg was noted as indicative of hydrocarbon contamination.

Total Petroleum Hydrocarbons (Mineral oil); TP12, 0.6m 18mg/kg exceeded the EPA trigger limit 50mg/kg; indicative of hydrocarbon contamination

With the exception of location TP12 0.6m, the speciated poly-cyclic aromatic hydrocarbons (Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Indeno(1,2,3-c,d)Pyrene, Dibenz(a,h)-Anthracene, Benzo[g,h,i]perylene and Coronene: $PAH_{16 + coronene}$) were at levels below the detectable limit <0.010mg/kg indicative of an absence of $PAH_{16 + coronene}$. $PAH_{16 + coronene/}$ PAH_{17} exceeded the 1mg/kg EPA soil trigger level, 2017.

Poly-cyclic aromatic hydrocarbons (PAH_{17}) TP12, 0.6m 6.1mg/kg exceeded the EPA trigger limit 1mg/kg; indicative of hydrocarbon contamination.

Total PCB $_{7}$ were measured below the level of detection limits <0.10mg/kg, noting the EPA soil trigger level, 2017 of 0.05mg/kg was presented as the LOD for this trigger level. By setting soil trigger levels for these compounds at the level of readily achievable detection limits, the risk of environmental pollution can be expected to be minimal. Speciated PCB's were below the 0.05mg/kg trigger level.

BTEX (Benzene, Toluene, Ethylbenzene and m, p & o Xylene) were measured below the level of detection limits <0.10mg/kg

Phenols were measured below the level of detection limits <0.10mg/kg

In general, determinands were either detected at relatively low concentration levels or at levels below the laboratory detection limits.

There was some evidence of localized hydrocarbon (Mineral oil/ TPH and PAH_{17}) contamination at TP12 (1 of the 5 locations assessed).

It is recommended that an environmental specialist assess the data, where this report only provided an environmental screening. Contamination may be present elsewhere within the site where such a risk was elevated due to the presence of Madeground deposits.

During construction any suspected contamination identified by either visual or olfactory means should be investigated and appropriate health and safety, waste disposal and remediation measures should be implemented where necessary.

Disposal

Landfill Waste acceptance criteria, WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Location	TP04	TP12	TP17	TP19	TP24	**Landfill Waste Acceptance Criteria**		
Top Depth, m bgl	0.5	0.6	2.0	0.6	0.5	**Inert Waste**	**Stable, Non-reactive hazardous waste in non-hazardous**	**Hazardous Waste**
Determinand	**Levels**							
Total Organic Carbon, %	0.61	0.56	0.68	0.99	0.3	3	5	6
Loss On Ignition, %	2.7	2.7	2.8	4.0	1.9	--	--	10
Total BTEX, mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	6	--	--
Total PCBs (7 Congeners), mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1	--	--
TPH Total WAC (Mineral Oil), mg/kg	< 10	18	< 10	< 10	< 10	500	--	--
Total (Of 17) PAH's, mg/kg	< 2.0	6.1	< 2.0	< 2.0	< 2.0	100	--	--
pH						--	>6	--
Acid Neutralisation Capacity, mol/kg	0.0050	0.013	0.0060	0.0050	< 0.002	--	To evaluate	

Location	TP04	TP12	TP17	TP19	TP24	Landfill Waste Acceptance Criteria		
						Inert Waste	Stable, Non-reactive hazardous waste in non-hazardous	Hazardous Waste
Top Depth, m bgl	0.5	0.6	2.0	0.6	0.5			
Determinand	Levels							
Eluate Analysis	10:1 Eluate mg/kg					Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.5	2	25
Barium	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	20	100	300
Cadmium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.04	1	5
Chromium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.5	10	70
Copper	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	2	50	100
Mercury	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.01	0.2	2
Molybdenum	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.5	10	30
Nickel	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.4	10	40
Lead	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.5	10	50
Antimony	< 0.01	< 0.01	< 0.01	< 0.01	0.012	0.06	0.7	5
Selenium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.1	0.5	7
Zinc	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	4	50	200
Chloride	< 10	< 10	12	< 10	23	800	15000	25000
Fluoride	1.5	1.2	1.4	1.0	1.0	10	150	500
Sulphate	< 10	< 10	75	14	< 10	1000	20000	50000
Total Dissolved Solids	400	430	520	240	210	4000	60000	100000
Phenol Index	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	1	-	-
Dissolved Organic Carbon	53	61	71	69	64	500	800	1000

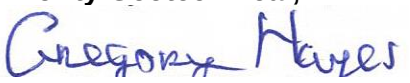
It is noted Total petrol hydrocarbon (Mineral oils) and PAH_{17} were identified at location TP12.

All determinands and eluate levels were within inert limits with regard to disposal of excavated deposits.

Screening of deleterious, inert and organic inclusions (PVC ducting, plastics, Boulders, concrete, re-bar, glass, metal, wire, concrete blocks, timber, red bricks, clay pipe and bituminous materials; TP04, TP08, TP09, TP13, TP15, TP16, TP17, TP18, TP21 and TP23) should be undertaken as part of good practice. It is noted much of the inclusions are of a construction and demolition waste origin and are expected to be successfully screened.

Should you have any queries in relation to the data collected, please do not hesitate to contact our office.

Yours sincerely,
For **Priority Geotechnical,**



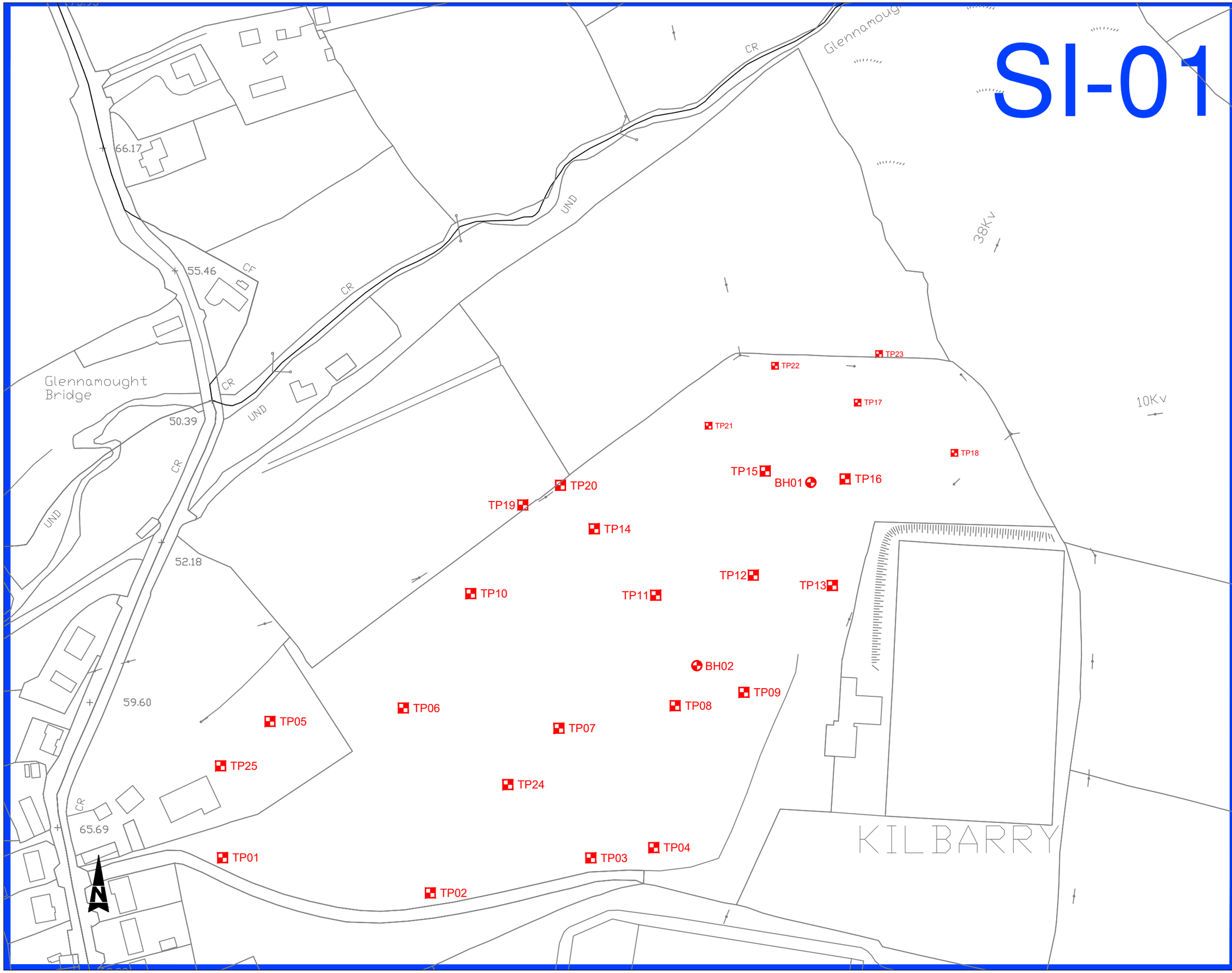
Greg Hayes BE MEngSc CEng MIEI
Geotechnical Specialist

No responsibility can be held by PGL for ground conditions between exploratory locations. The exploratory logs provide for ground profiles and configuration of strata relevant to the investigation depths achieved during the fieldworks. Caution shall be taken when extrapolating between such exploratory locations. No liability is accepted for ground conditions extraneous to the exploratory locations.

No account has been taken of potential subsidence or ground movement due to mineral extraction, mining works or karstification below or in proximity to the site, unless specifically addressed.

This report has been prepared for Employer and their Representative as outline, herein. The information should not be used without their prior written permission. PGL accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

SI-01



KEY:

ST00 DATUM	Denotes Slit Trench and Datum location
TP00	Denotes Trial Pit location
BH00	Denotes Borehole location
DP00	Denotes Dynamic Probe location
RC00	Denotes Rotary Core location
ST00	
AA00	

JOB NAME:

KILBARRY LANDS, CORK

Sheet Title:

EXPLORATION LOCATION PLAN

JOB NUMBER:

P19129

DRAWING NUMBER:

P19129-SI-01

DRAWN BY:

Gary Curtin

DATE:

ZZ/ZZ/2019

SCALE:	APPROVED:
1:2000 ON A3	GH

REVISION:

D01

pgl priority geotechnical

Appendix 3:

CORRESPONDENCE AND REPORTS IN RELATION TO UNAUTHORIZED DUMPING OF MATERIALS

Malachy Walsh and Partners
Engineering and Environmental Consultants
Cork | Tralee | Limerick | London

Park House | Mahon Technology Park | Bessboro Road | Blackrock | Cork | T12 X251 | Ireland
T 021 4536400 | Email: info@mwp.ie | Web: www.mwp.ie

PCAC/Misc 2019
2nd May 2019.

Attention: Mr. Frank Murphy,
Secretary,
Cork County GAA Board,
Mainport Offices,
Monahan Road,
Cork.

by e-mail: *[secretary.paircuichaoimhctr@gmail.com]*

Subject: ***Cork County GAA Board lands at Kilbarry and email of 30/04/2019.***

Dear Frank,

We refer to your email below of 30th.April to Seamus Kelly.

Our comments are:

- Attached is a letter and attachments from MWP to Mr. Louis Duffy, Cork County Council, dated 24/05/2005. This refers to the materials deposited by Sorenson Ltd. Contractor on CCB/ Delaney Rovers properties at Kilbarry from 1999. This was to deal with issues arising from unauthorized significant dumping on CCB lands. Also attached is Drawing 4000/5-W11-D, already issued on 16th. April.

- Also attached is an email from Sorenson Ltd. dated 02/04/2004 and relevant extracts in relation to 2 no. Soil Samples at Kilbarry that were tested.

No comment is offered by MWP on the current quality and composition of the fill material. It is understood that random dumping has occurred since 2005 and it is not known if any dumping of liquids has occurred on the fill material. Consequently, it is necessary in MWP opinion that appropriate testing is carried out by CCB to verify the current condition of the fill material as would be standard practice prior to advancing any plans for the site.

Please note that all topographical levels listed on drawings issued, need to be checked because of the possibility of changes occurring since 2004.

We trust that this addresses your query.

Yours sincerely,

Paul Collins
for Malachy Walsh and Partners

encl (2)

Malachy Walsh and Partners
CONSULTING ENGINEERS
Cork, Tralee and London

Park House
Mahon Technology Park,
Bessboro Road, Blackrock, Cork, Ireland.
Tel.: 021-4536400
Fax: 021-4536450
E-mail: info@mwp.ie
Web: www.mwp.ie

I.S. EN ISO 9001

Sk/ah/4000/5
24th May, 2005.

Mr. Louis Duffy,
Senior Engineer,
Environmental Department,
Cork County Council,
County Hall,
Cork.

Re: Cork County GAA Board Lands at Kilbarry, Co. Cork.

Dear Mr. Duffy,

We refer to the following letters:-

- Malachy Walsh & Partners to Cork County Council 16/12/04.
- Cork County Council to Malachy Walsh & Partners of 19/01/05.
- Malachy Walsh & Partners to Cork County Council of 25/01/05.
- Minutes of Meeting 28/01/05 – Cork County Council & Malachy Walsh & Partners.

We have updated in its entirety our response of the 16th December, 2004 to the notice issued in accordance with our discussions (2 copies of which are enclosed) and trust that this is satisfactory.

Contd.

We refer to the minutes of the meeting of 28/01/05 and comment in conjunction with this response that:-

Measure 2:-
A C1 Form does not exist for the movement of the asbestos ½ sheet from the site to the adjoining Loftus Yard at Kilbarry. The letter dated 25th January, 2005 and the Certificate of Disposal, Control Document No. SW417/0904037 deals with the method of disposal and is referred to in the report.

Measure 3:-

Work has taken place on site, particularly at the north west corner and an additional 20No. furze bushes – Ulex Europaeus have been sown on the west embankment by Birchill Landscape Ltd.

Yours sincerely,

Seamus Kelly

encl.

Malachy Walsh and Partners
CONSULTING ENGINEERS
Cork, Tralee and London

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Web: www.mwp.ie

I.S. EN ISO 9001

CORK COUNTY GAA BOARD

Subject: Lands at Kilbarry, Co. Cork.

Response to Waste register No. WM55, 19/03, 24/03

Revision B:- 23/05/05.

- Cork County GAA Board has undertaken that they will not permit any waste on to their lands and will seek to prevent unauthorised dumping by all reasonable means. They have examined their site boundaries and comment:-

Measure 1:- Response.

There is one entrance to the lands at Kilbarry and this consists of a steel gate which is locked when the Delaney Rovers GAA Grounds, also served by this entrance, is not in use. In fill mesh has been placed between the framework forming the gate structure and also to each side of the gate to inhibit any entry when the ground is not in use. Two signs have been placed near the entrance to the grounds. These state that dumping is not permitted and that trespassers will be prosecuted. Increased vigilance has also been exercised by Delaney Rovers Club members at the grounds.

The site is reasonably well secured, being protected by a high embankment, heavily covered with trees along the Whitechurch road to the West, by the IDA Business Park to the South and by Delaney GAA Club Grounds to the East. The Glenamought Valley lies along the Northern boundary and while access exists here, it is not possible to use any transport or gain easy access to the Cork County Board lands because of the steep sloping nature of the terrain existing.

Contd.

Measure 2:- Response.

- All waste, other than soil and stone, has been removed from the site and sent to authorised waste disposal facilities.

Notifications regarding the disposal of waste were sent by Malachy Walsh & Partners to Cork County Council on:-

- 16th January, 2004.
- 20th July, 2004.
- 27th July, 2004.
- 31st August, 2004.
- 20th September, 2004.
- 25th January, 2005.
- 23rd May, 2005.

Appendix A details the summary of waste disposed, the disposal facilities to which each waste type was delivered, the relevant Permit/Licence No. for each, the authorised company who transported the waste and copies of receipts, the originals of which have been lodged with Cork County Council.

It is estimated that the volume of material, incorporating soil, stone and top soil is 12,850m^3. This is derived from an original estimated volume of 22,100m^3 less an estimated figure of 9250m^3 stored by Delaney Rovers at the grounds pending use.

- **Trial Pit Excavations.**

52No. possible trial pit locations were originally identified to check the constituents of the fill material. 27No. holes were excavated, this number being determined by consistency of results. The pits were excavated to the bottom of the fill material which predominantly consisted of boulder clay and red sandstone rock. These pits are located on Drawing No. 4000/5-W11/D and the results are detailed on Appendix B to this document. Trial pits numbered S1-S5 inclusive are those test pits carried out where analysed by TES Bretby. The results were acceptable except for Trial Pit No. 18.

A half sheet of broken corrugated asbestos roof sheeting was encountered in the aforementioned trial pit. Three other trial pits in immediate and close proximity to Trial Pit 18 were excavated but no further contaminants of this nature were discovered. The asbestos content amounted to a maximum of 0.1% of the pit excavation and a minute fraction of the overall volume of fill. A decision was taken to remove all asbestos from the pit by a licensed operator.

A second trial pit in close proximity to T.P. 20 was also excavated to check foreign matter content but nothing untoward was discovered.

Plastic sheeting was discovered in Trial Pits 12, 18, 21 and 30 close to the surface and this has been removed to a licensed disposal facility. It is considered that this originated on the site. Details are included in Appendix A to this document.

Contd.

The remaining materials, other than boulder clay and stone, are predominantly of an inert waste and in view of their low percentage volume, are not considered to adversely affect compliance with the measure 2 requirement from Cork County Council.

- **Test Data.**

5 No. test pits numbered S1-S5 inclusive, were carried out by TES Bretby, Burton on Trent and the results form Appendix C to this document. The comments on the data and two earlier tests carried out on two samples in January, 1999 by the same company are:-

The TES Bretby Laboratory data provided by Sorensen Ltd. on 01/02/99 and by this office on 14/07/04 have been reviewed and compared to two sets of soil standards by EU environmental agencies outside Ireland. The evaluation conducted was to interpret the results for the various analytes, particularly the polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs), with respect to normal background levels.

Samples 1 and 2 from material analysed in January, 1999 (Sorensen 1999), contained low concentrations of various metals and PAHs. UK Soil Guideline Values and/or Dutch Intervention Values are available for the following analytes reported: arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc, total polycyclic aromatic hydrocarbons (PAHs), and various volatile organic compounds (VOCs).

Samples from all five test pits TP001 through TP005 (Malachy Walsh & Partners, June, 2004) contained low concentrations of various metals.

Table 1 compares all results with the soil standards already referred to and shows maximum concentrations for each parameter highlighted in yellow. Ireland currently has no soil contamination standards, so the results in Table 1 are compared to two sets of soil standards published by EU environmental agencies outside Ireland. These values presented are Soil Guideline Values for Residential Properties by the UK Environment Agency and the Dutch Intervention Values.

The Soil Guideline Values and the Intervention Values are threshold concentrations for various parameters at or above which further evaluation and possibly remediation, of the soil may be warranted. These values are based on known toxicity and health hazards presented by each compound. None of the analytes from the Kilbarry soil samples were reported at concentrations approaching either set of standards.

The results were further evaluated with respect to normal background levels. A search of the Irish Environmental Protection Agency website revealed no published background values for the compounds in question. Subsequent inquiry with the agency confirmed that Ireland currently has no published soil background values.

Background values for metals and PAHs in soil can vary considerably based on location and history and are subject to both natural and anthropogenic factors. The metals identified occur naturally in soil and bedrock and can vary widely in concentration depending on local geology. The concentrations reported are considered typical of urban soils and again, well below the action values in Table 1.

Contd.

Many PAHs including those identified at this property are almost ubiquitous in urban soils as they are produced by incomplete combustion of carbon-based compounds including wood and fossil fuels like coal and petroleum in fireplaces, furnaces or incinerators. They are also produced in exhausts from cars and trucks and burning of creosote or coal pitch containing materials. They may occur naturally due to forest fires.

The analyses for metals did not identify elevated concentrations of heavy metals, most notably lead. The PAHs were present in the test pit samples at consistent low concentrations typical of urban soils. Therefore, while these compounds are present, it is not apparent that the soil contains metals and PAHs from a distinct industrial source of environmental concern such as an incinerator or smelting operation.

The VOCs bromomethane and 1,2-dichlorobenzene were each identified at concentrations only slightly above their respective laboratory reporting limits. Although not naturally occurring in soil, the extremely low concentrations reported are far below values that might warrant any remedial action.

Based on the available data, the fill material at Cork County Board Grounds is not hazardous. The only anomaly is that the sample from TP004 had a pH of 9.4. The other four samples had reported pH values ranging from 7.3 to 8.2. No pH value was cited in either set of standards checked. The soil pH in that sample appears somewhat high but may be naturally occurring depending on the local geology and presence of alkaline materials such as fertilizers. That same sample had a reported value for ammoniacal nitrogen of 81.6 mg/kg versus a range of only 5.4 to 25.2 mg/kg for the other four samples. If anything, higher pH soils tend to increase adsorption of various metals to soil particles and decrease their mobility in the environment. This value then, is not of concern.

The samples taken are representative of the fill material and the results in relation to the extensive and wide range of tests undertaken, are acceptable.

The Measure 2 response on test data has been compiled by Mr. Brian Barney, P.E., B.Sc. (Geology), M.Sc.Eng. The signed report outlining the Measure 2 response, forms Appendix D to this document.

Measure 3:- Response.

Reference Drawing:-
4000/5 – W11/D forms part of this response.

- **Regrading of Fill.**

Regrading of the area of fill was carried out in accordance with the above drawing and involved the levelling and regrading of soil except for that area at the South West corner of the site, shown on Drawing No. 4000/5-W11. Fill has been deposited there by Delaney Rovers Club prior to its use on an approved road development, Planning Reference No. S/01/2419 and Waste Licence Permit Number 14904. Grassing over the area has been sown and 70No. furze (gorse) bushes – Ulex Europaeus, have been planted at the Northern and Western embankments.

Contd.

Measure 4:-

This measure was complied with by advance notice to Cork County Council of the works proposed, of the Contractors employed and receipts for waste disposal. Cork County Council representatives and Malachy Walsh & Partners jointly inspected the site throughout the remediation works.

The date for completion given by Cork County Council of 14th October, 2003, in view of the date notice of the measure was given, i.e. 16th September, 2003 did not take into account the period required for remediation proposals, acceptance of proposals, testing at a U.K. Laboratory, the nearest available Laboratory with the required facilities, remediation work and landscaping.

Signed: Seamus Kelly

Seamus Kelly
For Malachy Walsh & Partners

Date: 24th May, 2005

Appendix A – Summary of Waste Disposal

Cork County GA Board Lands,
Kilbarry,
Co. Cork.

Summary of Waste removed from site:-

Item	Tonnes
• Concrete, concrete blocks, brickwork	67.20
• Stone and hardcore	5.65
• Steelwork – reinforcement and steel sections	14.00
• Steel cladding	0.05
• Plastic	0.30
• Bituminous materials	1.10
• Timber	0.20
• Asbestos	0.03
Total	**88.53**

Malachy Walsh and Partners
CONSULTING ENGINEERS
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Web: www.mwp.ie

I.S. EN ISO 9001

Dr/ah/4000/5
31st August, 2004.

COPY

Ms. Lynn Morrissey,
Environmental Engineer,
Cork County Council,
County Hall,
Cork.

Re: Waste Disposal, Cork County GAA Board Lands, Kilbarry, Co. Cork.

Dear Ms. Morrissey,

We refer to our letters of the 20th and 27th July, 2004 and enclose 5No. delivery dockets relative to the disposal of waste. This was disposed of as previously advised at Roadhill, Ballinacurra.

Midleton Aggregates Ltd. is, we understand, a company owned by the same owners as Scarriff Plant Hire Ltd.

You will note that the volume of construction waste totals 81 tonnes. The Contractors estimate previously advised to you was 100 tonnes.

Yours sincerely,

Denis Roche

encl.

DELIVERY DOCKET

Scarriff,
Midleton.

Driver: J Hennessy

Truck No.: 00C20162

2-5-96

Phone: (021) 631396
Mobile: (086) 8124840

Mr Peter D'Sweeney
Delany Kilbarry

B 012416

Midleton Aggregates Ltd.

Material	Volume	Mileage
Construction Waste	15 Tons	(201

Received by _____

IN GOOD ORDER AND CONDITION

Title of goods does not pass until goods have been paid for in full.

COPY

Malachy Walsh and Partners
CONSULTING ENGINEERS
Cork, Tralee and London

Park House
Mahon Technology Park,
Bessboro Road, Blackrock, Cork, Ireland.
Tel.: 021-4536400
Fax: 021-4536450
E-mail: info@mwp.ie
Web: www.mwp.ie

I.S. EN ISO 9001

By Post & Fax.

Dr/ah/4000/5
20th September, 2004.

Ms. Jean Sayers,
Senior Engineer,
Environment Department,
Cork County Council,
County Hall,
Cork.

Re: Cork County GAA Board Lands at Kilbarry, Co. Cork.

Dear Ms. Sayers,

We enclose copy of letter from Loftus Civil Engineering Ltd., confirming removal of loose asbestos from the above site, shipped by AVR Safeway to a licensed landfill in Germany.

Should you require any additional information, please do not hesitate to contact me.

Yours sincerely,

Denis Roche

encl.

LOFTUS CIVIL ENGINEERING LTD.

Kilbarry House, Dublin Hill, Cork.
Telephone: (021) 4393655-4393719-4393698
Fax: (021) 4395006

Your Ref.

Our Ref.
COL/JOD

Date
25th January 2005

Attention: Denis Roche,
Malachy Walsh & Partners,
Park House,
Mahon Technology Park,
Bessboro Rd,
Blackrock,
Cork.

Re: **Asbestos Delany Rovers**

Dear Mr. Roche,

Following our recent discussions, please find accompanying disposal cert. In view of the small quantity approx 30 kgs the waste was included with the shipment from O'Donovans off licence.

Should you require any additional information, please do not hesitate to contact the undersigned

Yours faithfully,

pp Catherine Henry
Joe O'Dwyer

FOR LOFTUS CIVIL ENGINEERING LTD

COPY

AVR

AVR – SAFEWAY Ltd.

CERTIFICATE OF DISPOSAL

Control Document No.: SW417/0904037

Original C1 Form No: **B 200007**
Date of Original C1: 6th September 2004

Waste Stream No :

Company Name	:	O' Donovans Off Licence, c/o Loftus Civil Engineering
Address	:	Kilbarry House, Dublin House, Cork
For the attention of	:	Roy Loftus
Date of Issue	:	23rd September 2004

Details of Transfer of Waste from AVR– Safeway Ltd.

TFS No	:	IE 041592-5
TFS Date	:	Disposed on 15th September 2004
Quantity/L/Kg	:	27,080 Kg

We hereby certify that the waste has been disposed in accordance with the Waste Management Act 1996 and current regulations. The waste Licence No. 50-1 was granted by the Environmental Protection Agency (EPA).

Certified by:

COPY

FP Tom Creagh
Noel Coleman
Operations Manager

Licensed Hazardous Waste
Transfer Station
Licence No. 50-1

Corrin, Fermoy
County Cork
Ireland

T: +353 - (0) 25 - 42944
F: +353 - (0) 25 - 33885
E: info@avr-safeway.com

www.avr-safeway.com

Appendix B – Trial Pit Results

Trial Pit Results, Cork County Board Lands, Kilbarry, Co. Cork.

Test pits excavated:- 14 and 15/06/04.

Trial Pit No.	Co-ord X	Co-ord Y	Materials
TP 33	167478	75152	100% Soil and Stone
TP 37	167461	75145	100% Soil and Stone
TP 29	167457	75186	100% Soil and Stone
TP 30	167443	75189	95.5% Soil and Stone 0.5% Plastic Sheeting 4% Bricks, Tiles and Ceramics
TP 22	167477	75208	100% Soil and Stone
TP 18	167465	75259	98.4% Soil and Stone 1% Concrete Re-inforcement bar 0.5% Plastic Sheeting 0.1% Broken Corrugated Asbestos
TP 9	167468	75272	100% Soil and Stone
TP 10	167495	75267	98% Soil and Stone 2% Bituminous Material
TP 7	167532	75262	100% Soil and Stone
TP 5	167562	75242	99.5% Soil and Stone 0.5% concrete and associated re-inforcement bar
TP 12	167543	75211	99.5% Soil and Stone 0.5% Plastic
TP 47	167457	75079	100% Soil and Stone
TP 46	167449	75073	100% Soil and Stone
TP 52	167451	75051	100% Soil and Stone
TP 42	167486	75078	100% Soil and Stone
TP 17	167488	75239	99% Soil and Stone 1% concrete and associated re-inforcement bar
TP 21	167460	75230	98.5% Soil and Stone 0.5% Plastic, 1% Timber, 0.5% Brick
TP 20	167448	75238	90% Soil and Stone 7% Concrete, 3% Bricks, Tiles

Trial Pit No.	Co-ord X	Co-ord Y	Materials
TP 20a	167466	75205	100% Soil and Stone
TP 32	167462	75172	100% Soil and Stone
TP 28	167485	75179	100% Soil and Stone
TP 23	167507	75172	100% Soil and Stone
TP 24	167531	75164	100% Soil and Stone
TP 15	167537	75188	99.9% Soil and Stone 1% Road Planings
TP 16	167518	75196	99.9% Soil and Sand 1% Rebar
TP 11	167523	75220	100% Soil and Stone
TP 6	167537	75245	99.9% Soil and Stone
TP 8	167494	75281	100% Soil and Stone
TP 18a	167475	75257	98% Soil and Stone 2% Bricks, Tiles and Ceramics 5% Concrete 1% Timber
TP 18 c	167524	75243	100% Soil and Stone

Comment:-

The main percentage of soil and stone across the site is estimated at 98.9%.

All waste other than soil and stone was removed by licenced operators off-site. The half asbestos roof sheet was removed off site by a licenced operator and disposed of to an approved location.

Appendix C – Test Results – T.E.S. Bretby, Burton on Trent, England.
June, July, 2004 (15No. Pages).

TEST REPORT
SOIL SAMPLE ANALYSIS

1252

TES Report No. EFS/042542

Malachy Walsh & Partners
Peak House
Mahon Tech Park
Bessboro Road
Blackrock
Cork
Ireland

Site: Kilbarry GAA Grounds

The 5 samples described in this report were logged for analysis by TES Bretby on 16-Jun-2004.
The analysis was completed by: 14-Jul-2004

Tests marked 'not UKAS accredited' and any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by TES Bretby Laboratories.

The following tables are contained in this report:

On behalf of
TES Bretby :
J Hannah

J Hannah

Project Co-ordinator

Date of Issue: 14-Jul-2004

Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.
Tests marked '^' have been subcontracted to another laboratory.

TES Bretby accepts no responsibility for any sampling not carried out by our personnel.

Units :		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg	pH Units
Method Codes :		FIANH3S	ICPACIDS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICTSCN28	ICTSCN28	TPHFID	VOCSW	WSLM3
Method Reporting Limits :		0.5	10	0.5	0.1	0.5	0.5	0.5	0.10	0.5	0.5	3.0	1	5	10	5	
UKAS Accredited :		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
TES ID Number CL/	Client Sample Description	Ammoniacal Nitrogen.	SO4-- (acid sol)	Arsenic (MS)	Cadmium (MS)	Chromium (MS)	Copper (MS)	Lead (MS)	Mercury (MS)	Nickel (MS)	Selenium (MS)	Zinc (MS)	CN- (total)	Sulphide	DRO (AR)	VOC	pH units
0416637	TP001 4.0	11.6	195	3.30	<0.10	21.8	5.40	8.70	<0.10	26.7	<0.50	45.8	<1	<5	<10	Req	7.8
0416638	TP002 3.0	13.2	366	4.00	<0.10	19.5	7.10	11.00	<0.10	22.5	<0.50	40.8	<1	<5	57	Req	8.2
0416639	TP003 2.5	25.2	596	7.00	0.15	17.1	67.1	77.2	<0.10	24.3	<0.50	90.5	<1	<5	18	Req	8.2
0416640	TP004 2.5	81.6	556	5.10	<0.10	17.3	42.4	57.8	<0.10	24.5	<0.50	68.5	<1	<5	<10	Req	9.4
0416641	TP005 3.5	5.4	135	2.50	<0.10	21.5	5.20	8.60	<0.10	29.1	<0.50	46	<1	<5	<10	Req	7.3

TES Bretby

PO Box 100, Bretby Business Park,

Burton-on-Trent, Staffordshire, DE15 0XD

Tel +44 (0) 1283 554400

Fax +44 (0) 1283 554422

Client Name	Malachy Walsh & Partners
Contact	Mr D Roche

Kilbarry GAA Grounds

Soils Sample Analysis

Date Printed	14-Jul-04
Report Number	EFS/042542
Table Number	1

TES Bretby

Units :		mg/kg	mg/kg																
Method Codes :		FIASDO	ICPBOR																
Method Reporting Limits :		5.0	0.5																
UKAS Accredited :		no	no																
TES ID Number CL/	Client Sample Description	Chloride.	Boron.																
0416637	TP001 4.0	10.8	<0.5																
0416638	TP002 3.0	10.6	<0.5																
0416639	TP003 2.5	17.3	<0.5																
0416640	TP004 2.5	37.4	<0.5																
0416641	TP005 3.5	9.6	<0.5																

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Soils Sample Analysis

Date Printed	14-Jul-04
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Table Number	1

TES Bretby

Units :		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Method Codes :		PAHFID	PAHFID	PAHFID	PAHFID	PAHFID	PAHFID	PAHFID	PAHFID	PAHFID	PAHFID	PAHFID	PAHFID	PAHFID	PAHFID	PAHFID	PAHFID
Method Reporting Limits :		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
UKAS Accredited :		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
TES ID Number CL/	Client Sample Description	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(123-cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene
0416637	TP001 4.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
0416638	TP002 3.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
0416639	TP003 2.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1
0416640	TP004 2.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	2
0416641	TP005 3.5	<1	<1	<1	<1	2	<1	2	1	<1	<1	1	2	<1	<1	<1	2
		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

TES Bretby

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Client Name	Malachy Walsh & Partners
Contact	Mr D Roche

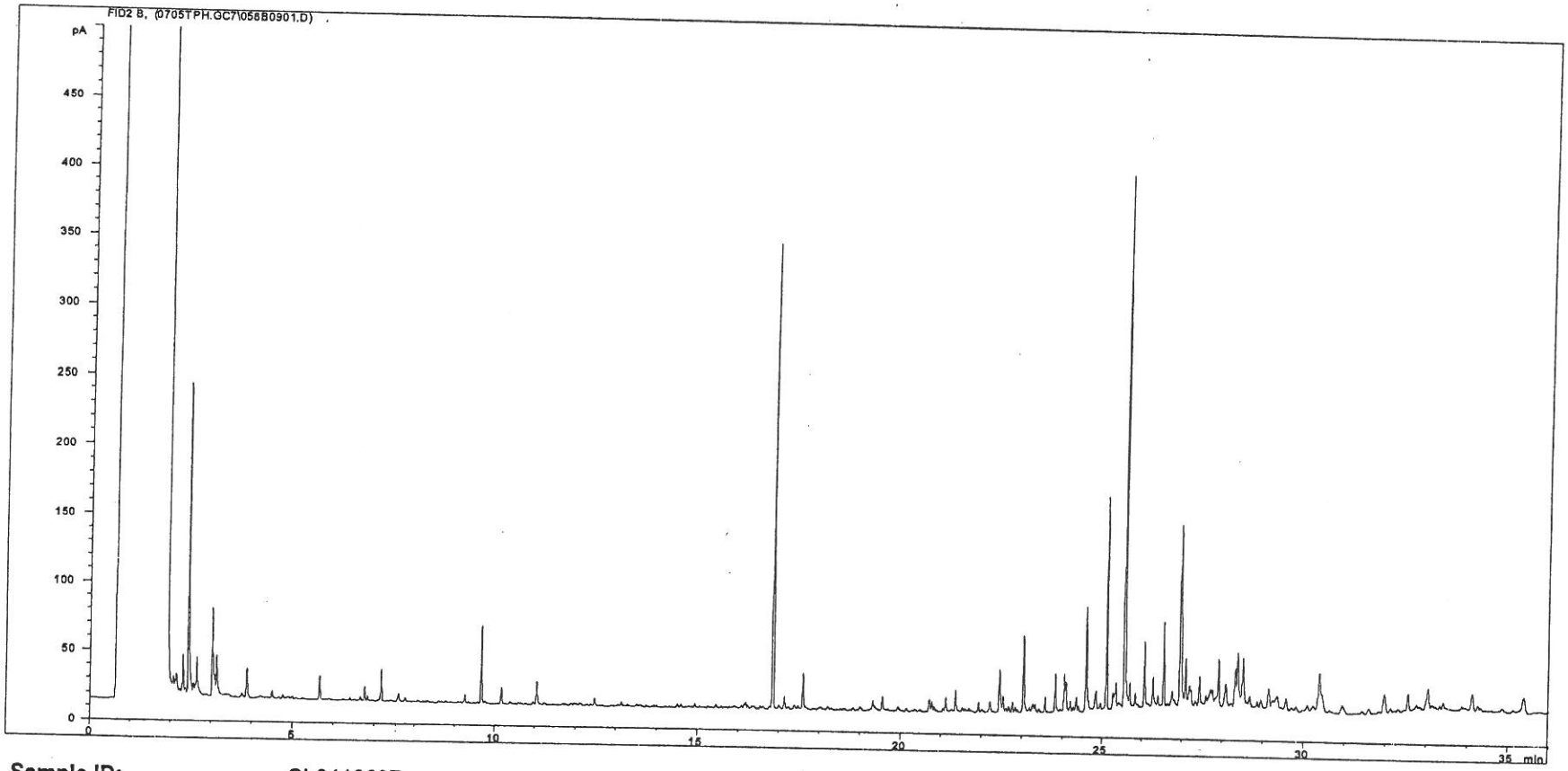
Kilbarry GAA Grounds

Soils Sample Analysis

Date Printed	14-Jul-04
Report Number	EFS/042542
Table Number	1

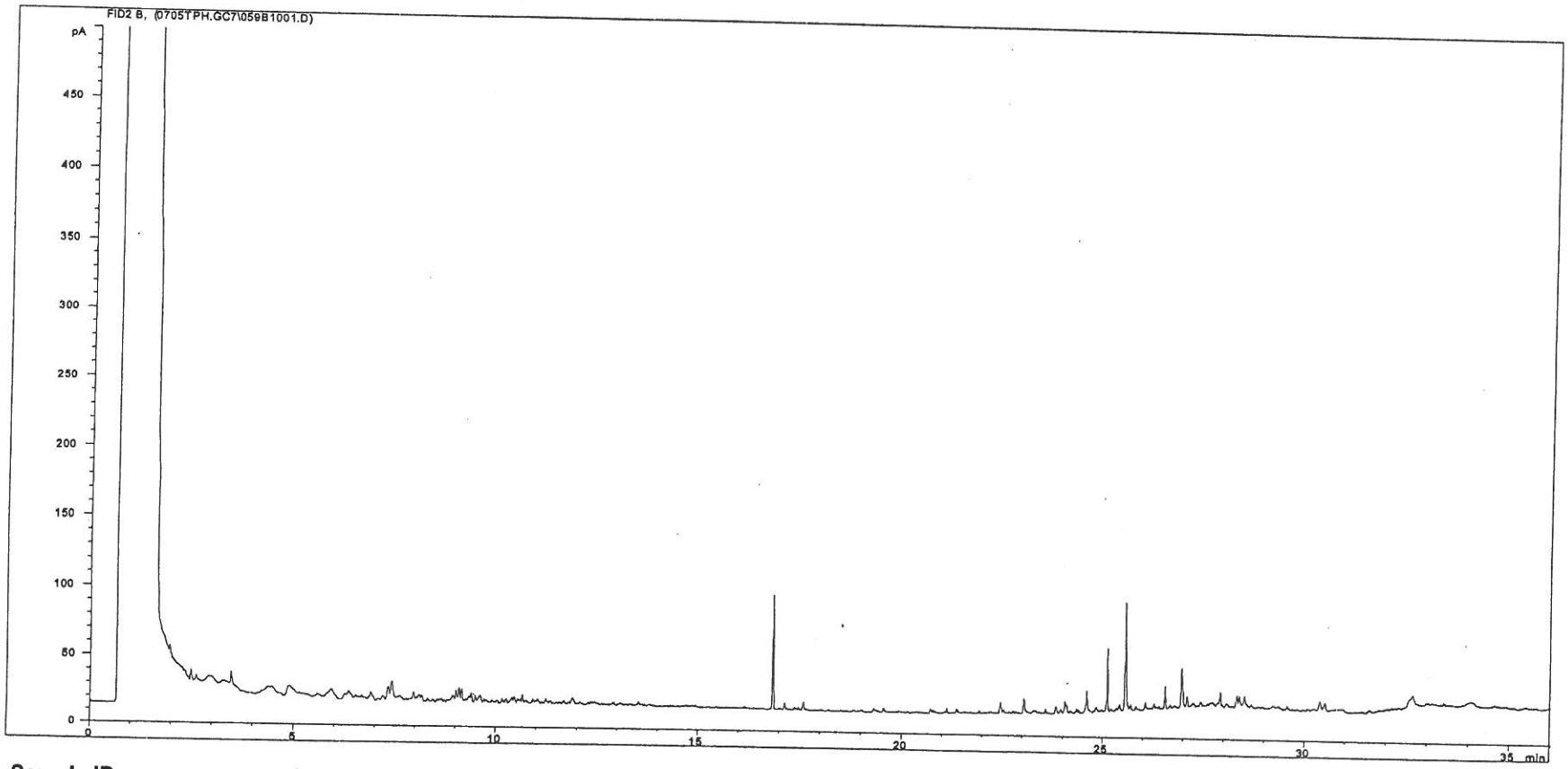
TES Bretby

Petroleum Hydrocarbons (C8 to C37) by GC/FID



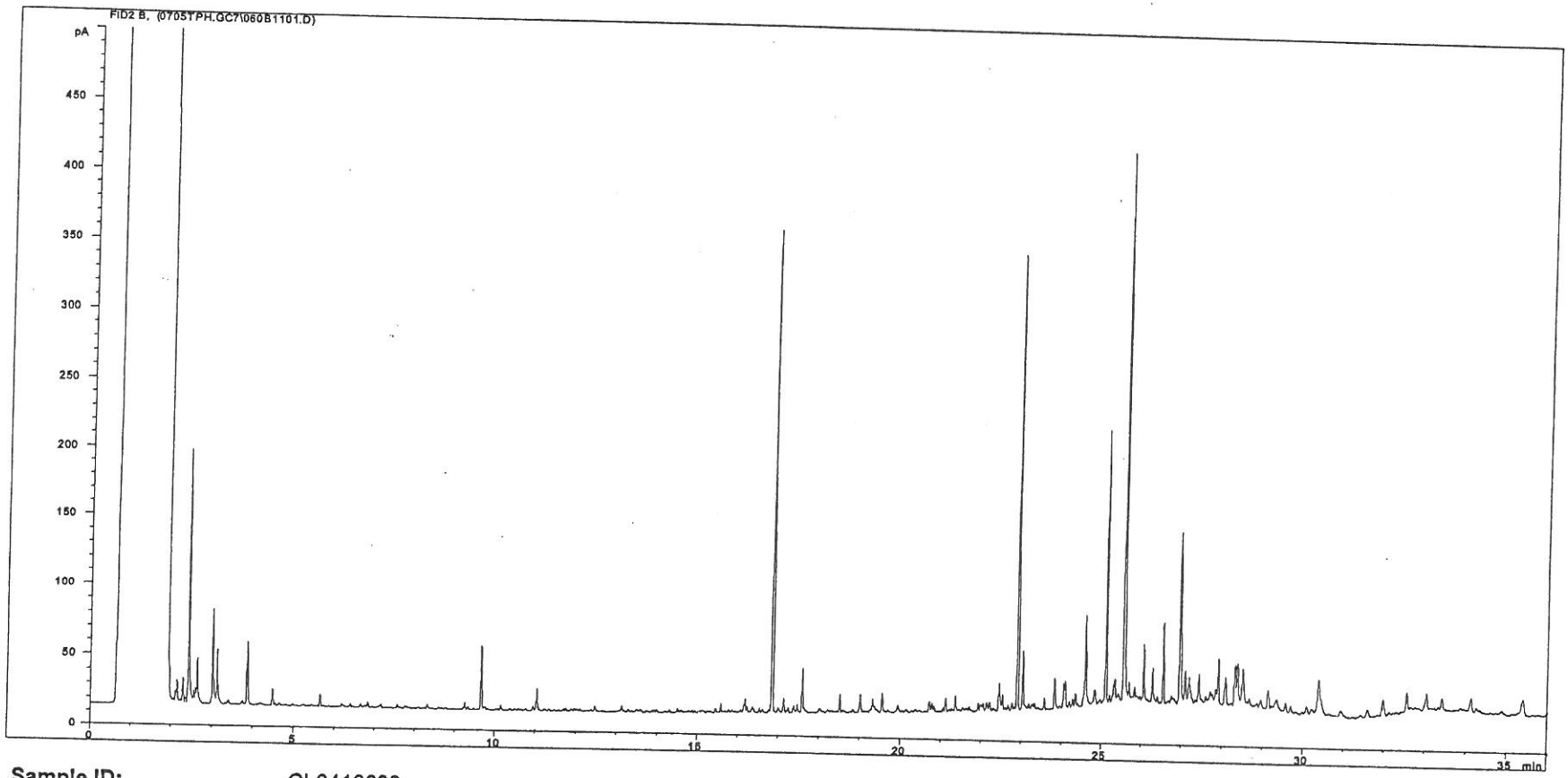
Sample ID:	CL0416637	**Job Number:**	S04_2542
Multiplier:	0.1	**Client:**	Malachy Walsh & Partners
Dilution:	1	**Site:**	Kilbarry GAA Grounds
Acquisition Method:	WMF_RUNF.M	**Client Sample Ref:**	TP001 4.0
Acquisition Date/Time:	07/05/2004		
Datafile:	C:\TES\DATA\0705TPH.GC7\058B0901.D		

Petroleum Hydrocarbons (C8 to C37) by GC/FID



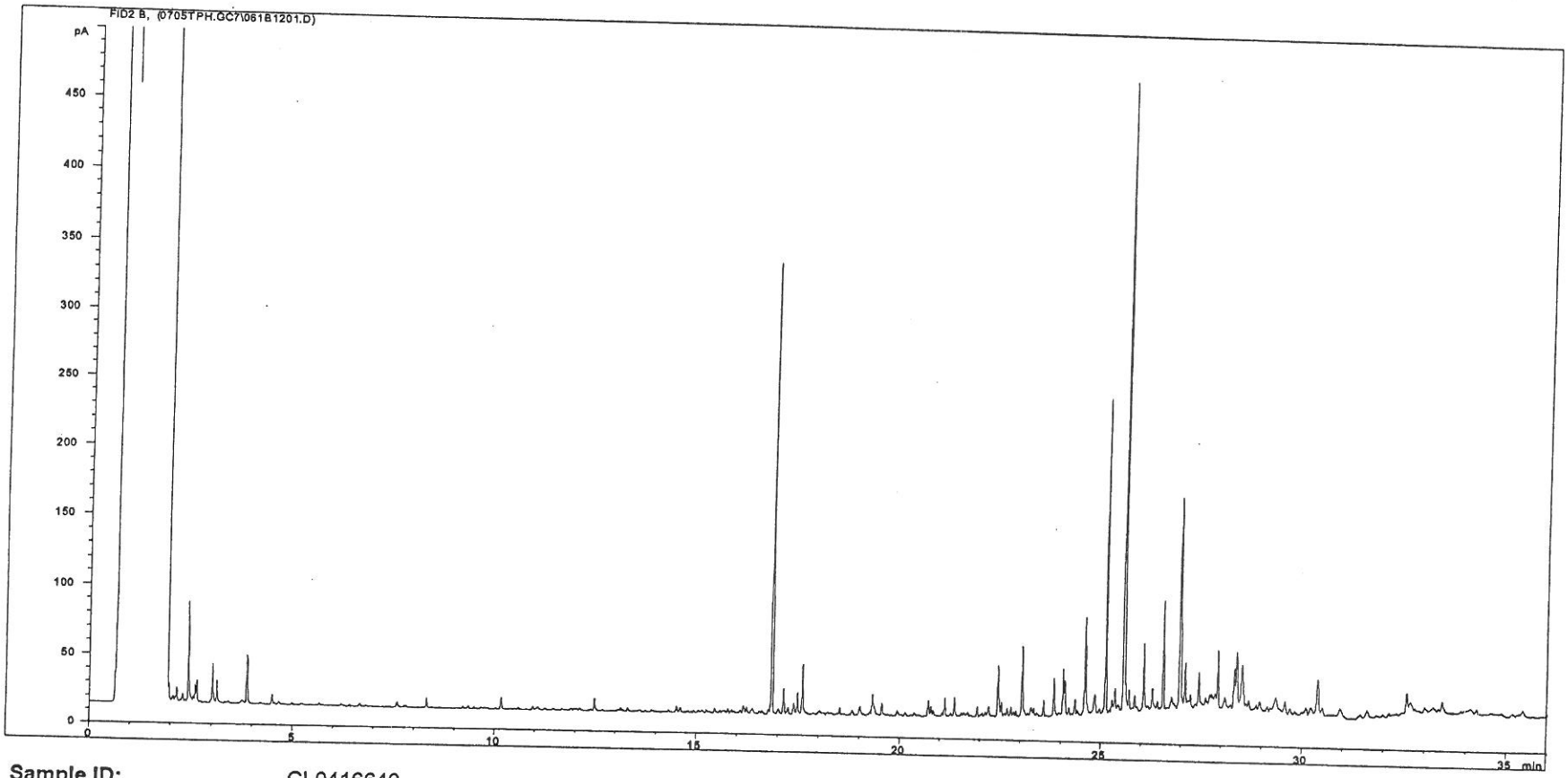
Sample ID:	CL0416638	**Job Number:**	S04_2542
Multiplier:	0.1	**Client:**	Malachy Walsh & Partners
Dilution:	5	**Site:**	Kilbarry GAA Grounds
Acquisition Method:	WMF_RUNF.M	**Client Sample Ref:**	TP002 3.0
Acquisition Date/Time:	07/05/2004		
Datafile:	C:\TES\DATA\0705TPH.GC7\059B1001.D		

Petroleum Hydrocarbons (C8 to C37) by GC/FID



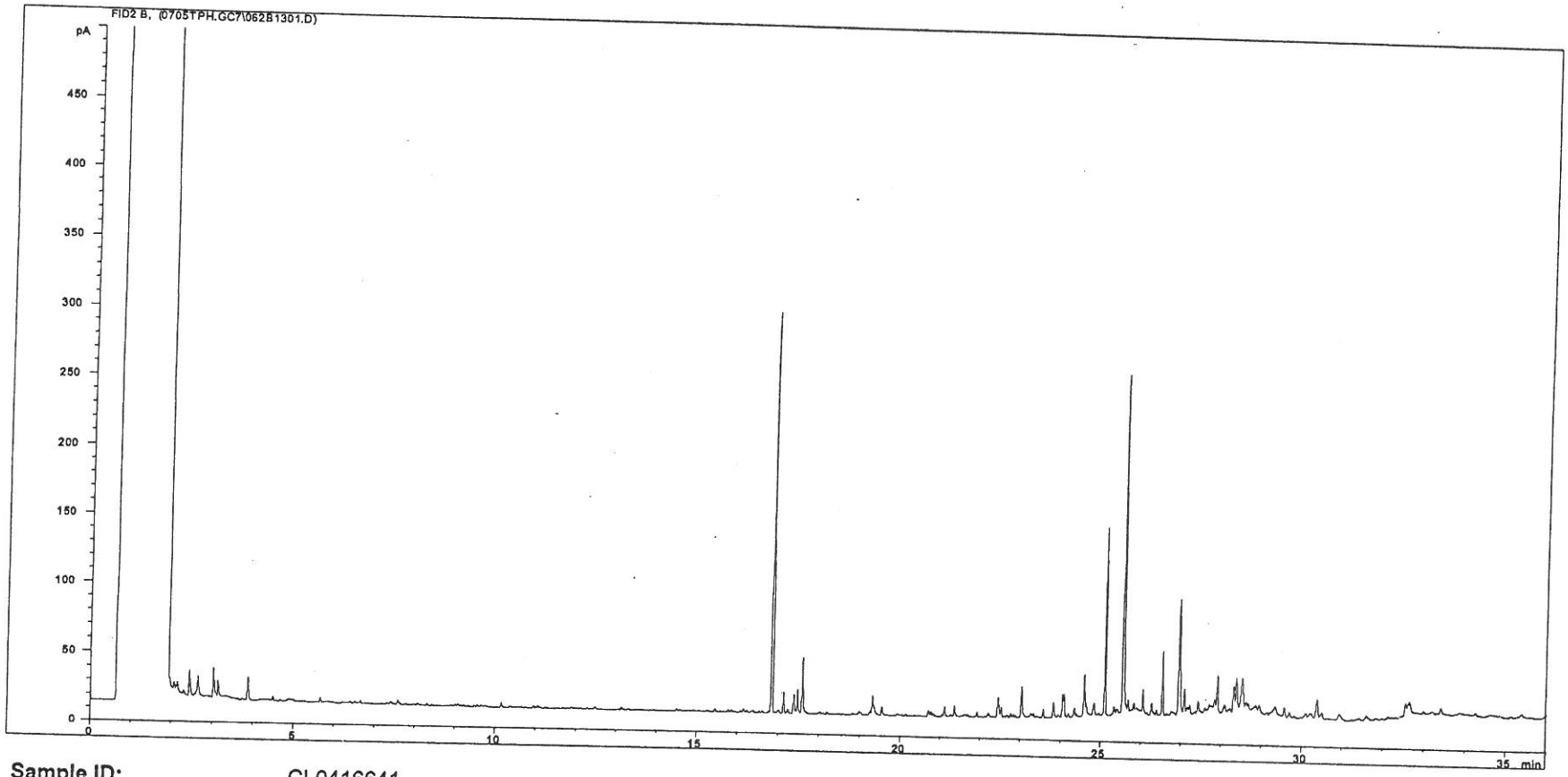
Sample ID:	CL0416639	**Job Number:**	S04_2542
Multiplier:	0.1	**Client:**	Malachy Walsh & Partners
Dilution:	1	**Site:**	Kilbarry GAA Grounds
Acquisition Method:	WMF_RUNF.M	**Client Sample Ref:**	TP003 2.5
Acquisition Date/Time:	07/05/2004		
Datafile:	C:\TES\DATA\0705TPH.GC7\060B1101.D		

Petroleum Hydrocarbons (C8 to C37) by GC/FID



Sample ID:	CL0416640	**Job Number:**	S04_2542
Multiplier:	0.1	**Client:**	Malachy Walsh & Partners
Dilution:	1	**Site:**	Kilbarry GAA Grounds
Acquisition Method:	WMF_RUNF.M	**Client Sample Ref:**	TP004 2.5
Acquisition Date/Time:	07/05/2004		
Datafile:	C:\TES\DATA\0705TPH.GC7\061B1201.D		

Petroleum Hydrocarbons (C8 to C37) by GC/FID



Sample ID:	CL0416641	**Job Number:**	S04_2542
Multiplier:	0.1	**Client:**	Malachy Walsh & Partners
Dilution:	1	**Site:**	Kilbarry GAA Grounds
Acquisition Method:	WMF_RUNF.M	**Client Sample Ref:**	TP005 3.5
Acquisition Date/Time:	07/05/2004		
Datafile:	C:\TES\DATA\0705TPH.GC7\062B1301.D		

Volatile Organic Compounds by PTGCMS

UKAS accredited?: No

Customer and Site Details:	Malachy Walsh & Part Site Site: Kilbarry GAA Grounds	**Directory/Quant file:**	0712VOC.MS1\ 0712CCC2.D	**Matrix:**	Soil
Sample Details:	TP001 4.0	**Date Booked In:**	16-Jun-04	**Method:**	Purge and Trap
LIMS ID Number:	CL0416637	**Date Analysed:**	12-Jul-04 17:25	**Dilution:**	5
Job Number:	S04_2542	**Operator:**	AB/SK	**Position:**	11

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8	-	< 5	-
Chloromethane	74-87-3	-	< 5	-
Vinyl Chloride	75-01-4	-	< 5	-
Bromomethane	74-83-9 *	-	< 5	-
Chloroethane	75-00-3 *	-	< 5	-
Trichlorofluoromethane	75-69-4	-	< 5	-
1,1-Dichloroethene	75-35-4	-	< 5	-
trans 1,2-Dichloroethene	156-60-5	-	< 5	-
1,1-Dichloroethane	75-34-3	-	< 5	-
2,2-Dichloropropane	594-20-7	-	< 5	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 5	-
Chloroform	67-66-3	-	< 5	-
1,1,1-Trichloroethane	71-55-6	-	< 5	-
Carbon Tetrachloride	56-23-5	-	< 5	-
1,1-Dichloropropene	563-58-6	-	< 5	-
Benzene	71-43-2	-	< 5	-
1,2-Dichloroethane	107-06-2	-	< 5	-
Trichloroethene	79-01-6	-	< 5	-
1,2-Dichloropropane	78-87-5	-	< 5	-
Dibromomethane	74-95-3	-	< 5	-
Bromodichloromethane	75-27-4	-	< 5	-
cis 1,3-Dichloropropene	10061-01-5	-	< 5	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 5	-
1,1,2-Trichloroethane	79-00-5	-	< 5	-
Tetrachloroethene	127-18-4	-	< 25	-
1,3-Dichloropropane	142-28-9	-	< 5	-
Dibromochloromethane	124-48-1	-	< 5	-
1,2-Dibromoethane	106-93-4	-	< 5	-
Chlorobenzene	108-90-7	-	< 5	-
Ethylbenzene	100-41-4	-	< 5	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 5	-
m and p-Xylene	108-38-3/106-42-3	-	< 5	-
o-Xylene	95-47-6	-	< 5	-

Concentrations are reported on a wet weight basis

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Styrene	100-42-5	-	< 5	-
Bromoform	75-25-2	-	< 5	-
Iso-Propylbenzene	98-82-8	-	< 5	-
1,1,2,2-Tetrachloroethane	79-34-5	-	< 5	-
Propylbenzene	103-65-1	-	< 5	-
Bromobenzene	108-86-1	-	< 5	-
1,2,3-Trichloropropane	96-18-4	-	< 5	-
2-Chlorotoluene	95-49-8	-	< 5	-
1,3,5-Trimethylbenzene	108-67-8	-	< 5	-
4-Chlorotoluene	106-43-4	-	< 5	-
tert-Butylbenzene	98-06-6	-	< 5	-
1,2,4-Trimethylbenzene	95-63-6	-	< 5	-
sec-Butylbenzene	135-98-8	-	< 5	-
p-Isopropyltoluene	99-87-6	-	< 5	-
1,3-Dichlorobenzene	541-73-1	-	< 5	-
1,4-Dichlorobenzene	106-46-7	-	< 5	-
n-Butylbenzene	104-51-8	-	< 5	-
1,2-Dichlorobenzene	95-50-1	-	< 5	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 25	-
1,2,4-Trichlorobenzene	120-82-1	-	< 25	-
Hexachlorobutadiene	87-68-3	-	< 25	-
Naphthalene	91-20-3	25.30	73	98
1,2,3-Trichlorobenzene	87-61-6	-	< 25	-

Concentrations are reported on a wet weight basis

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	11.06	104	Dibromofluoromethane	92
1,4-Difluorobenzene	12.33	95	Toluene-d8	104
Chlorobenzene-d5	17.22	101	Bromofluorobenzene	107
1,4-Dichlorobenzene-d4	21.16	102		

Volatile Organic Compounds by PTGCMS

UKAS accredited?: No

Customer and Site Details: Malachy Walsh & Part Site: Kilbarry GAA Grounds
Sample Details: TP002 3.0
LIMS ID Number: CL0416638
Job Number: S04_2542

Directory/Quant file: 0712VOC.MS1\ 0712CCC2.D
Date Booked In: 16-Jun-04
Date Analysed: 12-Jul-04 18:08
Operator: AB/SK

Matrix: Soil
Method: Purge and Trap
Dilution: 5
Position: 12

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8	-	< 5	-
Chloromethane	74-87-3	-	< 5	-
Vinyl Chloride	75-01-4	-	< 5	-
Bromomethane	74-83-9 *	-	< 5	-
Chloroethane	75-00-3 *	-	< 5	-
Trichlorofluoromethane	75-69-4	-	< 5	-
1,1-Dichloroethene	75-35-4	-	< 5	-
trans 1,2-Dichloroethene	156-60-5	-	< 5	-
1,1-Dichloroethane	75-34-3	-	< 5	-
2,2-Dichloropropane	594-20-7	-	< 5	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 5	-
Chloroform	67-66-3	-	< 5	-
1,1,1-Trichloroethane	71-55-6	-	< 5	-
Carbon Tetrachloride	56-23-5	-	< 5	-
1,1-Dichloropropene	563-58-6	-	< 5	-
Benzene	71-43-2	-	< 5	-
1,2-Dichloroethane	107-06-2	-	< 5	-
Trichloroethene	79-01-6	-	< 5	-
1,2-Dichloropropane	78-87-5	-	< 5	-
Dibromomethane	74-95-3	-	< 5	-
Bromodichloromethane	75-27-4	-	< 5	-
cis 1,3-Dichloropropene	10061-01-5	-	< 5	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 5	-
1,1,2-Trichloroethane	79-00-5	-	< 5	-
Tetrachloroethene	127-18-4	-	< 25	-
1,3-Dichloropropane	142-28-9	-	< 5	-
Dibromochloromethane	124-48-1	-	< 5	-
1,2-Dibromoethane	106-93-4	-	< 5	-
Chlorobenzene	108-90-7	-	< 5	-
Ethylbenzene	100-41-4	-	< 5	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 5	-
m and p-Xylene	108-38-3/106-42-3	-	< 5	-
o-Xylene	95-47-6	-	< 5	-

Concentrations are reported on a wet weight basis

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Styrene	100-42-5	-	< 5	-
Bromoform	75-25-2	-	< 5	-
Iso-Propylbenzene	98-82-8	-	< 5	-
1,1,2,2-Tetrachloroethane	79-34-5	-	< 5	-
Propylbenzene	103-65-1	-	< 5	-
Bromobenzene	108-86-1	-	< 5	-
1,2,3-Trichloropropane	96-18-4	-	< 5	-
2-Chlorotoluene	95-49-8	-	< 5	-
1,3,5-Trimethylbenzene	108-67-8	-	< 5	-
4-Chlorotoluene	106-43-4	-	< 5	-
tert-Butylbenzene	98-06-6	-	< 5	-
1,2,4-Trimethylbenzene	95-63-6	-	< 5	-
sec-Butylbenzene	135-98-8	-	< 5	-
p-Isopropyltoluene	99-87-6	-	< 5	-
1,3-Dichlorobenzene	541-73-1	-	< 5	-
1,4-Dichlorobenzene	106-46-7	-	< 5	-
n-Butylbenzene	104-51-8	-	< 5	-
1,2-Dichlorobenzene	95-50-1	-	< 5	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 25	-
1,2,4-Trichlorobenzene	120-82-1	-	< 25	-
Hexachlorobutadiene	87-68-3	-	< 25	-
Naphthalene	91-20-3	-	< 25	-
1,2,3-Trichlorobenzene	87-61-6	-	< 25	-

Concentrations are reported on a wet weight basis

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	11.07	125	Dibromofluoromethane	87
1,4-Difluorobenzene	12.34	117	Toluene-d8	96
Chlorobenzene-d5	17.22	108	Bromofluorobenzene	102
1,4-Dichlorobenzene-d4	21.17	101		

Volatile Organic Compounds by PTGCMS

UKAS accredited?: No

Customer and Site Details: Malachy Walsh & Part Site: Kilbarry GAA Grounds
Sample Details: TP003 2.5
LIMS ID Number: CL0416639
Job Number: S04_2542

Directory/Quant file: 0712VOC.MS1\ 0712CCC2.D
Date Booked In: 16-Jun-04
Date Analysed: 12-Jul-04 18:52
Operator: AB/SK

Matrix: Soil
Method: Purge and Trap
Dilution: 5
Position: 13

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8	-	< 5	-
Chloromethane	74-87-3	-	< 5	-
Vinyl Chloride	75-01-4	-	< 5	-
Bromomethane	74-83-9 *	4.90	6	98
Chloroethane	75-00-3 *	-	< 5	-
Trichlorofluoromethane	75-69-4	-	< 5	-
1,1-Dichloroethene	75-35-4	-	< 5	-
trans 1,2-Dichloroethene	156-60-5	-	< 5	-
1,1-Dichloroethane	75-34-3	-	< 5	-
2,2-Dichloropropane	594-20-7	-	< 5	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 5	-
Chloroform	67-66-3	-	< 5	-
1,1,1-Trichloroethane	71-55-6	-	< 5	-
Carbon Tetrachloride	56-23-5	-	< 5	-
1,1-Dichloropropene	563-58-6	-	< 5	-
Benzene	71-43-2	-	< 5	-
1,2-Dichloroethane	107-06-2	-	< 5	-
Trichloroethene	79-01-6	-	< 5	-
1,2-Dichloropropane	78-87-5	-	< 5	-
Dibromomethane	74-95-3	-	< 5	-
Bromodichloromethane	75-27-4	-	< 5	-
cis 1,3-Dichloropropene	10061-01-5	-	< 5	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 5	-
1,1,2-Trichloroethane	79-00-5	-	< 5	-
Tetrachloroethene	127-18-4	-	< 25	-
1,3-Dichloropropane	142-28-9	-	< 5	-
Dibromochloromethane	124-48-1	-	< 5	-
1,2-Dibromoethane	106-93-4	-	< 5	-
Chlorobenzene	108-90-7	-	< 5	-
Ethylbenzene	100-41-4	-	< 5	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 5	-
m and p-Xylene	108-38-3/106-42-3	-	< 5	-
o-Xylene	95-47-6	-	< 5	-

Concentrations are reported on a wet weight basis

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Styrene	100-42-5	-	< 5	-
Bromoform	75-25-2	-	< 5	-
Iso-Propylbenzene	98-82-8	-	< 5	-
1,1,2,2-Tetrachloroethane	79-34-5	-	< 5	-
Propylbenzene	103-65-1	-	< 5	-
Bromobenzene	108-86-1	-	< 5	-
1,2,3-Trichloropropane	96-18-4	-	< 5	-
2-Chlorotoluene	95-49-8	-	< 5	-
1,3,5-Trimethylbenzene	108-67-8	-	< 5	-
4-Chlorotoluene	106-43-4	-	< 5	-
tert-Butylbenzene	98-06-6	-	< 5	-
1,2,4-Trimethylbenzene	95-63-6	-	< 5	-
sec-Butylbenzene	135-98-8	-	< 5	-
p-Isopropyltoluene	99-87-6	-	< 5	-
1,3-Dichlorobenzene	541-73-1	-	< 5	-
1,4-Dichlorobenzene	106-46-7	-	< 5	-
n-Butylbenzene	104-51-8	-	< 5	-
1,2-Dichlorobenzene	95-50-1	-	< 5	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 25	-
1,2,4-Trichlorobenzene	120-82-1	-	< 25	-
Hexachlorobutadiene	87-68-3	-	< 25	-
Naphthalene	91-20-3	-	< 25	-
1,2,3-Trichlorobenzene	87-61-6	-	< 25	-

Concentrations are reported on a wet weight basis

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	11.07	115	Dibromofluoromethane	76
1,4-Difluorobenzene	12.34	102	Toluene-d8	98
Chlorobenzene-d5	17.22	90	Bromofluorobenzene	91
1,4-Dichlorobenzene-d4	21.16	72		

Volatile Organic Compounds by PTGCMS

UKAS accredited?: No

Customer and Site Details: Malachy Walsh & Part Site: Kilbarry GAA Grounds
Sample Details: TP004 2.5
LIMS ID Number: CL0416640
Job Number: S04_2542

Directory/Quant file: 0712VOC.MS1\ 0712CCC2.D
Date Booked In: 16-Jun-04
Date Analysed: 12-Jul-04 19:35
Operator: AB/SK

Matrix: Soil
Method: Purge and Trap
Dilution: 5
Position: 14

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8	-	< 5	-
Chloromethane	74-87-3	-	< 5	-
Vinyl Chloride	75-01-4	-	< 5	-
Bromomethane	74-83-9 *	4.90	9	88
Chloroethane	75-00-3 *	-	< 5	-
Trichlorofluoromethane	75-69-4	-	< 5	-
1,1-Dichloroethene	75-35-4	-	< 5	-
trans 1,2-Dichloroethene	156-60-5	-	< 5	-
1,1-Dichloroethane	75-34-3	-	< 5	-
2,2-Dichloropropane	594-20-7	-	< 5	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 5	-
Chloroform	67-66-3	-	< 5	-
1,1,1-Trichloroethane	71-55-6	-	< 5	-
Carbon Tetrachloride	56-23-5	-	< 5	-
1,1-Dichloropropene	563-58-6	-	< 5	-
Benzene	71-43-2	-	< 5	-
1,2-Dichloroethane	107-06-2	-	< 5	-
Trichloroethene	79-01-6	-	< 5	-
1,2-Dichloropropane	78-87-5	-	< 5	-
Dibromomethane	74-95-3	-	< 5	-
Bromodichloromethane	75-27-4	-	< 5	-
cis 1,3-Dichloropropene	10061-01-5	-	< 5	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 5	-
1,1,2-Trichloroethane	79-00-5	-	< 5	-
Tetrachloroethene	127-18-4	-	< 25	-
1,3-Dichloropropane	142-28-9	-	< 5	-
Dibromochloromethane	124-48-1	-	< 5	-
1,2-Dibromoethane	106-93-4	-	< 5	-
Chlorobenzene	108-90-7	-	< 5	-
Ethylbenzene	100-41-4	-	< 5	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 5	-
m and p-Xylene	108-38-3/106-42-3	-	< 5	-
o-Xylene	95-47-6	-	< 5	-

Concentrations are reported on a wet weight basis

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Styrene	100-42-5	-	< 5	-
Bromoform	75-25-2	-	< 5	-
iso-Propylbenzene	98-82-8	-	< 5	-
1,1,2,2-Tetrachloroethane	79-34-5	-	< 5	-
Propylbenzene	103-65-1	-	< 5	-
Bromobenzene	108-86-1	-	< 5	-
1,2,3-Trichloropropane	96-18-4	-	< 5	-
2-Chlorotoluene	95-49-8	-	< 5	-
1,3,5-Trimethylbenzene	108-67-8	-	< 5	-
4-Chlorotoluene	106-43-4	-	< 5	-
tert-Butylbenzene	98-06-6	-	< 5	-
1,2,4-Trimethylbenzene	95-63-6	-	< 5	-
sec-Butylbenzene	135-98-8	-	< 5	-
p-Isopropyltoluene	99-87-6	-	< 5	-
1,3-Dichlorobenzene	541-73-1	-	< 5	-
1,4-Dichlorobenzene	106-46-7	-	< 5	-
n-Butylbenzene	104-51-8	-	< 5	-
1,2-Dichlorobenzene	95-50-1	-	< 5	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 25	-
1,2,4-Trichlorobenzene	120-82-1	-	< 25	-
Hexachlorobutadiene	87-68-3	-	< 25	-
Naphthalene	91-20-3	-	< 25	-
1,2,3-Trichlorobenzene	87-61-6	-	< 25	-

Concentrations are reported on a wet weight basis

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	11.07	97	Dibromofluoromethane	77
1,4-Difluorobenzene	12.34	87	Toluene-d8	97
Chlorobenzene-d5	17.22	76	Bromofluorobenzene	89
1,4-Dichlorobenzene-d4	21.16	60		

Volatile Organic Compounds by PTGCMS

UKAS accredited?: No

Customer and Site Details:	Malachy Walsh & Part Site: Kilbarry GAA Grounds	**Directory/Quant file:**	0713VOC.MS1\ 0713CCC1.D	**Matrix:**	Soil
Sample Details:	TP005 3.5	**Date Booked in:**	16-Jun-04	**Method:**	Purge and Trap
LIMS ID Number:	CL0416641	**Date Analysed:**	13-Jul-04 15:38	**Dilution:**	5
Job Number:	S04_2542	**Operator:**	AB/SK	**Position:**	10

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Dichlorodifluoromethane	75-71-8	-	< 5	-
Chloromethane	74-87-3	-	< 5	-
Vinyl Chloride	75-01-4	-	< 5	-
Bromomethane	74-83-9 *	-	< 5	-
Chloroethane	75-00-3 *	-	< 5	-
Trichlorofluoromethane	75-69-4	-	< 5	-
1,1-Dichloroethene	75-35-4	-	< 5	-
trans 1,2-Dichloroethene	156-60-5	-	< 5	-
1,1-Dichloroethane	75-34-3	-	< 5	-
2,2-Dichloropropane	594-20-7	-	< 5	-
cis 1,2-Dichloroethene	156-59-2	-	< 5	-
Bromochloromethane	74-97-5	-	< 5	-
Chloroform	67-66-3	-	< 5	-
1,1,1-Trichloroethane	71-55-6	-	< 5	-
Carbon Tetrachloride	56-23-5	-	< 5	-
1,1-Dichloropropene	563-58-6	-	< 5	-
Benzene	71-43-2	-	< 5	-
1,2-Dichloroethane	107-06-2	-	< 5	-
Trichloroethene	79-01-6	-	< 5	-
1,2-Dichloropropane	78-87-5	-	< 5	-
Dibromomethane	74-95-3	-	< 5	-
Bromodichloromethane	75-27-4	-	< 5	-
cis 1,3-Dichloropropene	10061-01-5	-	< 5	-
Toluene	108-88-3	-	< 5	-
trans 1,3-Dichloropropene	10061-02-6	-	< 5	-
1,1,2-Trichloroethane	79-00-5	-	< 5	-
Tetrachloroethene	127-18-4	-	< 25	-
1,3-Dichloropropane	142-28-9	-	< 5	-
Dibromochloromethane	124-48-1	-	< 5	-
1,2-Dibromoethane	106-93-4	-	< 5	-
Chlorobenzene	108-90-7	-	< 5	-
Ethylbenzene	100-41-4	-	< 5	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 5	-
m and p-Xylene	108-38-3/106-42-3	-	< 5	-
o-Xylene	95-47-6	-	< 5	-

Concentrations are reported on a wet weight basis

Target Compounds	CAS #	R.T. (min.)	Concentration µg/kg	% Fit
Styrene	100-42-5	-	< 5	-
Bromoform	75-25-2	-	< 5	-
Iso-Propylbenzene	98-82-8	-	< 5	-
1,1,2,2-Tetrachloroethane	79-34-5	-	< 5	-
Propylbenzene	103-65-1	-	< 5	-
Bromobenzene	108-86-1	-	< 5	-
1,2,3-Trichloropropane	96-18-4	-	< 5	-
2-Chlorotoluene	95-49-8	-	< 5	-
1,3,5-Trimethylbenzene	108-67-8	-	< 5	-
4-Chlorotoluene	106-43-4	-	< 5	-
tert-Butylbenzene	98-06-6	-	< 5	-
1,2,4-Trimethylbenzene	95-63-6	-	< 5	-
sec-Butylbenzene	135-98-8	-	< 5	-
p-Isopropyltoluene	99-87-6	-	< 5	-
1,3-Dichlorobenzene	541-73-1	-	< 5	-
1,4-Dichlorobenzene	106-46-7	21.21	9	57
n-Butylbenzene	104-51-8	-	< 5	-
1,2-Dichlorobenzene	95-50-1	-	< 5	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 25	-
1,2,4-Trichlorobenzene	120-82-1	-	< 25	-
Hexachlorobutadiene	87-68-3	-	< 25	-
Naphthalene	91-20-3	25.30	53	98
1,2,3-Trichlorobenzene	87-61-6	-	< 25	-

Concentrations are reported on a wet weight basis

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	11.07	97	Dibromofluoromethane	95
1,4-Difluorobenzene	12.34	88	Toluene-d8	105
Chlorobenzene-d5	17.22	90	Bromofluorobenzene	94
1,4-Dichlorobenzene-d4	21.17	76		

Report Notes

Soil/Solid analysis specific:
Results expressed as mg/kg unless stated otherwise
S04 analysis not conducted in accordance with BS1377
Water Soluble Sulphate on 2:1 water:soil extract
AR denotes analysis conducted on the As Received sample
co-eluted with benzo(b)fluoranthene
co-eluted with Indeno(123-cd)pyrene
BTEX analysis expressed as ug/kg As Received
Phenol HPLC results expressed as mg/kg As Received

Water analysis specific:
Results expressed as mg/l unless stated otherwise

Oil analysis specific:
Results expressed as mg/kg unless stated otherwise
S.G. expressed as g/cm^3@ 15°C

Filter analysis specific:
Results expressed as mg on filter unless stated otherwise

VOC analysis specific:
Explanatory notes for data flagging
U = undetected above reporting limit
J = concentration at instrument was below lowest calibration standard
E = concentration at instrument was above top calibration standard
B = compound was detected in method blank

Gas (Tedlar bag) analysis specific:
Results expressed as ug/l unless stated otherwise

Air (Carbon tube) analysis specific:
Results expressed as ug on tube unless stated otherwise

Asbestos analysis specific:
CH denotes Chrysotile
CR denotes Crocidolite
AM denotes Amosite
NADIS denotes No Asbestos Detected in Sample
NBFO denotes No Bulk fibres Observed
T Trace
L Low (2-15%)
M Medium (15-50%)
H High (>50%)

General notes:
^ this analysis was subcontracted to another laboratory
$ Within laboratory tolerances
$$ unable to analyse due to nature of sample
¥ Results for guidance only, possible interference
& Blank corrected
I.S insufficient sample for analysis
Intf Unable to analyse due to interferences
N.D Not determined
N.R Not recorded
N.Det Not detected
Req Analysis Requested, see attached sheets for results
***** denotes this result not UKAS accredited on this sample
Þ Raised detection limit due to nature of sample

Appendix D – Test Data Commentary
(As Measure 2 Response Titled Test Data in Report)

Test Data.

5 No. tests were carried out by TES Bretby, Burton on Trent and the results form Appendix C to this document. The comments on the data and two earlier tests carried out on two samples in January, 1999 by the same company are:-

The TES Bretby Laboratory data provided by Sorensen Ltd. on 01/02/99 and by this office on 14/07/04 have been reviewed and compared to two sets of soil standards by EU environmental agencies outside Ireland. The evaluation conducted was to interpret the results for the various analytes, particularly the polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs), with respect to normal background levels.

Samples 1 and 2 from material analysed in January, 1999 (Sorensen 1999), contained low concentrations of various metals and PAHs. UK Soil Guideline Values and/or Dutch Intervention Values are available for the following analytes reported: arsenic, chromium, copper, lead, mercury, nickel, selenium, zinc, total polycyclic aromatic hydrocarbons (PAHs), and various volatile organic compounds (VOCs).

Samples from all five test pits TP001 through TP005 (Malachy Walsh & Partners, June, 2004) contained low concentrations of various metals.

Table 1 compares all results with the soil standards already referred to and shows maximum concentrations for each parameter highlighted in yellow. Ireland currently has no soil contamination standards, so the results in Table 1 are compared to two sets of soil standards published by EU environmental agencies outside Ireland. These values presented are Soil Guideline Values for Residential Properties by the UK Environment Agency and the Dutch Intervention Values.

The Soil Guideline Values and the Intervention Values are threshold concentrations for various parameters at or above which further evaluation and possibly remediation, of the soil may be warranted. These values are based on known toxicity and health hazards presented by each compound. None of the analytes from the Kilbarry soil samples were reported at concentrations approaching either set of standards.

The results were further evaluated with respect to normal background levels. A search of the Irish Environmental Protection Agency website revealed no published background values for the compounds in question. Subsequent inquiry with the agency confirmed that Ireland currently has no published soil background values.

Background values for metals and PAHs in soil can vary considerably based on location and history and are subject to both natural and anthropogenic factors. The metals identified occur naturally in soil and bedrock and can vary widely in concentration depending on local geology. The concentrations reported are considered typical of urban soils and again, well below the action values in Table 1.

Many PAHs including those identified at this property are almost ubiquitous in urban soils as they are produced by incomplete combustion of carbon-based compounds including wood and fossil fuels like coal and petroleum in fireplaces, furnaces or incinerators. They are also produced in exhausts from cars and trucks and burning of creosote or coal pitch containing materials. They may occur naturally due to forest fires.

The analyses for metals did not identify elevated concentrations of heavy metals, most notably lead. The PAHs were present in the test pit samples at consistent low concentrations typical of urban soils. Therefore, while these compounds are present, it is not apparent that the soil contains metals and PAHs from a distinct industrial source of environmental concern such as an incinerator or smelting operation.

The VOCs bromomethane and 1,2-dichlorobenzene were each identified at concentrations only slightly above their respective laboratory reporting limits. Although not naturally occurring in soil, the extremely low concentrations reported are far below values that might warrant any remedial action.

Based on the available data, the fill material at Cork County Board Grounds is not hazardous. The only anomaly is that the sample from TP004 had a pH of 9.4. The other four samples had reported pH values ranging from 7.3 to 8.2. No pH value was cited in either set of standards checked. The soil pH in that sample appears somewhat high but may be naturally occurring depending on the local geology and presence of alkaline materials such as fertilizers. That same sample had a reported value for ammoniacal nitrogen of 81.6 mg/kg versus a range of only 5.4 to 25.2 mg/kg for the other four samples. If anything, higher pH soils tend to increase adsorption of various metals to soil particles and decrease their mobility in the environment. This value then, is not of concern.

The samples taken are representative of the fill material and the results in relation to the extensive and wide range of tests undertaken, are acceptable.

W. Brian Barney, P.E., B.Sc.(Geology), M.Sc.Eng.

Analytical Results for Soil Samples
Kilbarry GAA Grounds, County Cork

TABLE 1

Sample No.	Report Date	Parameter (Mg/Kg)															
		Arsenic*		Copper*		Chromium*		Lead*		Nickel*		Zinc*		Cadmium*		Mercury*		Selenium*	
Soil																			
BH1 Jar GL-0.6	010299	6	*55/20*	37	*190*	16	*380/200*	57	*530/450*	18	*210/75*	49	*720*	<1	*12/30*	0.20	*10/15*	0.16	*260*
BH2 Jar GL-1.50	010299	9	*55/20*	37	*190*	19	*380/200*	60	*530/450*	12	*210/75*	52	*720*	<1	*12/30*	0.17	*10/15*	0.31	*260*
TP001 4.0	14/07/04	3.30	*55/20*	6.40	*190*	21.8	*380/200*	8.70	*530/450*	28.7	*210/75*	45.8	*720*	<0.10	*12/30*	<0.10	*10/15*	<0.50	*260*
TP002 3.0	14/07/04	4.00	*55/20*	7.10	*190*	19.5	*380/200*	11.00	*530/450*	22.5	*210/75*	40.8	*720*	<0.10	*12/30*	<0.10	*10/15*	<0.50	*260*
TP003 2.5	14/07/04	7.00	*55/20*	67.1	*190*	17.1	*380/200*	77.2	*530/450*	24.3	*210/75*	90.5	*720*	0.15	*12/30*	<0.10	*10/15*	<0.50	*260*
TP004 2.5	14/07/04	6.10	*55/20*	42.4	*190*	17.3	*380/200*	57.8	*530/450*	24.5	*210/75*	68.5	*720*	<0.10	*12/30*	<0.10	*10/15*	<0.50	*260*
TP005 3.5	14/07/04	2.50	*55/20*	5.20	*190*	21.6	*380/200*	8.60	*530/450*	29.1	*210/75*	46	*720*	<0.10	*12/30*	<0.10	*10/15*	<0.50	*260*

Sample No.	Report Date	Ammonical Nitrogen		S04-(acid sol)		Sulphide		DRO (AR)*		pH units		Chloride		Boron		Phenanthrene*	
Soil																	
BH1 Jar GL-0.6	010299	NA	*NS*	300	*NS*	<1	*NS*	NA	*5000*	6.0	*NS*	NA	*NS*	0.3	*NS*	NA	*40***
BH2 Jar GL-1.50	010299	NA	*NS*	376	*NS*	<1	*NS*	NA	*5000*	7.6	*NS*	NA	*NS*	0.3	*NS*	NA	*40***
TP001 4.0	14/07/04	11.6	*NS*	195	*NS*	<5	*NS*	<10	*5000*	7.8	*NS*	10.8	*NS*	<0.5	*NS*	<1	*40***
TP002 3.0	14/07/04	13.2	*NS*	366	*NS*	<5	*NS*	57	*5000*	8.2	*NS*	10.8	*NS*	<0.5	*NS*	<1	*40***
TP003 2.5	14/07/04	25.2	*NS*	596	*NS*	<5	*NS*	18	*5000*	8.2	*NS*	17.3	*NS*	<0.5	*NS*	<1	*40***
TP004 2.5	14/07/04	81.6	*NS*	556	*NS*	<5	*NS*	<10	*5000*	9.4	*NS*	37.4	*NS*	<0.5	*NS*	2	*40***
TP005 3.5	14/07/04	5.4	*NS*	135	*NS*	<5	*NS*	<10	*5000*	7.3	*NS*	9.6	*NS*	<0.5	*NS*	<1	*40***

Sample No.	Report Date	Fluoranthene*		Pyrene		Benzo(b)fluoranthene		Benzo(k)fluoranthene*		Benzo(ghi)perylene*		Naphthalene*		Bromomethane		1,2-Dichlorobenzene*	
Soil																	
BH1 Jar GL-0.6	010299	NA	*40***	NA	*NS*	NA	*NS*	NA	*40***	NA	*40***	NA	*40***	NA	*NS*	NA	*30****
BH2 Jar GL-1.50	010299	NA	*40***	NA	*NS*	NA	*NS*	NA	*40***	NA	*40***	NA	*40***	NA	*NS*	NA	*30****
TP001 4.0	14/07/04	<1	*40***	<1	*NS*	<1	*NS*	<1	*40***	<1	*40***	0.073	*40***	<0.005	*NS*	<0.005	*30****
TP002 3.0	14/07/04	<1	*40***	<1	*NS*	<1	*NS*	1	*40***	<1	*40***	<0.025	*40***	<0.005	*NS*	<0.005	*30****
TP003 2.5	14/07/04	<1	*40***	<1	*NS*	<1	*NS*	1	*40***	2	*40***	<0.025	*40***	0.006	*NS*	<0.005	*30****
TP004 2.5	14/07/04	2	*40***	1	*NS*	1	*NS*	2	*40***	2	*40***	<0.025	*40***	0.009	*NS*	<0.005	*30****
TP005 3.5	14/07/04	<1	*40***	<1	*NS*	<1	*NS*	<1	*40***	<1	*40***	0.053	*40***	<0.005	*NS*	0.009	*30****

*Standards in italics are Dutch target/intervention values uncorrected for %clay and %organic content. Standards in bold italics are UK Environment Agency residential soil guideline values.
Bold results signify exceedance of UK soil guideline value
Shaded results signify exceedance of Dutch Intervention Value
NS - No standard available
Chromium is total chromium
NA - Not analysed for parameter
Maximum concentration for each parameter detected is highlighted
**PAHs (total of 10) is the total of Anthracene, Benzo(a)anthracene, Benzo(a)fluoranthrene, Benzo(g,h,i)perylene, Benzo(k)fluoranthrene, Chrysene, Fluoroanthrene, Indenol(1,2,3-c,d)pyrene, Naphtalene, Phenanthrene

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ken@sorensen.ie

SORENSEN CIVIL ENGINEERING LIMITED.

FACSIMLE

To:	Seamus Kelly	**From:**	Eamonn McCarthy
Co:		**Pages:**	12 (incl this page)
Fax:	021-4536450	**Tel:**	
RE:	**Delaney's GAA, Kilabrry.**	**Date:**	02/04/2004

Dear Seamus,

After much searching I eventually located the relevant files.

Attached please find:

1. Communication dated 12/1/99 from E.G.Pettit & Co to RE re sampling/testing.
2. Instruction dated 14/1/99 from Asst. R.E. to carry out sampling & testing of material to include 2 No. at Delaney's grounds.
3. Manuscript record dated 15/1/99 of where samples were taken. Samples 1 & 2 from Delaney's grounds.
4. Sorensen letter of 15/1/99 to TES enclosing samples and noting source location of each.
5. TES report of 1/2/99 to EGP with results.
6. RE letter of 22/2/99 attaching test results from TES. Notes that samples 1 & 2 are within safe limits (i.e. the samples taken from Delaney's grounds).

Yours sincerely,

Eamonn McCarthy
Director

SORENSEN
CONSTRUCTION & PLANT COMPANY LTD

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15/1/99

TES Bretby
P.O.Box 100
Burton - on -Trent
Staffordshire
DE 15 0XD
UK

FAO. Dulcie Thornewill

Re Testing of Samples from the Glen, Bride and Kiln River Improvement Scheme Phase 3&4

Please find enclosed 6 number samples for testing. The testing is to be as per discussions between your self and Louisa Davies of E.G.Pettit, Consulting engineers , Cork ,Ireland

Sample number	Location
1	Delaney's Grounds
2	Delaney's Grounds
3	Suzies field material excavated from Ch385LHS
4	Culvert exit at ch 525- silt from bottom of culvert
5	culvert at ch 600 -silt from bottom of culvert
6	Ch 450 approx LHS-side of excavation (possible tanning pit)

If you require further details I can be contacted on the above numbers or on 00 353 21 552501

Yours Faithfully

Ken Boland

TEST REPORT
SOIL SAMPLE ANALYSIS

NAMAS
TESTING
No.1252
No.1411

E.G Pettit & Company
Springville House
Blackrock Road
Cork
Ireland

TES Report No. 990230

Site: Glen, Bride and Kiln River

Page No	Assessed Area	ID No. EPS/CL	Sample	Depth(m) from	to	Description
1	Glen, Bride & Kiln	9901265	/ 1/			1
1	Glen, Bride & Kiln	9901266	/ 2/			2
1	Glen, Bride & Kiln	9901267	/ 3/			3
1	Glen, Bride & Kiln	9901263	/ 4/			4
2	Glen, Bride & Kiln	9901264	/ 5/			5
2	Glen, Bride & Kiln	9901268	/ 6/			6

Date of Issue: 01/02 99

Tests not marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.

TES Bretby accepts no responsibility for the sampling related to the above results

TES Bretby
Report 990230
Table 1
Sheet 1/ 1

TES Bretby, P.O. Box 100, Burton-on-Trent, DE15 0XD Telephone: 01283 554400 Fax: 01283 554422
TES Bretby is a division of Environmental Services Group Limited. Registered in England Number 2880301

TEST REPORT
SOIL SAMPLE ANALYSIS

TESTING
No.1252
No.1411

E.G Pettit & Company
Springville House
Blackrock Road
Cork
Ireland

TES Report No. 990230

Site: Glen, Bride and Kiln River

Customer reference / Depth (m) / Date logged / TES Bretby ID Number	1 21/01/99 CL/9901265	2 21/01/99 CL/9901266	3 21/01/99 CL/9901267	4 21/01/99 CL/9901263
UKAS accredited	Test No.	CL/9901265	CL/9901266	CL/9901267	CL/9901263
Arsenic	ICPSSS11	6	9	18	15
Boron	ICPB41	0.3	0.3	0.6	0.5
Cadmium	ICPSSS11	<1	<1	<1	<1
Chromium (total)	ICPSSS11	16	19	19	24
Chromium (VI)	WSLM6	<0.1	<0.1	<0.1	<0.1
CN- (total)	ICTSCN28	<1	<1	<1	<1
Copper	ICPSSS11	37	37	260	184
Cyanide (Free)	SOCN22	<1	<1	<1	<1
Lead	ICPSSS11	57	60	2800	354
Mercury by CVAFS	HGCVAF60	0.20	0.17	1.04	0.59
Nickel	ICPSSS11	18	22	30	25
PAH (screening)	PAHSCUV	<10	15	50	280
pH units	WSLM3	8.0	7.6	8.6	7.4
Phenol Index	WSLM4	<0.5	0.7	<0.5	0.5
Selenium	SEMAFS59	0.16	0.31	0.45	0.44
SO4-- (acid sol)	ICPACS58	300	376	1610	708
Sulphide	ICTSCN28	<1	<1	<1	4
Thiocyanate	WSLM5	<2	<2	<2	2
Zinc	ICPSSS11	49	52	225	348

not UKAS accredited		CL/9901265	CL/9901266	CL/9901267	CL/9901263
Elemental Sulphur		<20	<20	130	230

Results expressed as mg/kg Air Dried unless stated otherwise
SO4 Analysis not conducted in accordance with BS1377

Date of Issue: 01/02/99

Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.

TES Bretby accepts no responsibility for the sampling related to the above results

TES Bretby
Report 990230
Table 2
Sheet 1/ 2

TES Bretby, P.O. Box 100, Burton-on-Trent, DE15 0XD Telephone: 01283 554400 Fax: 01283 554422
TES Bretby is a division of Environmental Services Group Limited Registered in England Number 2880401

TEST REPORT
SOIL SAMPLE ANALYSIS

TESTING
No.1252
No.1411

E.G Pettit & Company
Springville House
Blackrock Road
Cork
Ireland

TES Report No. 990230

Site: Glen, Bride and Kiln River

Customer reference		5	6		
Depth (m)					
Date logged		21/01/99	21/01/99		
TES Bretby ID Number		CL/9901264	CL/9901268		
UKAS accredited	Test No.	CL/9901264	CL/9901268		
Arsenic	ICPSSS11	16	19		
Boron	ICPB41	1.7	3.4		
Cadmium	ICPSSS11	2	<1		
Chromium (total)	ICPSSS11	96	20		
Chromium (VI)	WSLM6	<0.1	<0.1		
CN- (total)	ICTSCN28	<1	<1		
Copper	ICPSSS11	393	82		
Cyanide (Free)	BGCN22	<1	<1		
Lead	ICPSSS11	386	190		
Mercury by CVAFS	HGCVAF60	0.89	0.52		
Nickel	ICPSSS11	77	37		
PAH (screening)	PAHSCUV	640	24		
pH units	WSLM3	7.3	7.0		
Phenol Index	WSLN4	4.2	2.9		
Selenium	SEHAFS59	0.87	1.47		
SO4-- (acid sol)	ICPACS58	1850	671		
Sulphide	ICTSCN28	2	2		
Thiocyanate	WSLN5	6	4		
Zinc	ICPSSS11	629	82		
not UKAS accredited		CL/9901264	CL/9901268		
Elemental Sulphur		1380	92		

Results expressed as mg/kg Air Dried unless stated otherwise
SO4 Analysis not conducted in accordance with BS1377

Date of Issue: 01/02/99

Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.

TES Bretby accepts no responsibility for the sampling related to the above results

TES Bretby
Report 990230
Table 2
Sheet 2/ 2

TES Bretby, P.O. Box 100, Burton-on-Trent, DE15 0XD Telephone: 01283 554400 Fax: 01283 554422
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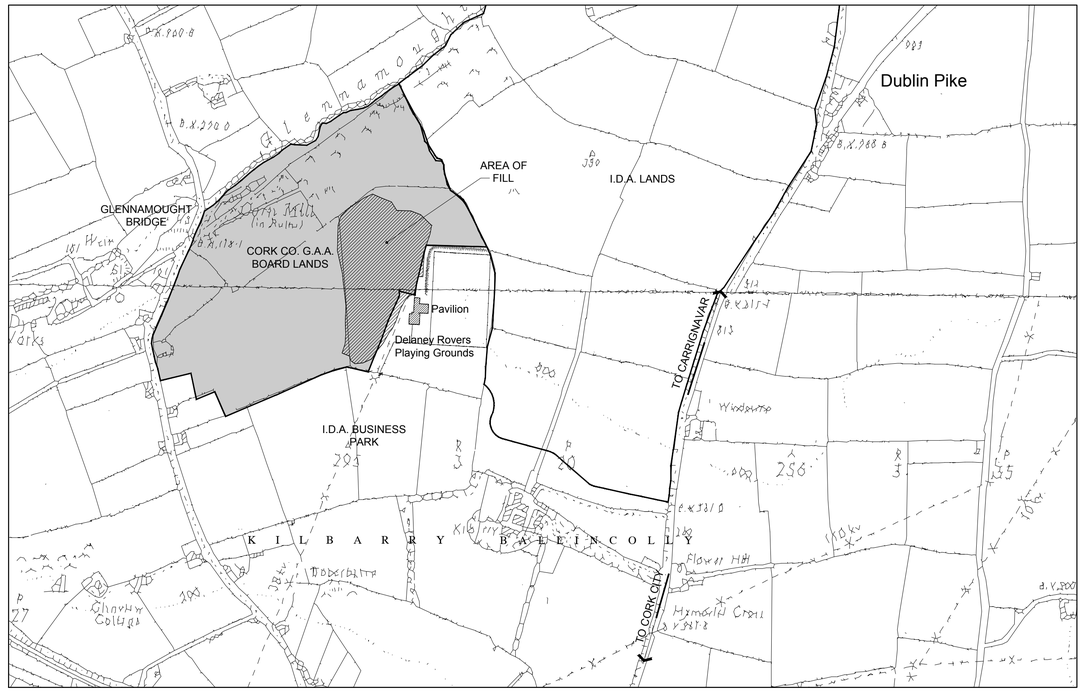
LEVEL SURVEY OF EXISTING GROUNDS Scale 1:500



KEY PLAN Scale 1:5000

Notes

1. All dimensions are in millimetres, unless noted otherwise.
2. All levels are in metres related to Ordinance Datum.
3. Drawings are not to be scaled.

Legend

TP6 – Denotes Trial pit

101.715 – Denotes Spot level

Rev.	Date	Description	by	ch'd	app
D	25.11.04	ISSUED FOR INFORMATION	POM	D.R	S.K.
C	08.03.04	ISSUED FOR APPROVAL	BMcC	S.K.	S.K.
B	21.01.04	ISSUED FOR APPROVAL	PFC	S.K.	S.K.
A	16.12.03	ISSUED FOR INFORMATION	PFC	S.K.	S.K.

Project: G.A.A. PROPERTY AT KILBARRY, Co. CORK

Title: SITE LEVEL SURVEY

C/A: COISTE CHONTAE CHORCAI CUMMAN LUTHCHLEAS GAEL.

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Scales (A1)	1:500, 1:5000	
Drawn	PFC	16.12.03
Ch'd(D.O.)	PFC	16.12.03
Ch'd(Eng.)	S.K.	16.12.03
Approved	S.K.	16.12.03

Drg. No. 4000/5-W11

Rev. D

Verde Environmental Consultants

Review of Existing Ground Investigation Data relating to Proposed Residential Development

Kilbarry, County Cork

June 2022

TABLE OF CONTENTS

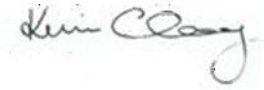
FIGURES

TABLES

APPENDICES

DOCUMENT CONTROL

Project Title:	Review of Available Ground Investigation Data for proposed Housing Development on Lands at Kilbarry, Co. Cork
Report Ref.:	54036
Status:	Final
Client:	J. B. Barry & Partners Limited
Site Details:	Kilbarry Lands, Cork City, County Cork
Issued By:	Verde Environmental Consultants Ltd

Document Production / Approval Record				
	Name	**Signature**	**Date**	**Position**
Created By	Jacqui O'Shea		20th June 2022	Environmental Scientist
Checked By	Donal Hogan		21st June 2022	Senior Hydrogeologist
Checked By	Malcolm Dowling		21st June 2022	Principal Environmental Consultant
Approved By	Kevin Cleary		29th June 2022	Operations Director

EXECUTIVE SUMMARY

Verde has completed a comprehensive review of available soil analysis associated with environmental sampling completed at a site at Kilbarry where material has been previously deposited. Five samples were collected and analysed during a phase of investigation in August 2019. Verde has analysed the findings of two reports and has assessed the general quality of sampled material, identifying potential environmental liability/risk associated with the soil remaining in situ and/or implications associated with the transfer of soil/fill material from the site.

In terms of retention of material at the site, to assess potential human health risk, results of analysis have been compared against Generic Assessment Criteria (GACs) that have been developed for a wide range of parameters. The outcome of this comparison indicates that all recorded parameter levels are below relevant GACs. Results to date do not indicate an exposure risk to construction workers or future site users. The further beneficial re-use of excavated uncontaminated material is provided for in national legislation and the non-applicability of the waste management act in the case where it is certain that excavated uncontaminated material will be used for the purposes of construction in its natural state on the site from which it was excavated.

In terms of excavation of soil/fill material for transfer off-site, previous investigations did not include for full waste classification only for waste acceptance criteria. Verde has completed a waste classification exercise using approved HazWasteOnline™ software. The outcome from this exercise confirmed material characterised by the five samples is non-hazardous and can be appropriated described under List of Waste Code, 17 05 04 (non-hazardous soil and stone).

Results have been compared against waste acceptance criteria as defined in Council Decision 2003/33/EC which prescribes waste acceptance criteria for various landfill types and this comparison confirms material would be acceptable at inert landfill facilities. Results are also compared with specific waste acceptance criteria and trigger values for soil waste recovery facilities as published by the EPA in 2020. This comparison indicates that majority of material would be acceptable at soil recovery facilities. Trace PAH was detected in one sample from TP12 which may be due to the decomposition of plant material associated with the top of an initial filling layer.

Using all of the analysis available, the outcome of the classification exercise and comparison against relevant acceptance criteria for landfill and soil recovery facilities, categories have been assigned to the material. Four of the samples are assigned as Category A with a single Category B1 designation for a sample collected from TP12.

Trial pit logs and associated photographic evidence supplied in the PGL report indicate a generally clean, uncontaminated fill material that would be suitable for on-site reuse, subject to caveats provided in the Section below. Where material is to be excavated and transferred from the site, based on analysis to date, this material would be suitable for acceptance at an inert facility.

An alternative to the transfer of soil from the site as a waste material would be to declare the material a by-product. Article 27 of the European Communities (Waste Directive) Regulations 2011, there is potential for clean, uncontaminated natural soil to be considered a by-product rather than a waste. To be regarded as a by-product and not a waste, the notified material must satisfy the conditions listed in article 27(1) (a) to (d) of the Regulations. More importantly, the Agency would need to have made a determination on the by-product notification prior to the material being moved to the notified destination site.

Based on our assessment, the following recommendations are made:

- Whilst evidence provided by soil analysis to date indicates fill material is largely uncontaminated, this is based on 5no samples across the footprint of the site. Where it is contemplated that a significant volume of soil/fill material will require excavation and transfer from the site, additional sampling and analysis should be considered over the course of development works.
- Similarly, where there is any doubt on material based on observations during excavations, additional testing should be undertaken. The appointed contractor for groundworks should retain the services of an experienced environmental engineer or scientist during excavation works, primarily to identify the depth of made ground and to identify any previously unidentified hotspots.
- The Contractor should develop a Soil and Material Management Plan (SMMP) and retain a competent person to manage and supervise soil excavation and removal from the site. This person should ensure correct procedures are followed and that waste soils are appropriately logged and tracked using appropriate docketing system.
- In recognition of national policy and sustainability, where material cannot be re-used as part of the on-site development works and requires transfer from the site, consideration should be given to the transfer of this material as a by-product under Article 27.

LIMITATIONS

This report provides a review of soil quality data presented in a report that followed the completion of a ground investigation in 2019 at a site proposed for residential development in Kilbarry townland on the northern outskirts of Cork City.

Verde was presented with a factual ground investigation report and laboratory analysis and the report is based herein is based upon our review of this third party information. Verde had no role in the site investigation, sample collection process or in scheduling of laboratory analysis of the sampled and where relevant information has been provided to Verde, it is assumed that such information is accurate.

Where any conclusions and recommendations contained in this Report are based upon information provided by others, it has been assumed that all relevant information has been provided by those parties and that such information is accurate. Any such information obtained by Verde has not been independently verified by Verde, unless otherwise stated in the Report. Verde accepts no liability for any inaccurate conclusions, assumptions or actions taken resulting from any inaccurate information supplied to Verde from others. The scope of this Report and the services are accordingly factually limited by these circumstances.

The opinions expressed in this report and the comments and recommendations given are based on third party information presented to us. Verde had no involvement in any intrusive investigation at the site. The characterisation of material described in this report is based upon the information made available to Verde at the time and where appropriate, is subject to further investigations or information which may become available.

Best practice was followed at all times and within the limitations stated above. This report is the property of Verdé Environmental Consultants Limited and cannot be used, copied or given to any third party without the explicit prior approval or agreement of Verdé Environmental Consultants Limited.

Unless specifically requested by JB Barry & Partners, Verde disclaims any obligation to update the report for the events taking place after the time during which we conducted our assessment.

1 INTRODUCTION

1.1 Project Contractual Basis & Parties Involved

Verde Environmental Consultants, (Verde) was retained by J. B. Barry & Partners (JBB) to complete a review of existing site investigation information including soil analyses relating to a proposed development site that is located in the townland of Kilbarry on north side of Cork City.

1.2 Objectives

The key overall objective is to assess and characterise soil/fill quality at the site from information contained in a factual ground investigation report completed by Priority Geotechnical following an investigation in 2019. Through this assessment, the quality of material from an environmental perspective and its suitability for retention at the development site is reviewed. It is understood that c. 9,600m³ of topsoil and c. 8,400m³ of subsoil/fill material will require excavation and transfer from the site. This will constitute surplus material generated from general levelling work and excavations for drainage and services. Where considered a waste, the material will require transfer to an authorised soil waste facility and in such cases, material requires soil waste classification and characterisation. Where material is determined to be clean and uncontaminated, consideration may be given to the transferring material as a by-product or 'non-waste' under Article 27 of the European Communities (Waste Directive) Regulations 2011. Although other criteria must be met, to a large extent, suitability for this non-waste option is determined by the characterisation of material quality at the site. Verde is aware that there will be areas of cut and fill across the development and an assessment is required in relation to the quality of material to be retained and the risk and potential liability associated with the re-use of site won material at the site.

1.3 Scope of Works

The scope of works involved the completion of the following tasks:

- A site visit to conduct a walkover;
- A high level review of available site investigation reports. Including a review of methodologies used during the investigation and findings in terms of any risk with regard to soil remaining on site and classification with regard to soil being excavated;
- Classification of soil material using the HazWasteOnline™ Tool;
- Comparison of soil quality data against standard criteria for acceptance at landfill (Waste Acceptance Criteria/WAC) and against proposed trigger levels contained in Guidance produced by the Environmental Protection Agency in relation to soil acceptance at soil recovery facilities;
- Comparison of soil analysis against published Generic Assessment Criteria that have been derived for residential land use. In general, GACs represent conservative screening criteria protective of human health;

- Present a discussion of the general condition of the soil/fill at the site in the context of contamination status and suitability for retention within the development.

To meet the objective of the brief, Verde has reviewed the following documentation.

- Kilbarry Lands, Cork – Site Investigation, Factual Report by Priority Geotechnical (PGL) on behalf of JB Barry & Partners, 8th April 2020;
- Kilbarry Lands, Cork – Site Investigation, Interpretive Report by PGL on behalf of JB Barry & Partners, 9th April 2020.

In addition, Verde has been provided with laboratory data in a format that can be uploaded directly to the HazWasteOnline software. This facilitates the classification of material sampled from 5no locations across the site during the PGL ground investigation in 2019.

2 BACKGROUND

2.1 Background

A planning process is in train in relation to the development of a strategic housing development on lands owned by the GAA that are located in Kilbarry approximately 3km north of Cork City Centre. It is understood that the Cork County Board completed a nine-week long pre-planning consultation with the appeals board that also involved input from Cork City Council planners. The County Board is proposing the construction of 197 houses, 112 apartments, a crèche and associated works on land on Old Whitechurch Road in the city. It is now open to the Cork County Board to take into account the views expressed by An Bord Pleanála before lodging an SHD application to the board. Supporting documentation for the proposed development will include an Environmental Impact Assessment Report (EIAR) which is being developed by the Applicant.

It is understood that the development will not include basement structures, however there will be widespread excavation of material associated with levelling works and installation of drainage and services. It is intended to re-use as much material as possible within the development subject to its suitability minimising the volume of fill to be exported.

Several phases of investigation have occurred at the site. The site was historically used for unauthorised dumping of material and correspondence from 2005 from Malachy Walsh and Partners confirms the removal of material from the site to authorised facilities in the Cork Region. What remains is essentially a soil fill material that has been the subject of more recent investigation completed by Priority Geotechnical Limited (PGL) in 2019 and described in two reports from April 2020.

Verde has been presented with a historic documentation relating to correspondence between Malachy Walsh & Partners and the Environmental Department of Cork County Council. Whilst the more recent reports by PGL are mainly focussed on investigating the geotechnical properties of the remaining fill material, the reports include trial pit and borehole logs and soil analysis results for 5no samples of fill material. Classification of material was not previously completed.

For the purpose of this report, Verde has focussed on recent information that is contained within the PGL reports.

2.2 Site Location

The subject lands are located in Kilbarry approximately 3km north of Cork City Centre and are within the development boundary of the city as presented in Figure 1.

The lands are 15.29ha (37.8 acres) in area and are in disuse. They comprise open fields with established boundaries. Their extent and location is illustrated below.

The lands are bounded to their north by the Glenamought River and Valley (a tributary of the River Bride). The river flows in a south westerly direction. Here, the lands slope steeply down to the river and informal walking paths are evident. To the north of this, land is undeveloped and in agricultural use. To the east, the lands are bounded by the Delaney Rovers GAA grounds and pitches. South of the site is an access road and south of this lie industrial premises. The western extent of the site is bound by the Old Whitechurch Road which is further bordered by residential dwellings. The land use in the general area is a mixture of residential, commercial and agricultural.

2.3 Site Description and Walkover

A Verde environmental scientist conducted a site walkover on 8th June 2022 and a selection of site photographs are presented in Appendix A. The site was accessed from the Old Whitechurch Road to the south west of the site. The gate is bordered by residential properties to the south and disused sheds to the north (former hurling making factory). The site was found to be vegetated in most parts with long grass (see Photo 1) and there were obvious well trafficked walkways present through the grass. A gravel track was present from the gate on the Old Whitechurch Road to the entrance of Delany's GAA Club to the east of the site as shown in Photos 3 and 4. There is a noticeable elevation change between the east and the west of the site (See Photo 2). The area to the west of the site was approximately 10m lower than the area to the west.

There was evidence of some localised fly tipping in the area adjacent to the GAA club (see Photo 8). The site generally slopes to the river valley to the north of the site. There are pylons on the site to the north of the GAA club (see Photos 11 and 12). The base of the pylon to the north of the GAA pitch is approximately 10m lower than the pitch with a narrow pathway bordering the fence of the GAA club. No surface water courses were noted through the site. While stockpiles of rock were noted in areas of the site close the GAA club (see Photos 9 and 10) no bedrock outcrop was noted during the walkover. There was no groundwater wells noted during the site visit.

3 REVIEW OF RECENT GROUND INVESTIGATION

Verde has been provided with copies of reports relating to a ground investigation completed in August/September 2019.

A factual report by PGL describes investigation undertaken at the site from the 7th August to 13th September 2019. The stated objective of the works was to assess subsoil and bedrock conditions in order to inform the engineering design solutions of the proposed residential development at the site. The investigation included the drilling of two cable percussion boreholes with penetration to a maximum depth of 4.9mBGL. In addition, 25No trial pits were excavated to depths ranging from 0.7mBGL to 4.2mBGL, the locations of the trial pits are presented in Figure 2. The investigation included in-situ geotechnical testing and the collection of samples for further geotechnical testing and environmental analysis. The focus of Verde's assessment is on the results of environmental analysis of 5No samples. The proposed development together with the five sampled trail pits are presented in Figure 3.

3.1 Ground Conditions

From the boreholes and trial pit logs and associated photographic record, general ground conditions can be summarised as follows:

- Topsoil comprising slightly sandy SILT where encountered was 0.1m to 0.6m thick
- Made Ground/fill was detected at several locations and comprises medium dense, brown, very sandy, very clayey GRAVEL with low cobble content and stiff brown, slightly sandy gravelly SILT. Construction and demolition type material was encountered at some locations including timber, red brick, concrete, wire, metal, glass, clay piping etc. The made ground where encountered, was to depths ranging from 0.3mBGL up to 4.9mBGL (BH01). The photographic record contained in the factual report suggests that anthropogenic material is below 2% of total fill material
- Made ground/fill was underlain by mixed glacial deposits of brown, slightly sandy gravelly SILT with low cobble content to depths 0.7mBGL to 1.3mBGL overlying medium dense purple brown, silty sandy GRAVEL with medium cobble content and low boulder content to a depth 1.6mBGL to 3.1mBGL.
- Weathered rock or suspected weathered bedrock was encountered by several trial pit. Depth to bedrock was varied within
- No groundwater was encountered during the investigative works.

Made ground/fill was detected at the following locations (BH01, BH02, TP04, TP08, TP09, TP11, TP12, TP13, TP15, TP16, TP17, TP18, TP21 and TP23).

At locations, TP04, TP11, TP12 and TP13 the made ground/fill was less than 2.0m thick whereas borehole logs indicate greater thickness (2.0 to 4.0m) of made ground/fill at locations, TP08, TP09, TP15, TP16, TP17, TP18, TP21 and TP23.

3.2 Soil Sampling

Environmental samples were recovered from 5No trial pits on 7th/8th August 2019: TP04 (fill/made ground), TP12 (fill/made ground), TP17 (fill/made ground), TP19 (natural soil) and TP24 (natural soil). Sample depths ranged from 0.5 to 2.0mBGL. Samples were analysed for an environmental suite that includes the waste acceptance criteria for landfill suite (WAC Suite).and a Waste Acceptance Criteria suite but no soil waste classification was completed.

The interpretive report (PGL, April 2020) includes a section on environmental assessment based on analysis of the 5no samples. A screening was completed with soil analysis compared against the following:

- Soil Guideline Values Contaminated Land Exposure Assessment, CLEA Model UK) for residential usage (with plant uptake)
- DRAFT Guidance for Soil Recovery Facility WAC, EPA December, 2017, and
- Dutch N-List (2000, 2006) for public open space.

The PGL Report notes that the exercise completed does not constitute an environmental risk assessment.

In the following section, Verde has taken the same set of results and compared these against more up to date and relevant criteria, namely:

- Final version of Guidance on waste acceptance criteria at authorised soil recovery facilities, EPA, 2020
- WAC limits set out in Council Decision 2003/33/EC
- Soil Generic Assessment Criteria for Human Health Risk Assessment (a screening tool for industry agreed contaminant specific parameter values in the assessment of risks from land contamination)

For human health, the EPA recommends the use of GAC, based on the UKEA Contaminated Land Exposure Assessment (CLEA)8 model, either produced by the UKEA itself (known as Soil Guideline Values/SGVs) or values generated using the CLEA model by reputable third-party organisations such as Land Quality Management (LQM)9 or Contaminated Land: Applications in Real Environments (CL:AIRE).

In additional to this, Verde has completed a soil classification exercise on the samples using HazWasteOnline™ (HWOL) software. The HWOL Classification Engine, developed in the UK by One Touch Data Ltd, was used to determine the waste classification. This tool was developed specifically to establish whether waste is non-hazardous or hazardous and has been approved for use in Ireland by the Environmental Protection Agency. This exercise was not previously undertaken. Results are described in Section 4.2.1 below.

4 SOIL CHARACTERISATION

4.1 Soil Chemical Analysis

As mentioned above, 5No environmental samples were collected for chemical analysis. Samples were analysed for a standard range of parameters including metals (lead, nickel, copper, zinc, arsenic, cadmium, chromium, and mercury), total organic carbon (TOC), BTEX (benzene, toluene, ethylbenzene and xylene) aliphatic and aromatic hydrocarbons, polychlorinated biphenyls (PCB), mineral oil and polycyclic aromatic hydrocarbons (PAH). Leachate generated from the samples was tested for arsenic, barium, cadmium, chromium, copper, mercury, molybdenum, nickel, lead, antimony, selenium and zinc, chloride, fluoride, soluble sulphate, phenols, dissolved organic carbon (DOC), total dissolved solids (TDS). It is noted that the same laboratory was used to screen and analyse samples for the presence of trace asbestos. This standard parameter range facilitates an assessment of the material against published generic assessment criteria (for material remaining on-site – as described below).

The suite of analysed parameters facilitates an assessment of the hazardous properties of the soil/fill material allowing waste classification to be completed using the HazWasteOnline™ software (section 4.2.1 below) and a determination of appropriate off-site management options for the materials based on a comparison of values with waste acceptance criteria (WAC) for Landfills and a comparison against proposed trigger values for soil waste recovery facilities as recommended in guidance produced by the EPA in 2020.

4.2 Results compared with Generic Assessment Criteria for Residual Land Use

To assess the human health risk associated with retaining the soil and fill material on site, results of analysis are compared against Generic Assessment Criteria (GACs) that have been developed for a wide range of parameters. GACs are effectively soil screening levels that are designed to be representative of minimal risk to human health in a number of land use scenarios and their use is considered best practice by the EPA.

The report compares parameter concentrations against GACs developed for Residential Land Use with Plant Uptake (typically used for domestic dwelling with a private garden). Potential Exposure pathways for human health risk assessment in this scenario include direct soil and indoor dust ingestion, consumption of home grown produce, skin contact with soils and indoor dust and inhalation of indoor and outdoor dust and vapours.

Verde have compared the soil sample results to the residential GACs. For both scenarios (with and without home-grown produce) all parameters are significantly below the relevant GACs for all samples as presented in Tables 1 and 2 attached.

4.3 Soil Waste Classification and Characterisation

4.3.1 Stage 1 (Hazardous or Non-Hazardous)

Based on an evaluation of hazardous components using the approved tool (HazWasteOnline™), all analysed samples are classified as Non-Hazardous, as presented in Table 4.1 below. Based on the completed classification and from photographs of trial pit excavations provided in the factual investigation report, the appropriate List of Waste code for the fill and soil material is 17 05 04 – non-hazardous soil and stone.

A copy of the completed HazWasteOnline™ Certificate is presented in Appendix B.

Table 4.1 – Summary of Waste Classification Results

Sample No.	Depth (mBGL)	Material	Classification	List of Waste Code
TP-04	0.5	Made Ground/Fill	Non-Hazardous	17 05 04
TP-12	0.6	Made Ground/Fill	Non-Hazardous	17 05 04
TP-17	2.0	Made Ground/Fill	Non-Hazardous	17 05 04
TP-19	0.6	Natural Soil	Non-Hazardous	17 05 04
TP-24	0.5	Natural Soil	Non-Hazardous	17 05 04

4.3.2 Stage 2 Waste Acceptance Criteria

For Stage 2, results of analysis are compared against limit values for the landfill categories as defined in Council Decision 2003/33/EC which prescribes waste acceptance criteria for various landfill types. Analytical results for solid and eluate portions of the test materials are provided in Table 3 (WAC Results) attached to this report.

For all five soil samples, parameter concentrations indicate acceptability at licensed inert waste landfill facilities. Material would be acceptable under standard inert limits as parameter concentrations are well below the relevant WAC.

4.3.3 Asbestos

Asbestos can be present in soil fill at brownfield sites as either asbestos containing materials (ACMs) or as fibres of asbestos that are detected during laboratory analysis. In the instance, there is no identification of ACM from the trial pit excavations across the site. Screening of the samples analysed did not detect the presence of trace asbestos.

4.3.4 Soil Waste Recovery Guidelines

In early 2020, the Environmental Protection Agency published guidance on waste acceptance criteria/proposed trigger values for material acceptance at authorised soil recovery facilities. In essence, non-landfill facilities including licensed and permitted soil waste recovery facilities, are now required to base soil waste acceptance criteria on values contained in this guidance and cannot rely upon WAC limits for landfill as they have traditionally done. Geological Survey Ireland, in partnership with the Environmental Protection Agency, has developed Geochemically Appropriate Levels (GALs) for Soil

Recovery Facilities specifically in relation to metals and metalloids in uncontaminated soil and stone. This is to support the Environmental Protection Agency's Guidance on waste acceptance criteria at authorised soil recovery facilities. The GALs vary across the country by geochemical domain, to account for the natural variation in soil metal contents we see in Ireland. There are 7 geochemical domains encompassing the main soil parent materials and rock types.

Table 4 attached to this report compares parameter concentrations analysed for the 5No samples against the soil waste facility guidance values Domain 4. The site itself it located within this domain as is much of north Cork. The GSI Mapping Tool notes bedrock associated with Domain 4 as comprising Devonian sandstone, siltstone and shale (ORS). The geochemically appropriate levels for Domain 4 are indicated in table below for each relevant metal species.

Table 4.2 – Metal Concentrations (PGL, 2019) compared with relevant proposed trigger values for Soil Recovery facilities in Domains 4

	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
Proposed Trigger Value for Domain 4	32.3	0.97	51.7	80.4	0.285	50.3	91.4	155
TP4 (0.5mbgl)	4.2	<0.10	27	10	<0.10	39	18	58
TP12 (0.6mbgl)	4	<0.10	19	8.8	<0.10	29	14	42
TP17 (2.0mbgl)	5.6	<0.10	20	11	<0.10	30	20	51
TP19 (0.6mbgl)	3.1	<0.10	25	4.7	<0.10	32	8.8	41
TP24 (0.5mbgl)	2.9	<0.10	21	5.6	<0.10	31	7.4	42

As indicated by the table above, all metal parameter concentrations are well below the proposed trigger value for Domain 4.

In the case of non-metal parameters, this relates to the concentration of total organic carbon (TOC), Total BTEX, Mineral Oil, Total PAHs and Total PCBs. All parameters are below the proposed trigger values apart from one instance. The sample collected at 0.6mbgl from TP12 records a trace amount of PAH (polycyclic aromatic hydrocarbons) which is slightly in excess of the trigger value. In relation to the non-metal parameters, however, limits are strictly interpreted. The guidance states that "*No TOC, total BTEX, mineral oil, total PCBs, total PAH or asbestos results should exceed the respective maximum concentration and/or soil trigger level*". Trace PAH concentrations can be naturally occurring in peaty soil and can be introduced to soil through fires, exhausts or decomposition of vegetable matter. The concentration recorded from sample TP12 is not regarded as significant (6.1mg/kg) and it is noted from the relevant trial pit log for TP12 that the PGL engineer records "*roots at top of layer which may suggest two separate filling events*". It is therefore possible, that this sample is associated with decomposition of vegetable matter.

PAH was not detected above the laboratory Limit of Detection from any of the four other samples.

In summary, sample analysis when compared against the Maximum Concentrations and/or Trigger Levels in Soil & Stone for Soil Recovery Facilities as provided by the EPA Guidance document, indicates that material as sampled can be generally regarded as clean and uncontaminated.

4.4 Options for Management of Soil

Through consideration of the outcome of the waste classification (HWOL) exercise in combination with results of the asbestos screening and comparison of parameter concentrations against waste acceptance criteria for landfill (WAC) and acceptance criteria for soil recovery facilities, sampled material can be assigned a specific Soil Waste Category which informs the type of waste management facility that can accept the material. These categories are described in the following table.

Table 4.3 – Soil Waste Categories

Waste Category	Classification Criteria
Category A Suitable for Soil Recovery	Reported concentrations determined as non-hazardous using HazWasteOnline™ (HWOL)*. Generally only soil and stone free from anthropogenic contamination (e.g., physical contaminants brick, concrete etc. <2%. Free from hydrocarbons etc.). Defined in the EPA Guidance document for Soil Recovery Facilities (individual licensed sites can also agree specific limits with the EPA). Also applies to permitted sites.
Category B1 Inert Landfills	Reported concentrations determined as non-hazardous using HWOL and within inert waste (WAC) limits, which are set out by the adopted EU Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Annex II of Directive 1999/31/EC (2002).
Category B2 Inert Landfills increased limits	Reported concentrations determined as non-hazardous using HWOL. Soil not suitable for soil recovery facility and reported concentrations of some parameters exceed the inert limits but do not exceed the increased limits permitted by the EPA at certain Inert landfills.
Category C1 Non-Hazardous	Reported concentrations determined as non-hazardous using HWOL. Soil not suitable for inert landfills as reported concentrations of some parameters exceed both the inert waste limits and increased inert limits.
Category C2 Non Hazardous with trace asbestos	As per C1 but containing >0.001% and <0.01% w/w asbestos fibres. Options include specialist waste management (e.g. Soil treatment at licensed hazardous facility)
Category D Hazardous Treatment/Export	Results found to be hazardous using HWOL application. Options – Soil Treatment at licensed hazardous facility, Export.

Based on results obtained from the PGL investigation, soil/fill at the site would be generally suitable for acceptance at Category A sites. Soil/fill sampled from four of the trial pits indicates clean, uncontaminated material that is suitable for acceptance at authorised soil recovery facilities. The exception to this is material sampled from trial pit TP12. Analysis of

the sample in question (fill material recovered from 0.6mBGL) is indicative of material that is acceptable at licensed inert landfill facilities (all relevant parameter concentrations were significantly below the inert WAC limits). As noted above, however, based on observations contained in the associated trial pit log, it is possible that trace PAH is the result of decomposition of vegetable matter that was associated with an initial phase of filling.

Table 4.4 – Verde interpretation of results

Category	Samples
Category A	TP04, TP17, TP19, TP24
Category B1	TP12

5 SUMMARY

Verde has completed a comprehensive review of available soil analysis associated with environmental sampling completed in August 2019. Five samples were collected during this phase of ground investigation and sent for analysis at a suitably accredited laboratory. Our main objective was to analyse the findings of two reports and to provide commentary on the general quality of sampled material, identifying potential environmental liability/risk associated with the soil remaining in situ or to increased costs associated with the removal of soil from the site.

5.1 Conclusions

To assess the human health risk associated with retaining the soil and fill material on site, results of analysis have been compared against Generic Assessment Criteria (GACs) that have been developed for a wide range of parameters. The outcome of this comparison indicates that all recorded parameter levels are below relevant GACs. Results do not indicate an exposure risk to construction workers or future site users. Based on this analysis, the reuse of soil on-site as part of the development would not require specific remedial measures to mitigate exposure risk.

The further beneficial re-use of uncontaminated material is provided for in national legislation and the non-applicability of the waste management act in the case of uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated[1].

In terms of excavation of soil/fill material for transfer off-site, the previous investigation did not include for full waste classification only for waste acceptance criteria. Verde has been provided with laboratory certificates for the 5no samples and has completed a waste classification exercise using approved HazWasteOnline™ software. The outcome from this exercise confirmed material characterised by the five samples is non-hazardous and can be appropriated described under List of Waste Code, 17 05 04 (non-hazardous soil and stone).

Results have been compared against waste acceptance criteria as defined in Council Decision 2003/33/EC which prescribes waste acceptance criteria for various landfill types and this comparison confirms material would be acceptable at inert landfill facilities. Results are also compared with specific waste acceptance criteria and trigger values for soil waste recovery facilities as published by the EPA in 2020. This comparison indicates that majority of material would be acceptable at soil recovery facilities. Trace PAH was detected in one sample from TP12 which may be due to the decomposition of plant material associated with the top of an initial filling layer.

[1] *Article 3.1.c. of the waste management act excludes the re-use of uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated. Article 3.1.b further excludes land (in situ) including unexcavated contaminated soil and buildings permanently connected with land*.

Using all of the analysis available, outcome of classification exercise using HWOL and comparison against relevant acceptance criteria for landfill and soil recovery facilities, categories have been applied to the material. As expected, four of the samples are assigned as Category A material with a single Category B1 designation for the sample collected from TP12.

Trial pit logs and associated photographic evidence supplied in the PGL report indicate a generally clean, uncontaminated fill material that would be suitable for on-site reuse, subject to caveats provided in the Section below. Where material is to be excavated and transferred from the site, based on analysis to date, this material would be suitable for acceptance at an inert facility.

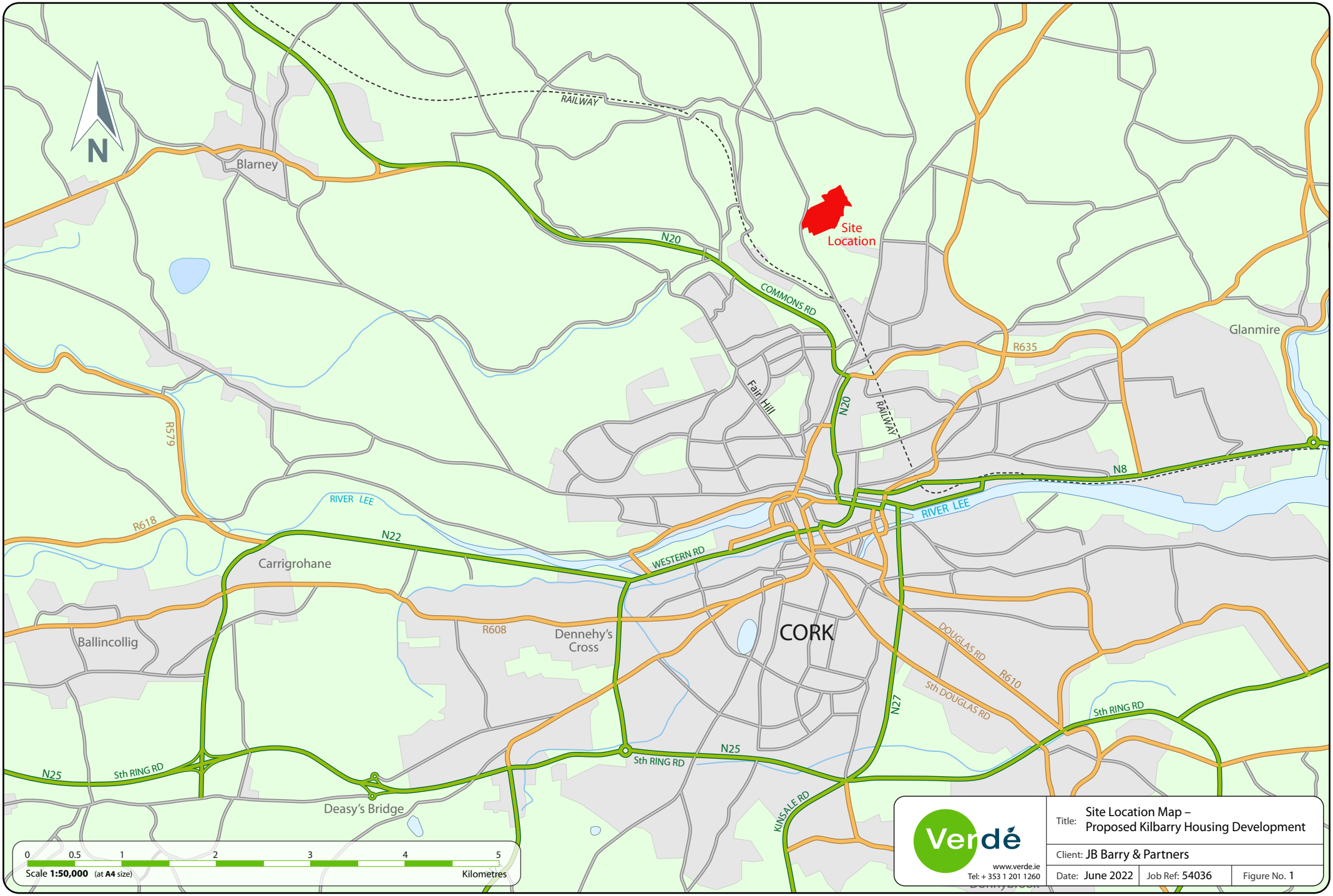
An alternative to the transfer of soil from the site as a waste material would be to declare the material a by-product. Article 27 of the European Communities (Waste Directive) Regulations 2011, there is potential for clean, uncontaminated natural soil to be considered a by-product rather than a waste. To be regarded as a by-product and not a waste, the notified material must satisfy the conditions listed in article 27(1) (a) to (d) of the Regulations. More importantly, the Agency would need to have made a determination on the by-product notification prior to the material being moved to the notified destination site.

5.2 Recommendations

- Whilst evidence provided by soil analysis to date indicates fill material is largely uncontaminated, this is based on 5no samples across the footprint of the site. Where it is contemplated that a significant volume of soil/fill material will require excavation and transfer from the site, additional sampling and analysis should be considered over the course of development works.
- Similarly, where there is any doubt on material based on observations during excavations, additional testing should be undertaken.
- Notwithstanding the findings of the report, it remains the responsibility of the groundwork Contractor to ensure that material is appropriately managed during the development. In particular, the Contractor will be responsible for the appropriate segregation of excavated materials. The Contractor should retain a competent person to manage and supervise soil excavation and removal from the site. This person should ensure correct procedures are followed and that waste soils are appropriately logged and tracked using appropriate docketing system.
- The appointed contractor for future groundworks will be expected to retain the services of an experienced environmental engineer or scientist during bulk excavation works, primarily to identify the depth of made ground and to identify any previously unidentified hotspots.
- It is recommended that a Soil and Material Management Plan (SMMP) is produced by the appointed Contractor, to detail procedures to manage the excavation and removal of soil during construction works.

- In recognition of national policy and sustainability, where material cannot be re-used as part of the on-site development works and requires transfer from the site, consideration should be given to the transfer of this material as a by-product under Article 27.

FIGURES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RAILWAY
Site Location
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Glanmire
R635
Fair Hill
N20
RAILWAY
R579
N8
RIVER LEE
RIVER LEE
R618
N22
WESTERN RD
Carrigrohane
R608
Dennehy's Cross
CORK
DOUGLAS RD
R610
Sth DOUGLAS RD
Sth RING RD
N27
Ballincollig
N25
Sth RING RD
N25
Sth RING RD
Deasy's Bridge
KINSALE RD
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Kilometres
Verdé
www.verde.ie
Tel: + 353 1 201 1260
Title: Site Location Map – Proposed Kilbarry Housing Development
Client: JB Barry & Partners
Date: June 2022
Job Ref: 54036
Figure No. 1


N
LEGEND
TP PGL Trial Pit Locations
A A' Cross Section Line
Site Boundary
Glennamought River
Glennamought Bridge
B
B'
A
A'
TP01
TP02
TP03
TP04
TP05
TP06
TP07
TP08
TP09
TP10
TP11
TP12
TP13
TP14
TP15
TP16
TP17
TP18
TP19
TP20
TP21
TP22
TP23
TP24
TP25
KILBARRY
Football Pitch
0 50 100 150 200
Scale 1:3,000 (at A4 size)
Metres
Verdé
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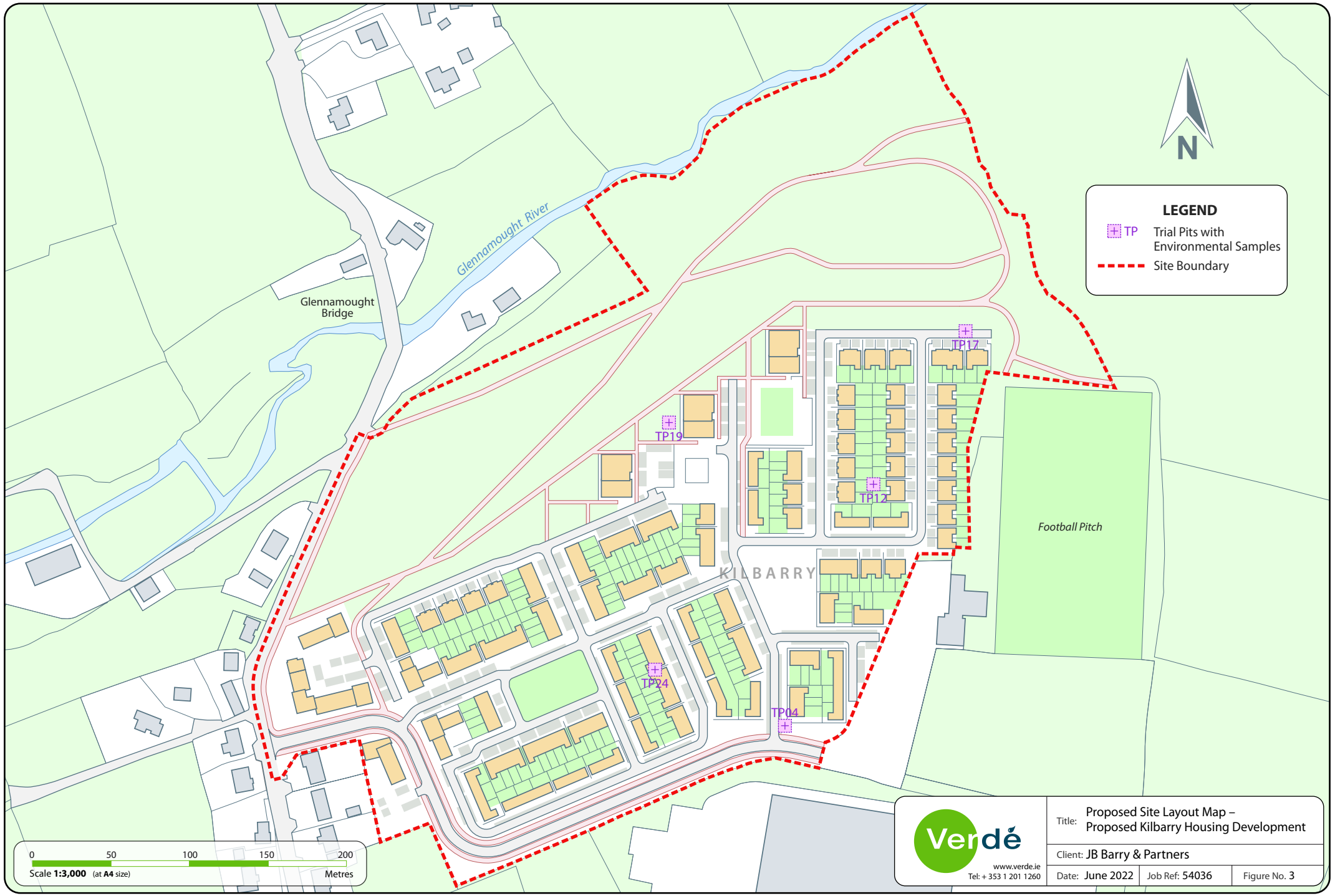
Tel: + 353 1 201 1260
Title: Site Layout Map with PGL Trial Pit Locations – Proposed Kilbarry Housing Development
Client: JB Barry & Partners
Date: June 2022
Job Ref: 54036
Figure No. 2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LEGEND
TP Trial Pits with Environmental Samples
Site Boundary
Glennamought River
Glennamought Bridge
TP19
TP17
TP12
TP24
TP04
KILBARRY
Football Pitch
0 50 100 150 200
Scale 1:3,000 (at A4 size)
Metres
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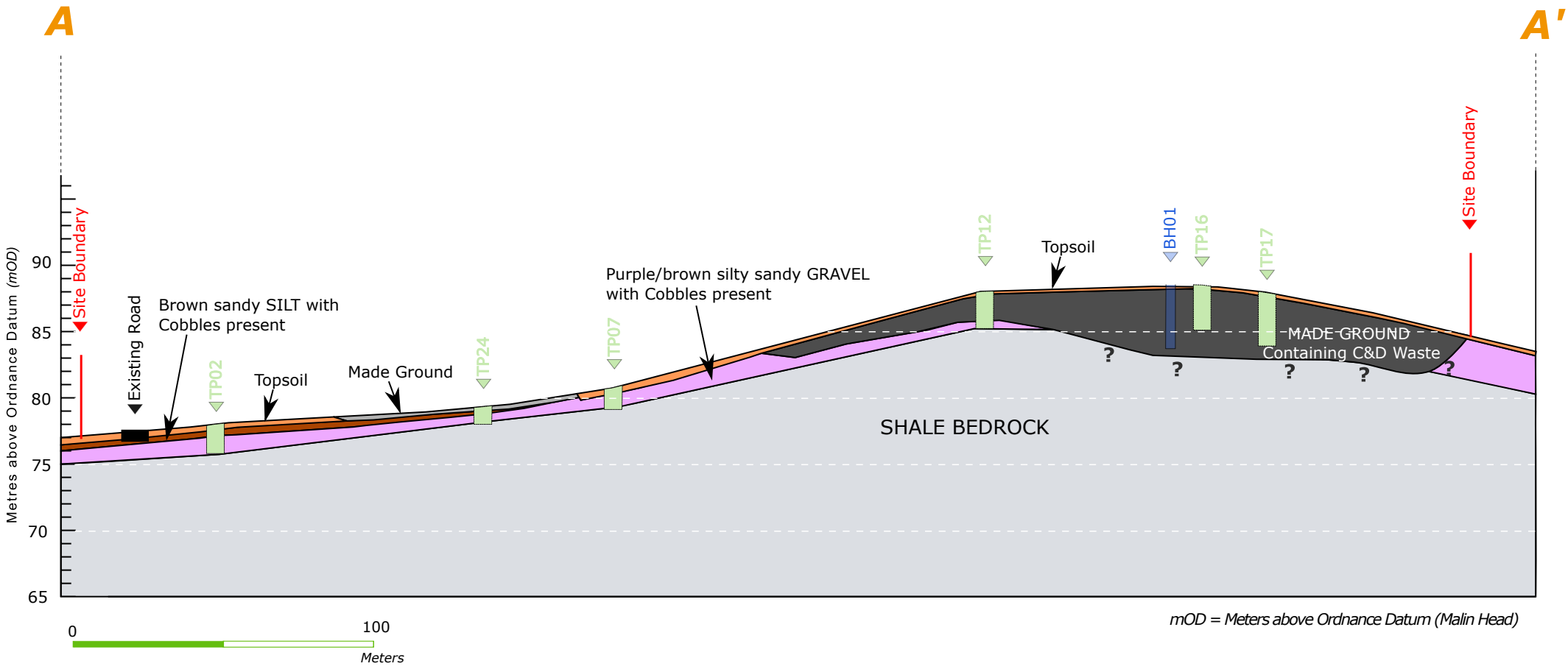
Title: Proposed Site Layout Map – Proposed Kilbarry Housing Development
Client: JB Barry & Partners
Date: June 2022
Job Ref: 54036
Figure No. 3



LEGEND

- Trial Pit
- Borehole
- ? Depth uncertainties

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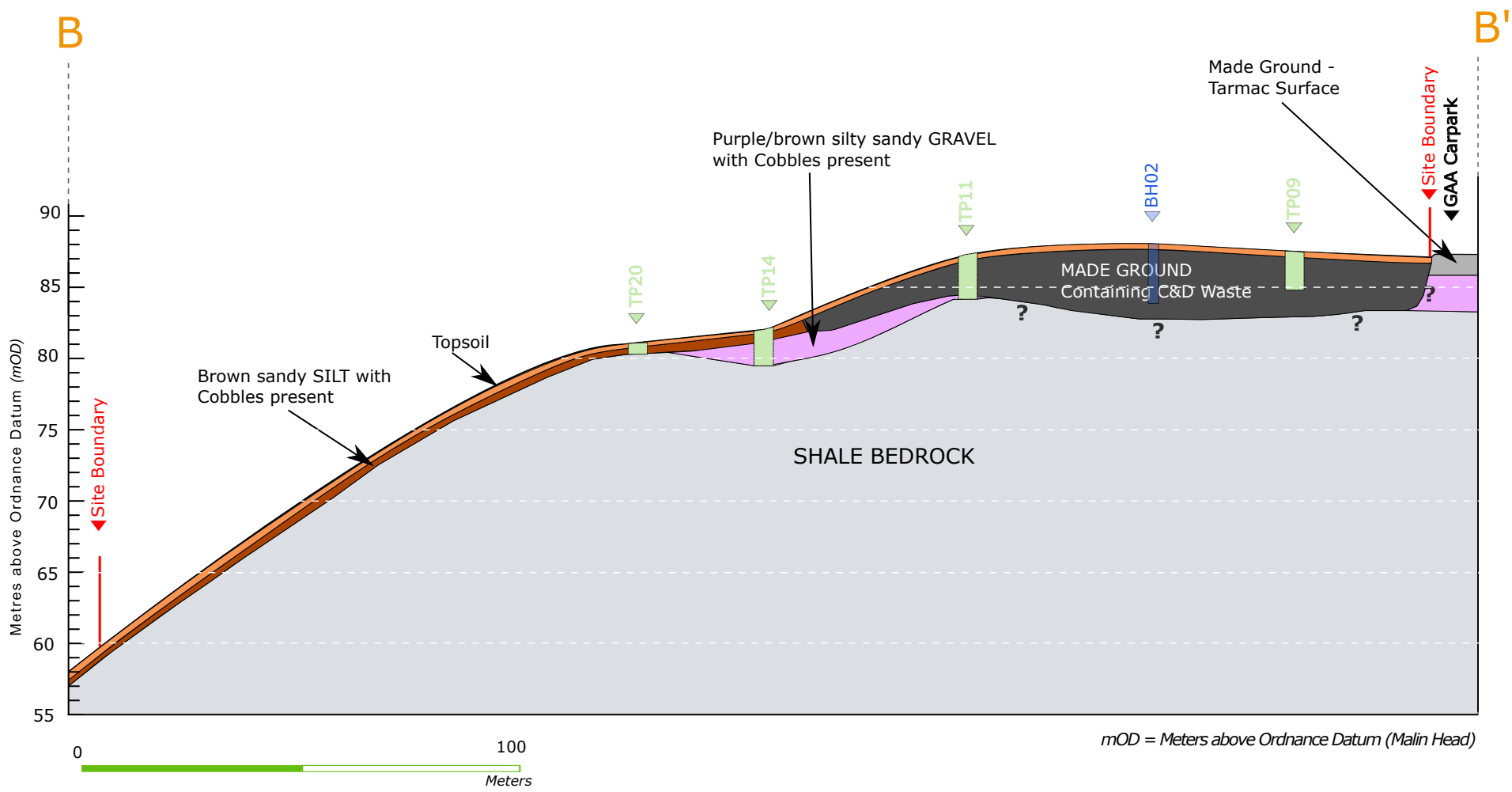
Title: Kilbarry Cross Section A-A'
Client: JB Barry & Partners
Date: Jun. 2022 | Job Ref: 54036 | Figure No. 4



LEGEND

Trial Pit		?	Depth uncertainties
Borehole			

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Title: Kilbarry Cross Section B-B'			
Client: JB Barry & Partners			
Date: Jun. 2022	Job Ref: 54036	Figure No. 5	

TABLES

Table 1 - PAHs, TPH and BTEX

Parameter	Units	Sample ID	TP4	TP12	TP17	TP19	TP24	Residential with homegrown produce	Residential without homegrown produce
		Depth	0.5	0.6	2.0	0.6	0.5		
		Date Sampled	08/08/2019	08/08/2019	08/08/2019	07/08/2019	08/08/2019		
		LOD							
PAHs									
Naphthalene	mg/kg	0.1	<	0.45	<	<	<	5.6	5.6
Acenaphthylene	mg/kg	0.1	<	0.46	<	<	<	420	4600 (212[sol])
Acenaphthene	mg/kg	0.1	<	0.43	<	<	<	510	4700 (141[sol])
Fluorene	mg/kg	0.1	<	0.34	<	<	<	400	3800 (76.5[sol])
Phenanthrene	mg/kg	0.1	<	0.6	<	<	<	220	1500
Anthracene	mg/kg	0.1	<	0.45	<	<	<	5400	35000
Fluoranthene	mg/kg	0.1	<	0.52	<	<	<	560	1600
Pyrene	mg/kg	0.1	<	0.47	<	<	<	1200	3800
Benzo(a)anthracene	mg/kg	0.1	<	0.29	<	<	<	11	14
Chrysene	mg/kg	0.1	<	0.32	<	<	<	22	31
Benzo(a)pyrene	mg/kg	0.1	<	0.24	<	<	<	2.7	3.2
Indeno(123cd)pyrene	mg/kg	0.1	<	0.32	<	<	<	36	46
Dibenzo(ah)anthracene	mg/kg	0.1	<	0.18	<	<	<	0.28	0.32
Benzo(ghi)perylene	mg/kg	0.1	<	0.39	<	<	<	340	360
Coronene	mg/kg	0.1	<	<	<	<	<	-	-
Benzo(b)fluoranthene	mg/kg	0.1	<	0.34	<	<	<	3.3	4
Benzo(k)fluoranthene	mg/kg	0.1	<	0.3	<	<	<	93	110
PAH 17 Total	mg/kg	2	<	6.1	<	<	<	-	-
TPH CWG									
Aliphatics									
>C5-C6	mg/kg	1	<	<	<	<	<	78	78
>C6-C8	mg/kg	1	<	<	<	<	<	230	230
>C8-C10	mg/kg	1	<	<	<	<	<	65	65
>C10-C12	mg/kg	1	<	<	<	<	<	330 (118[vap])	330 (118[vap])
>C12-C16	mg/kg	1	<	<	<	<	<	2400 (59[sol])	2400 (59[sol])
>C16-C21	mg/kg	1	<	<	<	<	<		
>C21-C35	mg/kg	1	<	<	<	<	<	92000 (21[sol])	92000 (21[sol])
>C35-C404	mg/kg	1	<	<	<	<	<	-	-
Total aliphatics C5-44	mg/kg	5	<	<	<	<	<	-	-
Aromatics									
>C5-C7	mg/kg	1	<	<	<	<	<	140	690
>C7-C8	mg/kg	1	<	<	<	<	<	290	1800
>C8-C10	mg/kg	1	<	<	<	<	<	83	110
>C10-C12	mg/kg	1	<	<	<	<	<	180	590
>C12-C16	mg/kg	1	<	<	<	<	<	330	2300 (419[sol])
>C16-C21	mg/kg	1	<	6.2	<	<	<	540	1900
>C21-C35	mg/kg	1	<	12	<	<	<	1500	1900
>C35-C44	mg/kg	1	<	<	<	<	<	-	-
Total aromatics C5-44	mg/kg	5	<	18	<	<	<	-	-
Total Petroleum Hydrocarbons	mg/kg	10	<	18	<	<	<	-	-
MTBE & BTEX									
Methyl Tertiary Butyl Ether	mg/kg	0.001	<	<	<	<	<	-	-
Benzene	mg/kg	0.001	<	<	<	<	<	0.17	0.7
Toluene	mg/kg	0.001	<	<	<	<	<	290	1900
Ethylbenzene	mg/kg	0.001	<	<	<	<	<	110	190
m/p-Xylene	mg/kg	0.001	<	<	<	<	<	130	180
o-Xylene	mg/kg	0.001	<	<	<	<	<	140	210

Notes

< = Less than Limit of Detection (LOD)

The criteria assume a sandy loam soil type, which will be conservative for the great majority of soils (including made ground) encountered on historically contaminated sites.

In cases where S4ULs exceed vapour (vap) and solubility (sol) saturation limits, the saturation concentrations are presented in brackets

Exceeding a solubility limit

Exceeding a limit

Table 2 - PCBs and Metals

Parameter	Units	Sample ID	TP4	TP12	TP17	TP19	TP24	Residential with homegrown produce	Residential without homegrown produce
		Depth	0.5	0.6	2.0	0.6	0.5		
		Date Sampled	08/08/2019	08/08/2019	08/08/2019	07/08/2019	08/08/2019		
		LOD							
PCB 28	mg/kg	0.01	<	<	<	<	<	-	-
PCB 52	mg/kg	0.01	<	<	<	<	<	-	-
PCB 101	mg/kg	0.01	<	<	<	<	<	-	-
PCB 118	mg/kg	0.01	<	<	<	<	<	-	-
PCB 138	mg/kg	0.01	<	<	<	<	<	-	-
PCB 153	mg/kg	0.01	<	<	<	<	<	-	-
PCB 180	mg/kg	0.01	<	<	<	<	<	-	-
Total 7 PCBs	mg/kg	0.1	<	<	<	<	<	-	-
Phenol	mg/kg	0.3	<	<	<	<	<	-	-
Natural Moisture Content	%	0.02	6.8	8.7	13	6.1	6.7	-	-
Hexavalent Chromium	mg/kg	0.5	<	<	<	<	<	6	6
Trivalent Chromium	mg/kg	1	27	19	20	25	21	910	910
Total Cyanide	mg/kg	0.5	<	<	<	<	<	-	-
Total Organic Carbon	%	0.2	0.61	0.56	0.68	0.99	0.3	-	-
Sulphide	mg/kg	0.5	1.7	1.2	3.4	<	1.1	-	-
Elemental Sulphur	mg/kg	1	<	<	11	<	<	-	-
Loss on Ignition	%	-	2.7	2.7	2.8	4	1.9	-	-
pH	pH units	-	8.3	8	8.2	6.3	7.1	-	-
Antimony	mg/kg	2	<	<	<	<	<	-	-
Arsenic	mg/kg	1	4.2	4	5.6	3.1	2.9	37	40
Barium	mg/kg	10	48	38	41	25	38	-	-
Cadmium	mg/kg	0.1	<	<	0.11	<	<	11	85
Chromium	mg/kg	1	27	19	20	25	21	910	910
Copper	mg/kg	0.5	10	8.8	11	4.7	5.6	2400	7100
Lead	mg/kg	0.5	18	14	20	8.8	7.4	200	310
Mercury	mg/kg	0.1	<	<	<	<	<	40	56
Molybdenum	mg/kg	2	<	<	<	<	<	-	-
Nickel	mg/kg	0.5	39	29	30	32	31	130	180
Selenium	mg/kg	0.2	<	<	<	0.23	<	250	430
Total Sulphate	%	0.01	<	<	0.019	0.023	<	-	-
Water Soluble Boron	mg/kg	0.4	<	<	<	<	<	290	11000
Zinc	mg/kg	0.5	58	42	51	41	42	3700	40000

Notes

< = Less than Limit of Detection (LOD)

The criteria assume a sandy loam soil type, which will be conservative for the great majority of soils (including made ground) encountered on historically contaminated sites.

In cases where S4ULs exceed vapour (vap) and solubility (sol) saturation limits, the saturation concentrations are presented in brackets

Exceeding a solubility limit

Exceeding a limit

Table 3 - Waste Acceptance Criteria (Kilbarry 2019 Trial Pit Samples)

						Landfill WAC Limits			
Sample ID:	**TP4**	**TP12**	**TP17**	**TP19**	**TP24**	**Inert Waste Landfill**	**Stable non-reactive Waste in Non-Haz Landfill**	**Hazardous Waste Landfill**	Inert Increased Limits
Sample Date:	**08/08/2019**	**08/08/2019**	**08/08/2019**	**07/08/2019**	**08/08/2019**				
Sample Depth (mBGL):	**0.5**	**0.6**	**2.0**	**0.6**	**0.5**				
Solid Waste Analysis									
Total Organic Carbon (%)	0.61	0.56	0.68	0.99	0.3	3	5	6	6
Loss on Ignition	2.7	2.7	2.8	4	1.9				
Sum of BTEX (mg/kg)	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	6	-	-	6
Sum of 7 PCBs (mg/kg)	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1	-	-	1
Mineral Oil (mg/kg)	< 10	18	< 10	< 10	< 10	500	-	-	500
PAH Sum of 17(mg/kg)	< 2.0	6.1	< 2.0	< 2.0	< 2.0	100	-	-	100
pH									
Acid Neutralisation Capacity	0.005	0.013	0.006	0.005	< 0.0020				
						Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg			
Eluate Analysis (mg/Kg)						**mg/kg**	**mg/kg**	**mg/kg**	mg/kg
Arsenic	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	0.5	2	25	1.5
Barium	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	20	100	300	20
Cadmium	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.04	1	5	0.04
Chromium	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	0.5	10	70	0.5
Copper	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	2	50	100	2
Mercury	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.01	0.2	2	0.01
Molybdenum	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	0.5	10	30	1.5
Nickel	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	0.4	10	40	0.4
Lead	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.5	10	50	0.5
Antimony	< 0.010	< 0.010	< 0.010	< 0.010	0.012	0.06	0.7	5	0.18
Selenium	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.1	0.5	7	0.3
Zinc	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	4	50	200	4
Chloride	< 10	< 10	12	< 10	23	800	15000	25000	2400
Fluoride	1.5	1.2	1.4	1	1	10	150	500	10
Sulphate as SO4	< 10	< 10	75	14	< 10	1000	20000	50000	3000
Total Dissolved Solids	400	430	520	240	210	4000	60000	100000	12000
Phenol	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	1	-	-	1
Dissolved Organic Carbon	53	61	71	69	64	500	800	1000	500

Table 4 - Parameter and proposed Trigger Value for Domain 4 (where site is location)
Taken from Guidance on waste acceptance criteria at Soil Recovery Facilities at authorised soil recovery facilities

	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn	TOC	Total BTEX	Min Oil	Total PAHs	Total PCBs	Asbestos
Proposed Trigger Value for Domain 4	32.3	0.97	51.7	80.4	0.285	50.3	91.4	155	3%	0.05	50	1	0.05	NAD
TP4 (0.5mbgl)	4.2	<0.10	27	10	<0.10	39	18	58	0.61	<0.010	<10	<2.0	<0.10	NAD
TP12 (0.6mbgl)	4	<0.10	19	8.8	<0.10	29	14	42	0.56	<0.010	18	**6.1**	<0.10	NAD
TP17 (2.0mbgl)	5.6	<0.10	20	11	<0.10	30	20	51	0.68	<0.010	<10	<2.0	<0.10	NAD
TP19 (0.6mbgl)	3.1	<0.10	25	4.7	<0.10	32	8.8	41	0.99	<0.010	<10	<2.0	<0.10	NAD
TP24 (0.5mbgl)	2.9	<0.10	21	5.6	<0.10	31	7.4	42	0.3	<0.010	<10	<2.0	<0.10	NAD

Notes:

NA - Not Analysed

NAD - No Asbestos Detected

APPENDIX A

Site Photographs

Photo 1: View of the overall site looking from the west to east.

Photo 2: View of the site looking west to east from the more elevated area to the east of Delany's GAA Club.

Photo 3: Gravel track crossing the site facing west to east.

Photo 4: Gate to Delany's GAA to the east of the site.

Photo 5: View from the gravel track crossing the site to the north.

Photo 6: View from the gravel track crossing the site to the south.

Photo 7: Wild flowers growing on the elevated ground to the west of the site.

Photo 8: Evidence of fly-tipping to the west of the site close to Delany's GAA.

Photo 9: Stockpile of sandstone type material on the site to the west.

Photo 10: Stockpiles of similar material on the opposite side of the fence at Delany's GAA.

Photo 11: Pylon in place to the west of the site, approximate 10m elevation change from base of pylon to Delany's GAA site.

Photo 12: Track along the west of the site, border with Delany's GAA.

Photo 13: Steep slope marked by large grey boulders.

APPENDIX B

HazWasteOnline™ Certificates

HazWasteOnline™

Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

a) understand the origin of the waste
b) select the correct List of Waste code(s)
c) confirm that the list of determinands, results and sampling plan are fit for purpose
d) select and justify the chosen metal species (Appendix B)
e) correctly apply moisture correction and other available corrections
f) add the meta data for their user-defined substances (Appendix A)
g) check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in pale yellow.

GDEQK-59MZX-5EV4H

Job name

HWOL-19-27836-20190829 124036[2]

Description/Comments

Material sampled by Priority Geotechnical - 8 August 2019

Project

54036

Site

Kilbarry

Classified by

Name:
Malcolm Dowling
Date:
28 May 2022 07:01 GMT
Telephone:
+353 1 201 1260

Company:
Verde Environmental Consultants
E7 Network Enterprise Park
Kilcoole
A63 KV04

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification: **CERTIFIED**

Course	Date
Hazardous Waste Classification	09 Dec 2021

Next 3 year Refresher due by Dec 2024

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	TP4-875684-08/08/2019-0.5	0.5	Non Hazardous		2
2	TP12-875685-08/08/2019-0.6	0.6	Non Hazardous		5
3	TP17-875686-08/08/2019-2.0	2.0	Non Hazardous		8
4	TP19-875687-07/08/2019-0.6	0.6	Non Hazardous		11
5	TP24-875688-08/08/2019-0.5	0.5	Non Hazardous		14

Related documents

#	Name	Description
1	HWOL-19-27836-20190829 124036.hwol	.hwol file used to create the Job

Report

Created by: Malcolm Dowling

Created date: 28 May 2022 07:01 GMT

Classification of sample: TP4-875684-08/08/2019-0.5

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP4-875684-08/08/2019-0.5
Sample Depth:
0.5 m
Moisture content:
6.8%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 6.8% Wet Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	pH			PH		8.3 pH		8.3 pH	8.3 pH		
2	sulfur { sulfur }	016-094-00-1	231-722-6	7704-34-9		<1 mg/kg		<1 mg/kg	<0.0001 %		<LOD
3	benzene	601-020-00-8	200-753-7	71-43-2		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
4	toluene	601-021-00-3	203-625-9	108-88-3		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
5	ethylbenzene	601-023-00-4	202-849-4	100-41-4		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
6	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
7	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				<0.5 mg/kg	1.884	<0.942 mg/kg	<0.0000942 %		<LOD
8	zinc { zinc oxide }	030-013-00-7	215-222-5	1314-13-2		58 mg/kg	1.245	67.284 mg/kg	0.00673 %	✓	
9	selenium { selenium }	034-001-00-2	231-957-4	7782-49-2		<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
10	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }	082-001-00-6			1	18 mg/kg		16.776 mg/kg	0.00168 %	✓	
11	nickel { nickel(IV) oxide (nickel dioxide) }	028-004-00-8	234-823-3	12035-36-8		39 mg/kg	1.545	56.164 mg/kg	0.00562 %	✓	
12	mercury { mercury(II) sulfide }		215-696-3	1344-48-5		<0.1 mg/kg	1.16	<0.116 mg/kg	<0.0000116 %		<LOD
13	copper { copper(II) oxide }	029-016-00-6	215-269-1	1317-38-0		10 mg/kg	1.252	11.667 mg/kg	0.00117 %	✓	
14	barium { barium oxide }		215-127-9	1304-28-5		48 mg/kg	1.117	49.948 mg/kg	0.00499 %	✓	
15	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		<0.1 mg/kg	1.142	<0.114 mg/kg	<0.0000114 %		<LOD

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
16	molybdenum { molybdenum(VI) oxide }	042-001-00-9	215-204-7	1313-27-5		<2 mg/kg	1.5	<3 mg/kg	<0.0003 %		<LOD
17	antimony { antimony trioxide }	051-005-00-X	215-175-0	1309-64-4		<2 mg/kg	1.197	<2.394 mg/kg	<0.000239 %		<LOD
18	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		4.2 mg/kg	1.32	5.168 mg/kg	0.000517 %	✓	
19	monohydric phenols			P1186		<0.3 mg/kg		<0.3 mg/kg	<0.00003 %		<LOD
20	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		27 mg/kg	1.462	36.779 mg/kg	0.00368 %	✓	
21	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		<0.4 mg/kg	3.22	<1.288 mg/kg	<0.000129 %		<LOD
22	chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<0.5 mg/kg	1.923	<0.962 mg/kg	<0.0000962 %		<LOD
23	polychlorobiphenyls; PCB	602-039-00-4	215-648-1	1336-36-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
24	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
25	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
26	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
27	indeno[123-cd]pyrene		205-893-2	193-39-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
28	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
29	benzo[ghi]perylene		205-883-8	191-24-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
30	coronene		205-881-7	191-07-1		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
31	naphthalene	601-052-00-2	202-049-5	91-20-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
32	acenaphthylene		205-917-1	208-96-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
33	acenaphthene		201-469-6	83-32-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
34	fluorene		201-695-5	86-73-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
35	phenanthrene		201-581-5	85-01-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
36	anthracene		204-371-1	120-12-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
37	fluoranthene		205-912-4	206-44-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
38	pyrene		204-927-3	129-00-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
39	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
40	chrysene	601-048-00-0	205-923-4	218-01-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
41	TPH (C6 to C40) petroleum group			TPH		<10 mg/kg		<10 mg/kg	<0.001 %		<LOD
42	xylene	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<2 µg/kg		<0.002 mg/kg	<0.0000002 %		<LOD
								Total:	0.0266 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: TP12-875685-08/08/2019-0.6

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP12-875685-08/08/2019-0.6
Sample Depth:
0.6 m
Moisture content:
8.7%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 8.7% Wet Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1	pH			PH		8	pH		8	pH	8pH		
2	sulfur { sulfur }	016-094-00-1	231-722-6	7704-34-9		<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
3	benzene	601-020-00-8	200-753-7	71-43-2		<1	µg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
4	toluene	601-021-00-3	203-625-9	108-88-3		<1	µg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
5	ethylbenzene	601-023-00-4	202-849-4	100-41-4		<1	µg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
6	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4		<1	µg/kg		<0.001	mg/kg	<0.0000001 %		<LOD
7	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				<0.5	mg/kg	1.884	<0.942	mg/kg	<0.0000942 %		<LOD
8	zinc { zinc oxide }	030-013-00-7	215-222-5	1314-13-2		42	mg/kg	1.245	47.73	mg/kg	0.00477 %	✓	
9	selenium { selenium }	034-001-00-2	231-957-4	7782-49-2		<0.2	mg/kg		<0.2	mg/kg	<0.00002 %		<LOD
10	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }	082-001-00-6			1	14	mg/kg		12.782	mg/kg	0.00128 %	✓	
11	nickel { nickel(IV) oxide (nickel dioxide) }	028-004-00-8	234-823-3	12035-36-8		29	mg/kg	1.545	40.912	mg/kg	0.00409 %	✓	
12	mercury { mercury(II) sulfide }		215-696-3	1344-48-5		<0.1	mg/kg	1.16	<0.116	mg/kg	<0.0000116 %		<LOD
13	copper { copper(II) oxide }	029-016-00-6	215-269-1	1317-38-0		8.8	mg/kg	1.252	10.057	mg/kg	0.00101 %	✓	
14	barium { barium oxide }		215-127-9	1304-28-5		38	mg/kg	1.117	38.736	mg/kg	0.00387 %	✓	
15	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		<0.1	mg/kg	1.142	<0.114	mg/kg	<0.0000114 %		<LOD

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
16	molybdenum { molybdenum(VI) oxide }	042-001-00-9	215-204-7	1313-27-5		<2 mg/kg	1.5	<3 mg/kg	<0.0003 %		<LOD
17	antimony { antimony trioxide }	051-005-00-X	215-175-0	1309-64-4		<2 mg/kg	1.197	<2.394 mg/kg	<0.000239 %		<LOD
18	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		4 mg/kg	1.32	4.822 mg/kg	0.000482 %	✓	
19	monohydric phenols			P1186		<0.3 mg/kg		<0.3 mg/kg	<0.00003 %		<LOD
20	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		19 mg/kg	1.462	25.354 mg/kg	0.00254 %	✓	
21	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		<0.4 mg/kg	3.22	<1.288 mg/kg	<0.000129 %		<LOD
22	chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<0.5 mg/kg	1.923	<0.962 mg/kg	<0.0000962 %		<LOD
23	polychlorobiphenyls; PCB	602-039-00-4	215-648-1	1336-36-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
24	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		0.34 mg/kg		0.31 mg/kg	0.000031 %	✓	
25	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		0.3 mg/kg		0.274 mg/kg	0.0000274 %	✓	
26	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		0.24 mg/kg		0.219 mg/kg	0.0000219 %	✓	
27	indeno[123-cd]pyrene		205-893-2	193-39-5		0.32 mg/kg		0.292 mg/kg	0.0000292 %	✓	
28	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		0.18 mg/kg		0.164 mg/kg	0.0000164 %	✓	
29	benzo[ghi]perylene		205-883-8	191-24-2		0.39 mg/kg		0.356 mg/kg	0.0000356 %	✓	
30	coronene		205-881-7	191-07-1		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
31	naphthalene	601-052-00-2	202-049-5	91-20-3		0.45 mg/kg		0.411 mg/kg	0.0000411 %	✓	
32	acenaphthylene		205-917-1	208-96-8		0.46 mg/kg		0.42 mg/kg	0.000042 %	✓	
33	acenaphthene		201-469-6	83-32-9		0.43 mg/kg		0.393 mg/kg	0.0000393 %	✓	
34	fluorene		201-695-5	86-73-7		0.34 mg/kg		0.31 mg/kg	0.000031 %	✓	
35	phenanthrene		201-581-5	85-01-8		0.6 mg/kg		0.548 mg/kg	0.0000548 %	✓	
36	anthracene		204-371-1	120-12-7		0.45 mg/kg		0.411 mg/kg	0.0000411 %	✓	
37	fluoranthene		205-912-4	206-44-0		0.52 mg/kg		0.475 mg/kg	0.0000475 %	✓	
38	pyrene		204-927-3	129-00-0		0.47 mg/kg		0.429 mg/kg	0.0000429 %	✓	
39	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		0.29 mg/kg		0.265 mg/kg	0.0000265 %	✓	
40	chrysene	601-048-00-0	205-923-4	218-01-9		0.32 mg/kg		0.292 mg/kg	0.0000292 %	✓	
41	TPH (C6 to C40) petroleum group			TPH		18 mg/kg		16.434 mg/kg	0.00164 %	✓	
42	xylene	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<2 µg/kg		<0.002 mg/kg	<0.0000002 %		<LOD
								Total:	0.0213 %		

Key	
	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous property to non hazardous because HP3, flammability, has been discounted for soils / solid waste without a free-draining liquid phase. The waste fill material is not anticipated to illustrate the properties described in the definition of HP3 "Flammable" as laid out in Annex III of the Waste Framework Directive.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.00164%)

Classification of sample: TP17-875686-08/08/2019-2.0

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP17-875686-08/08/2019-2.0
Sample Depth:
2.0 m
Moisture content:
13%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 13% Wet Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	pH			PH		8.2 pH		8.2 pH	8.2 pH		
2	sulfur { sulfur }	016-094-00-1	231-722-6	7704-34-9		11 mg/kg		9.57 mg/kg	0.000957 %	✓	
3	benzene	601-020-00-8	200-753-7	71-43-2		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
4	toluene	601-021-00-3	203-625-9	108-88-3		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
5	ethylbenzene	601-023-00-4	202-849-4	100-41-4		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
6	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
7	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				<0.5 mg/kg	1.884	<0.942 mg/kg	<0.0000942 %		<LOD
8	zinc { zinc oxide }	030-013-00-7	215-222-5	1314-13-2		51 mg/kg	1.245	55.228 mg/kg	0.00552 %	✓	
9	selenium { selenium }	034-001-00-2	231-957-4	7782-49-2		<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
10	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }	082-001-00-6			1	20 mg/kg		17.4 mg/kg	0.00174 %	✓	
11	nickel { nickel(IV) oxide (nickel dioxide) }	028-004-00-8	234-823-3	12035-36-8		30 mg/kg	1.545	40.329 mg/kg	0.00403 %	✓	
12	mercury { mercury(II) sulfide }		215-696-3	1344-48-5		<0.1 mg/kg	1.16	<0.116 mg/kg	<0.0000116 %		<LOD
13	copper { copper(II) oxide }	029-016-00-6	215-269-1	1317-38-0		11 mg/kg	1.252	11.98 mg/kg	0.0012 %	✓	
14	barium { barium oxide }		215-127-9	1304-28-5		41 mg/kg	1.117	39.826 mg/kg	0.00398 %	✓	
15	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		0.11 mg/kg	1.142	0.109 mg/kg	0.0000109 %	✓	

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
16	molybdenum { molybdenum(VI) oxide }	042-001-00-9	215-204-7	1313-27-5		<2 mg/kg	1.5	<3 mg/kg	<0.0003 %		<LOD
17	antimony { antimony trioxide }	051-005-00-X	215-175-0	1309-64-4		<2 mg/kg	1.197	<2.394 mg/kg	<0.000239 %		<LOD
18	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		5.6 mg/kg	1.32	6.433 mg/kg	0.000643 %	✓	
19	monohydric phenols			P1186		<0.3 mg/kg		<0.3 mg/kg	<0.00003 %		<LOD
20	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		20 mg/kg	1.462	25.431 mg/kg	0.00254 %	✓	
21	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		<0.4 mg/kg	3.22	<1.288 mg/kg	<0.000129 %		<LOD
22	chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<0.5 mg/kg	1.923	<0.962 mg/kg	<0.0000962 %		<LOD
23	polychlorobiphenyls; PCB	602-039-00-4	215-648-1	1336-36-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
24	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
25	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
26	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
27	indeno[123-cd]pyrene		205-893-2	193-39-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
28	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
29	benzo[ghi]perylene		205-883-8	191-24-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
30	coronene		205-881-7	191-07-1		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
31	naphthalene	601-052-00-2	202-049-5	91-20-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
32	acenaphthylene		205-917-1	208-96-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
33	acenaphthene		201-469-6	83-32-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
34	fluorene		201-695-5	86-73-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
35	phenanthrene		201-581-5	85-01-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
36	anthracene		204-371-1	120-12-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
37	fluoranthene		205-912-4	206-44-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
38	pyrene		204-927-3	129-00-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
39	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
40	chrysene	601-048-00-0	205-923-4	218-01-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
41	TPH (C6 to C40) petroleum group			TPH		<10 mg/kg		<10 mg/kg	<0.001 %		<LOD
42	xylene	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<2 µg/kg		<0.002 mg/kg	<0.0000002 %		<LOD
								Total:	0.0227 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: TP19-875687-07/08/2019-0.6

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP19-875687-07/08/2019-0.6
Sample Depth:
0.6 m
Moisture content:
6.1%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 6.1% Wet Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	pH			PH		6.3 pH		6.3 pH	6.3 pH		
2	sulfur { sulfur }	016-094-00-1	231-722-6	7704-34-9		<1 mg/kg		<1 mg/kg	<0.0001 %		<LOD
3	benzene	601-020-00-8	200-753-7	71-43-2		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
4	toluene	601-021-00-3	203-625-9	108-88-3		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
5	ethylbenzene	601-023-00-4	202-849-4	100-41-4		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
6	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
7	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				<0.5 mg/kg	1.884	<0.942 mg/kg	<0.0000942 %		<LOD
8	zinc { zinc oxide }	030-013-00-7	215-222-5	1314-13-2		41 mg/kg	1.245	47.92 mg/kg	0.00479 %	✓	
9	selenium { selenium }	034-001-00-2	231-957-4	7782-49-2		0.23 mg/kg		0.216 mg/kg	0.0000216 %	✓	
10	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }	082-001-00-6			1	8.8 mg/kg		8.263 mg/kg	0.000826 %	✓	
11	nickel { nickel(IV) oxide (nickel dioxide) }	028-004-00-8	234-823-3	12035-36-8		32 mg/kg	1.545	46.43 mg/kg	0.00464 %	✓	
12	mercury { mercury(II) sulfide }		215-696-3	1344-48-5		<0.1 mg/kg	1.16	<0.116 mg/kg	<0.0000116 %		<LOD
13	copper { copper(II) oxide }	029-016-00-6	215-269-1	1317-38-0		4.7 mg/kg	1.252	5.524 mg/kg	0.000552 %	✓	
14	barium { barium oxide }		215-127-9	1304-28-5		25 mg/kg	1.117	26.21 mg/kg	0.00262 %	✓	
15	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		<0.1 mg/kg	1.142	<0.114 mg/kg	<0.0000114 %		<LOD

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
16	molybdenum { molybdenum(VI) oxide }	042-001-00-9	215-204-7	1313-27-5		<2 mg/kg	1.5	<3 mg/kg	<0.0003 %		<LOD
17	antimony { antimony trioxide }	051-005-00-X	215-175-0	1309-64-4		<2 mg/kg	1.197	<2.394 mg/kg	<0.000239 %		<LOD
18	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		3.1 mg/kg	1.32	3.843 mg/kg	0.000384 %	✓	
19	monohydric phenols			P1186		<0.3 mg/kg		<0.3 mg/kg	<0.00003 %		<LOD
20	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		25 mg/kg	1.462	34.31 mg/kg	0.00343 %	✓	
21	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		<0.4 mg/kg	3.22	<1.288 mg/kg	<0.000129 %		<LOD
22	chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<0.5 mg/kg	1.923	<0.962 mg/kg	<0.0000962 %		<LOD
23	polychlorobiphenyls; PCB	602-039-00-4	215-648-1	1336-36-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
24	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
25	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
26	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
27	indeno[123-cd]pyrene		205-893-2	193-39-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
28	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
29	benzo[ghi]perylene		205-883-8	191-24-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
30	coronene		205-881-7	191-07-1		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
31	naphthalene	601-052-00-2	202-049-5	91-20-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
32	acenaphthylene		205-917-1	208-96-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
33	acenaphthene		201-469-6	83-32-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
34	fluorene		201-695-5	86-73-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
35	phenanthrene		201-581-5	85-01-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
36	anthracene		204-371-1	120-12-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
37	fluoranthene		205-912-4	206-44-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
38	pyrene		204-927-3	129-00-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
39	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
40	chrysene	601-048-00-0	205-923-4	218-01-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
41	TPH (C6 to C40) petroleum group			TPH		<10 mg/kg		<10 mg/kg	<0.001 %		<LOD
42	xylene	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<2 µg/kg		<0.002 mg/kg	<0.0000002 %		<LOD
								Total:	0.0195 %		

Key	
	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: TP24-875688-08/08/2019-0.5

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP24-875688-08/08/2019-0.5
Sample Depth:
0.5 m
Moisture content:
6.7%
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 6.7% Wet Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	pH			PH		7.1 pH		7.1 pH	7.1 pH		
2	sulfur { sulfur }	016-094-00-1	231-722-6	7704-34-9		<1 mg/kg		<1 mg/kg	<0.0001 %		<LOD
3	benzene	601-020-00-8	200-753-7	71-43-2		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
4	toluene	601-021-00-3	203-625-9	108-88-3		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
5	ethylbenzene	601-023-00-4	202-849-4	100-41-4		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
6	tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4		<1 µg/kg		<0.001 mg/kg	<0.0000001 %		<LOD
7	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				<0.5 mg/kg	1.884	<0.942 mg/kg	<0.0000942 %		<LOD
8	zinc { zinc oxide }	030-013-00-7	215-222-5	1314-13-2		42 mg/kg	1.245	48.775 mg/kg	0.00488 %	✓	
9	selenium { selenium }	034-001-00-2	231-957-4	7782-49-2		<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
10	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }	082-001-00-6			1	7.4 mg/kg		6.904 mg/kg	0.00069 %	✓	
11	nickel { nickel(IV) oxide (nickel dioxide) }	028-004-00-8	234-823-3	12035-36-8		31 mg/kg	1.545	44.691 mg/kg	0.00447 %	✓	
12	mercury { mercury(II) sulfide }		215-696-3	1344-48-5		<0.1 mg/kg	1.16	<0.116 mg/kg	<0.0000116 %		<LOD
13	copper { copper(II) oxide }	029-016-00-6	215-269-1	1317-38-0		5.6 mg/kg	1.252	6.54 mg/kg	0.000654 %	✓	
14	barium { barium oxide }		215-127-9	1304-28-5		38 mg/kg	1.117	39.585 mg/kg	0.00396 %	✓	
15	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		<0.1 mg/kg	1.142	<0.114 mg/kg	<0.0000114 %		<LOD

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
16	molybdenum { molybdenum(VI) oxide }	042-001-00-9	215-204-7	1313-27-5		<2 mg/kg	1.5	<3 mg/kg	<0.0003 %		<LOD
17	antimony { antimony trioxide }	051-005-00-X	215-175-0	1309-64-4		<2 mg/kg	1.197	<2.394 mg/kg	<0.000239 %		<LOD
18	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		2.9 mg/kg	1.32	3.572 mg/kg	0.000357 %	✓	
19	monohydric phenols			P1186		<0.3 mg/kg		<0.3 mg/kg	<0.00003 %		<LOD
20	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		21 mg/kg	1.462	28.636 mg/kg	0.00286 %	✓	
21	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		<0.4 mg/kg	3.22	<1.288 mg/kg	<0.000129 %		<LOD
22	chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<0.5 mg/kg	1.923	<0.962 mg/kg	<0.0000962 %		<LOD
23	polychlorobiphenyls; PCB	602-039-00-4	215-648-1	1336-36-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
24	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
25	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
26	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
27	indeno[123-cd]pyrene		205-893-2	193-39-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
28	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
29	benzo[ghi]perylene		205-883-8	191-24-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
30	coronene		205-881-7	191-07-1		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
31	naphthalene	601-052-00-2	202-049-5	91-20-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
32	acenaphthylene		205-917-1	208-96-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
33	acenaphthene		201-469-6	83-32-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
34	fluorene		201-695-5	86-73-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
35	phenanthrene		201-581-5	85-01-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
36	anthracene		204-371-1	120-12-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
37	fluoranthene		205-912-4	206-44-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
38	pyrene		204-927-3	129-00-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
39	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
40	chrysene	601-048-00-0	205-923-4	218-01-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
41	TPH (C6 to C40) petroleum group			TPH		<10 mg/kg		<10 mg/kg	<0.001 %		<LOD
42	xylene	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<2 µg/kg		<0.002 mg/kg	<0.0000002 %		<LOD
								Total:	0.0201 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Appendix A: Classifier defined and non EU CLP determinands

pH (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: None.

ethylbenzene (EC Number: 202-849-4, CAS Number: 100-41-4)

EU CLP index number: 601-023-00-4
Description/Comments:
Additional Hazard Statement(s): Carc. 2; H351
Reason for additional Hazards Statement(s):
03 Jun 2015 - Carc. 2; H351 hazard statement sourced from: IARC Group 2B (77) 2000

salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex

EU CLP index number: 006-007-00-5
Description/Comments: Conversion factor based on a worst case compound: sodium cyanide
Additional Hazard Statement(s): EUH032 >= 0.2 %
Reason for additional Hazards Statement(s):
14 Dec 2015 - EUH032 >= 0.2 % hazard statement sourced from: WM3, Table C12.2

lead compounds with the exception of those specified elsewhere in this Annex (worst case)

EU CLP index number: 082-001-00-6
Description/Comments: Worst Case: IARC considers lead compounds Group 2A; Probably carcinogenic to humans; Lead REACH Consortium, following CLP protocols, considers lead compounds from smelting industries, flue dust and similar to be Carcinogenic category 1A
Additional Hazard Statement(s): Carc. 1A; H350
Reason for additional Hazards Statement(s):
03 Jun 2015 - Carc. 1A; H350 hazard statement sourced from: IARC Group 2A (Sup 7, 87) 2006; Lead REACH Consortium www.reach-lead.eu/substanceinformation.html (worst case lead compounds). Review date 29/09/2015

mercury(II) sulfide (EC Number: 215-696-3, CAS Number: 1344-48-5)

Description/Comments: Data from ECHA's C&L and SDS Sigma Aldrich V6 dated 17/9/2019 Threshold for EUH031 based on calculation method in WM3 Box C12.1
Data source: https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/8530
Data source date: 14 May 2020
Hazard Statements: EUH031 >= 1 % , EUH031 , Skin Sens. 1; H317 , STOT RE 2; H373

barium oxide (EC Number: 215-127-9, CAS Number: 1304-28-5)

Description/Comments: Data from ECHA's C&L Inventory Database, Sigma Aldrich SDS dated 6/2/20
Data source: https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/88825
Data source date: 02 Apr 2020
Hazard Statements: Acute Tox. 3; H301 , Skin Corr. 1B; H314 , Eye Dam. 1; H318 , Acute Tox. 1; H332

monohydric phenols (CAS Number: P1186)

Description/Comments: Combined hazards statements from harmonised entries in CLP for phenol, cresols and xylenols (604-001-00-2, 604-004-00-9, 604-006-00-X)
Data source: CLP combined data
Data source date: 26 Mar 2019
Hazard Statements: Muta. 2; H341 , Acute Tox. 3; H331 , Acute Tox. 3; H311 , Acute Tox. 3; H301 , STOT RE 2; H373 , Skin Corr. 1B; H314 , Skin Corr. 1B; H314 >= 3 % , Skin Irrit. 2; H315 1 £ conc. < 3 % , Eye Irrit. 2; H319 1 £ conc. < 3 % , Aquatic Chronic 2; H411

chromium(III) oxide (worst case) (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database
Data source: https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H332 , Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Resp. Sens. 1; H334 , Skin Sens. 1; H317 , Repr. 1B; H360FD , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **polychlorobiphenyls; PCB** (EC Number: 215-648-1, CAS Number: 1336-36-3)

EU CLP index number: 602-039-00-4
Description/Comments: Worst Case: IARC considers PCB Group 1; Carcinogenic to humans; POP specific threshold from ATP1 (Regulation 756/2010/EU) to POPs Regulation (Regulation 850/2004/EC). Where applicable, the calculation method laid down in European standards EN 12766-1 and EN 12766-2 shall be applied.
Additional Hazard Statement(s): Carc. 1A; H350
Reason for additional Hazards Statement(s):
29 Sep 2015 - Carc. 1A; H350 hazard statement sourced from: IARC Group 1 (23, Sup 7, 100C) 2012

- **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2; H351

- **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **coronene** (EC Number: 205-881-7, CAS Number: 191-07-1)

Description/Comments: Data from C&L Inventory Database; no entries in Registered Substances or Pesticides Properties databases; SDS: Sigma Aldrich, 1907/2006 compliant, dated 2012 - no entries; IARC – Group 3, not carcinogenic.
Data source: http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=17010&HarmOnly=no?fc=true&lang=en
Data source date: 16 Jun 2014
Hazard Statements: STOT SE 2; H371

- **acenaphthylene** (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

- **acenaphthene** (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

- **fluorene** (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **phenanthrene** (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

- **anthracene** (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **fluoranthene** (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

pyrene (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

TPH (C6 to C40) petroleum group (CAS Number: TPH)

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: Flam. Liq. 3; H226 , Asp. Tox. 1; H304 , STOT RE 2; H373 , Muta. 1B; H340 , Carc. 1B; H350 , Repr. 2; H361d , Aquatic Chronic 2; H411

Appendix B: Rationale for selection of metal species

sulfur {sulfur}

chemtest reports Elemental sulfur using this CAS

cyanides {salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex}

Most plausible species selected

zinc {zinc oxide}

Laboratory results indicate that Chromium is present as Cr III rather than Cr VI and this has been factored into the classification exercise. The Hazwasteonline default scenario assumes that lead, nickel and zinc are present as chromates however laboratory results indicate that they are not likely to be present as chromates. These metal species are therefore in their default worst case scenario species (uncorrected) as they are not present at concentrations influencing the hazardous assessment.

selenium {selenium}

edit

lead {lead compounds with the exception of those specified elsewhere in this Annex (worst case)}

Laboratory results indicate that Chromium is present as Cr III rather than Cr VI and this has been factored into the classification exercise. The Hazwasteonline default scenario assumes that lead, nickel and zinc are present as chromates however laboratory results indicate that they are not likely to be present as chromates. These metal species are therefore in their default worst case scenario species (uncorrected) as they are not present at concentrations influencing the hazardous assessment.

nickel {nickel(IV) oxide (nickel dioxide)}

Laboratory results indicate that Chromium is present as Cr III rather than Cr VI and this has been factored into the classification exercise. The Hazwasteonline default scenario assumes that lead, nickel and zinc are present as chromates however laboratory results indicate that they are not likely to be present as chromates. These metal species are therefore in their default worst case scenario species (uncorrected) as they are not present at concentrations influencing the hazardous assessment.

mercury {mercury(II) sulfide}

Most plausible species selected

copper {copper(II) oxide}

Most plausible species selected

barium {barium oxide}

Most plausible species selected

cadmium {cadmium oxide}

Most plausible species selected

molybdenum {molybdenum(VI) oxide}

Most plausible species selected

antimony {antimony trioxide}

Most plausible species selected

arsenic {arsenic trioxide}

Most plausible species selected

chromium in chromium(III) compounds {chromium(III) oxide (worst case)}

Most plausible species selected

boron {diboron trioxide}

Most plausible species selected

chromium in chromium(VI) compounds {chromium(VI) oxide}

Most plausible species selected

Appendix C: Version

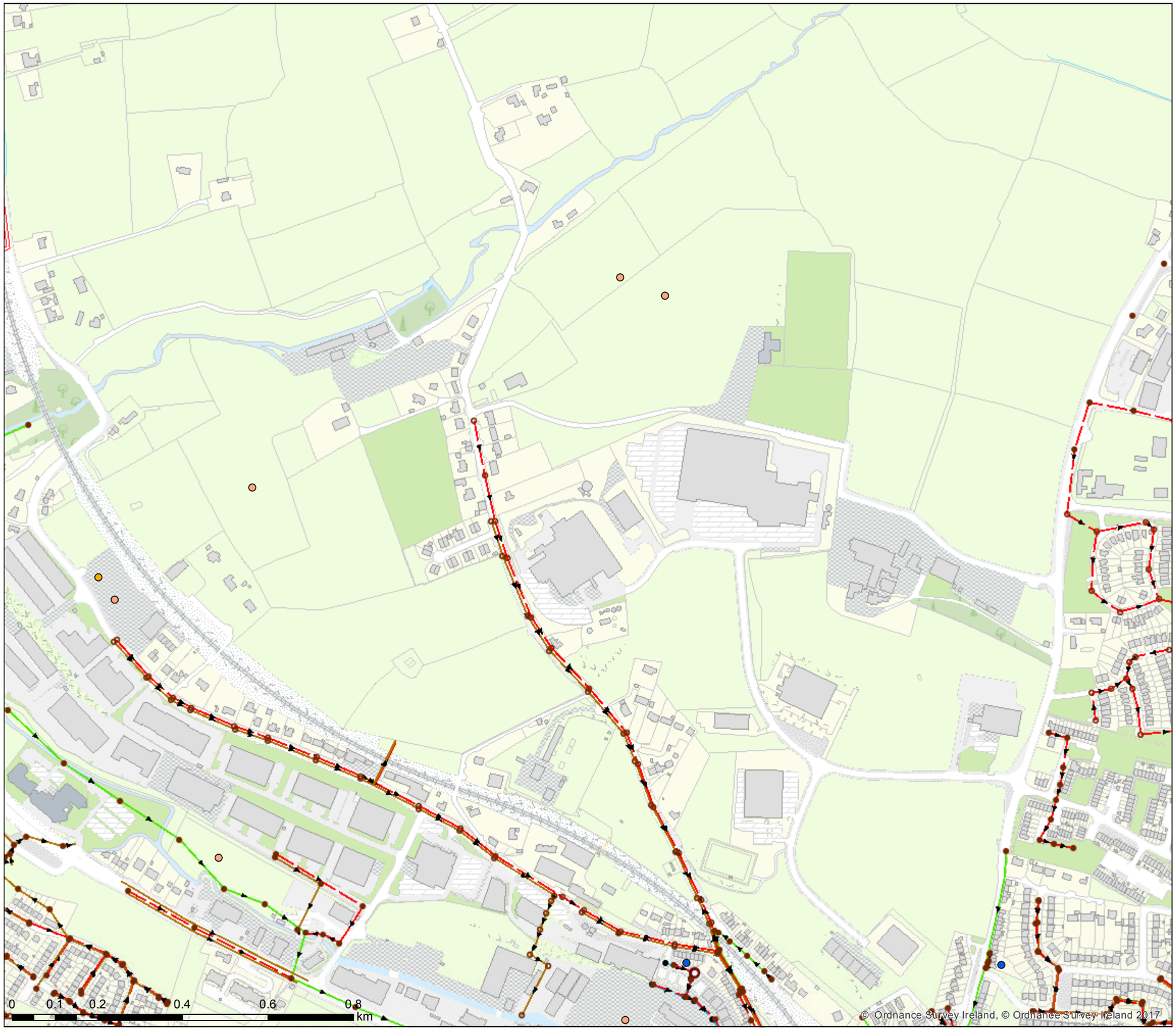
HazWasteOnline Classification Engine: EU WM3 1st Edition v1.1.NI using the EU LoW
HazWasteOnline Classification Engine Version: 2022.146.5158.9719 (26 May 2022)
HazWasteOnline Database: 2022.146.5158.9719 (26 May 2022)

This classification utilises the following guidance and legislation:
WM3 v1.1.NI - Waste Classification - 1st Edition v1.1.NI - Jan 2021
CLP Regulation - Regulation 1272/2008/EC of 16 December 2008
1st ATP - Regulation 790/2009/EC of 10 August 2009
2nd ATP - Regulation 286/2011/EC of 10 March 2011
3rd ATP - Regulation 618/2012/EU of 10 July 2012
4th ATP - Regulation 487/2013/EU of 8 May 2013
Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013
5th ATP - Regulation 944/2013/EU of 2 October 2013
6th ATP - Regulation 605/2014/EU of 5 June 2014
WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014
Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014
7th ATP - Regulation 2015/1221/EU of 24 July 2015
8th ATP - Regulation (EU) 2016/918 of 19 May 2016
9th ATP - Regulation (EU) 2016/1179 of 19 July 2016
10th ATP - Regulation (EU) 2017/776 of 4 May 2017
HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017
13th ATP - Regulation (EU) 2018/1480 of 4 October 2018
14th ATP - Regulation (EU) 2020/217 of 4 October 2019
15th ATP - Regulation (EU) 2020/1182 of 19 May 2020
The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020
The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1540 of 16th December 2020
17th ATP - Regulation (EU) 2021/849 of 11 March 2021

Appendix 4:

EXISTING WASTEWATER NETWORK

Irish Water Web Map



UISCE ÉIREANN : IRISH WATER

Print Date: 20/06/2022

Printed by:Irish Water

Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

ESB HV Lines
- HV Underground
- HV Overhead
- HV Abandoned

ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

Appendix 5:

IRISH WATER - CONFIRMATION OF FEASIBILITY & STATEMENT OF DESIGN ACCEPTANCE

Tim Finn
JB Barry Consulting Engineers, 3 Eastgate Business Park,
Little Island
Cork

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

11 March 2020

Dear Tim Finn,

Re: Connection Reference No CDS19003564 pre-connection enquiry - Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 330 unit(s) at Kilbarry, Cork, Cork.

Irish Water has reviewed your pre-connection enquiry in relation to a water connection at Kilbarry, Cork, Cork.

Based upon the details that you have provided with your pre-connection enquiry and on the capacity currently available in the network(s), as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network(s) can be facilitated.

In order to facilitate your drinking water connection it will be necessary for you to connect via a 250mm diameter watermain to the 300mm watermain in the Kilbarry Business Park to the south. This can be done by upgrading approximately 750m of watermain on the Whitechurch road to 250mm, or finding another route with a wayleave through the adjoining business park, (see layout map attached). An initial phase of approximately 100 houses can be connected without upgrade requirements.

In order to facilitate the wastewater connection, it will be required to upgrade apporximately 150m of foul sewer on the Whitechurch road from 225mm to 300mm at a minimum. It is likely that further sewer network upgrades will be required downstream, however the scope of these upgrades is currently unknown. Irish Water have an ongoing project to survey and model the sewer networks in the Cork City area. When these studies are complete the scope of the upgrades will be known. In the meantime, a first phase of 100 housing units could be connected without any sewer upgrade requirements.

All infrastructure should be designed and installed in accordance with the Irish Water Codes of Practice and Standard Details. A design proposal for the water and/or wastewater infrastructure should be submitted to Irish Water for assessment. Prior to submitting your planning application, you are required to submit these detailed design proposals to Irish Water for review.

You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed at a later date.

A connection agreement can be applied for by completing the connection application form available at **www.water.ie/connections**. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities.

If you have any further questions, please contact Brian O'Mahony from the design team on 022 52205 or email bomahony@water.ie. For further information, visit **www.water.ie/connections.**

Yours sincerely,

Maria O'Dwyer

Connections and Developer Services

Uisce Éireann
Bosca OP 6000
Baile Átha Cliath 1
Éire

Irish Water
PO Box 6000
Dublin 1
Ireland

T: +353 1 89 25000
F: +353 1 89 25001
www.water.ie

Your Ref: ABP-311924-21
Our Ref: CDS19003564

An Bord Pleanála,
64 Marlborough Street,
Dublin

8th December 2021

Dear Sir/ Madam,

Re: Strategic Housing Development – Demolition of buildings, construction of 309 no. residential units (197 no. houses, 112 no. apartments), creche and associated site works. Cork GAA Lands, Old Whitechurch Road, Kilbarry, Cork City.

Irish Water has received notification of the GAA request to enter into consultations under Section 5 of the Planning and Development (Housing) and Residential Tenancies Act 2016 in respect of the above-mentioned proposed development.

Irish Water has reviewed the plans and particulars submitted for this Strategic Housing Development and confirms that a Confirmation of Feasibility has been issued to the applicant advising that connection(s) are feasible subject to the following contingencies:

In respect of Wastewater:

In order to facilitate the wastewater connection, it will be required to upgrade approximately 150m of foul sewer on the Whitechurch road from 225mm to 300mm at a minimum. It is likely that further upgrades will be required downstream, however the scope of these upgrades is currently unknown. Irish Water currently have an ongoing project to survey and model the sewer networks in the Cork City area to confirm the available capacity and to determine the full extent of any upgrades which may be required to be completed to Irish Water infrastructure in order to service a wastewater connection for the overall development proposal. The applicant is required to agree a high-level solution for any upgrades identified with Irish Water ahead of any SHD application to ensure adequate provision of wastewater facilities.

In the interim, a first phase of 100 housing units could be facilitated without any sewer upgrade requirements.

In respect of Water:

In order to facilitate a water connection for this development proposal a local upgrading approx 750m of watermain on the Whitechurch road to 250mm is required. The applicant will be required to fund this extension as part of a connection agreement which is expected to be within the public domain.

Planning Observations;

In respect to the contingencies above which are required to provide a water and wastewater facilities to service this development proposal, the applicant is required to engage with Irish Water to agree works and/or upgrades required to the public infrastructure in advance of any SHD application.

The applicant is required to confirm the proposed phasing of this development in advance of any SHD application.

Connection(s) to the public network are subject to a Connection Agreement with Irish Water.

All development is to be carried out in compliance with Irish Waters Standards Codes and Practices and that design layouts for the development proposal, within the redline boundary have been submitted to Irish Water and that a Statement of Design Acceptance has been issued to the applicant by Irish Water ahead of any SHD Application.

Irish Water does not permit build over of its assets and the separation distances as per Irish Waters Standards Codes and Practices which must be achieved. In order to ensure appropriate and access to existing infrastructure(s) the applicants are required to engage with Irish Water Diversions to agree to assess feasibility of any potential build over/diversion(s) which may be required, separation distances, appropriate wayleaves and or access ahead of any SHD application.

Queries relating to the observations above should be sent to planning@water.ie

PP. Ali Robinson

Yvonne Harris
Connections and Developer Services

Tim Finn
JB Barry Consulting Engineers, 3 Eastgate Business Park,
Little Island
Cork

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

27 June 2022

Re: Design Submission for Kilbarry, Cork, Cork (the "Development")
(the "Design Submission") / Connection Reference No: CDS19003564

Dear Tim Finn,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form at www.water.ie/connections. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Irish Water representative:
Name: Adrian Daly
Phone: 022 52290
Email: addaly@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix 6:

FOUL SEWER – MICRODRAINAGE CALCULATIONS

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	150.00	Maximum Backdrop Height (m)	4.000
Persons per House	2.70	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	49.364	0.823	60.0	0.000	6	0.0	1.500	o	150	Pipe/Conduit	
F1.001	49.364	0.329	150.0	0.000	5	0.0	1.500	o	150	Pipe/Conduit	
F1.002	63.908	0.320	200.0	0.000	25	0.0	1.500	o	225	Pipe/Conduit	
F1.003	63.908	0.320	200.0	0.000	12	0.0	1.500	o	225	Pipe/Conduit	
F2.000	88.490	0.442	200.0	0.000	22	0.0	1.500	o	225	Pipe/Conduit	
F2.001	5.953	0.249	23.9	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
F2.002	56.620	2.574	22.0	0.000	12	0.0	1.500	o	225	Pipe/Conduit	
F1.004	56.276	2.558	22.0	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
F3.000	44.178	0.221	200.0	0.000	22	0.0	1.500	o	225	Pipe/Conduit	
F3.001	44.178	0.221	200.0	0.000	5	0.0	1.500	o	225	Pipe/Conduit	
F1.005	11.859	0.059	200.0	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
F1.006	8.172	0.042	195.7	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F4.000	14.707	0.669	22.0	0.000	3	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	85.377	0.000	0.0	6	0.0	10	0.33	1.13	20.0	0.2
F1.001	84.554	0.000	0.0	11	0.0	17	0.29	0.71	12.6	0.3
F1.002	84.150	0.000	0.0	36	0.0	28	0.36	0.81	32.2	1.0
F1.003	83.830	0.000	0.0	48	0.0	32	0.40	0.81	32.2	1.4
F2.000	86.776	0.000	0.0	22	0.0	22	0.31	0.81	32.2	0.6
F2.001	86.334	0.000	0.0	24	0.0	14	0.67	2.35	93.6	0.7
F2.002	86.085	0.000	0.0	36	0.0	16	0.78	2.45	97.6	1.0
F1.004	83.510	0.000	0.0	86	0.0	25	1.03	2.45	97.5	2.4
F3.000	80.474	0.000	0.0	22	0.0	22	0.31	0.81	32.2	0.6
F3.001	80.253	0.000	0.0	27	0.0	24	0.33	0.81	32.2	0.8
F1.005	80.032	0.000	0.0	115	0.0	48	0.52	0.81	32.2	3.2
F1.006	79.973	0.000	0.0	115	0.0	48	0.52	0.82	32.6	3.2
F4.000	84.331	0.000	0.0	3	0.0	6	0.36	1.87	33.1	0.1

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F5.000	41.183	0.686	60.0	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
F4.001	24.671	0.164	150.0	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F6.000	25.314	1.151	22.0	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F4.002	16.364	0.273	60.0	0.000	1	0.0	1.500	o	150	Pipe/Conduit	
F4.003	11.175	0.186	60.0	0.000	1	0.0	1.500	o	150	Pipe/Conduit	
F4.004	50.761	1.084	46.8	0.000	9	0.0	1.500	o	225	Pipe/Conduit	
F1.007	55.975	2.544	22.0	0.000	5	0.0	1.500	o	225	Pipe/Conduit	
F1.008	8.583	0.390	22.0	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
F1.009	41.169	1.334	30.9	0.000	3	0.0	1.500	o	225	Pipe/Conduit	
F7.000	73.057	1.218	60.0	0.000	6	0.0	1.500	o	150	Pipe/Conduit	
F1.010	49.028	2.050	23.9	0.000	4	0.0	1.500	o	225	Pipe/Conduit	
F1.011	9.744	0.443	22.0	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
F8.000	30.479	1.266	24.1	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
F1.012	61.992	2.818	22.0	0.000	14	0.0	1.500	o	225	Pipe/Conduit	
F9.000	16.065	0.080	200.8	0.000	21	0.0	1.500	o	225	Pipe/Conduit	
F9.001	10.466	0.105	99.7	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F5.000	82.400	0.000	0.0	4	0.0	8	0.29	1.13	20.0	0.1
F4.001	81.714	0.000	0.0	9	0.0	15	0.27	0.71	12.6	0.3
F6.000	83.700	0.000	0.0	2	0.0	5	0.32	1.87	33.1	0.1
F4.002	81.549	0.000	0.0	12	0.0	14	0.41	1.13	20.0	0.3
F4.003	81.276	0.000	0.0	13	0.0	14	0.42	1.13	20.0	0.4
F4.004	81.015	0.000	0.0	22	0.0	16	0.51	1.68	66.8	0.6
F1.007	79.931	0.000	0.0	142	0.0	31	1.20	2.45	97.5	4.0
F1.008	77.387	0.000	0.0	144	0.0	31	1.20	2.45	97.5	4.1
F1.009	76.997	0.000	0.0	147	0.0	34	1.08	2.07	82.3	4.1
F7.000	76.956	0.000	0.0	6	0.0	10	0.33	1.13	20.0	0.2
F1.010	75.663	0.000	0.0	157	0.0	33	1.20	2.35	93.5	4.4
F1.011	73.613	0.000	0.0	159	0.0	33	1.24	2.45	97.6	4.5
F8.000	74.511	0.000	0.0	4	0.0	7	0.39	1.79	31.6	0.1
F1.012	73.170	0.000	0.0	177	0.0	35	1.28	2.45	97.5	5.0
F9.000	76.758	0.000	0.0	21	0.0	21	0.31	0.81	32.1	0.6
F9.001	76.678	0.000	0.0	21	0.0	18	0.39	1.15	45.7	0.6

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F9.002	78.671	3.576	22.0	0.000	9	0.0	1.500	o	225	Pipe/Conduit	
F10.000	50.552	3.146	16.1	0.000	12	0.0	1.500	o	150	Pipe/Conduit	
F9.003	5.792	0.263	22.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F9.004	14.693	0.668	22.0	0.000	1	0.0	1.500	o	225	Pipe/Conduit	
F9.005	10.723	0.487	22.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F9.006	84.528	2.415	35.0	0.000	9	0.0	1.500	o	225	Pipe/Conduit	
F9.007	5.071	0.145	35.0	0.000	3	0.0	1.500	o	225	Pipe/Conduit	
F9.008	20.500	0.564	36.3	0.000	3	0.0	1.500	o	225	Pipe/Conduit	
F11.000	25.881	0.129	200.0	0.000	25	0.0	1.500	o	225	Pipe/Conduit	
F11.001	10.196	0.051	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F9.009	37.052	0.185	200.3	0.000	7	0.0	1.500	o	225	Pipe/Conduit	
F1.013	4.652	0.023	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F12.000	57.153	0.381	150.0	0.000	13	0.0	1.500	o	150	Pipe/Conduit	
F12.001	10.005	0.100	100.1	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F13.000	23.503	1.765	13.3	0.000	5	0.0	1.500	o	150	Pipe/Conduit	
F13.001	44.209	0.737	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F12.002	10.098	0.252	40.1	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F12.003	71.965	2.399	30.0	0.000	3	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F9.002	76.573	0.000	0.0	30	0.0	15	0.74	2.45	97.5	0.8
F10.000	76.218	0.000	0.0	12	0.0	10	0.65	2.19	38.8	0.3
F9.003	72.997	0.000	0.0	42	0.0	18	0.82	2.45	97.5	1.2
F9.004	72.734	0.000	0.0	43	0.0	18	0.82	2.45	97.6	1.2
F9.005	72.066	0.000	0.0	43	0.0	18	0.82	2.45	97.5	1.2
F9.006	71.579	0.000	0.0	52	0.0	22	0.75	1.94	77.3	1.5
F9.007	69.164	0.000	0.0	55	0.0	22	0.76	1.94	77.3	1.5
F9.008	69.019	0.000	0.0	58	0.0	23	0.76	1.91	75.8	1.6
F11.000	68.635	0.000	0.0	25	0.0	23	0.32	0.81	32.2	0.7
F11.001	68.506	0.000	0.0	25	0.0	23	0.32	0.81	32.2	0.7
F9.009	68.455	0.000	0.0	90	0.0	43	0.48	0.81	32.2	2.5
F1.013	68.270	0.000	0.0	267	0.0	74	0.66	0.81	32.2	7.5
F12.000	78.733	0.000	0.0	13	0.0	18	0.31	0.71	12.6	0.4
F12.001	78.352	0.000	0.0	15	0.0	17	0.37	0.88	15.5	0.4
F13.000	80.754	0.000	0.0	5	0.0	7	0.51	2.41	42.6	0.1
F13.001	78.989	0.000	0.0	5	0.0	9	0.31	1.13	20.0	0.1
F12.002	78.252	0.000	0.0	20	0.0	16	0.56	1.39	24.5	0.6
F12.003	77.925	0.000	0.0	23	0.0	14	0.61	2.10	83.5	0.6

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F12.004	71.965	1.439	50.0	0.000	5	0.0	1.500	o	225	Pipe/Conduit	
F12.005	5.652	0.094	60.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F12.006	6.070	0.101	60.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F12.007	37.740	1.000	37.7	0.000	3	0.0	1.500	o	225	Pipe/Conduit	
F14.000	76.799	3.072	25.0	0.000	13	0.0	1.500	o	150	Pipe/Conduit	
F14.001	7.464	0.075	99.5	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F14.002	16.369	0.164	99.8	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F12.008	15.803	0.718	22.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F15.000	22.420	0.112	200.2	0.000	0	0.6	1.500	o	225	Pipe/Conduit	
F15.001	4.769	0.024	198.7	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F12.009	44.596	0.223	200.0	0.000	7	0.0	1.500	o	225	Pipe/Conduit	
F1.014	84.255	3.830	22.0	0.000	1	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F12.004	75.526	0.000	0.0	28	0.0	18	0.54	1.63	64.6	0.8
F12.005	74.087	0.000	0.0	28	0.0	18	0.51	1.48	58.9	0.8
F12.006	73.993	0.000	0.0	28	0.0	18	0.51	1.48	58.9	0.8
F12.007	73.892	0.000	0.0	31	0.0	17	0.62	1.87	74.4	0.9
F14.000	76.540	0.000	0.0	13	0.0	12	0.57	1.76	31.0	0.4
F14.001	73.468	0.000	0.0	13	0.0	16	0.35	0.88	15.5	0.4
F14.002	73.393	0.000	0.0	13	0.0	16	0.36	0.88	15.5	0.4
F12.008	72.892	0.000	0.0	44	0.0	18	0.83	2.45	97.5	1.2
F15.000	71.800	0.000	0.6	0	0.0	22	0.31	0.81	32.2	0.6
F15.001	71.688	0.000	0.6	0	0.0	22	0.31	0.81	32.3	0.6
F12.009	71.664	0.000	0.6	51	0.0	38	0.45	0.81	32.2	2.0
F1.014	68.246	0.000	0.6	319	0.0	48	1.56	2.45	97.5	9.6

Area Summary for Foul - Main

Pipe Number	Gross Area (ha)	Pipe Total (ha)
1.000	0.000	0.000
1.001	0.000	0.000
1.002	0.000	0.000
1.003	0.000	0.000
2.000	0.000	0.000
2.001	0.000	0.000
2.002	0.000	0.000
1.004	0.000	0.000
3.000	0.000	0.000
3.001	0.000	0.000
1.005	0.000	0.000
1.006	0.000	0.000
4.000	0.000	0.000
5.000	0.000	0.000
4.001	0.000	0.000
6.000	0.000	0.000
4.002	0.000	0.000
4.003	0.000	0.000
4.004	0.000	0.000
1.007	0.000	0.000
1.008	0.000	0.000
1.009	0.000	0.000
7.000	0.000	0.000
1.010	0.000	0.000
1.011	0.000	0.000
8.000	0.000	0.000
1.012	0.000	0.000
9.000	0.000	0.000
9.001	0.000	0.000
9.002	0.000	0.000
10.000	0.000	0.000
9.003	0.000	0.000
9.004	0.000	0.000
9.005	0.000	0.000
9.006	0.000	0.000
9.007	0.000	0.000
9.008	0.000	0.000
11.000	0.000	0.000
11.001	0.000	0.000
9.009	0.000	0.000
1.013	0.000	0.000
12.000	0.000	0.000
12.001	0.000	0.000
13.000	0.000	0.000
13.001	0.000	0.000
12.002	0.000	0.000
12.003	0.000	0.000
12.004	0.000	0.000
12.005	0.000	0.000
12.006	0.000	0.000
12.007	0.000	0.000
14.000	0.000	0.000
14.001	0.000	0.000
14.002	0.000	0.000
12.008	0.000	0.000
15.000	0.000	0.000
15.001	0.000	0.000
12.009	0.000	0.000
1.014	0.000	0.000
	Total	Total

Area Summary for Foul - Main

Pipe Number	Gross Area (ha)	Pipe Total (ha)
	0.000	0.000

Free Flowing Outfall Details for Foul - Main

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.014	F60	67.398	64.416	0.000	0	0

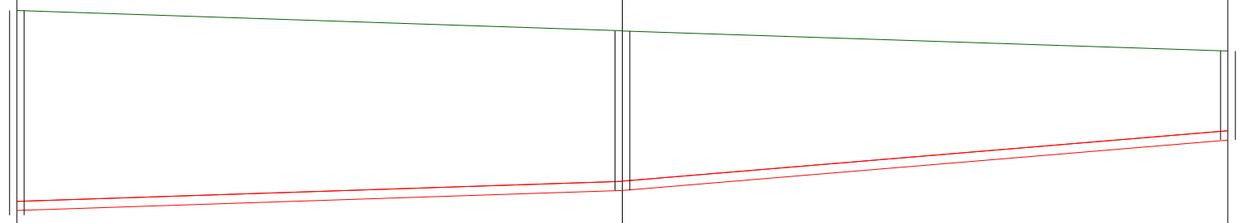
Simulation Criteria for Foul - Main

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

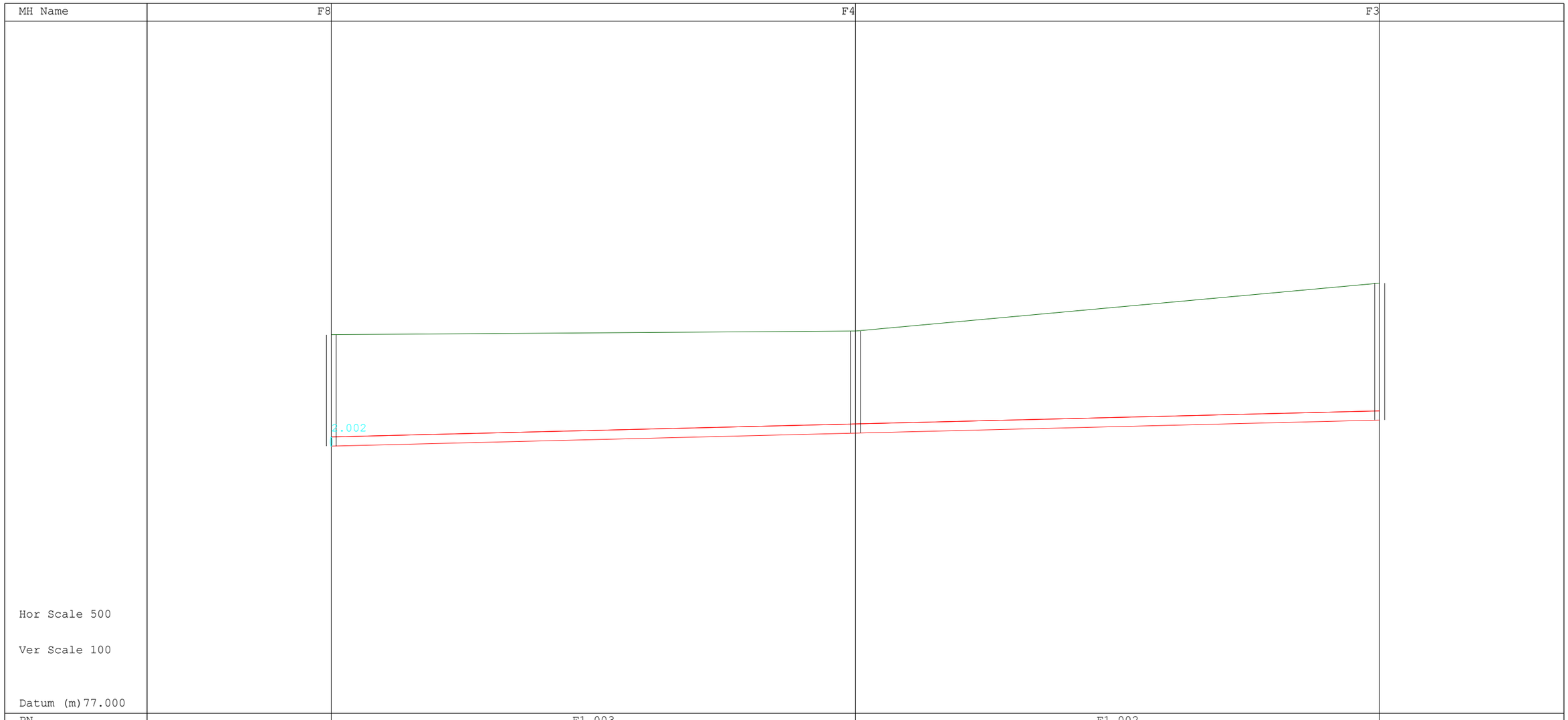
Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

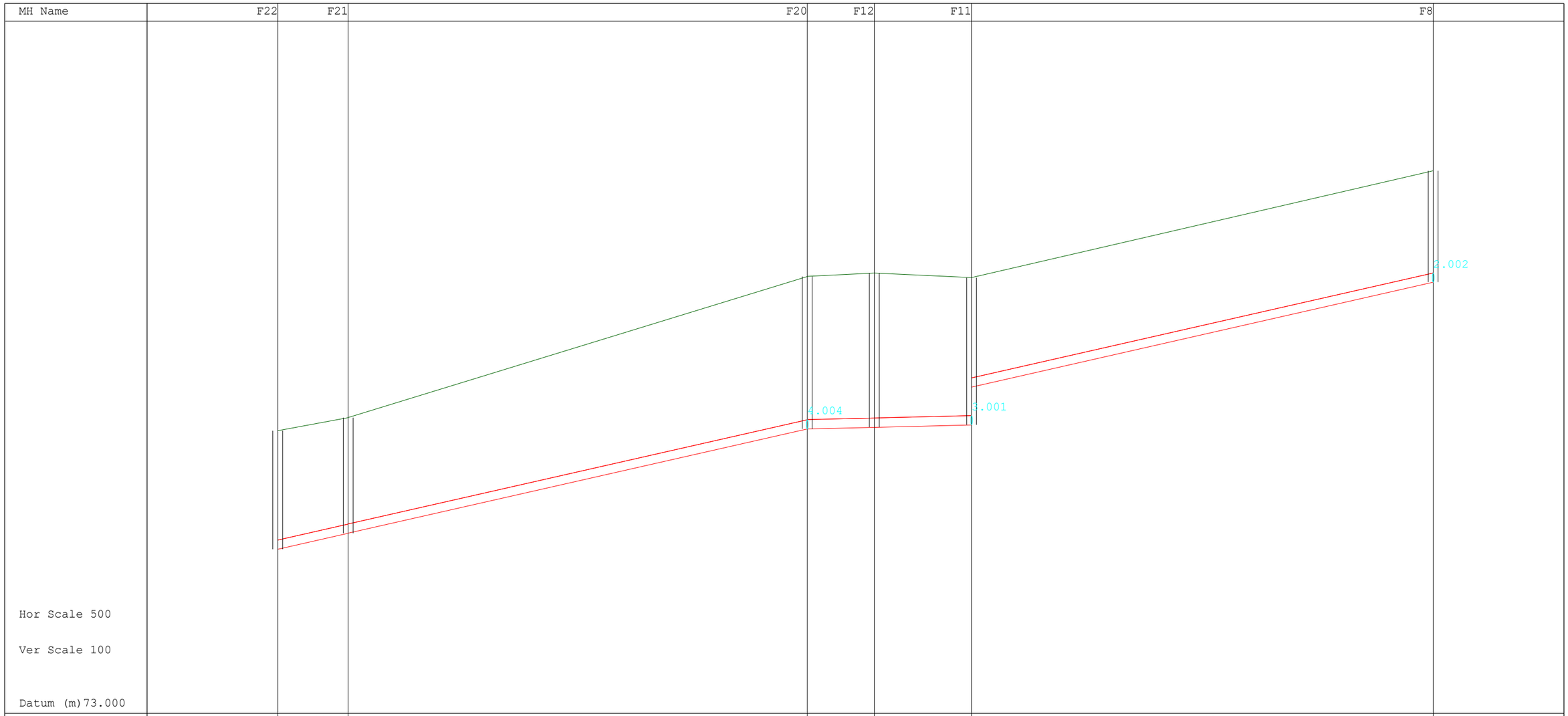
Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.250		



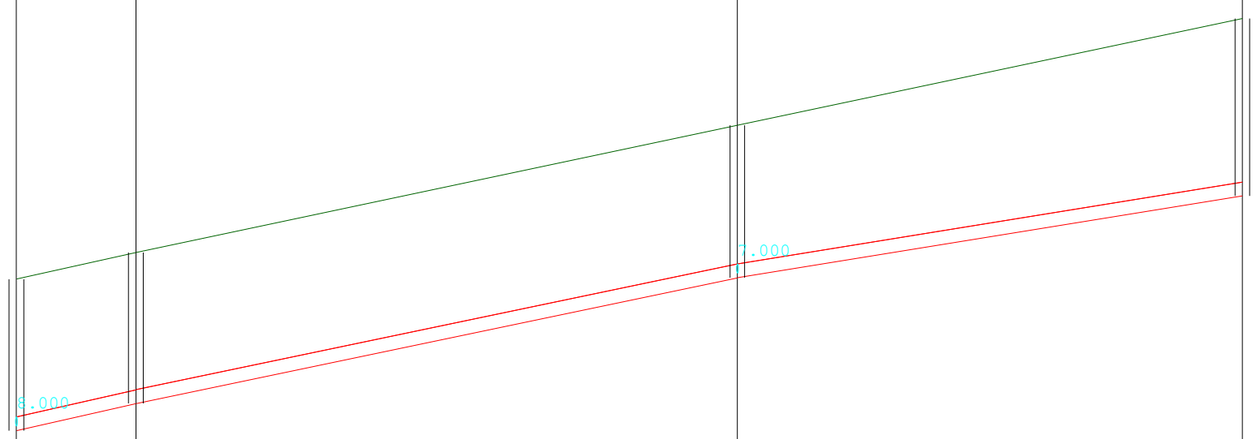
MH Name	F3	F2	F1	
Hor Scale 500 Ver Scale 100 Datum (m) 77.000				
PN		F1.001	F1.000	
Dia (mm)		150	150	
Slope (1:X)		150.0	60.0	
Cover Level (m)	87.488	87.156	86.827	
Invert Level (m)	84.225	84.554	84.554 85.377	
Length (m)		49.364	49.364	



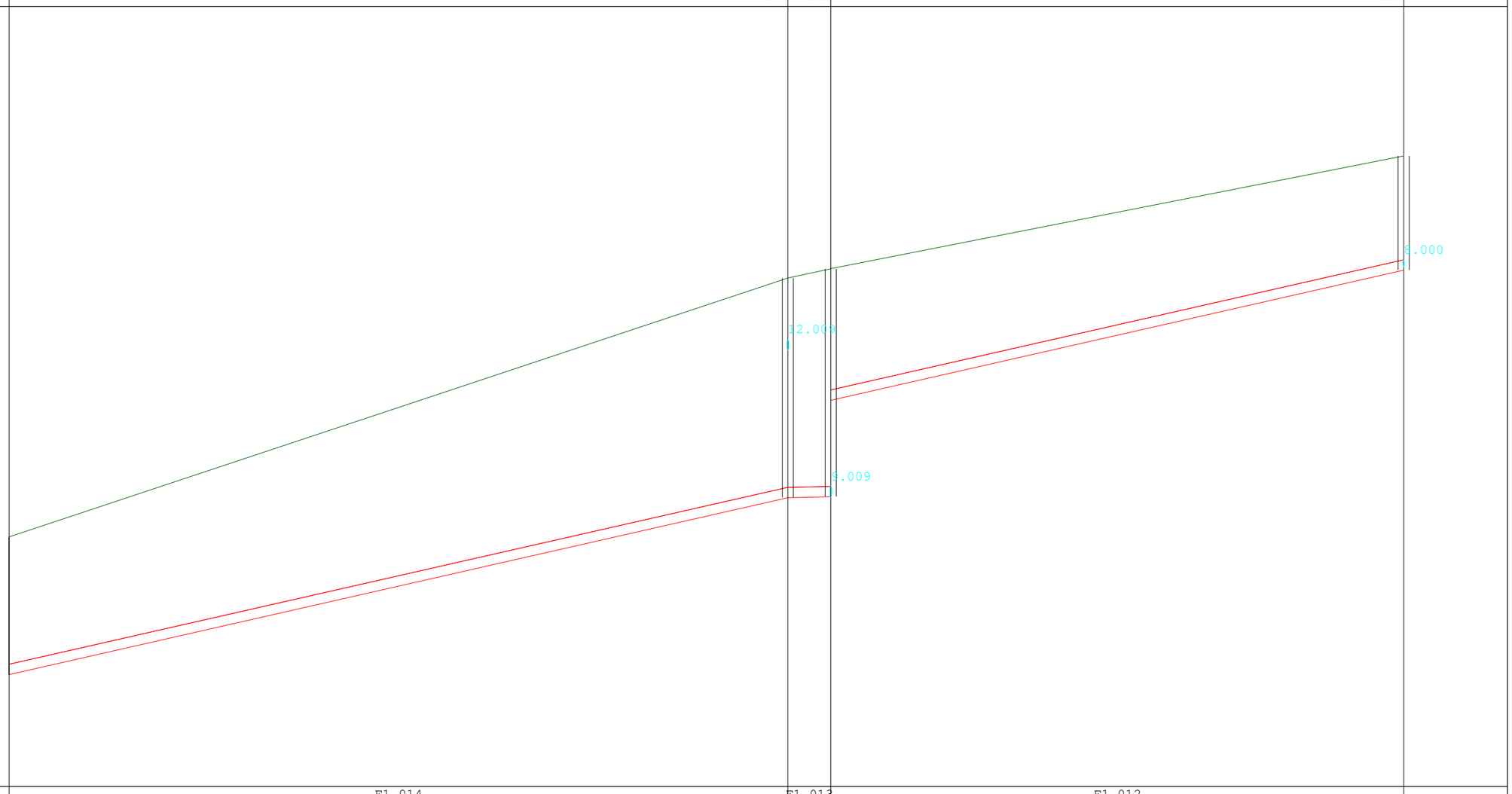
PN		F1.003	F1.002	
Dia (mm)		225	225	
Slope (1:X)		200.0	200.0	
Cover Level (m)	86.228	86.319	87.488	
Invert Level (m)	83.511	83.830	83.830 84.150	
Length (m)		63.908	63.908	



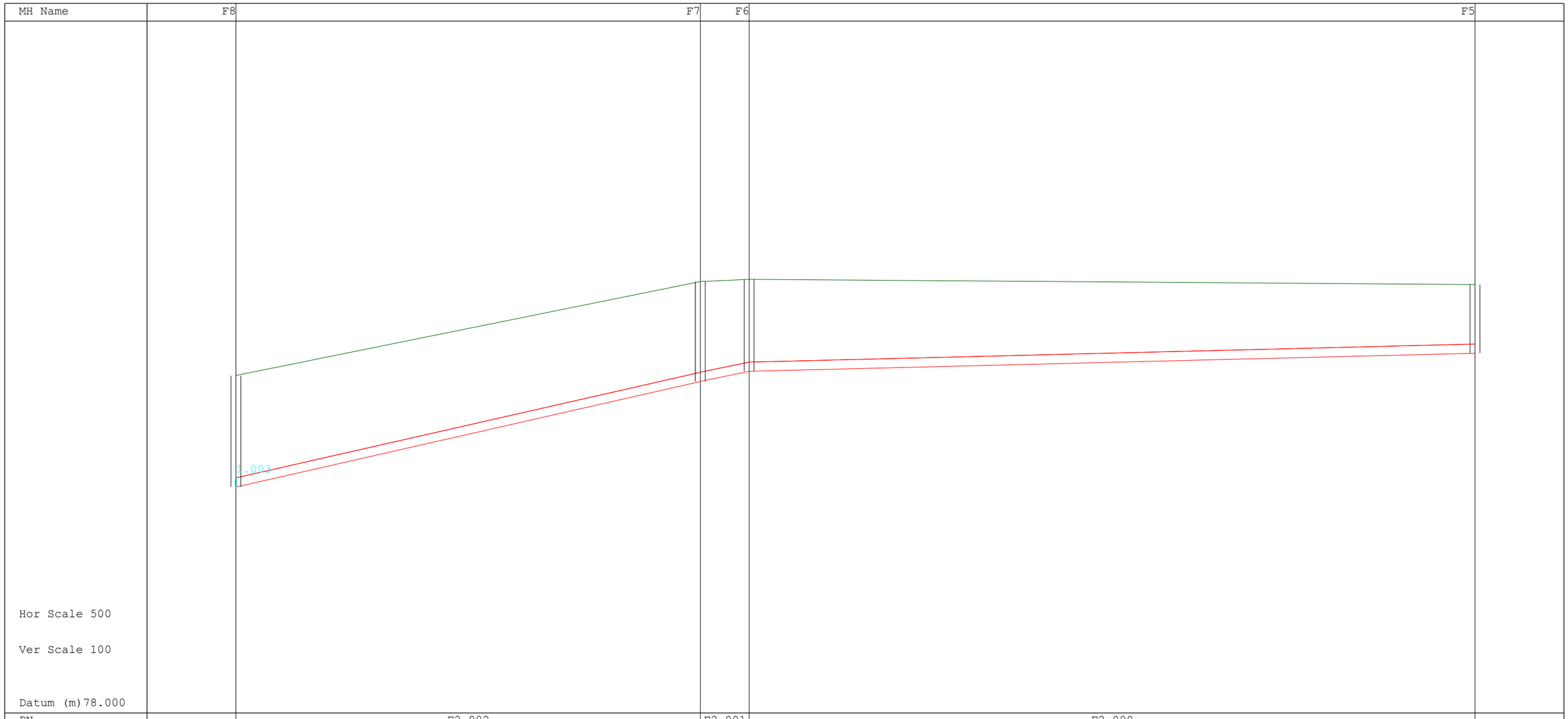
PN		F1.008	F1.007	F1.006	F1.005	F1.004	
Dia (mm)		225	225	225	225	225	
Slope (1:X)		22.0	22.0	195.7	200.0	22.0	
Cover Level (m)	79.891	80.210	83.651	83.734	83.622	86.228	
Invert Level (m)		76.997	77.387	77.387	79.931	79.931	79.973	79.973	80.032	80.952	83.510	
Length (m)		8.583	55.975	8.172	11.859	56.276	



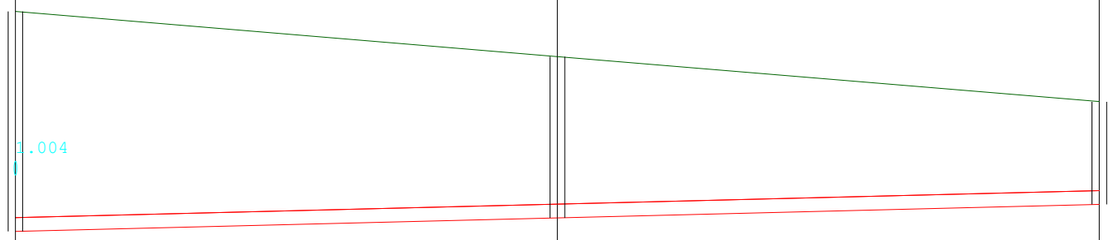
MH Name		F27	F25	F24	F22	
Hor Scale 500 Ver Scale 100 Datum (m) 68.000						
PN			F1.011	F1.010	F1.009	
Dia (mm)			225	225	225	
Slope (1:X)			22.0	23.9	30.9	
Cover Level (m)		75.641	76.076	78.151	79.891	
Invert Level (m)			73.170 73.613	73.613 75.663	75.663 76.997	
Length (m)			9.744	49.028	41.169	



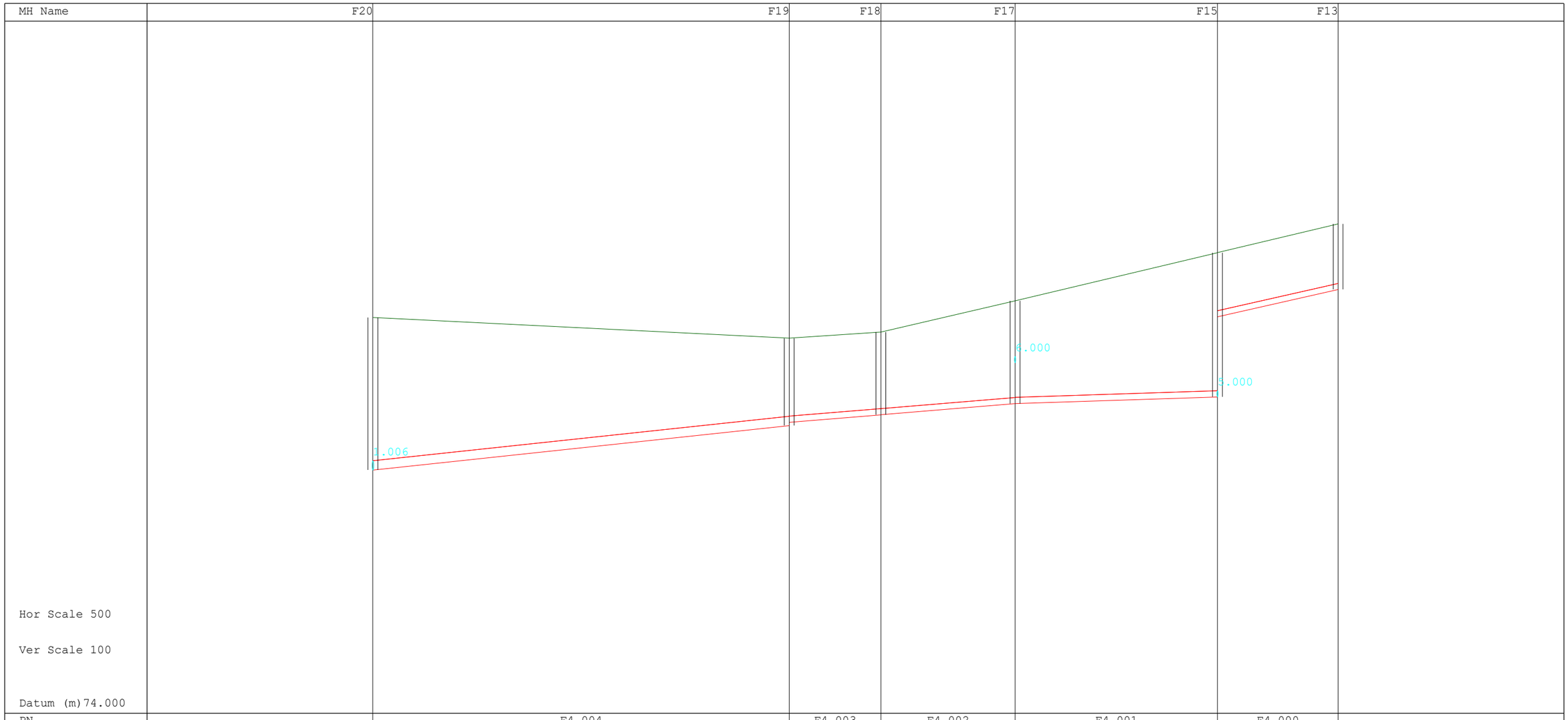
PN		F1.014	F1.013	F1.012	
Dia (mm)		225	225	225	
Slope (1:X)		22.0	200.0	22.0	
Cover Level (m)	67.398	73.000	73.200	75.641	
Invert Level (m)	64.416	68.246	68.246 68.270	70.352 73.170	
Length (m)		84.255	4.652	61.992	



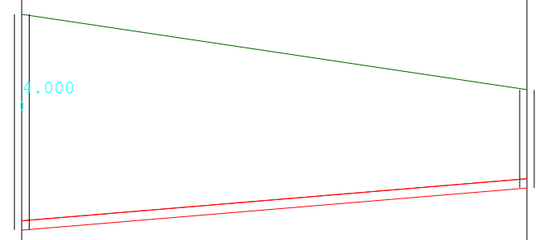
PN		F2.002	F2.001	F2.000	
Dia (mm)		225	225	225	
Slope (1:X)		22.0	23.9	200.0	
Cover Level (m)	86.228	88.521	88.579	88.451	
Invert Level (m)	83.510	86.085	86.085 86.334	86.334 86.776	
Length (m)		56.620	5.953	88.490	

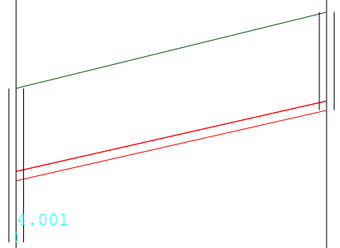


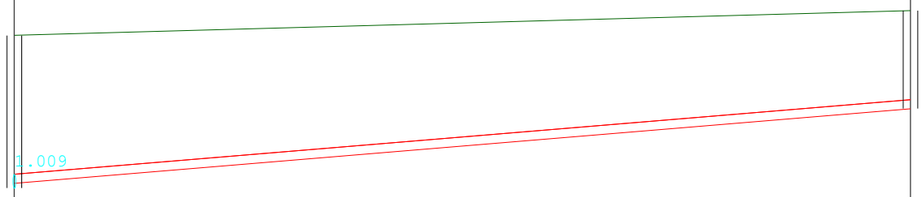
MH Name	F11	F10	F9	
Hor Scale 500 Ver Scale 100 Datum (m) 73.000				
PN		F3.001	F3.000	
Dia (mm)		225	225	
Slope (1:X)		200.0	200.0	
Cover Level (m)	83.622	82.885	82.149	
Invert Level (m)	80.032	80.253	80.253	80.474
Length (m)		44.178	44.178	

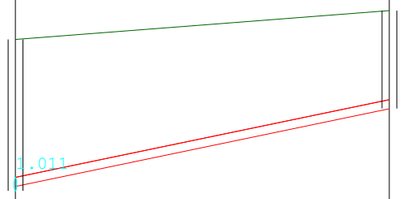


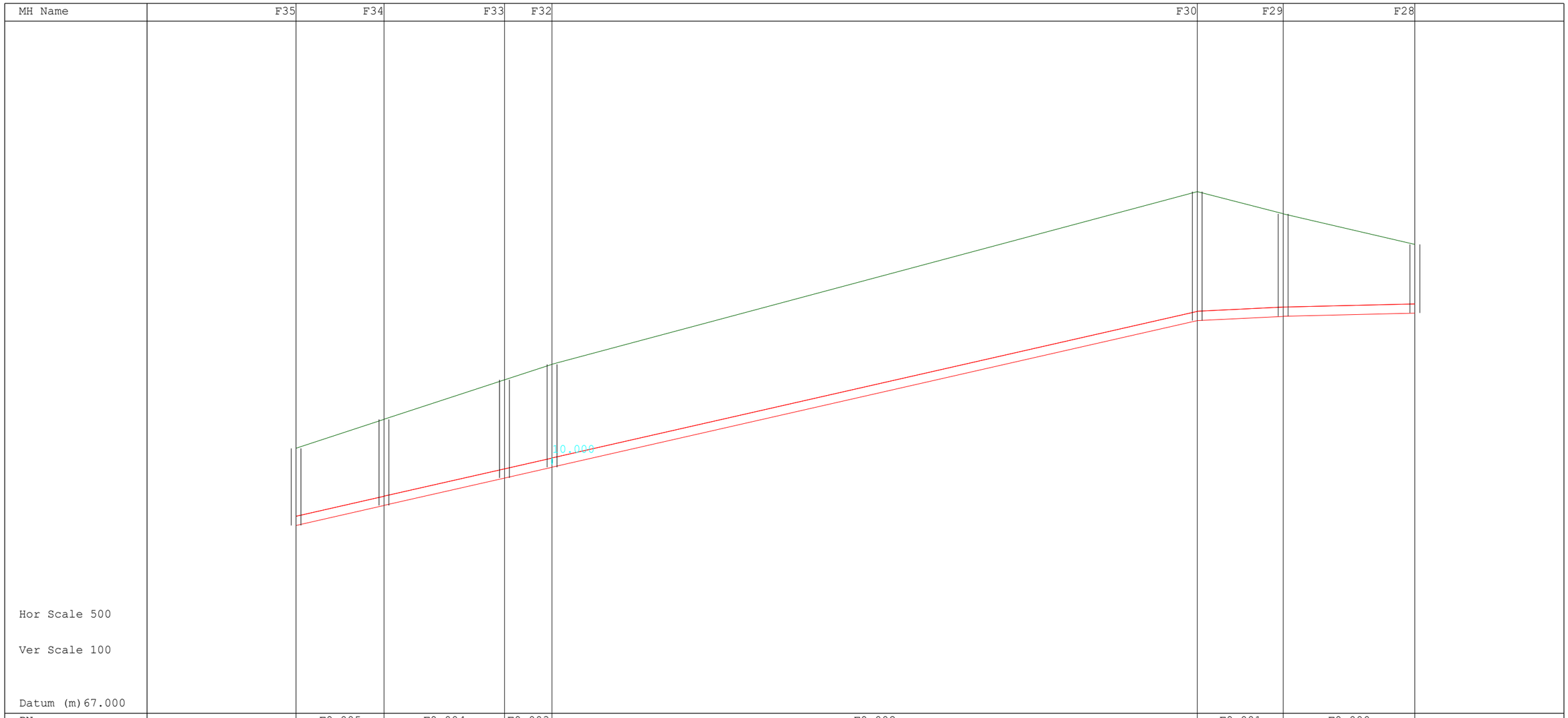
PN	F4.004	F4.003	F4.002	F4.001	F4.000
Dia (mm)	225	150	150	150	150
Slope (1:X)	46.8	60.0	60.0	150.0	22.0
Cover Level (m)	83.651 / 83.143	83.294	84.056	85.230	85.931
Invert Level (m)	79.931 / 81.015	81.090 / 81.276	81.276 / 81.549	81.549 / 81.714	83.663 / 84.331
Length (m)	50.761	11.175	16.364	24.671	14.707

MH Name	F15	F14	
			
Hor Scale 500 Ver Scale 100 Datum (m) 75.000			
PN		F5.000	
Dia (mm)		150	
Slope (1:X)		60.0	
Cover Level (m)	85.230	84.000	
Invert Level (m)	81.714	82.400	
Length (m)		41.183	

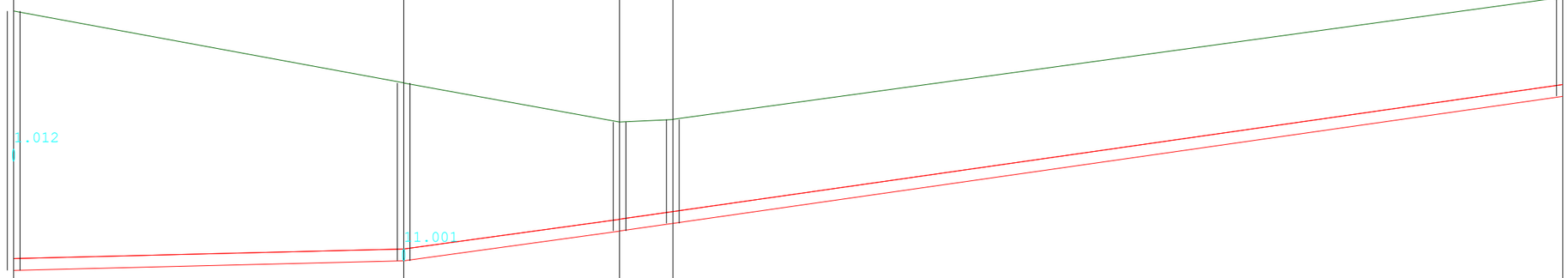
MH Name	F17	F16	
			
Hor Scale 500 Ver Scale 100 Datum (m) 75.000			
PN		F6.000	
Dia (mm)		150	
Slope (1:X)		22.0	
Cover Level (m)	84.056	85.300	
Invert Level (m)	82.549	83.700	
Length (m)		25.314	

MH Name	F24	F23	
Hor Scale 500 Ver Scale 100 Datum (m) 69.000			
PN		F7.000	
Dia (mm)		150	
Slope (1:X)		60.0	
Cover Level (m)	78.151	78.556	
Invert Level (m)	75.738	76.956	
Length (m)		73.057	

MH Name	F27	F26	
			
Hor Scale 500 Ver Scale 100 Datum (m) 66.000			
PN		F8.000	
Dia (mm)		150	
Slope (1:X)		24.1	
Cover Level (m)	75.641	76.111	
Invert Level (m)	73.245	74.511	
Length (m)		30.479	



PN		F9.005	F9.004	F9.003	F9.002	F9.001	F9.000	
Dia (mm)		225	225	225	225	225	225	
Slope (1:X)		22.0	22.0	22.0	22.0	99.7	200.8	
Cover Level (m)	73.461	74.167	75.130	75.509	79.720	79.179	78.433	
Invert Level (m)		71.579 / 72.066	72.066 / 72.734	72.734 / 72.997	72.997 / 76.573	76.573 / 76.678	76.678 / 76.758	
Length (m)		10.723	14.693	5.792	78.671	10.466	16.065	

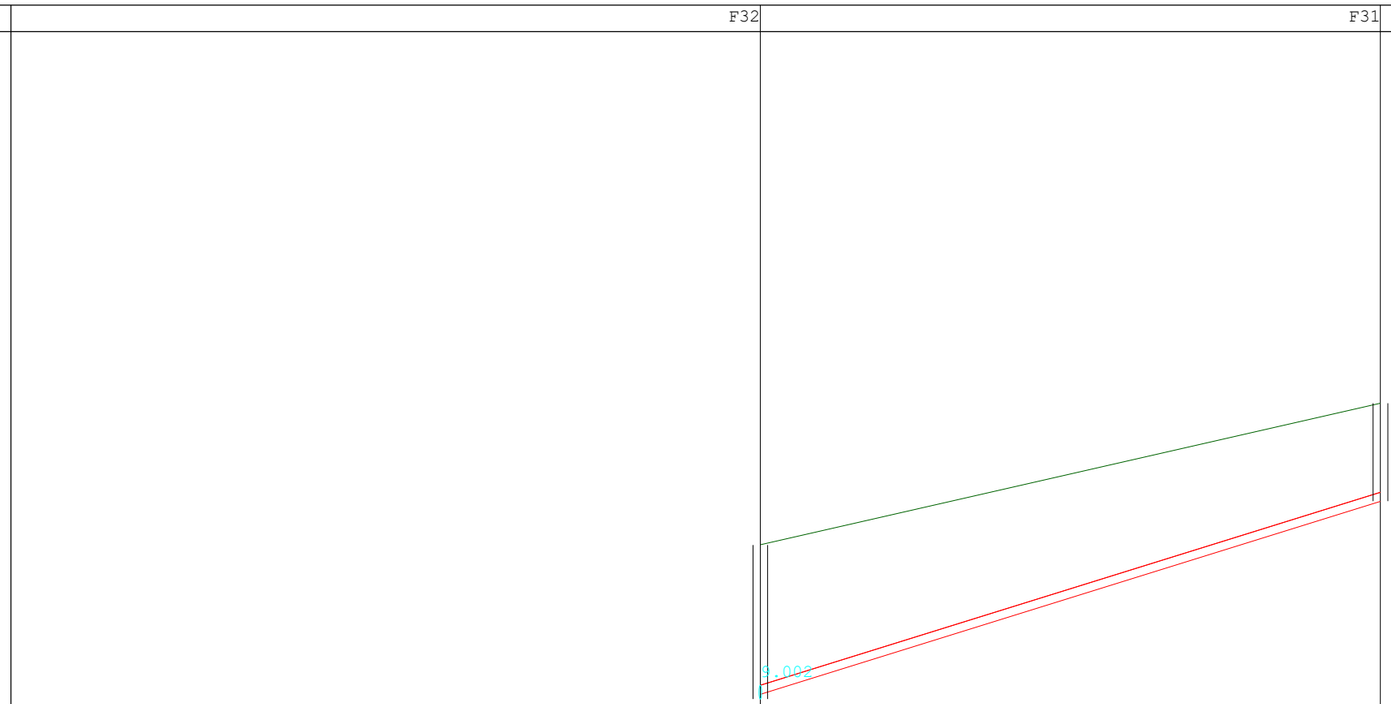


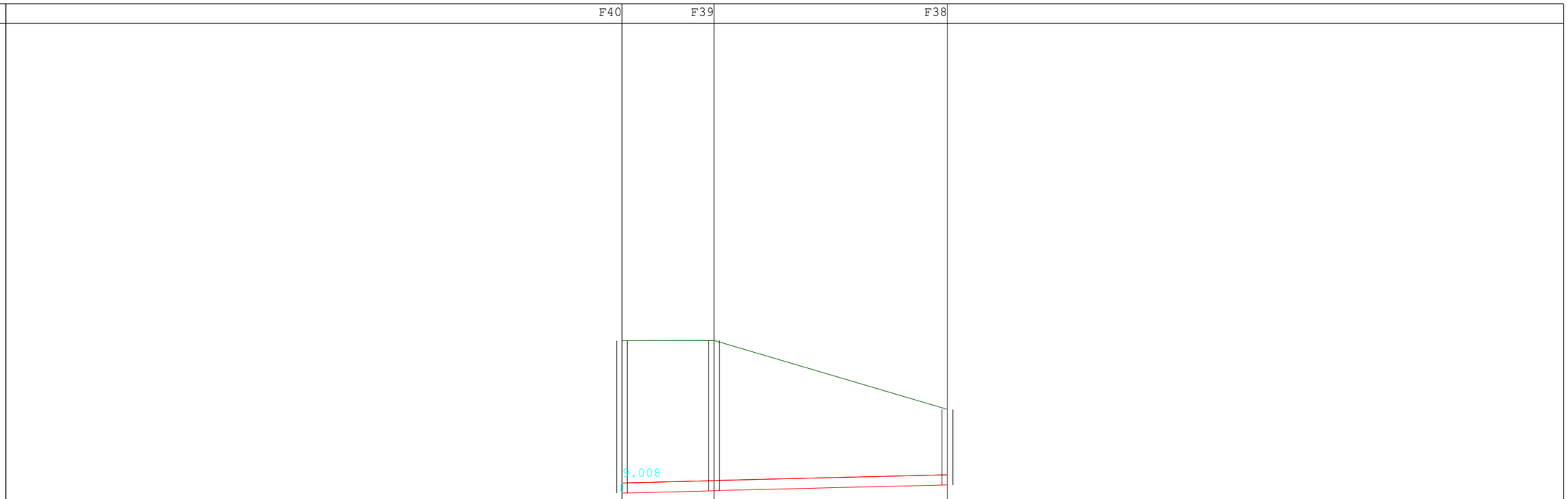
Hor Scale 500

Ver Scale 100

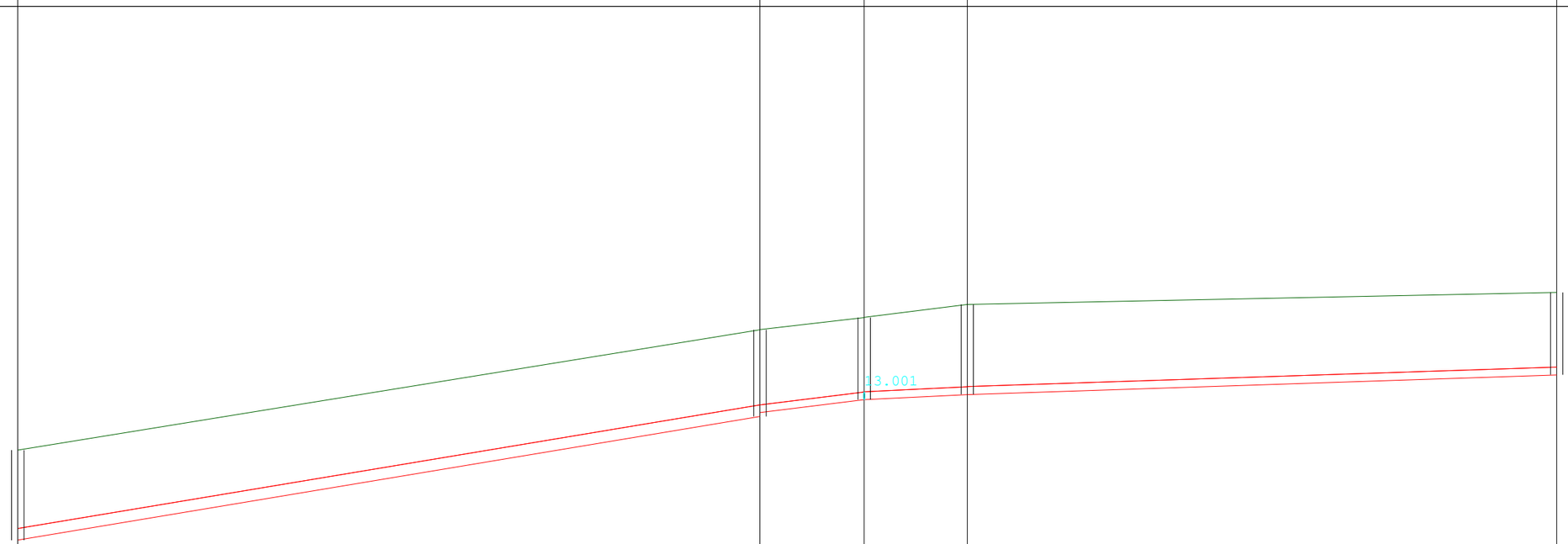
Datum (m) 62.000

MH Name	F41	F40	F37	F36	F35	
PN		F9.009	F9.008	F9.007	F9.006	
Dia (mm)		225	225	225	225	
Slope (1:X)		200.3	36.3	35.0	35.0	
Cover Level (m)	73.200	71.833	71.092	71.139	73.461	
Invert Level (m)	68.270	68.455	68.455 69.019	69.019 69.164	69.164 71.579	
Length (m)		37.052	20.500	5.071	84.528	

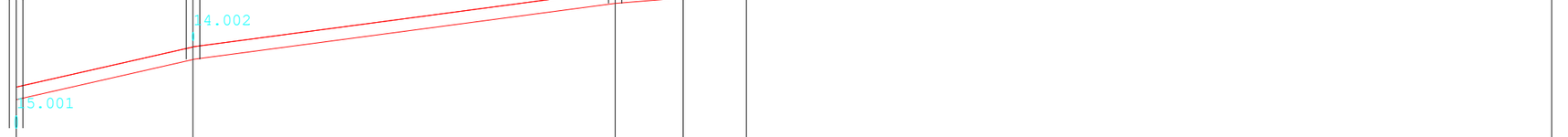
MH Name	F32	F31	
Hor Scale 500 Ver Scale 100 Datum (m) 67.000			
PN		F10.000	
Dia (mm)		150	
Slope (1:X)		16.1	
Cover Level (m)	75.509	77.818	
Invert Level (m)	73.072	76.218	
Length (m)		50.552	



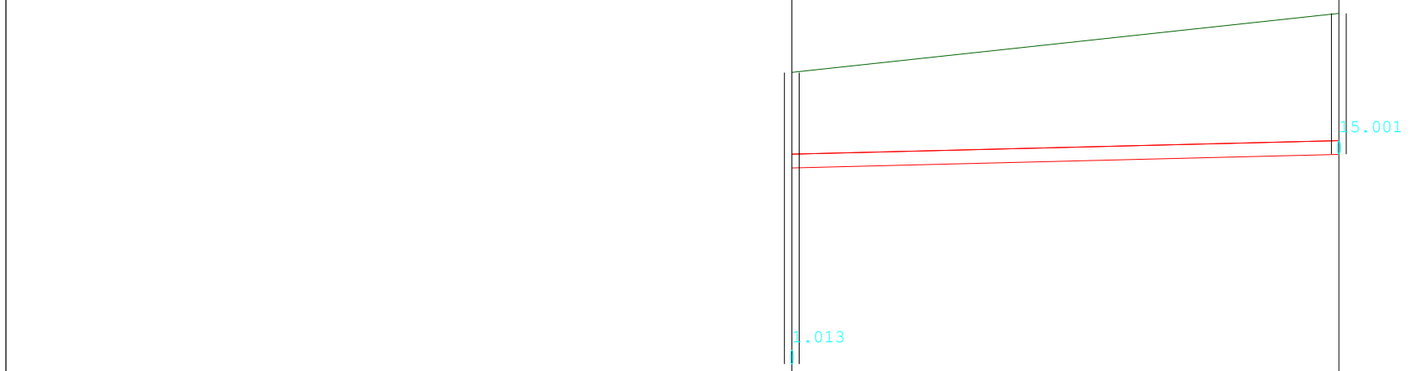
MH Name	F40	F39	F38	
Hor Scale 500 Ver Scale 100 Datum (m) 62.000				
PN		F11.001	F11.000	
Dia (mm)		225	225	
Slope (1:X)		200.0	200.0	
Cover Level (m)	71.833	71.840	70.310	
Invert Level (m)	68.455	68.506 68.506	68.635	
Length (m)		10.196	25.881	



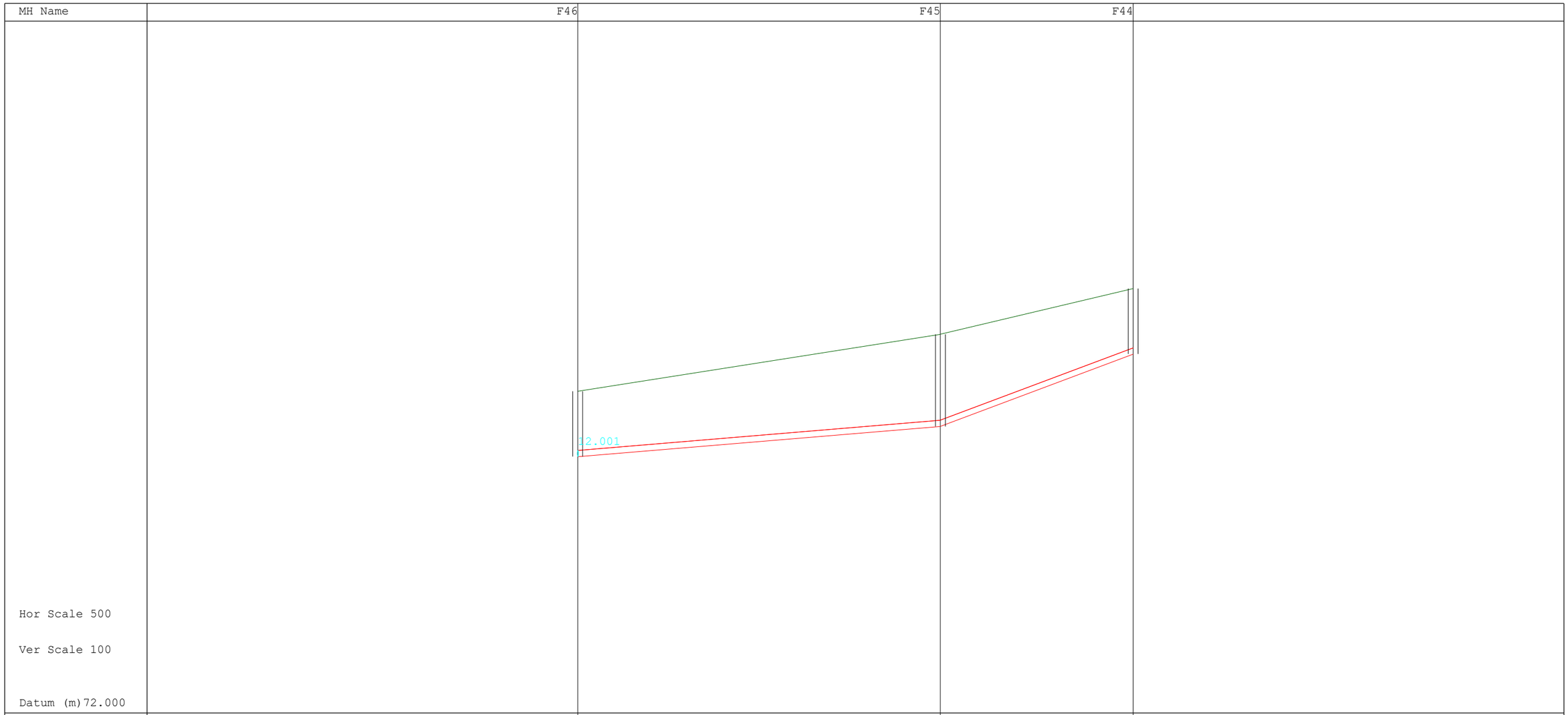
PN		F12.003	F12.002	F12.001	F12.000	
Dia (mm)		225	150	150	150	
Slope (1:X)		30.0	40.1	100.1	150.0	
Cover Level (m)	77.276	79.609	79.846	80.099	80.333	
Invert Level (m)	75.526	77.925	78.000	78.252 78.252	78.352 78.352	78.733
Length (m)		71.965	10.098	10.005	57.153	



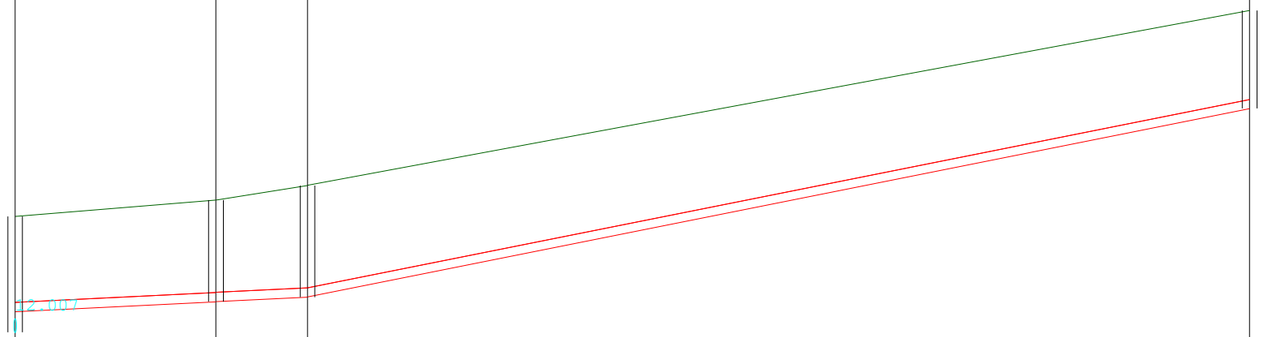
MH Name		F58	F55	F51	F50	F49	F48	
Hor Scale 500 Ver Scale 100 Datum (m) 66.000								
PN		F12.008	F12.007	F12.006	F12.005	F12.004		
Dia (mm)		225	225	225	225	225		
Slope (1:X)		22.0	37.7	60.1	60.1	50.0		
Cover Level (m)	73.962	74.782	75.694	75.865	76.026	77.276		
Invert Level (m)		72.174 / 72.892	72.892 / 73.892	73.892 / 73.993	73.993 / 74.087	74.087 / 75.526		
Length (m)		15.803	37.740	6.070	5.652	71.965		



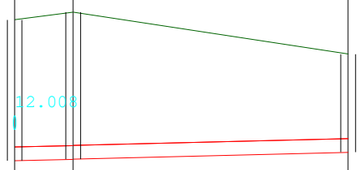
MH Name	F59	F58	
Hor Scale 500 Ver Scale 100 Datum (m) 63.000			
PN		F12.009	
Dia (mm)		225	
Slope (1:X)		200.0	
Cover Level (m)	73.000	73.962	
Invert Level (m)	71.441	71.664	
Length (m)		44.596	



PN		F13.001	F13.000	
Dia (mm)		150	150	
Slope (1:X)		60.0	13.3	
Cover Level (m)	79.846	81.238	82.354	
Invert Level (m)	78.252	78.989	78.989 80.754	
Length (m)		44.209	23.503	



MH Name		F55	F54	F53	F52	
Hor Scale 500 Ver Scale 100 Datum (m) 67.000						
PN			F14.002	F14.001	F14.000	
Dia (mm)			150	150	150	
Slope (1:X)			99.8	99.5	25.0	
Cover Level (m)		74.782	75.049	75.289	78.140	
Invert Level (m)		73.229	73.393 / 73.393	73.468 / 73.468	76.540	
Length (m)			16.369	7.464	76.799	

MH Name	F58	F57	F56	
				
Hor Scale 500 Ver Scale 100 Datum (m) 64.000				
PN		F15.001	F15.000	
Dia (mm)		225	225	
Slope (1:X)		198.7	200.2	
Cover Level (m)	73.962	74.085	73.400	
Invert Level (m)		71.664 71.688	71.688 71.800	
Length (m)		4.769	22.420	

Appendix 7:

GROUND INVESTIGATION INFILTRATION TEST REPORT

Our Ref: GH/Rp/P21016 + attachments (*.pdf)

16th February, 2021

JB Barry and Partners.
3 Eastgate Road,
Eastgate Business park,
Littleisland,
Co. Cork
T45 KH74.

Re: Strategic housing development, Kilbarry, Co. Cork, Ground Investigation, Infiltration test report(s).

Introduction

In January 2021, Priority Geotechnical (PGL) were requested by JB Barry, Consulting Engineers, to undertake soakaway tests at the site of a proposed strategic housing development in Kilbarry, Co. Cork. Previous works were undertaken by PGL report ref: P19129, April, 2020 (25Nr trial pits and 2Nr. boreholes).

Fieldworks

Seven (7) number percolation/ soakaway tests were carried out in general accordance with BRE Digest 365, Soakaway Design (2003/ 2007). The data from the testing is accompanying the relevant exploratory records attached, herein.

The fieldworks were undertaken between the 29th January and 01st February 2021 under the supervision of PGL, Engineering Geologist(s) in accordance with Eurocode 7-Geotechnical Design Part 2, ground investigation and testing (BS EN 1997-2: 2007) and the relevant British Standards (BS 5930 (2015) Code of Practice for Site Investigation and BS 1377, Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests Parts 1 to 9). Details of the plant and equipment used are detailed on the relevant exploratory records, accompanying this report.

The fieldworks were summarised as follows:

Locations	Depth of excavation, m bgl	Date dd/mm/yyyy	Groundwater remarks	Stability remarks
TPIT01	2.3	01/02/2021	None encountered.	Moderate
TPIT02	3.0	29/01/2021	None encountered.	Moderate – good
TPIT03	1.4	29/01/2021	None encountered.	Good
TPIT04	3.0	29/01/2021	None encountered.	Poor
TPIT05	2.8	01/02/2021	None encountered.	Moderate
TPIT06	3.0	01/02/2021	Trickle 1.1m, slow ingress 2.8m	Moderate to poor
TPIT07	3.0	01/02/2021	Trickle 1.3m, slow ingress 2.1m	Poor

Location	Infiltration rate, *f* ms^{-1}		
	1	2	3
IT01	1.19E-4	1.45E-4	1.66E-4
IT02	1.05E-5	-	-
IT03	2.34E-4	1.95E-4	3.04E-4
IT04	1.18E-5	-	-
IT05	1.48E-4	1.47E-4	2.65E-4
IT06	2.24E-5	7.43E-6	-
IT07	1.38E-5	4.51E-5	-

Sampling

A total of eighteen (18) bulk disturbed samples (B) and a single small disturbed sample (D) were recovered from the exploratory holes in accordance with Geotechnical Investigation and Sampling – Sampling Methods and Groundwater Measurements (EN ISO 22475-1:2006).

Location	Sampling, m bgl		Sample type
	from	to	
TPIT01	0.5	1.0	B
TPIT01	1.5	2.3	B
TPIT02	0.5	1.0	B
TPIT02	1.5	2.0	B
TPIT02	2.5	3.0	B
TPIT03	0.5	1.4	B
TPIT04	0.5	1.0	B
TPIT04	1.5	2.0	B

Location	Sampling, m bgl		Sample type
	from	to	
TPIT04	2.5	3.0	B
TPIT05	0.5	1.0	B
TPIT05	1.5	2.0	B
TPIT05	2.5	3.0	B
TPIT06	0.5	1.0	B
TPIT06	1.5	2.0	B
TPIT06	1.5	2.0	D
TPIT06	2.5	3.0	B
TPIT07	0.5	1.0	B
TPIT07	1.5	2.0	B
TPIT07	2.5	3.0	B

Survey and Drawings

Upon completion of the fieldworks, the 'as built' exploration locations were surveyed using Trimble 5700/5800 GPS equipment to the Ordinance Survey Irish Transverse Mercator system of co-ordinates (ITM) and elevations to Malin Head datum. The exploratory locations were shown on the exploratory location plans attached, P21016_SI_01 and P21016_SI_02.

Location	ING		Ground Level (mOD, Malin)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
	Easting	Northing			
IT01	167224.878	75149.398	69.354	2.3	01/02/2021
IT02	167262.486	74975.819	75.995	3.0	29/01/2021
IT03	167304.091	75065.298	76.990	1.4	29/01/2021
IT04	167328.626	75140.645	78.337	3.0	29/01/2021
IT05	167408.519	75064.408	81.397	2.8	01/02/2021
IT06	167480.162	75116.491	87.428	3.0	01/02/2021
IT07	167495.824	75202.972	88.344	3.0	01/02/2021

Location	ITM		Ground Level (mOD, Malin)	Final Depth (m bgl)	Date Start (dd/mm/yyyy)
	Easting	Northing			
IT01	567182.275	575210.888	69.354	2.3	01/02/2021
IT02	567219.875	575037.347	75.995	3.0	29/01/2021
IT03	567261.471	575126.806	76.990	1.4	29/01/2021
IT04	567286.001	575202.137	78.337	3.0	29/01/2021
IT05	567365.877	575125.916	81.397	2.8	01/02/2021
IT06	567437.505	575177.987	87.428	3.0	01/02/2021
IT07	567453.164	575264.449	88.344	3.0	01/02/2021

Laboratory Testing

There was no requirement for laboratory testing.

Please note that all samples shall be retained for a period no longer than 28 days from the date of this report. Thereafter all remaining samples shall be appropriately disposed of unless a written instruction to the contrary is received by PGL prior to the date of this reporting and within the 28 day period outlined above. Laboratory testing will result in a reduction of sample quantity and in some cased the use of the full sample mass. Samples already tested may not be suitable or available for further testing.

Ground and Groundwater conditions

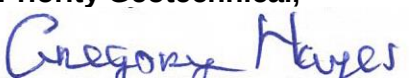
The full details of the ground conditions encountered are provided for on the exploratory records, attached. The records provide descriptions, in accordance with BS 5930 (2015) and Eurocode 7, Geotechnical Investigation and Testing, Identification and classification of soils, Part 1, Identification and description (EN ISO 14688-1: 2002),– Identification and Classification of Soil, Part 2: Classification Principles (EN ISO 14688-2:2004) and Identification and Classification of Rock, Part 1: Identification & Description (EN ISO 14689-1:2004) of the materials encountered, in situ testing and details of the samples taken, together with any observations made during the investigation.

Topsoil 300mm thick overlay purple- brown, sandy, gravelly SILT with high Cobble content with medium Boulder contents to depths up to 3.0m bgl. SILTSTONE/ SANDSTONE was encountered at TPIT03 1.4m bgl. Made ground was encountered at TPIT06 and TPIT07 1.1m to 1.2m thick,

Groundwater was recorded between 1.1m bgl and 2.8m bgl during the period of works. Groundwater conditions observed in the boreholes and pits are those appertaining to the period of the investigation. Groundwater levels may be subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc. The groundwater regime should be assessed from standpipe well installations, where available.

Should you have any queries in relation to the data collected, discussed and presented herein, please do not hesitate to contact our office.

Yours sincerely,
For **Priority Geotechnical,**



Greg Hayes BE MEngSc CEng MIEI
Geotechnical Specialist

No responsibility can be held by PGL for ground conditions between exploratory locations. The exploratory logs provide for ground profiles and configuration of strata relevant to the investigation depths achieved during the fieldworks. Caution shall be taken when extrapolating between such exploratory locations. No liability is accepted for ground conditions extraneous to the exploratory locations.

No account has been taken of potential subsidence or ground movement due to mineral extraction, mining works or karstification below or in proximity to the site, unless specifically addressed.

This report has been prepared for Employer and their Representative as outline, herein. The information should not be used without their prior written permission. PGL accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

All linear dimensions are in metres or millimetres

DESCRIPTIONS

**	Drillers Description
Friable	Easily crumbled

SAMPLES

U( )	Undisturbed 102mm diameter sample, ( ) denotes number of blows to drive sampler
U( )F, U( )P	F- not recovered, P-partially recovered
U38	Undisturbed 38mm diameter sample
P(F), (P)	Piston sample - disturbed
B	Bulk sample - disturbed
D	Jar Sample - disturbed
W	Water Sample
CBR	California Bearing Ratio mould sample
ES	Chemical Sample for Contamination Analysis
SPTLS	Standard Penetration Test S lump sample from split sampler

CORE RECOVERY AND ROCK QUALITY

TCR	Total Core Recovery (% of Core Run)
SCR	Solid Core Recovery (length of core having at least one full diameter as % of core run)
RQD	Rock Quality Designation (length of solid core greater than 100mm as % of core run)

Where there is insufficient space for the TCR, SCR and RQD, the results may be found in the remarks column

If	Fracture Spacing in mm (Minimum/Average/Maximum) NI - non intact, NR - no recovery
AZCL	Assumed Zone of Core Loss
NI	Non intact

GROUNDWATER

▽	Groundwater strike
▼	Groundwater level after standing period
Date/Water	Date of shift (day/month)/Depth to water at end of previous shift shown above the date and depth to water at beginning of shift given below the date

INSITU TESTING

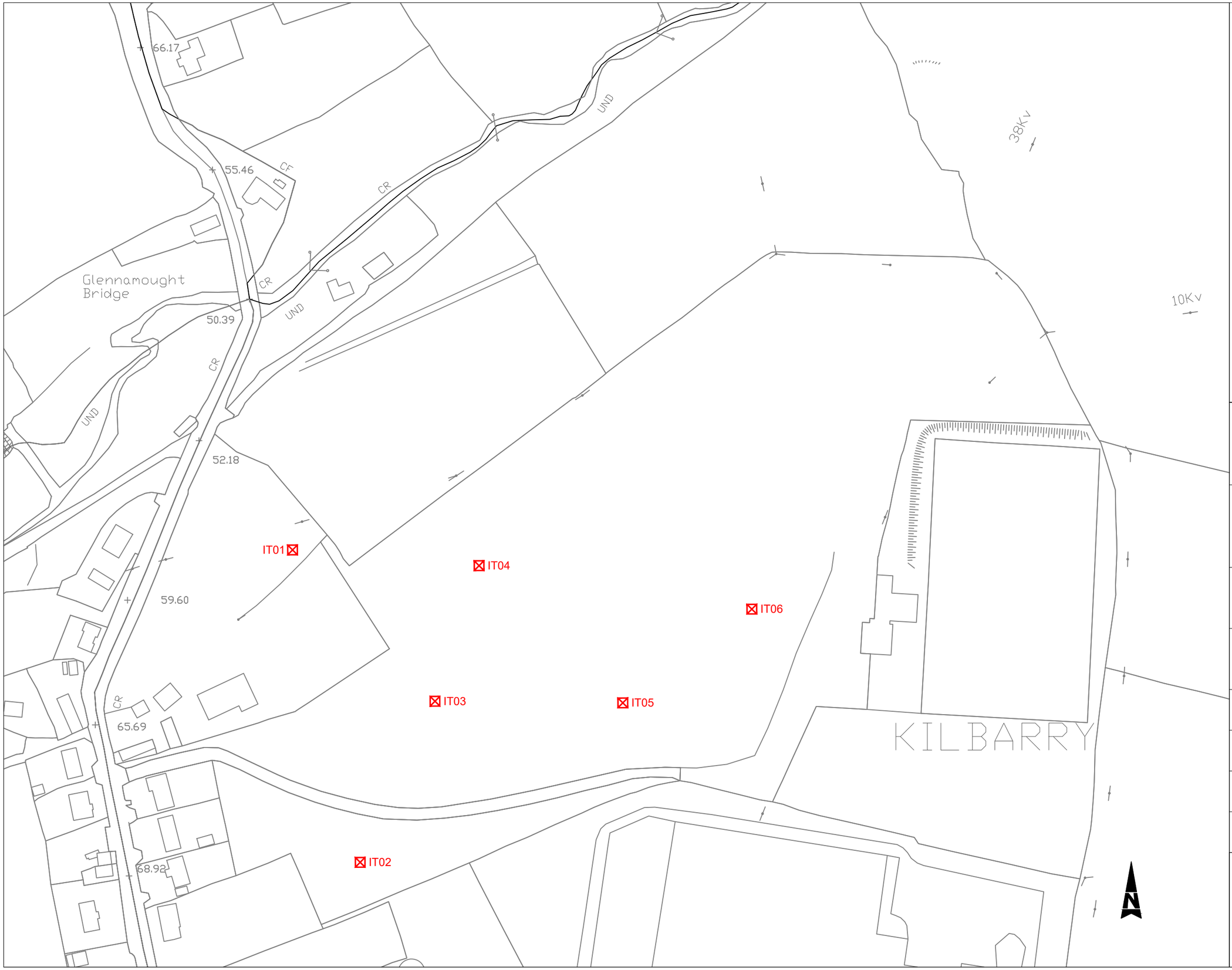
S	Standard Penetration Test - split barrel sampler
C	Standard Penetration Test - solid 60^o cone
SW	Self Weight Penetration
Ivp, HVp (R)	In Situ Vane Test, Hand Vane Test (R) demonstrates remoulded strength
K(F), (C), (R), (P)	Permeability Test
HP	Hand Penetrometer Test

MEASURED PROPERTIES

N	Standard Penetration Test - blows required to drive 300mm after seating drive
x/y	Denotes x blows for y mm within the Standard Penetration Test
x*/y	Denotes x blows for y mm within the seating drive
c_u	Undrained Shear Strength (kN/m^2)
CBR	California Bearing Ratio

ROTARY DRILLING SIZES

Index Letter	Nominal Diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113



KEY:

IT00 Denotes Infiltration Test location

JOB NAME:

KILBARRY LANDS, CORK

Sheet Title:

EXPLORATION LOCATION PLAN

JOB NUMBER:

P21016

DRAWING NUMBER:

P21016-SI-01

DRAWN BY:

Gary Curtin

DATE:

29/01/2021

SCALE:	APPROVED:
1:2000 ON A3	GH

REVISION:

D01

pgl priority geotechnical

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Trial Pit No
TPIT01
Sheet 1 of 1

Project Name: Kilbarry housing	**Project No.** P21016	**Co-ords:** 567182E - 575211N **Level:** 69.35m OD	**Date** 01/02/2021
Location: Kilbarry		**Dimensions (m):** 2.60 × 0.70 **Depth:** 2.30m BGL	**Scale** 1:25
Client: JB Barry & Partners			**Logged** KH.

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL).
				0.30	69.05		
	0.50 - 1.00	B					Purple, brown, loose, sandy, very gravelly SILT with high cobble content with medium boulder content. Sand is fine to coarse. Gravel is fine to coarse, very angular to sub-angular. Cobbles are up to 200mm dia, very angular to sub-angular. Boulders are up to 450mm dia, very angular to sub-angular.
	1.50 - 2.30	B					
				2.30	67.05		End of Pit at 2.300m

Stability: Moderate.
Plant: 14 Tonne Track Machine.
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.30m bgl. Required depth reached. Infiltration test carried out at 1.35m (first fill), 1.01m bgl (second fill) and 1.15m bgl (third fill).

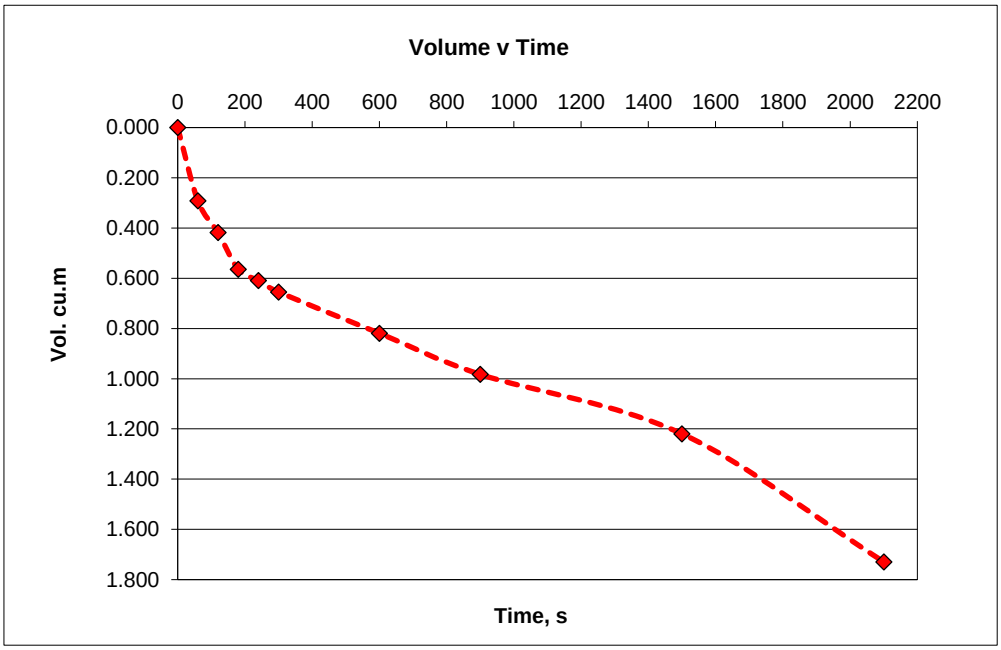
P21016 **Kilbarry**

Test 1 **IT01** **01/02/2021**

				d, m	**2.30**
l, m	**2.60**	b, m	**0.70**	d_eff, m	**0.95**
l_base, m	**2.60**			GW, m bgl none	
l_eff, m	**2.60**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
Start 14:17	0	1.35	0	0.95	0.00	0.000
	1	1.51	60	0.79	0.16	0.291
	2	1.58	120	0.72	0.23	0.419
	3	1.66	180	0.64	0.31	0.564
	4	1.69	240	0.62	0.34	0.610
	5	1.71	300	0.59	0.36	0.655
	10	1.80	600	0.50	0.45	0.819
	15	1.89	900	0.41	0.54	0.983
	25	2.02	1500	0.28	0.67	1.219
End 14:52	35	2.30	2100	0.00	0.95	1.729

Area	1.82 m^2				
50% Area_eff, a_{p50}	4.955 m^2	$V_{p75\text{-}25\ theory}$	volume	0.8645	m^3
50% Area_act, a_{p50}	4.955 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	0.8645	m^3
		$t_{p\ 75\text{-}\ 25\ actual}$	time	1470	s
		Infiltration Coefficient	*f*	1.19E-04	ms^-1



NOTES:

See TPIT01 for detailed soil description

Groundwater None encountered

Pit unsaturated,

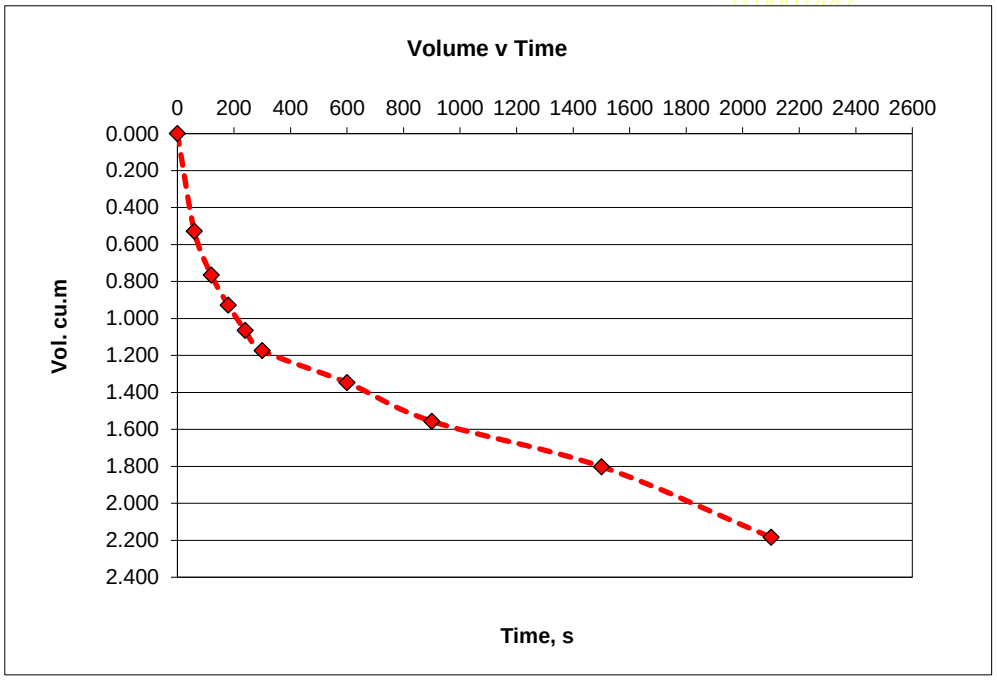
P21016 **Kilbarry**

Test 2 **IT01** **01/02/2021**

				d, m	**2.30**
l, m	**2.60**	b, m	**0.70**	d_eff, m	**1.29**
l_base, m	**2.60**			GW, m bgl	None
l_eff, m	**2.60**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
15:35	0	1.01	0	1.29	0.00	0.000
	1	1.30	60	1.00	0.29	0.528
	2	1.43	120	0.87	0.42	0.764
	3	1.52	180	0.78	0.51	0.928
	4	1.60	240	0.71	0.59	1.065
	5	1.66	300	0.65	0.65	1.174
	10	1.75	600	0.55	0.74	1.347
	15	1.865	900	0.44	0.86	1.556
	25	2	1500	0.30	0.99	1.802
	35	2.21	2100	0.09	1.20	2.184
16:15	40	2.3	2400	0.00	1.29	2.348

Area	1.82	m^2				
50% Area_eff, a_{p50}	6.077	m^2	$V_{p75\text{-}25\ theory}$	volume	1.1739	m^3
50% Area_act, a_{p50}	6.077	m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	1.1739	m^3
			$t_{p\ 75\text{-}\ 25\ actual}$	time	1335	s
			Infiltration Coefficient	*f*	1.45E-04	ms^-1



NOTES:
See TPIT01 for detailed soil description.
Groundwater None encountered

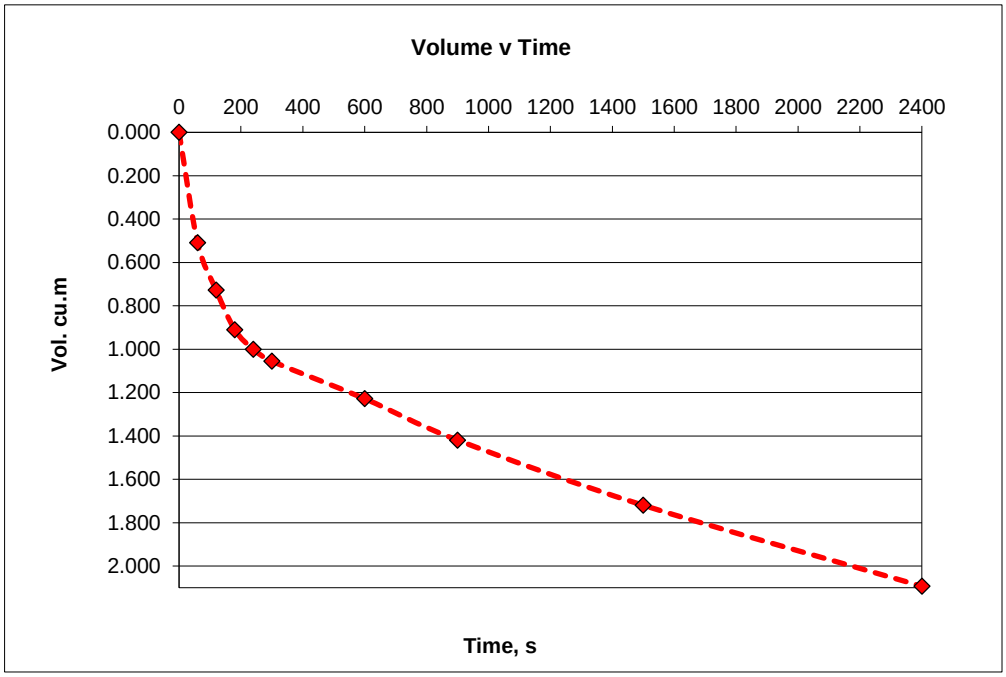
P21016 **Kilbarry**

Test 3 **IT01** **01/02/2021**

				d, m	**2.30**
l, m	**2.60**	b, m	**0.70**	d_eff, m	**1.15**
l_base, m	**2.60**				
l_eff, m	**2.60**				

Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
0	1.15	0	1.15	0.00	0.000
1	1.43	60	0.87	0.28	0.510
2	1.55	120	0.75	0.40	0.728
3	1.65	180	0.65	0.50	0.910
4	1.70	240	0.60	0.55	1.001
5	1.73	300	0.57	0.58	1.056
10	1.825	600	0.48	0.68	1.229
15	1.93	900	0.37	0.78	1.420
25	2.095	1500	0.21	0.95	1.720
40	2.3	2400	0.00	1.15	2.093

Area	1.82 m^2				
50% Area_eff, a_{p50}	5.615 m^2	$V_{p75\text{-}25\ theory}$	volume	1.0465	m^3
50% Area_act, a_{p50}	5.615 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	1.0465	m^3
		$t_{p\ 75\text{-}\ 25\ actual}$	time	1125	s
		Infiltration Coefficient	*f*	1.66E-04	ms^-1



NOTES:
See TPIT01 for detailed soil description.
Groundwater None encountered

Photographic Record

Number:	**TPIT01**	**Project**	Strategic housing, Kilbarry	
		Project No	P21016	
		Engineer	JB Barry & Partners	

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Trial Pit No
TPIT02
Sheet 1 of 1

Project Name: Kilbarry housing	**Project No.** P21016	**Co-ords:** 567220E - 575037N **Level:** 76.00m OD	**Date** 29/01/2021
Location: Kilbarry		**Dimensions (m):** 3.00 x 0.60 **Depth:** 3.00m BGL	**Scale** 1:25
Client: JB Barry & Partners			**Logged** KH.

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL).
				0.30	75.69		Purple, brown, loose, sandy, gravelly SILT with medium cobble content with low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are up to 200mm dia, angular to sub-rounded. Boulders are up to 300mm dia, angular to sub-rounded.
	0.50 - 1.00	B					*Cobble and boulder content increasing with depth.*
	1.50 - 2.00	B					
	2.50 - 3.00	B					
				3.00	73.00		End of Pit at 3.000m

Stability: Moderate to good.
Plant: 14 Tonne Track Machine.
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 3.00m bgl. Required depth reached. Infiltration test carried out at 0.92m bgl.

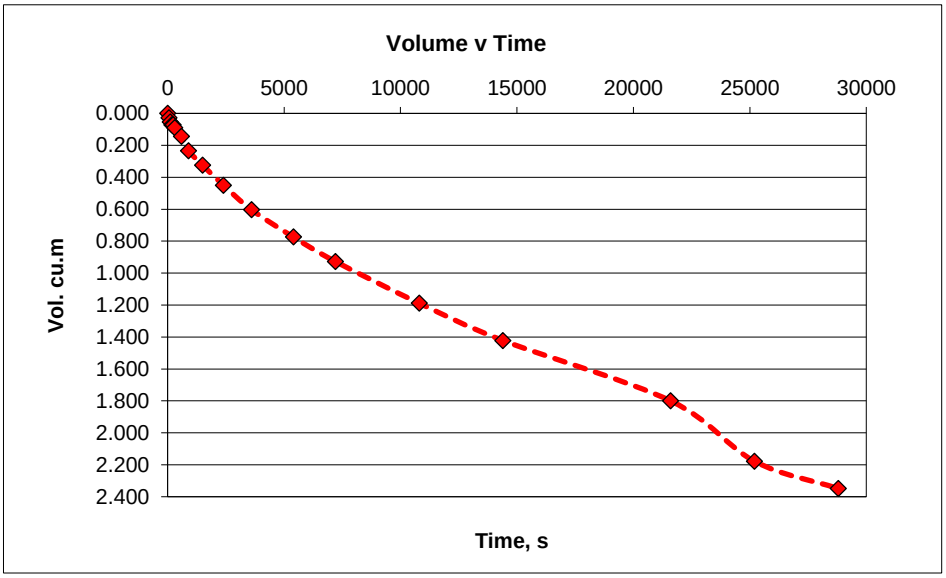
P21016 **Kilbarry**

Test 1 **IT02** **29/01/2021**

				d, m	**3.00**
l, m	**3.00**	b, m	**0.60**	d_eff, m	**2.08**
l_base, m	**3.00**			GW, m bgl	None
l_eff, m	**3.00**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
start 09:18:00	0	0.92	0	2.08	0.00	0.000
	1	0.94	60	2.07	0.02	0.027
	2	0.95	120	2.05	0.03	0.054
	3	0.96	180	2.04	0.04	0.072
	4	0.96	240	2.04	0.04	0.072
	5	0.97	300	2.03	0.05	0.090
	10	1.00	600	2.00	0.08	0.144
	15	1.05	900	1.95	0.13	0.234
	25	1.10	1500	1.90	0.18	0.324
	40	1.17	2400	1.83	0.25	0.450
	60	1.26	3600	1.75	0.34	0.603
	90	1.35	5400	1.65	0.43	0.774
	120	1.44	7200	1.57	0.52	0.927
	180	1.58	10800	1.42	0.66	1.188
	240	1.71	14400	1.29	0.79	1.422
	360	1.92	21600	1.08	1.00	1.800
	420	2.13	25200	0.87	1.21	2.178
end 17:18:00	480	2.23	28800	0.78	1.31	2.349

Area	1.8	m^2				
50% Area_eff, a_{p50}	9.288	m^2	$V_{p75\text{-}25\ theory}$	volume	1.872	m^3
50% Area_act, a_{p50}	6.498	m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	1.1745	m^3
			$t_{p\ 75\text{-}\ 25\ actual}$	time	17172	s
			Infiltration Coefficient	*f*	1.05E-05	ms^-1



NOTES:
See IT02 for detailed soil description.
No groundwater

Photographic Record

Number:	**TPIT02**	**Project**	Strategic housing, Kilbarry	
		Project No	P21016	
		Engineer	JB Barry & Partners	

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Trial Pit No
TPIT03
Sheet 1 of 1

Project Name: Kilbarry housing	**Project No.** P21016	**Co-ords:** 567261E - 575127N **Level:** 76.99m OD	**Date** 29/01/2021
Location: Kilbarry		**Dimensions (m):** 2.50 x 0.60 **Depth:** 1.40m BGL	**Scale** 1:25
Client: JB Barry & Partners			**Logged** KH.

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL).
				0.30	76.69		Purple, brown, loose, sandy, gravelly SILT with medium cobble content with low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are up to 200mm dia, angular to sub-rounded. Boulders are up to 500mm dia, angular to sub-rounded.
	0.50 - 1.40	B					
				1.40	75.59		Broken purple SILTSTONE and SANDSTONE bedrock.
				1.40	75.59		End of Pit at 1.400m

1
2
3
4
5

Stability: Good.
Plant: 14 Tonne Track Machine.
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.30m bgl. Required depth reached. Infiltration test carried out at 0.65m bgl (first fill), 0.68m bgl (second fill) and 0.61m bgl (third fill).

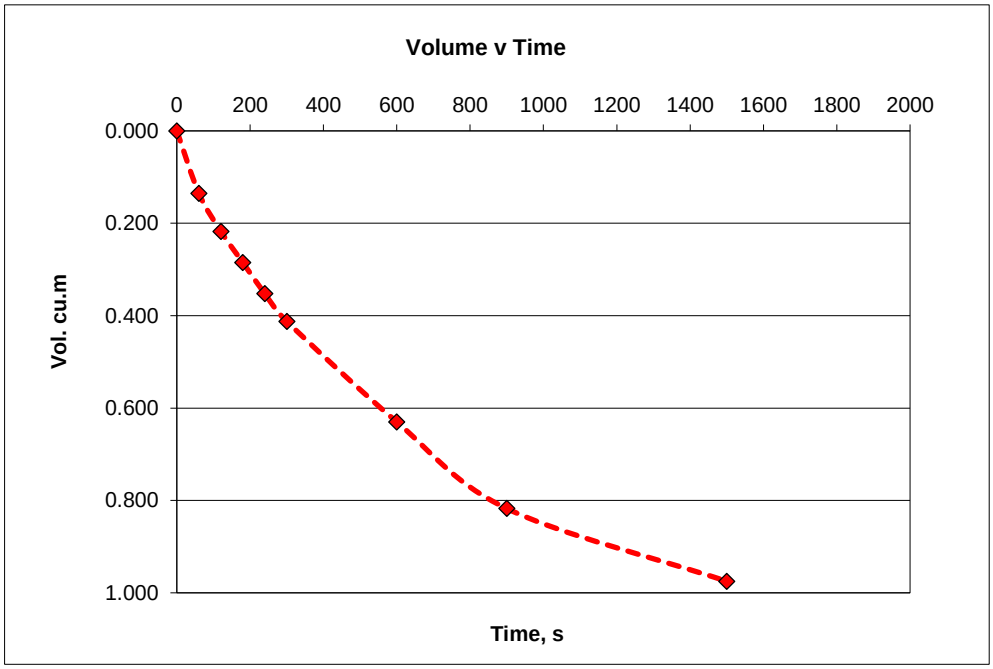
P21016 **Kilbarry**

Test 1 **IT03** **29/01/2021**

				d, m	**1.30**
l, m	**2.50**	b, m	**0.60**	d_eff, m	**0.65**
l_base, m	**2.50**			GW, m bgl	None
l_eff, m	**2.50**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
start 11:57	0	0.65	0	0.65	0.00	0.000
	1	0.74	60	0.56	0.09	0.135
	2	0.80	120	0.51	0.15	0.218
	3	0.84	180	0.46	0.19	0.285
	4	0.89	240	0.42	0.24	0.353
	5	0.93	300	0.38	0.28	0.413
	10	1.07	600	0.23	0.42	0.630
	15	1.20	900	0.11	0.55	0.818
end 12:22	25	1.30	1500	0.00	0.65	0.975

Area	1.5	m^2				
50% Area_eff, a_{p50}	3.515	m^2	$V_{p75\text{-}25\ theory}$	volume	0.4875	m^3
50% Area_act, a_{p50}	3.515	m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	0.4875	m^3
			$t_{p\ 75\text{-}\ 25\ actual}$	time	592	s
			Infiltration Coefficient	*f*	2.34E-04	ms^-1



NOTES:
See IT03 for detailed soil description.
Pit unsaturated.

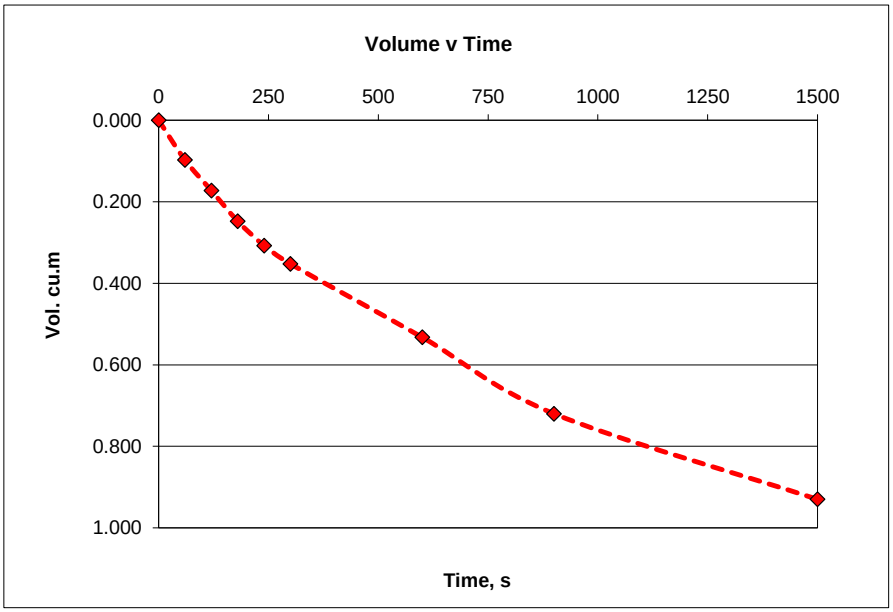
P21016 **Kilbarry**

Test 2 **IT03** **29/01/2021**

				d, m	**1.30**
l, m	**2.50**	b, m	**0.60**	d_eff, m	**0.62**
l_base, m	**2.50**			GW, m bgl	None
l_eff, m	**2.50**				

Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
Start 14:10					
0	0.68	0	0.62	0.00	0.000
1	0.75	60	0.56	0.06	0.097
2	0.80	120	0.51	0.12	0.173
3	0.85	180	0.46	0.17	0.248
4	0.89	240	0.42	0.21	0.308
5	0.92	300	0.39	0.24	0.353
10	1.035	600	0.27	0.36	0.533
15	1.16	900	0.14	0.48	0.720
25	1.3	1500	0.00	0.62	0.930

Area	1.5	m^2			
50% Area_eff, a_{p50}	3.422	m^2	$V_{p75\text{-}25\ theory}$	volume	0.465 m^3
50% Area_act, a_{p50}	3.422	m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	0.465 m^3
			$t_{p\ 75\text{-}\ 25\ actual}$	time	698 s
			Infiltration Coefficient	*f*	1.95E-04 ms^-1



NOTES:
See IT03 for detailed soil description.
No groundwater

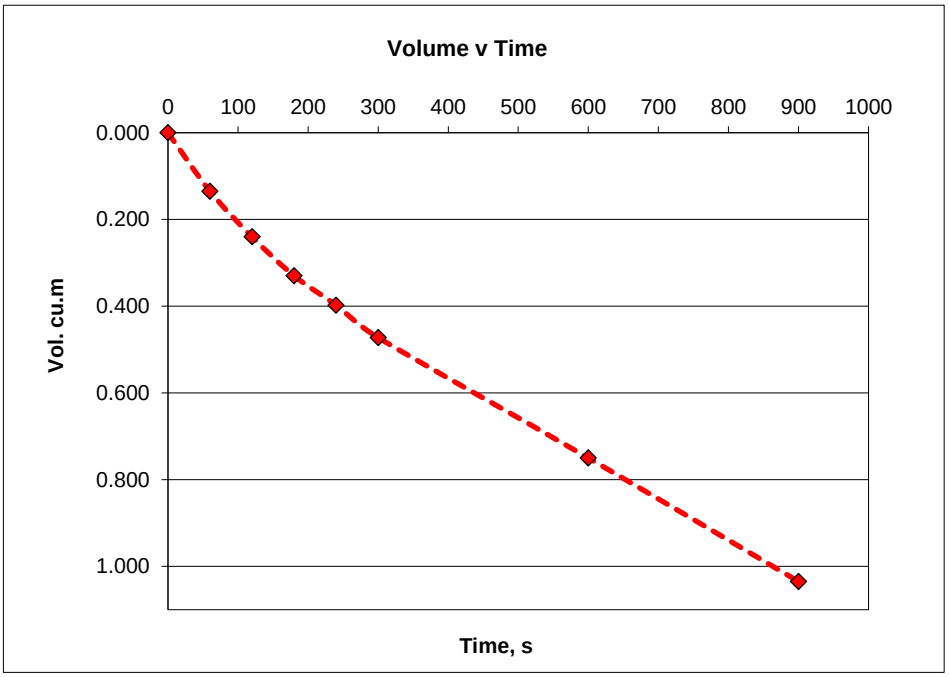
P21016 **Kilbarry**

Test 3 **IT03** **29/01/2021**

				d, m	**1.30**
l, m	**2.50**	b, m	**0.60**	d_eff, m	**0.69**
l_base, m	**2.50**				
l_eff, m	**2.50**				

Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
Start 12.45					
0	0.61	0	0.69	0.00	0.000
1	0.70	60	0.60	0.09	0.135
2	0.77	120	0.53	0.16	0.240
3	0.83	180	0.47	0.22	0.330
4	0.88	240	0.43	0.27	0.398
5	0.93	300	0.38	0.32	0.473
10	1.11	600	0.19	0.50	0.750
15	1.30	900	0.00	0.69	1.035

Area	1.5	m^2			
50% Area_eff, a_{p50}	3.639	m^2	$V_{p75\text{-}25\ theory}$	volume	0.5175 m^3
50% Area_act, a_{p50}	3.639	m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	0.5175 m^3
			$t_{p\ 75\text{-}\ 25\ actual}$	time	467 s
			Infiltration Coefficient	*f*	3.04E-04 ms^-1



NOTES:
See IT03 for detailed soil description, Bedrock 1.4m.
Groundwater
Pit collpased to 1.30m after water added.

Photographic Record

Number:	**TPIT03**	**Project**	Strategic housing, Kilbarry	
		Project No	P21016	
		Engineer	JB Barry & Partners	

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Trial Pit No
TPIT04
Sheet 1 of 1

Project Name: Kilbarry housing	**Project No.** P21016	**Co-ords:** 567286E - 575202N **Level:** 78.34m OD	**Date** 29/01/2021
Location: Kilbarry		**Dimensions (m):** 2.60 x 0.60 **Depth:** 3.00m BGL	**Scale** 1:25
Client: JB Barry & Partners			**Logged** KH.

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL).
				0.30	78.04		Purple, brown, loose, sandy, gravelly SILT with medium cobble content with low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are up to 200mm dia, angular to sub-rounded. Boulders are up to 350mm dia, angular to sub-rounded.
	0.50 - 1.00	B					*Cobble and boulder content increasing with depth.*
	1.50 - 2.00	B					
	2.50 - 3.00	B					
				3.00	75.34		End of Pit at 3.000m

Stability: Moderate to poor.
Plant: 14 Tonne Track Machine.
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 3.00m bgl. Required depth reached. Infiltration test carried out at 0.985m bgl.

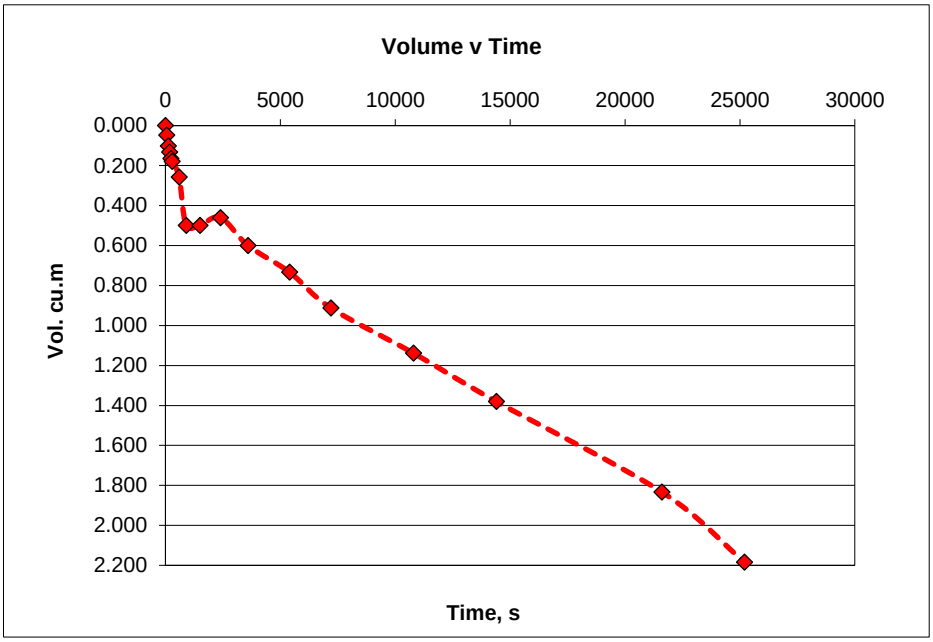
P21016 **Kilbarry**

Test 1 **IT04** **29/01/2021**

				d, m	**3.00**
l, m	**2.60**	b, m	**0.60**	d_eff, m	**2.07**
l_base, m	**2.60**			GW m bgl	None
l_eff, m	**2.60**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
Start 10:07	0	0.94	0	2.07	0.00	0.000
	1	0.97	60	2.04	0.03	0.047
	2	1.00	120	2.00	0.06	0.101
	3	1.02	180	1.98	0.09	0.133
	4	1.04	240	1.96	0.11	0.164
	5	1.05	300	1.95	0.12	0.179
	10	1.10	600	1.90	0.17	0.257
	15	*1.26*	*900*	*1.75*	*0.32*	*0.499*
	25	*1.26*	*1500*	*1.75*	*0.32*	*0.499*
	40	*1.23*	*2400*	*1.77*	*0.30*	*0.460*
	60	1.32	3600	1.68	0.39	0.601
	90	1.41	5400	1.60	0.47	0.733
	120	1.52	7200	1.48	0.59	0.913
	180	1.67	10800	1.34	0.73	1.139
	240	1.82	14400	1.18	0.89	1.381
	360	2.11	21600	0.89	1.18	1.833
End 17:07	420	2.34	25200	0.67	1.40	2.184

Area	1.56	m^2				
50% Area_eff, a_{p50}	8.168	m^2	$V_{p75\text{-}25\ theory}$	volume	1.6107	m^3
50% Area_act, a_{p50}	6.04	m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	1.092	m^3
			$t_{p\ 75\text{-}\ 25\ actual}$	time	15384	s
			Infiltration Coefficient	*f*	1.18E-05	ms^-1



NOTES:
See IT04 for
Pit wall section collapsed at 28minutes, causing the waters to fluctuate.
Pit assumed unsaturated.

Photographic Record

Number:	**TPIT04**	**Project**	Strategic housing, Kilbarry	
		Project No	P21016	
		Engineer	JB Barry & Partners	

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Trial Pit No
TPIT05
Sheet 1 of 1

Project Name: Kilbarry housing	**Project No.** P21016	**Co-ords:** 567366E - 575126N **Level:** 81.40m OD	**Date** 01/02/2021
Location: Kilbarry		**Dimensions (m):** 2.60 x 0.60 **Depth:** 2.80m BGL	**Scale** 1:25
Client: JB Barry & Partners			**Logged** KH.

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
							(TOPSOIL).
				0.30	81.10		
	0.50 - 1.00	B					Purple, brown, loose, sandy, gravelly SILT with high cobble content with low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are up to 200mm dia, angular to sub-rounded. Boulders are up to 400mm dia, angular to sub-rounded.
	1.50 - 2.00	B					
	2.50 - 3.00	B					
				2.80	78.60		End of Pit at 2.800m

1
2
3
4
5

Stability: Moderate.
Plant: 14 Tonne Track Machine.
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.80m bgl. Required depth reached. Infiltration test carried out at 1.08m bgl (first fill), 1.22m bgl (second fill) and 1.05m bgl (third fill).

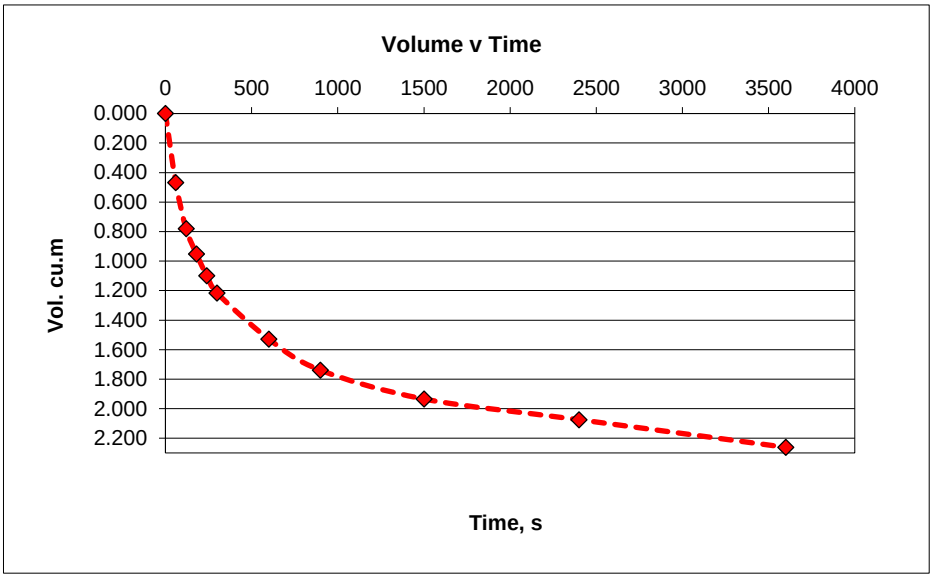
P21016 **Kilbarry**

Test 1 **IT05** **01/02/2021**

				d, m	**2.80**
l, m	**2.60**	b, m	**0.60**	d_eff, m	**1.72**
l_base, m	**2.60**			GW m bgl	None
l_eff, m	**2.60**				

Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
0	1.08	0	1.72	0.00	0.000
1	1.38	60	1.42	0.30	0.468
2	1.58	120	1.22	0.50	0.780
3	1.69	180	1.11	0.61	0.952
4	1.79	240	1.02	0.71	1.100
5	1.86	300	0.94	0.78	1.217
10	2.06	600	0.74	0.98	1.529
15	2.20	900	0.61	1.12	1.739
25	2.32	1500	0.48	1.24	1.934
40	2.41	2400	0.39	1.33	2.075
60	2.53	3600	0.27	1.45	2.262

Area	1.56 m^2				
50% Area_eff, a_{p50}	7.064 m^2	$V_{p75\text{-}25\ theory}$	volume	1.3416	m^3
50% Area_act, a_{p50}	6.200 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	1.76436	m^3
		$t_{p\ 75\text{-}\ 25\ actual}$	time	1919	s
		Infiltration Coefficient	*f*	1.48E-04	ms^-1



NOTES:
See IT05 for
Pit assumed unsaturated
Pit collpased to 2.53m after water added.

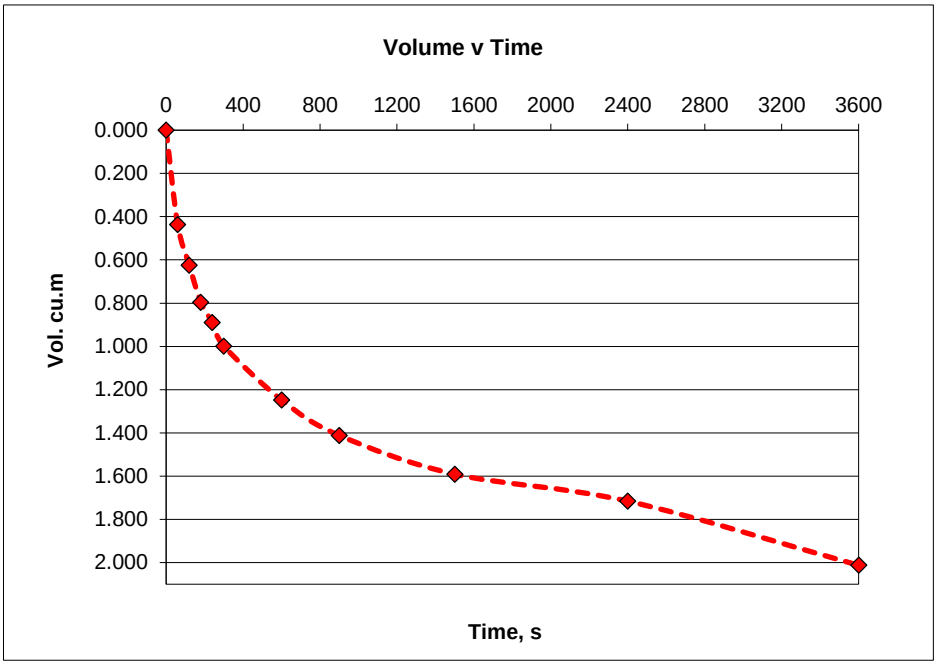
P21016 **Kilbarry**

Test 2 **IT05** **01/02/2021**

				d, m	**2.53**
l, m	**2.60**	b, m	**0.60**	d_eff, m	**1.31**
l_base, m	**2.60**			GW m bgl	None
l_eff, m	**2.60**				

Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
0	1.22	0	1.31	0.00	0.000
1	1.50	60	1.03	0.28	0.437
2	1.62	120	0.91	0.40	0.624
3	1.73	180	0.80	0.51	0.796
4	1.79	240	0.74	0.57	0.889
5	1.86	300	0.67	0.64	0.998
10	2.02	600	0.51	0.80	1.248
15	2.13	900	0.41	0.91	1.412
25	2.24	1500	0.29	1.02	1.591
40	2.32	2400	0.21	1.10	1.716
60	2.51	3600	0.02	1.29	2.012

Area	1.56 m^2				
50% Area_eff, a_{p50}	5.752 m^2	$V_{p75\text{-}25\ theory}$	volume	1.0218	m^3
50% Area_act, a_{p50}	5.688 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	1.0218	m^3
		$t_{p\ 75\text{-}\ 25\ actual}$	time	1223	s
		Infiltration Coefficient	*f*	1.47E-04	ms^-1



NOTES:
See IT05 for detailed soil description,
Pit collpased to 2.53m after water added.

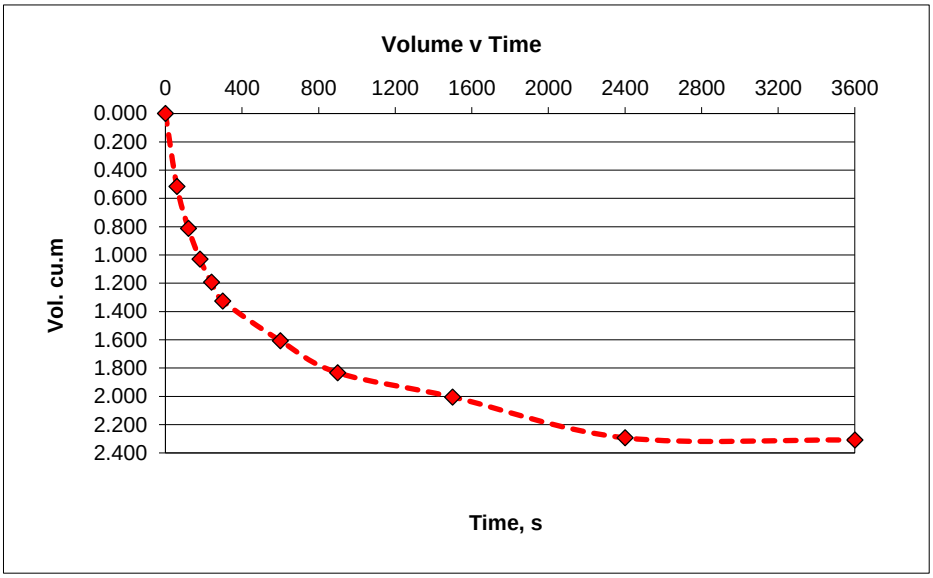
P21016 **Kilbarry**

Test 3 **IT05** **01/02/2021**

				d, m	**2.53**
l, m	**2.60**	b, m	**0.60**	d_eff, m	**1.48**
l_base, m	**2.60**		o	GW m bgl	None
l_eff, m	**2.60**				

Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
0	1.05	0	1.48	0.00	0.000
1	1.38	60	1.15	0.33	0.515
2	1.57	120	0.96	0.52	0.811
3	1.71	180	0.82	0.66	1.030
4	1.82	240	0.72	0.77	1.193
5	1.90	300	0.63	0.85	1.326
10	2.08	600	0.45	1.03	1.607
15	2.23	900	0.31	1.18	1.833
25	2.34	1500	0.20	1.29	2.005
40	2.52	2400	0.01	1.47	2.293
60	2.53	3600	0.00	1.48	2.309

Area	1.56	m^2			
50% Area_eff, a_{p50}	6.296	m^2	$V_{p75\text{-}25\ theory}$	volume	1.1544 m^3
50% Area_act, a_{p50}	6.296	m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	1.1544 m^3
			$t_{p\ 75\text{-}\ 25\ actual}$	time	692 s
			Infiltration Coefficient	*f*	2.65E-04 ms^-1



NOTES:
See IT05 for detailed soil description,

Photographic Record

Number:	**TPIT05**	**Project**	Strategic housing, Kilbarry	
		Project No	P21016	
		Engineer	JB Barry & Partners	

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Trial Pit No
TPIT06
Sheet 1 of 1

Project Name: Kilbarry housing	**Project No.** P21016	**Co-ords:** 567438E - 575178N **Level:** 87.43m OD	**Date** 01/02/2021
Location: Kilbarry		**Dimensions (m):** 2.70 x 0.60 **Depth:** 3.00m BGL	**Scale** 1:25
Client: JB Barry & Partners			**Logged** KH.

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
	0.50 - 1.00	B					(MADE GROUND) Brown, loose, slightly clayey, sandy, gravelly SILT with pieces of plastic, metal and red bricks. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded.
				1.10	86.33		
	1.50 - 2.00 1.50 - 2.00	B D					Purple, soft, slightly clayey, sandy, gravelly SILT with high cobble content with low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are up to 200mm dia, angular to sub-rounded. Boulders are up to 350mm dia, angular to sub-rounded. *Cobble and boulder content increasing with depth. Getting progressively more wet with depth. Material becomes more loose at 2.00m bgl.*
	2.50 - 3.00	B					
				3.00	84.43		End of Pit at 3.000m

Stability: Moderate to poor.
Plant: 14 Tonne Track Machine.
Backfill: Arisings.

Groundwater: Trickling flow rate.

Remarks: Trial pit terminated at 3.0m bgl. Required depth reached. Infiltration test carried out at 0.86m bgl (first fill) and 0.69m bgl (second fill). Water level the morning after at 1.48m bgl (02/02/21).

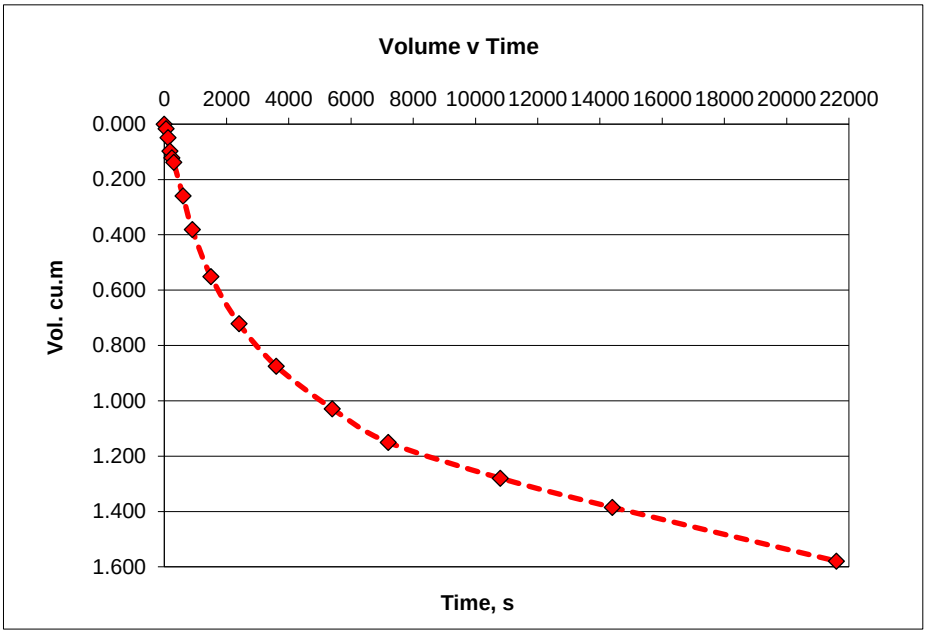
P21016 **Kilbarry**

Test 1 **IT06** **01/02/2021**

				d, m	**3.00**
l, m	**2.70**	b, m	**0.60**	d_eff, m	**1.94**
l_base, m	**2.70**			GW m bgl	2.80
l_eff, m	**2.70**				

Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
0	0.86	0	1.94	0.00	0.000
1	0.87	60	1.93	0.01	0.016
2	0.89	120	1.91	0.03	0.049
3	0.92	180	1.88	0.06	0.097
4	0.94	240	1.87	0.08	0.122
5	0.95	300	1.86	0.09	0.138
10	1.02	600	1.78	0.16	0.259
15	1.095	900	1.71	0.24	0.381
25	1.2	1500	1.60	0.34	0.551
40	1.305	2400	1.50	0.45	0.721
60	1.4	3600	1.40	0.54	0.875
90	1.495	5400	1.31	0.64	1.029
120	1.57	7200	1.23	0.71	1.150
180	1.65	10800	1.15	0.79	1.280
240	1.715	14400	1.09	0.86	1.385
360	1.835	21600	0.97	0.98	1.580

Area	1.62	m^2			
50% Area_eff, a_{p50}	8.022	m^2	$V_{p75\text{-}25\ theory}$	volume	1.5714 m^3
50% Area_act, a_{p50}	4.8375	m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	0.78975 m^3
			$t_{p\ 75\text{-}\ 25\ actual}$	time	7290 s
			Infiltration Coefficient	*f*	2.24E-05 ms^-1



NOTES:
See IT06 for detailed soil description,
Pit assumed unsaturated

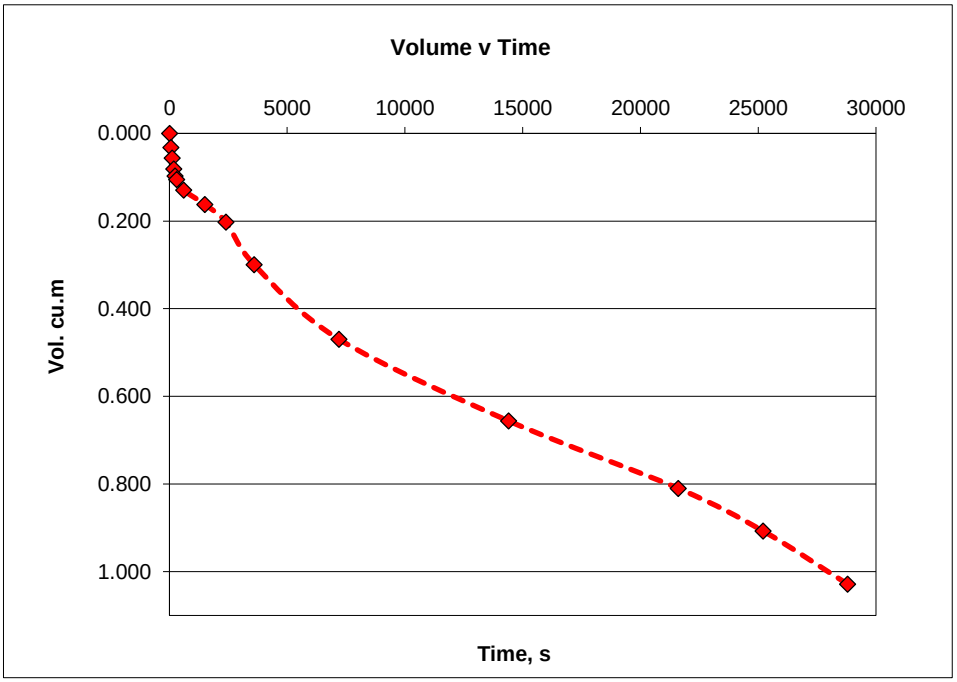
P21016 **Kilbarry**

Test 2 **IT06** **02/02/2021**

				d, m	**3.00**
l, m	**2.70**	b, m	**0.60**	d_eff, m	**0.79**
l_base, m	**2.70**			GW m bgl	1.48
l_eff, m	**2.70**				

Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
0	0.69	0	0.79	0.00	0.000
1	0.71	60	0.77	0.02	0.032
2	0.73	120	0.76	0.04	0.057
3	0.74	180	0.74	0.05	0.081
4	0.75	240	0.73	0.06	0.097
5	0.76	300	0.73	0.07	0.105
10	0.77	600	0.71	0.08	0.130
25	0.79	1500	0.69	0.10	0.162
40	0.815	2400	0.67	0.13	0.203
60	0.875	3600	0.61	0.19	0.300
120	0.98	7200	0.50	0.29	0.470
240	1.095	14400	0.39	0.41	0.656
360	1.19	21600	0.29	0.50	0.810
420	1.25	25200	0.23	0.56	0.907
480	1.325	28800	0.16	0.64	1.029

Area	1.62	m^2				
50% Area_eff, a_{p50}	4.227	m^2	$V_{p75\text{-}25\ theory}$	volume	0.6399	m^3
50% Area_act, a_{p50}	3.7155	m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	0.6399	m^3
			$t_{p\ 75\text{-}\ 25\ actual}$	time	23166	s
			Infiltration Coefficient	*f*	7.43E-06	ms^-1



NOTES:
See IT06 for detailed soil description,

Photographic Record

Number:	**TPIT06**	**Project**	Strategic housing, Kilbarry	
		Project No	P21016	
		Engineer	JB Barry & Partners	

Photographic Record

Number:	**TPIT06**	**Project**	Strategic housing, Kilbarry	
		Project No	P21016	
		Engineer	JB Barry & Partners	

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Trial Pit No
TPIT07
Sheet 1 of 1

Project Name: Kilbarry housing	**Project No.** P21016	**Co-ords:** 567453E - 575264N **Level:** 88.34m OD	**Date** 01/02/2021
Location: Kilbarry		**Dimensions (m):** 2.50 x 0.60 **Depth:** 3.00m BGL	**Scale** 1:25
Client: JB Barry & Partners			**Logged** KH.

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
	0.50 - 1.00	B					(MADE GROUND) Purple, brown, loose, slightly clayey, sandy, gravelly SILT with medium cobble content with low boulder content with plastic. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded. Cobbles are up to 200mm dia, angular to sub-rounded. Boulders are up to 350mm dia, angular to sub-rounded.
▼				1.20	87.14		
	1.50 - 2.00	B					Purple, brown, loose, very slightly clayey, sandy, gravelly SILT with high cobble content with low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular. Cobbles are up to 200mm dia, very angular to sub-angular. Boulders are up to 400mm dia, very angular to sub-angular.
▼							
	2.50 - 3.00	B					
				3.00	85.34		End of Pit at 3.000m

1 2 3 4 5

Stability: Poor.
Plant: 14 Tonne Track Machine.
Backfill:

Groundwater: Trickling flow rate.

Remarks: Trial pit terminated at 3.00m bgl. Required depth reached. Infiltration test carried out at 0.89m bgl (first fill) and 1.13m bgl (second fill).

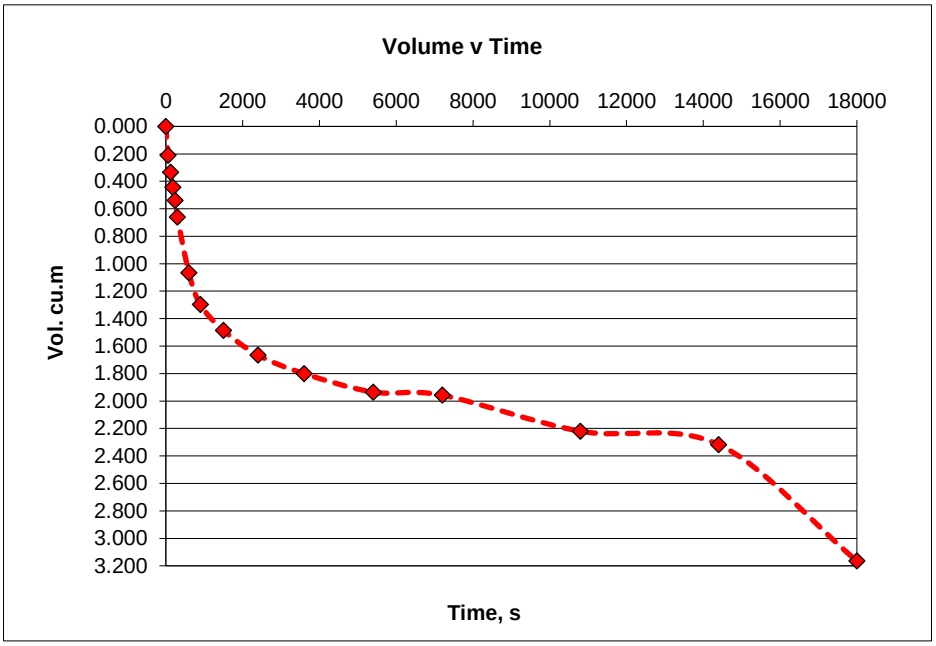
P21016 **Kilbarry**

Test 1 **IT07** **01/02/2021**

				d, m	**3.00**
l, m	**2.50**	b, m	**0.60**	d_eff, m	**2.11**
l_base, m	**2.50**			GW m bgl	2.1
l_eff, m	**2.50**				

Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
0	0.89	0	2.11	0.00	0.000
1	1.03	60	1.97	0.14	0.210
2	1.11	120	1.89	0.22	0.333
3	1.19	180	1.82	0.30	0.443
4	1.25	240	1.75	0.36	0.540
5	1.33	300	1.67	0.44	0.660
10	1.60	600	1.40	0.71	1.065
15	1.76	900	1.25	0.87	1.298
25	1.88	1500	1.12	0.99	1.485
40	2.00	2400	1.00	1.11	1.665
60	2.09	3600	0.91	1.20	1.800
90	2.18	5400	0.82	1.29	1.935
120	2.20	7200	0.81	1.31	1.958
180	2.37	10800	0.63	1.48	2.220
240	2.44	14400	0.57	1.55	2.318
300	3.00	18000	0.00	2.11	3.165

Area	1.5	m^2				
50% Area_eff, a_{p50}	8.041	m^2	$V_{p75\text{-}25\ theory}$	volume	1.5825	m^3
50% Area_act, a_{p50}	8.041	m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	1.5825	m^3
			$t_{p\ 75\text{-}\ 25\ actual}$	time	14273	s
			Infiltration Coefficient	*f*	1.38E-05	ms^-1



NOTES:
See IT07 for detailed soil description,
Pit assumed unsaturated
Section of pit wall collapsed at 110 minutes on the clock causing the percolation to slow

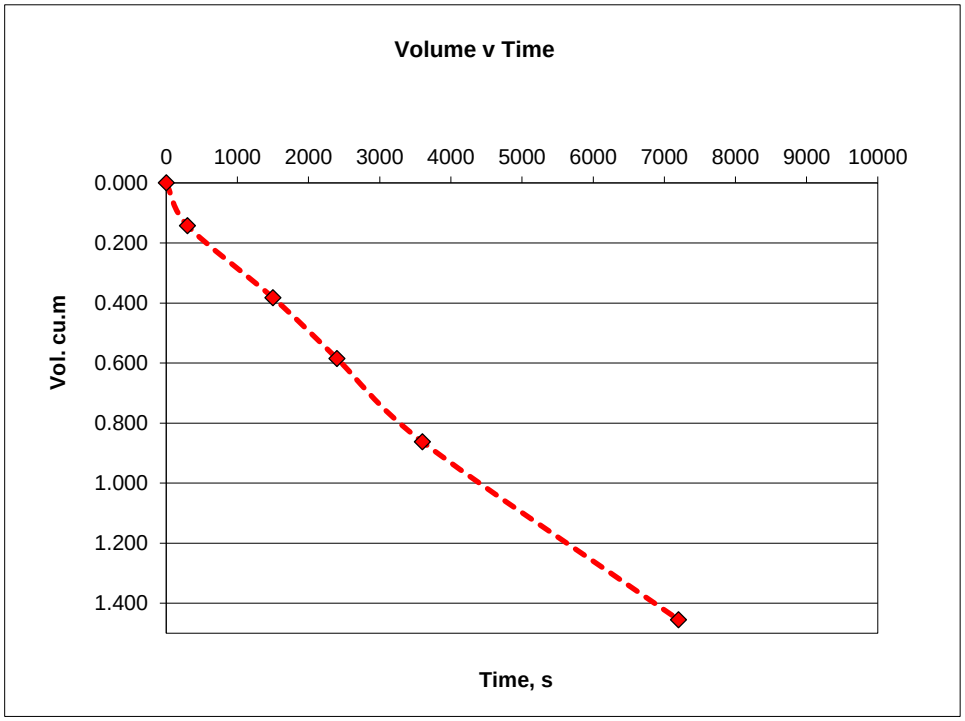
P21016 **Kilbarry**

Test 2 **IT07** **02/02/2021**

				d, m	**2.10**
l, m	**2.50**	b, m	**0.60**	d_eff, m	**0.97**
l_base, m	**2.50**			GW m bgl	
l_eff, m	**2.50**				

Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
0	1.13	0	0.97	0.00	0.000
5	1.23	300	0.88	0.10	0.143
25	1.39	1500	0.72	0.26	0.383
40	1.52	2400	0.58	0.39	0.585
60	1.71	3600	0.40	0.58	0.863
120	2.10	7200	0.00	0.97	1.455

Area	1.5	m^2				
50% Area_eff, a_{p50}	4.507	m^2	$V_{p75\text{-}25\ theory}$	volume	0.7275	m^3
50% Area_act, a_{p50}	4.507	m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	0.7275	m^3
			$t_{p\ 75\text{-}\ 25\ actual}$	time	3576	s
			Infiltration Coefficient	*f*	4.51E-05	ms^-1



NOTES:
See IT07 for detailed soil description,
Section of pit wall collapsed to 2.10m over night.

Photographic Record

Number:	**TPIT07**	**Project**	Strategic housing, Kilbarry	
		Project No	P21016	
		Engineer	JB Barry & Partners	

Appendix 8:

HR WALLINGFORD GREENFIELD RUNOFF ESTIMATION

Print | Close Report

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Diarmuid O'Brien
Site name:	Kilbarry
Site location:	Kilbarry, Cork

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.92755° N
Longitude:	8.47635° W
Reference:	1010490336
Date:	Jun 07 2022 17:01

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 8.07

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics	Default	Edited
SAAR (mm):	1149	1149
Hydrological region:	13	13
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	1.65	1.65
Growth curve factor 100 years:	1.95	1.95
Growth curve factor 200 years:	2.15	2.15

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	26.26	26.26
1 in 1 year (l/s):	22.32	22.32
1 in 30 years (l/s):	43.33	43.33
1 in 100 year (l/s):	51.21	51.21
1 in 200 years (l/s):	56.46	56.46

Appendix 9:

SURFACE WATER - MICRODRAINAGE CALCULATIONS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.250	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	4.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.000	4-8	1.214	8-12	2.565	12-16	0.368

Total Area Contributing (ha) = 4.146

Total Pipe Volume (m³) = 161.432

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	48.952	0.326	150.0	0.107	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	48.952	0.326	150.0	0.075	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	67.113	0.447	150.0	0.202	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	63.601	0.459	138.5	0.130	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	87.323	1.092	80.0	0.279	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.001	6.188	0.077	80.0	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.002	59.162	0.740	80.0	0.155	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	53.526	3.089	17.3	0.052	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.77	85.393	0.107	0.0	0.0	0.0	1.07	42.4	14.6
S1.001	50.00	5.53	85.067	0.183	0.0	0.0	0.0	1.07	42.4	24.7
S1.002	49.06	6.40	84.665	0.385	0.0	0.0	0.0	1.28	90.6	51.1
S1.003	46.81	7.20	84.218	0.515	0.0	0.0	0.0	1.33	94.3	65.3
S2.000	50.00	4.99	86.300	0.279	0.0	0.0	0.0	1.46	58.2	37.8
S2.001	50.00	5.06	85.208	0.294	0.0	0.0	0.0	1.46	58.2	39.8
S2.002	50.00	5.63	85.056	0.449	0.0	0.0	0.0	1.76	124.4	60.8
S1.004	46.20	7.43	83.759	1.016	0.0	0.0	0.0	3.80	268.3	127.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S3.000	11.312	0.566	20.0	0.037	4.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	39.909	0.200	200.0	0.060	4.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	27.171	0.679	40.0	0.021	0.00	0.0	0.600	o	225	Pipe/Conduit	
S5.000	22.392	1.244	18.0	0.025	4.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	16.256	0.406	40.0	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.003	8.877	0.222	40.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.004	56.201	0.281	200.0	0.124	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.005	10.788	0.150	72.0	0.036	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	44.065	0.391	112.7	0.060	0.00	0.0	0.600	o	375	Pipe/Conduit	
S6.000	44.233	0.295	149.9	0.118	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	11.099	0.074	150.0	0.036	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.007	24.820	0.165	150.4	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.008	2.244	0.015	149.6	0.007	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.009	15.780	0.105	150.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.010	18.782	0.094	199.8	0.088	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.011	8.408	0.042	200.2	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.012	75.418	2.928	25.8	0.107	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.000	49.468	2.473	20.0	0.164	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	50.00	4.06	84.377	0.037	0.0	0.0	0.0	2.94	116.9	5.0
S4.000	50.00	4.72	82.682	0.060	0.0	0.0	0.0	0.92	36.6	8.1
S3.001	50.00	4.94	82.482	0.117	0.0	0.0	0.0	2.07	82.5	15.9
S5.000	50.00	4.12	83.870	0.025	0.0	0.0	0.0	3.10	123.2	3.4
S3.002	50.00	5.07	81.803	0.178	0.0	0.0	0.0	2.07	82.4	24.0
S3.003	50.00	5.14	81.397	0.178	0.0	0.0	0.0	2.07	82.5	24.0
S3.004	50.00	5.99	81.100	0.301	0.0	0.0	0.0	1.11	78.3	40.8
S3.005	50.00	6.08	80.819	0.337	0.0	0.0	0.0	1.86	131.2	45.7
S1.005	45.12	7.86	80.595	1.414	0.0	0.0	0.0	1.71	188.4	172.8
S6.000	50.00	4.69	80.744	0.118	0.0	0.0	0.0	1.07	42.4	16.0
S1.006	44.85	7.98	80.129	1.568	0.0	0.0	0.0	1.66	263.7	190.4
S1.007	44.27	8.23	80.055	1.568	0.0	0.0	0.0	1.66	263.3	190.4
S1.008	50.00	4.04	79.890	0.000	10.9	0.0	0.0	1.07	42.4	10.9
S1.009	50.00	4.28	77.002	0.000	10.9	0.0	0.0	1.07	42.4	10.9
S1.010	50.00	4.62	76.897	0.088	10.9	0.0	0.0	0.92	36.6	22.8
S1.011	50.00	4.77	76.803	0.096	10.9	0.0	0.0	0.92	36.6	23.9
S1.012	50.00	5.26	76.761	0.203	10.9	0.0	0.0	2.59	102.9	38.4
S7.000	50.00	4.28	76.306	0.164	0.0	0.0	0.0	2.94	116.9	22.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.013	8.452	0.282	30.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.014	12.235	0.408	30.0	0.012	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.015	13.172	0.329	40.0	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.016	89.881	2.247	40.0	0.151	0.00	0.0	0.600	o	300	Pipe/Conduit	
S8.000	44.067	2.754	16.0	0.080	4.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	6.530	0.327	20.0	0.012	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.002	47.043	1.882	25.0	0.061	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.000	73.492	0.522	140.8	0.113	4.00	0.0	0.600	o	225	Pipe/Conduit	
S8.003	49.625	2.103	23.6	0.049	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.004	6.434	0.161	40.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S10.000	26.094	0.408	64.0	0.048	4.00	0.0	0.600	o	225	Pipe/Conduit	
S8.005	66.442	1.107	60.0	0.165	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.000	76.223	2.823	27.0	0.136	4.00	0.0	0.600	o	225	Pipe/Conduit	
S11.001	7.226	0.268	27.0	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
S11.002	16.321	0.398	41.0	0.025	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.000	53.686	0.537	100.0	0.178	4.00	0.0	0.600	o	225	Pipe/Conduit	
S12.001	23.016	0.288	79.9	0.041	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.002	73.655	1.841	40.0	0.067	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.013	50.00	5.32	72.500	0.372	10.9	0.0	0.0	2.40	95.3	61.2
S1.014	50.00	5.40	72.218	0.383	10.9	0.0	0.0	2.40	95.3	62.8
S1.015	50.00	5.51	71.810	0.394	10.9	0.0	0.0	2.07	82.5	64.3
S1.016	49.97	6.11	71.406	0.545	10.9	0.0	0.0	2.49	176.2	84.7
S8.000	50.00	4.22	81.566	0.080	0.0	0.0	0.0	3.29	130.7	10.8
S8.001	50.00	4.26	78.812	0.092	0.0	0.0	0.0	2.94	117.0	12.4
S8.002	50.00	4.56	78.485	0.153	0.0	0.0	0.0	2.63	104.5	20.7
S9.000	50.00	5.11	77.126	0.113	0.0	0.0	0.0	1.10	43.7	15.3
S8.003	50.00	5.42	76.603	0.315	0.0	0.0	0.0	2.70	107.6	42.7
S8.004	50.00	5.47	72.800	0.315	0.0	0.0	0.0	2.08	82.5	42.7
S10.000	50.00	4.27	74.676	0.048	0.0	0.0	0.0	1.64	65.1	6.5
S8.005	50.00	6.02	72.564	0.527	0.0	0.0	0.0	2.03	143.7	71.4
S11.000	50.00	4.50	76.636	0.136	0.0	0.0	0.0	2.53	100.5	18.5
S11.001	50.00	4.55	73.813	0.147	0.0	0.0	0.0	2.53	100.6	19.9
S11.002	50.00	4.68	73.545	0.172	0.0	0.0	0.0	2.05	81.5	23.3
S12.000	50.00	4.68	78.920	0.178	0.0	0.0	0.0	1.31	52.0	24.1
S12.001	50.00	4.95	78.383	0.219	0.0	0.0	0.0	1.46	58.2	29.6
S12.002	50.00	5.54	78.095	0.285	0.0	0.0	0.0	2.07	82.5	38.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S12.003	72.276	1.205	60.0	0.092	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.004	4.037	0.067	60.0	0.004	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.005	6.113	0.102	60.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.006	41.777	0.696	60.0	0.055	0.00	0.0	0.600	o	225	Pipe/Conduit	
S11.003	13.174	0.471	28.0	0.002	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.000	42.778	1.711	25.0	0.091	4.00	0.0	0.600	o	225	Pipe/Conduit	
S13.001	13.242	0.530	25.0	0.053	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.002	15.081	0.603	25.0	0.018	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.003	75.583	2.100	36.0	0.095	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.004	75.500	1.888	40.0	0.097	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.005	10.936	0.273	40.1	0.013	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.006	10.936	0.312	35.0	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.007	11.072	0.316	35.0	0.014	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.008	11.015	0.315	35.0	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.009	25.217	0.720	35.0	0.029	0.00	0.0	0.600	o	225	Pipe/Conduit	
S14.000	28.083	0.281	100.0	0.028	4.00	0.0	0.600	o	225	Pipe/Conduit	
S13.010	7.590	0.051	148.8	0.010	0.00	0.0	0.600	o	300	Pipe/Conduit	
S11.004	41.246	0.311	132.6	0.059	0.00	0.0	0.600	o	375	Pipe/Conduit	
S8.006	36.684	1.161	31.6	0.042	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S12.003	49.53	6.25	75.000	0.378	0.0	0.0	0.0	1.69	67.3	50.6
S12.004	49.41	6.29	73.795	0.381	0.0	0.0	0.0	1.69	67.3	51.0
S12.005	49.22	6.35	73.728	0.381	0.0	0.0	0.0	1.69	67.3	51.0
S12.006	48.02	6.76	73.626	0.437	0.0	0.0	0.0	1.69	67.3	56.8
S11.003	47.77	6.85	72.930	0.611	0.0	0.0	0.0	2.48	98.7	79.0
S13.000	50.00	4.27	81.333	0.091	0.0	0.0	0.0	2.63	104.5	12.4
S13.001	50.00	4.36	79.622	0.144	0.0	0.0	0.0	2.63	104.5	19.6
S13.002	50.00	4.45	79.092	0.163	0.0	0.0	0.0	2.63	104.5	22.0
S13.003	50.00	5.03	78.489	0.258	0.0	0.0	0.0	2.19	87.0	34.9
S13.004	50.00	5.63	75.200	0.355	0.0	0.0	0.0	2.07	82.5	48.0
S13.005	50.00	5.72	73.313	0.368	0.0	0.0	0.0	2.07	82.4	49.8
S13.006	50.00	5.80	73.040	0.383	0.0	0.0	0.0	2.22	88.2	51.8
S13.007	50.00	5.89	72.728	0.396	0.0	0.0	0.0	2.22	88.2	53.7
S13.008	50.00	5.97	72.412	0.411	0.0	0.0	0.0	2.22	88.3	55.7
S13.009	49.81	6.16	72.097	0.440	0.0	0.0	0.0	2.22	88.2	59.4
S14.000	50.00	4.36	71.670	0.028	0.0	0.0	0.0	1.31	52.0	3.7
S13.010	49.51	6.26	71.302	0.478	0.0	0.0	0.0	1.29	90.9	64.1
S11.004	46.58	7.29	71.176	1.148	0.0	0.0	0.0	1.57	173.6	144.8
S8.006	46.09	7.48	70.865	1.717	0.0	0.0	0.0	3.23	357.1	214.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S15.000	24.813	1.241	20.0	0.159	4.00	0.0	0.600	o	225	Pipe/Conduit	
S15.001	5.660	0.283	20.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.007	27.569	1.378	20.0	0.056	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.017	5.210	0.261	20.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.018	22.762	0.217	105.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S16.000	42.826	3.059	14.0	0.088	4.00	0.0	0.600	o	225	Pipe/Conduit	
S16.001	40.740	0.204	199.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S16.002	36.281	0.181	200.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S16.003	55.904	0.280	199.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S16.004	5.173	0.134	38.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.019	7.112	0.036	197.6	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.020	61.784	0.122	506.4	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
S1.021	135.778	0.679	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.022	51.634	0.258	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S15.000	50.00	4.14	68.500	0.159	0.0	0.0	0.0	2.94	116.9	21.6
S15.001	50.00	4.17	67.259	0.164	0.0	0.0	0.0	2.94	116.9	22.3
S8.007	45.80	7.59	66.826	1.938	0.0	0.0	0.0	4.07	449.2	240.3
S1.017	45.75	7.61	65.448	2.483	10.9	0.0	0.0	4.07	449.3	318.5
S1.018	45.32	7.78	65.037	2.483	10.9	0.0	0.0	2.19	473.2	318.5
S16.000	50.00	4.20	69.698	0.088	0.0	0.0	0.0	3.52	139.8	12.0
S16.001	50.00	4.94	66.639	0.088	0.0	0.0	0.0	0.92	36.6	12.0
S16.002	50.00	5.60	66.435	0.088	0.0	0.0	0.0	0.92	36.6	12.0
S16.003	48.46	6.61	66.254	0.088	0.0	0.0	0.0	0.92	36.6	12.0
S16.004	48.34	6.65	65.974	0.088	0.0	0.0	0.0	2.12	84.1	12.0
S1.019	45.13	7.86	64.820	2.571	10.9	0.0	0.0	1.59	344.2	325.2
S1.020	43.10	8.75	64.634	2.571	10.9	0.0	0.0	1.16	414.3	325.2
S1.021	48.90	6.46	64.512	0.000	26.2	0.0	0.0	0.92	36.6	26.2
S1.022	46.31	7.39	63.833	0.000	26.2	0.0	0.0	0.92	36.6	26.2

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Roofs	95	0.046	0.044	0.044
	Classification	Roofs	95	0.009	0.009	0.053
	Classification	Roads	90	0.059	0.053	0.105
	Classification	Permeable	10	0.017	0.002	0.107
	Classification	Permeable	10	0.003	0.000	0.107
1.001	Classification	Roofs	95	0.049	0.046	0.046
	Classification	Roads	90	0.030	0.027	0.073
	Classification	Permeable	10	0.019	0.002	0.075
1.002	Classification	Roofs	95	0.071	0.068	0.068
	Classification	Roofs	95	0.037	0.035	0.103
	Classification	Roads	90	0.096	0.086	0.189
	Classification	Roads	90	0.009	0.008	0.197
	Classification	Permeable	10	0.001	0.000	0.197
	Classification	Permeable	10	0.012	0.001	0.198
	Classification	Permeable	10	0.021	0.002	0.200
	Classification	Permeable	10	0.018	0.002	0.202
1.003	-	-	100	0.130	0.130	0.130
2.000	Classification	Roofs	95	0.125	0.119	0.119
	Classification	Roofs	95	0.093	0.088	0.207
	Classification	Roads	90	0.070	0.063	0.270
	Classification	Permeable	10	0.047	0.005	0.275
	Classification	Permeable	10	0.040	0.004	0.279
2.001	Classification	Roofs	95	0.008	0.008	0.008
	Classification	Roads	90	0.007	0.007	0.014
	Classification	Permeable	10	0.008	0.001	0.015
2.002	Classification	Roofs	95	0.067	0.064	0.064
	Classification	Roofs	95	0.041	0.039	0.102
	Classification	Roads	90	0.044	0.039	0.141
	Classification	Roads	90	0.011	0.010	0.152
	Classification	Permeable	10	0.009	0.001	0.152
	Classification	Permeable	10	0.027	0.003	0.155
1.004	-	-	100	0.052	0.052	0.052
3.000	Classification	Roofs	95	0.022	0.021	0.021
	Classification	Roads	90	0.013	0.011	0.033
	Classification	Permeable	10	0.003	0.000	0.033
	Classification	Permeable	10	0.003	0.000	0.033
	Classification	Roads	90	0.004	0.003	0.037
4.000	Classification	Roofs	95	0.041	0.038	0.038
	Classification	Roads	90	0.022	0.020	0.059
	Classification	Permeable	10	0.012	0.001	0.060
3.001	Classification	Roads	90	0.011	0.010	0.010
	Classification	Permeable	10	0.006	0.001	0.010
	Classification	Permeable	10	0.004	0.000	0.011
	Classification	Roads	90	0.006	0.005	0.016
	Classification	Roads	90	0.005	0.005	0.021
5.000	Classification	Roofs	95	0.027	0.025	0.025
3.002	Classification	Roofs	95	0.022	0.021	0.021
	Classification	Roads	90	0.008	0.007	0.028
	Classification	Permeable	10	0.004	0.000	0.028
	Classification	Permeable	10	0.003	0.000	0.029
	Classification	Roads	90	0.004	0.003	0.032
	Classification	Roads	90	0.003	0.003	0.035
3.003	-	-	100	0.000	0.000	0.000
3.004	Classification	Roofs	95	0.065	0.062	0.062
	Classification	Roads	90	0.050	0.045	0.107
	Classification	Permeable	10	0.024	0.002	0.109
	Classification	Roads	90	0.011	0.010	0.119
	Classification	Permeable	10	0.047	0.005	0.124
3.005	Classification	Roofs	95	0.026	0.025	0.025
	Classification	Roads	90	0.008	0.007	0.032

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	Classification	Permeable	10	0.008	0.001	0.033
	Classification	Roads	90	0.004	0.003	0.036
1.005	Classification	Roofs	95	0.017	0.017	0.017
	Classification	Roofs	95	0.020	0.019	0.035
	Classification	Roads	90	0.007	0.007	0.042
	Classification	Permeable	10	0.008	0.001	0.043
	Classification	Roads	90	0.013	0.012	0.054
	Classification	Permeable	10	0.012	0.001	0.056
	Classification	Roads	90	0.005	0.005	0.060
6.000	Classification	Roofs	95	0.071	0.068	0.068
	Classification	Roads	90	0.034	0.031	0.099
	Classification	Permeable	10	0.006	0.001	0.099
	Classification	Permeable	10	0.039	0.004	0.103
	Classification	Roads	90	0.017	0.015	0.118
1.006	Classification	Roofs	95	0.010	0.010	0.010
	Classification	Roads	90	0.029	0.026	0.036
1.007	-	-	100	0.000	0.000	0.000
1.008	Classification	Roads	90	0.007	0.007	0.007
	Classification	Permeable	10	0.006	0.001	0.007
1.009	-	-	100	0.000	0.000	0.000
1.010	Classification	Roofs	95	0.072	0.068	0.068
	Classification	Roads	90	0.019	0.017	0.085
	Classification	Permeable	10	0.016	0.002	0.086
	Classification	Permeable	10	0.011	0.001	0.088
1.011	Classification	Roads	90	0.009	0.008	0.008
	Classification	Permeable	10	0.005	0.000	0.008
1.012	Classification	Roofs	95	0.057	0.054	0.054
	Classification	Roads	90	0.056	0.051	0.105
	Classification	Permeable	10	0.025	0.002	0.107
7.000	Classification	Roofs	95	0.057	0.054	0.054
	Classification	Roofs	95	0.057	0.054	0.108
	Classification	Roads	90	0.034	0.031	0.138
	Classification	Permeable	10	0.027	0.003	0.141
	Classification	Permeable	10	0.027	0.003	0.144
	Classification	Roads	90	0.011	0.010	0.154
	Classification	Roads	90	0.011	0.010	0.164
1.013	Classification	Roads	90	0.006	0.005	0.005
1.014	Classification	Roads	90	0.013	0.012	0.012
1.015	Classification	Roads	90	0.012	0.011	0.011
1.016	Classification	Roofs	95	0.079	0.075	0.075
	Classification	Roads	90	0.081	0.073	0.148
	Classification	Permeable	10	0.029	0.003	0.151
8.000	Classification	Roofs	95	0.033	0.031	0.031
	Classification	Roads	90	0.042	0.038	0.069
	Classification	Permeable	10	0.019	0.002	0.071
	Classification	Roads	90	0.010	0.009	0.080
8.001	Classification	Roads	90	0.013	0.012	0.012
8.002	Classification	Roofs	95	0.020	0.019	0.019
	Classification	Roads	90	0.028	0.025	0.044
	Classification	Permeable	10	0.007	0.001	0.045
	Classification	Permeable	10	0.008	0.001	0.045
	Classification	Roads	90	0.009	0.008	0.053
	Classification	Roads	90	0.009	0.008	0.061
9.000	Classification	Roofs	95	0.060	0.057	0.057
	Classification	Roads	90	0.045	0.041	0.098
	Classification	Permeable	10	0.015	0.001	0.100
	Classification	Roads	90	0.015	0.013	0.113
8.003	Classification	Roofs	95	0.020	0.019	0.019
	Classification	Roads	90	0.023	0.021	0.039
	Classification	Permeable	10	0.009	0.001	0.040

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	Classification	Roads	90	0.010	0.009	0.049
8.004	-	-	100	0.000	0.000	0.000
10.000	Classification	Roofs	95	0.028	0.027	0.027
	Classification	Roads	90	0.022	0.020	0.046
	Classification	Permeable	10	0.012	0.001	0.048
8.005	Classification	Roofs	95	0.044	0.042	0.042
	Classification	Roofs	95	0.025	0.023	0.065
	Classification	Roofs	95	0.032	0.030	0.096
	Classification	Roads	90	0.047	0.042	0.138
	Classification	Permeable	10	0.027	0.003	0.140
	Classification	Permeable	10	0.006	0.001	0.141
	Classification	Roads	90	0.018	0.016	0.157
	Classification	Roads	90	0.008	0.008	0.165
11.000	Classification	Roofs	95	0.095	0.091	0.091
	Classification	Roads	90	0.046	0.041	0.132
	Classification	Permeable	10	0.048	0.005	0.136
11.001	Classification	Roads	90	0.006	0.005	0.005
	Classification	Permeable	10	0.007	0.001	0.006
	Classification	Roads	90	0.005	0.005	0.011
11.002	Classification	Roofs	95	0.016	0.015	0.015
	Classification	Roads	90	0.009	0.008	0.023
	Classification	Roads	90	0.002	0.002	0.025
	Classification	Permeable	10	0.003	0.000	0.025
12.000	Classification	Roofs	95	0.050	0.047	0.047
	Classification	Roofs	95	0.074	0.070	0.118
	Classification	Roads	90	0.037	0.034	0.151
	Classification	Permeable	10	0.011	0.001	0.152
	Classification	Permeable	10	0.028	0.003	0.155
	Classification	Roads	90	0.012	0.010	0.166
	Classification	Roads	90	0.014	0.012	0.178
12.001	Classification	Roofs	95	0.011	0.010	0.010
	Classification	Roofs	95	0.015	0.014	0.024
	Classification	Roads	90	0.012	0.011	0.035
	Classification	Permeable	10	0.003	0.000	0.035
	Classification	Permeable	10	0.003	0.000	0.036
	Classification	Roads	90	0.006	0.005	0.041
12.002	Classification	Roofs	95	0.019	0.018	0.018
	Classification	Roads	90	0.040	0.036	0.054
	Classification	Permeable	10	0.007	0.001	0.055
	Classification	Roads	90	0.008	0.007	0.062
	Classification	Roads	90	0.004	0.004	0.066
	Classification	Permeable	10	0.005	0.000	0.067
12.003	Classification	Roofs	95	0.047	0.044	0.044
	Classification	Roads	90	0.036	0.032	0.077
	Classification	Roads	90	0.016	0.014	0.091
	Classification	Permeable	10	0.014	0.001	0.092
12.004	Classification	Roads	90	0.004	0.004	0.004
12.005	-	-	100	0.000	0.000	0.000
12.006	Classification	Roofs	95	0.030	0.028	0.028
	Classification	Roads	90	0.021	0.019	0.047
	Classification	Permeable	10	0.002	0.000	0.048
	Classification	Permeable	10	0.007	0.001	0.048
	Classification	Permeable	10	0.002	0.000	0.049
	Classification	Roads	90	0.008	0.007	0.055
11.003	Classification	Roads	90	0.002	0.002	0.002
13.000	Classification	Roofs	95	0.023	0.022	0.022
	Classification	Roofs	95	0.019	0.018	0.040
	Classification	Roads	90	0.031	0.028	0.068
	Classification	Permeable	10	0.010	0.001	0.069
	Classification	Permeable	10	0.010	0.001	0.070

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	Classification	Roads	90	0.016	0.014	0.084
	Classification	Roads	90	0.009	0.008	0.091
13.001	Classification	Roads	90	0.059	0.053	0.053
13.002	Classification	Roads	90	0.020	0.018	0.018
13.003	Classification	Roads	90	0.106	0.095	0.095
13.004	Classification	Roads	90	0.107	0.097	0.097
13.005	Classification	Roads	90	0.015	0.013	0.013
13.006	Classification	Roads	90	0.017	0.015	0.015
13.007	Classification	Roads	90	0.015	0.014	0.014
13.008	Classification	Roads	90	0.017	0.015	0.015
13.009	Classification	Roads	90	0.032	0.029	0.029
14.000	Classification	Green Roof	30	0.037	0.011	0.011
	Classification	Roads	90	0.015	0.014	0.025
	Classification	Permeable	10	0.025	0.003	0.028
13.010	Classification	Roads	90	0.011	0.010	0.010
11.004	Classification	Roads	90	0.066	0.059	0.059
8.006	Classification	Roofs	95	0.013	0.012	0.012
	Classification	Roads	90	0.022	0.020	0.032
	Classification	Roads	90	0.010	0.009	0.041
	Classification	Permeable	10	0.012	0.001	0.042
15.000	Classification	Roofs	95	0.082	0.078	0.078
	Classification	Roofs	95	0.022	0.021	0.099
	Classification	Roads	90	0.019	0.017	0.116
	Classification	Roads	90	0.044	0.040	0.156
	Classification	Permeable	10	0.022	0.002	0.158
	Classification	Permeable	10	0.009	0.001	0.159
15.001	Classification	Roads	90	0.006	0.005	0.005
8.007	Classification	Roofs	95	0.014	0.013	0.013
	Classification	Roofs	95	0.027	0.025	0.038
	Classification	Roads	90	0.017	0.015	0.054
	Classification	Permeable	10	0.012	0.001	0.055
	Classification	Permeable	10	0.009	0.001	0.056
1.017	-	-	100	0.000	0.000	0.000
1.018	-	-	100	0.000	0.000	0.000
16.000	Classification	Roads	90	0.098	0.088	0.088
16.001	-	-	100	0.000	0.000	0.000
16.002	-	-	100	0.000	0.000	0.000
16.003	-	-	100	0.000	0.000	0.000
16.004	-	-	100	0.000	0.000	0.000
1.019	-	-	100	0.000	0.000	0.000
1.020	-	-	100	0.000	0.000	0.000
1.021	-	-	100	0.000	0.000	0.000
1.022	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				5.300	4.146	4.146

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.022	S77	65.323	63.575	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.250		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S21, DS/PN: S1.008, Volume (m³): 7.5

Unit Reference	MD-SHE-0141-1090-1680-1090
Design Head (m)	1.680
Design Flow (l/s)	10.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	141
Invert Level (m)	79.890
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.680	10.9	Kick-Flo®	1.029	8.7
Flush-Flo™	0.489	10.9	Mean Flow over Head Range	-	9.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.1	0.800	10.3	2.000	11.8	4.000	16.5	7.000	21.5
0.200	9.6	1.000	9.0	2.200	12.4	4.500	17.4	7.500	22.2
0.300	10.4	1.200	9.3	2.400	12.9	5.000	18.3	8.000	22.9
0.400	10.8	1.400	10.0	2.600	13.4	5.500	19.2	8.500	23.6
0.500	10.9	1.600	10.7	3.000	14.3	6.000	20.0	9.000	24.3
0.600	10.8	1.800	11.3	3.500	15.4	6.500	20.8	9.500	24.9

Hydro-Brake® Optimum Manhole: S75, DS/PN: S1.021, Volume (m³): 29.5

Unit Reference	MD-SHE-0214-2620-1680-2620
Design Head (m)	1.680
Design Flow (l/s)	26.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	214
Invert Level (m)	64.512
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.680	26.2	Kick-Flo®	1.094	21.3
Flush-Flo™	0.504	26.1	Mean Flow over Head Range	-	22.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.3	0.400	25.8	0.800	25.2	1.400	24.0	2.000	28.4
0.200	20.8	0.500	26.1	1.000	23.3	1.600	25.6	2.200	29.8
0.300	24.9	0.600	25.9	1.200	22.3	1.800	27.0	2.400	31.0

Hydro-Brake® Optimum Manhole: S75, DS/PN: S1.021, Volume (m³): 29.5

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
2.600	32.2	4.000	39.7	5.500	46.3	7.000	52.0	8.500	57.2
3.000	34.5	4.500	42.0	6.000	48.3	7.500	53.8	9.000	58.8
3.500	37.2	5.000	44.2	6.500	50.2	8.000	55.5	9.500	60.3

Storage Structures for Storm

Cellular Storage Manhole: S21, DS/PN: S1.008

Invert Level (m) 79.890 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.67
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	750.0	0.0	0.900	750.0	0.0	1.681	0.0	0.0
0.100	750.0	0.0	1.000	750.0	0.0	1.900	0.0	0.0
0.200	750.0	0.0	1.100	750.0	0.0	2.000	0.0	0.0
0.300	750.0	0.0	1.200	750.0	0.0	2.100	0.0	0.0
0.400	750.0	0.0	1.300	750.0	0.0	2.200	0.0	0.0
0.500	750.0	0.0	1.400	750.0	0.0	2.300	0.0	0.0
0.600	750.0	0.0	1.500	750.0	0.0	2.400	0.0	0.0
0.700	750.0	0.0	1.600	750.0	0.0	2.500	0.0	0.0
0.800	750.0	0.0	1.680	750.0	0.0			

Cellular Storage Manhole: S75, DS/PN: S1.021

Invert Level (m) 64.512 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.21420 Porosity 0.67
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	820.0	820.0	0.900	820.0	923.1	1.681	0.0	1012.5
0.100	820.0	831.5	1.000	820.0	934.5	1.900	0.0	1037.6
0.200	820.0	842.9	1.100	820.0	946.0	2.000	0.0	1049.1
0.300	820.0	854.4	1.200	820.0	957.5	2.100	0.0	1060.5
0.400	820.0	865.8	1.300	820.0	968.9	2.200	0.0	1072.0
0.500	820.0	877.3	1.400	820.0	980.4	2.300	0.0	1083.4
0.600	820.0	888.7	1.500	820.0	991.8	2.400	0.0	1094.9
0.700	820.0	900.2	1.600	820.0	1003.3	2.500	0.0	1106.4
0.800	820.0	911.6	1.680	820.0	1012.4			

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.800
Region	Scotland and Ireland	Ratio R	0.250
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Winter	1	+10%	30/15 Summer				85.490	-0.128
S1.001	S2	15 Winter	1	+10%	30/15 Summer				85.191	-0.100
S1.002	S3	15 Winter	1	+10%	30/15 Summer				84.822	-0.144
S1.003	S4	15 Winter	1	+10%	30/15 Summer				84.395	-0.123
S2.000	S5	15 Winter	1	+10%	30/15 Summer				86.442	-0.083
S2.001	S6	15 Winter	1	+10%	30/15 Summer				85.420	-0.013
S2.002	S7	15 Winter	1	+10%	100/15 Summer				85.203	-0.153
S1.004	S8	15 Winter	1	+10%	30/15 Summer				83.902	-0.157
S3.000	S9	15 Winter	1	+10%					84.411	-0.191
S4.000	S10	15 Winter	1	+10%	100/15 Summer				82.758	-0.149
S3.001	S11	15 Winter	1	+10%	100/15 Summer				82.553	-0.155
S5.000	S12	15 Winter	1	+10%					83.896	-0.199
S3.002	S13	15 Winter	1	+10%	30/15 Summer				81.892	-0.136
S3.003	S14	15 Winter	1	+10%	30/15 Summer				81.491	-0.131
S3.004	S15	15 Winter	1	+10%	30/15 Summer				81.254	-0.147
S3.005	S16	15 Winter	1	+10%	30/15 Summer				80.956	-0.164
S1.005	S17	15 Winter	1	+10%	30/15 Summer				80.893	-0.077
S6.000	S18	15 Winter	1	+10%	30/15 Summer				80.847	-0.122
S1.006	S19	15 Winter	1	+10%	30/15 Summer				80.570	-0.008
S1.007	S20	600 Winter	1	+10%	30/15 Summer				80.397	-0.107
S1.008	S21	600 Winter	1	+10%	1/30 Winter				80.393	0.278
S1.009	S22	600 Winter	1	+10%	100/30 Summer				77.084	-0.143
S1.010	S23	60 Winter	1	+10%	100/15 Summer				77.007	-0.115
S1.011	S24	60 Winter	1	+10%	30/30 Summer				76.922	-0.106
S1.012	S25	60 Summer	1	+10%					76.837	-0.148
S7.000	S26	15 Winter	1	+10%					76.376	-0.155
S1.013	S27	15 Winter	1	+10%	30/15 Summer				72.631	-0.094
S1.014	S28	15 Winter	1	+10%	30/15 Summer				72.344	-0.099
S1.015	S29	15 Winter	1	+10%	30/15 Summer				71.949	-0.086
S1.016	S30	15 Winter	1	+10%	100/15 Summer				71.536	-0.170
S8.000	S31	15 Winter	1	+10%					81.612	-0.179
S8.001	S32	15 Winter	1	+10%					78.872	-0.165

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.37			15.1	OK	
S1.001	S2	0.000	0.57			23.1	OK	
S1.002	S3	0.000	0.52			44.6	OK	
S1.003	S4	0.000	0.63			56.8	OK	
S2.000	S5	0.000	0.68			38.4	OK	
S2.001	S6	0.000	1.00			39.2	OK	
S2.002	S7	0.000	0.48			57.0	OK	
S1.004	S8	0.000	0.46			117.9	OK	
S3.000	S9	0.000	0.05			5.4	OK	
S4.000	S10	0.000	0.24			8.5	OK	
S3.001	S11	0.000	0.21			16.1	OK	
S5.000	S12	0.000	0.03			3.7	OK	
S3.002	S13	0.000	0.32			23.7	OK	
S3.003	S14	0.000	0.36			23.8	OK	
S3.004	S15	0.000	0.49			36.7	OK	
S3.005	S16	0.000	0.42			40.9	OK	
S1.005	S17	0.000	0.94			161.8	OK	
S6.000	S18	0.000	0.43			17.3	OK	
S1.006	S19	0.000	1.00			169.1	OK	
S1.007	S20	0.000	0.15			33.7	OK	
S1.008	S21	0.000	0.38		310	10.9	SURCHARGED	
S1.009	S22	0.000	0.29			10.9	OK	
S1.010	S23	0.000	0.47			15.6	OK	
S1.011	S24	0.000	0.55			16.2	OK	
S1.012	S25	0.000	0.25			24.7	OK	
S7.000	S26	0.000	0.21			24.0	OK	
S1.013	S27	0.000	0.62			46.6	OK	
S1.014	S28	0.000	0.59			48.5	OK	
S1.015	S29	0.000	0.70			50.0	OK	
S1.016	S30	0.000	0.39			66.4	OK	
S8.000	S31	0.000	0.09			11.7	OK	
S8.001	S32	0.000	0.16			13.1	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S8.002	S33	15 Winter	1	+10%					78.554	-0.156
S9.000	S34	15 Winter	1	+10%	100/15 Summer				77.223	-0.128
S8.003	S35	15 Winter	1	+10%	100/15 Summer				76.702	-0.126
S8.004	S36	15 Winter	1	+10%	30/15 Summer				72.944	-0.081
S10.000	S37	15 Winter	1	+10%					74.727	-0.174
S8.005	S38	15 Winter	1	+10%	30/15 Summer				72.712	-0.152
S11.000	S39	15 Winter	1	+10%					76.705	-0.156
S11.001	S40	15 Winter	1	+10%	100/15 Summer				73.896	-0.142
S11.002	S41	15 Winter	1	+10%	100/15 Summer				73.634	-0.136
S12.000	S42	15 Winter	1	+10%	30/15 Summer				79.036	-0.109
S12.001	S43	15 Winter	1	+10%	30/15 Summer				78.505	-0.103
S12.002	S44	15 Winter	1	+10%	30/15 Winter				78.204	-0.116
S12.003	S45	15 Winter	1	+10%	30/15 Summer				75.145	-0.080
S12.004	S46	15 Winter	1	+10%	1/15 Summer				74.064	0.044
S12.005	S47	15 Winter	1	+10%	30/15 Summer				73.953	0.000
S12.006	S48	15 Winter	1	+10%	30/15 Summer				73.780	-0.070
S11.003	S49	15 Winter	1	+10%	30/15 Summer				73.085	-0.070
S13.000	S50	15 Winter	1	+10%					81.388	-0.170
S13.001	S51	15 Winter	1	+10%					79.693	-0.154
S13.002	S52	15 Winter	1	+10%	100/15 Summer				79.166	-0.151
S13.003	S53	15 Winter	1	+10%	100/15 Summer				78.586	-0.128
S13.004	S54	15 Winter	1	+10%	30/15 Summer				75.319	-0.106
S13.005	S55	15 Winter	1	+10%	30/15 Summer				73.444	-0.093
S13.006	S56	15 Winter	1	+10%	30/15 Summer				73.169	-0.096
S13.007	S57	15 Winter	1	+10%	30/15 Summer				72.859	-0.094
S13.008	S58	15 Winter	1	+10%	30/15 Summer				72.545	-0.091
S13.009	S59	15 Winter	1	+10%	30/15 Summer				72.228	-0.094
S14.000	S60	15 Winter	1	+10%	30/15 Summer				71.713	-0.182
S13.010	S61	15 Winter	1	+10%	30/15 Summer				71.526	-0.075
S11.004	S62	15 Winter	1	+10%	30/15 Summer				71.439	-0.112
S8.006	S63	15 Winter	1	+10%	30/15 Summer				71.077	-0.162
S15.000	S64	15 Winter	1	+10%	30/15 Summer	100/15 Winter			68.571	-0.154
S15.001	S65	15 Winter	1	+10%	30/15 Summer				67.346	-0.138
S8.007	S66	15 Winter	1	+10%	30/15 Summer				67.026	-0.175
S1.017	S67	15 Winter	1	+10%	1/15 Summer				66.092	0.269
S1.018	S68	15 Winter	1	+10%	1/15 Winter				65.570	0.008
S16.000	S68	15 Winter	1	+10%					69.745	-0.178
S16.001	S69	15 Summer	1	+10%	100/15 Summer				66.734	-0.130
S16.002	S70	15 Winter	1	+10%					66.529	-0.131
S16.003	S71	15 Winter	1	+10%					66.346	-0.133
S16.004	S72	15 Winter	1	+10%					66.046	-0.153
S1.019	S73	15 Winter	1	+10%	1/15 Summer				65.433	0.087
S1.020	S74	15 Winter	1	+10%	30/15 Summer				65.094	-0.215
S1.021	S75	180 Winter	1	+10%	1/15 Winter				64.914	0.176
S1.022	S76	240 Summer	1	+10%					63.976	-0.082

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S8.002	S33	0.000	0.20			20.1	OK	
S9.000	S34	0.000	0.36			15.4	OK	
S8.003	S35	0.000	0.40			41.3	OK	
S8.004	S36	0.000	0.73			41.4	OK	
S10.000	S37	0.000	0.12			7.0	OK	
S8.005	S38	0.000	0.48			66.5	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S11.000	S39	0.000	0.20			19.8	OK	
S11.001	S40	0.000	0.29			21.0	OK	
S11.002	S41	0.000	0.33			23.7	OK	
S12.000	S42	0.000	0.51			25.3	OK	
S12.001	S43	0.000	0.56			30.0	OK	
S12.002	S44	0.000	0.47			37.3	OK	
S12.003	S45	0.000	0.72			47.0	OK	
S12.004	S46	0.000	1.27			46.5	SURCHARGED	
S12.005	S47	0.000	1.03			46.4	OK	
S12.006	S48	0.000	0.80			51.4	OK	
S11.003	S49	0.000	0.82			70.2	OK	
S13.000	S50	0.000	0.13			13.4	OK	
S13.001	S51	0.000	0.22			19.6	OK	
S13.002	S52	0.000	0.24			21.6	OK	
S13.003	S53	0.000	0.39			32.8	OK	
S13.004	S54	0.000	0.53			42.8	OK	
S13.005	S55	0.000	0.64			44.4	OK	
S13.006	S56	0.000	0.62			46.2	OK	
S13.007	S57	0.000	0.64			47.7	OK	
S13.008	S58	0.000	0.66			49.2	OK	
S13.009	S59	0.000	0.64			52.0	OK	
S14.000	S60	0.000	0.08			4.0	OK	
S13.010	S61	0.000	0.91			55.6	OK	
S11.004	S62	0.000	0.83			130.9	OK	
S8.006	S63	0.000	0.61			196.0	OK	
S15.000	S64	0.000	0.22			23.4	OK	3
S15.001	S65	0.000	0.32			24.0	OK	
S8.007	S66	0.000	0.56			218.9	OK	
S1.017	S67	0.000	1.41			282.3	SURCHARGED	
S1.018	S68	0.000	0.79			282.2	SURCHARGED	
S16.000	S68	0.000	0.10			13.0	OK	
S16.001	S69	0.000	0.35			12.3	OK	
S16.002	S70	0.000	0.35			12.2	OK	
S16.003	S71	0.000	0.32			11.5	OK	
S16.004	S72	0.000	0.22			11.6	OK	
S1.019	S73	0.000	1.44			295.1	SURCHARGED	
S1.020	S74	0.000	0.79			288.9	OK	
S1.021	S75	0.000	0.71		84	25.6	SURCHARGED	
S1.022	S76	0.000	0.73			25.6	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 18.800	Cv (Summer) 0.750
Region	Scotland and Ireland	Ratio R 0.250	Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Winter	30	+10%	30/15 Summer				85.771	0.153
S1.001	S2	15 Winter	30	+10%	30/15 Summer				85.660	0.369
S1.002	S3	15 Winter	30	+10%	30/15 Summer				85.293	0.328
S1.003	S4	15 Winter	30	+10%	30/15 Summer				84.888	0.370
S2.000	S5	15 Winter	30	+10%	30/15 Summer				87.476	0.951
S2.001	S6	15 Winter	30	+10%	30/15 Summer				85.628	0.195
S2.002	S7	15 Winter	30	+10%	100/15 Summer				85.297	-0.058
S1.004	S8	15 Winter	30	+10%	30/15 Summer				84.265	0.207
S3.000	S9	15 Winter	30	+10%					84.429	-0.173
S4.000	S10	15 Winter	30	+10%	100/15 Summer				82.803	-0.104
S3.001	S11	15 Winter	30	+10%	100/15 Summer				82.616	-0.091
S5.000	S12	15 Winter	30	+10%					83.910	-0.185
S3.002	S13	15 Winter	30	+10%	30/15 Summer				82.540	0.511
S3.003	S14	15 Winter	30	+10%	30/15 Summer				82.432	0.810
S3.004	S15	15 Winter	30	+10%	30/15 Summer				82.362	0.962
S3.005	S16	15 Winter	30	+10%	30/15 Summer				82.168	1.048
S1.005	S17	15 Winter	30	+10%	30/15 Summer				82.093	1.124
S6.000	S18	960 Winter	30	+10%	30/15 Summer				81.138	0.169
S1.006	S19	960 Winter	30	+10%	30/15 Summer				81.136	0.557
S1.007	S20	960 Winter	30	+10%	30/15 Summer				81.133	0.628
S1.008	S21	960 Winter	30	+10%	1/30 Winter				81.129	1.014
S1.009	S22	30 Summer	30	+10%	100/30 Summer				77.132	-0.095
S1.010	S23	30 Summer	30	+10%	100/15 Summer				77.116	-0.006
S1.011	S24	30 Summer	30	+10%	30/30 Summer				77.029	0.001
S1.012	S25	15 Winter	30	+10%					76.893	-0.093
S7.000	S26	15 Winter	30	+10%					76.415	-0.116
S1.013	S27	15 Winter	30	+10%	30/15 Summer				73.920	1.195
S1.014	S28	15 Winter	30	+10%	30/15 Summer				73.332	0.889
S1.015	S29	15 Winter	30	+10%	30/15 Summer				72.563	0.527
S1.016	S30	15 Winter	30	+10%	100/15 Summer				71.632	-0.074
S8.000	S31	15 Winter	30	+10%					81.636	-0.155
S8.001	S32	15 Winter	30	+10%					78.907	-0.130

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.77			31.1	SURCHARGED	
S1.001	S2	0.000	1.04			42.3	SURCHARGED	
S1.002	S3	0.000	1.01			87.8	SURCHARGED	
S1.003	S4	0.000	1.17			105.7	SURCHARGED	
S2.000	S5	0.000	1.27			72.0	SURCHARGED	
S2.001	S6	0.000	1.90			74.6	SURCHARGED	
S2.002	S7	0.000	0.98			115.8	OK	
S1.004	S8	0.000	0.84			214.2	SURCHARGED	
S3.000	S9	0.000	0.12			12.0	OK	
S4.000	S10	0.000	0.54			18.9	OK	
S3.001	S11	0.000	0.49			37.3	OK	
S5.000	S12	0.000	0.07			8.3	OK	
S3.002	S13	0.000	0.70			50.8	SURCHARGED	
S3.003	S14	0.000	0.64			42.3	SURCHARGED	
S3.004	S15	0.000	0.85			62.9	SURCHARGED	
S3.005	S16	0.000	0.75			72.3	SURCHARGED	
S1.005	S17	0.000	1.67			289.0	SURCHARGED	
S6.000	S18	0.000	0.09			3.5	SURCHARGED	
S1.006	S19	0.000	0.27			45.7	SURCHARGED	
S1.007	S20	0.000	0.21			45.6	SURCHARGED	
S1.008	S21	0.000	0.38		736	10.9	SURCHARGED	
S1.009	S22	0.000	0.29			10.9	OK	
S1.010	S23	0.000	0.93			30.6	OK	
S1.011	S24	0.000	1.10			32.6	SURCHARGED	
S1.012	S25	0.000	0.63			62.9	OK	
S7.000	S26	0.000	0.48			53.4	OK	
S1.013	S27	0.000	1.48			111.0	SURCHARGED	
S1.014	S28	0.000	1.37			111.6	SURCHARGED	
S1.015	S29	0.000	1.61			114.8	SURCHARGED	
S1.016	S30	0.000	0.89			152.0	OK	
S8.000	S31	0.000	0.21			26.1	OK	
S8.001	S32	0.000	0.37			30.0	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S8.002	S33	15 Summer	30	+10%					78.598	-0.112
S9.000	S34	15 Winter	30	+10%	100/15 Summer				77.288	-0.063
S8.003	S35	15 Winter	30	+10%	100/15 Summer				76.780	-0.048
S8.004	S36	15 Winter	30	+10%	30/15 Summer				73.649	0.624
S10.000	S37	15 Winter	30	+10%					74.753	-0.148
S8.005	S38	15 Winter	30	+10%	30/15 Summer				73.190	0.326
S11.000	S39	15 Winter	30	+10%					76.742	-0.119
S11.001	S40	15 Winter	30	+10%	100/15 Summer				73.946	-0.092
S11.002	S41	15 Winter	30	+10%	100/15 Summer				73.745	-0.025
S12.000	S42	15 Winter	30	+10%	30/15 Summer				79.289	0.144
S12.001	S43	15 Winter	30	+10%	30/15 Summer				78.719	0.111
S12.002	S44	15 Winter	30	+10%	30/15 Winter				78.397	0.077
S12.003	S45	15 Winter	30	+10%	30/15 Summer				77.082	1.857
S12.004	S46	15 Winter	30	+10%	1/15 Summer				75.332	1.312
S12.005	S47	15 Winter	30	+10%	30/15 Summer				75.014	1.061
S12.006	S48	15 Winter	30	+10%	30/15 Summer				74.692	0.842
S11.003	S49	15 Winter	30	+10%	30/15 Summer				73.579	0.425
S13.000	S50	15 Winter	30	+10%					81.417	-0.141
S13.001	S51	15 Winter	30	+10%					79.737	-0.110
S13.002	S52	15 Summer	30	+10%	100/15 Summer				79.215	-0.102
S13.003	S53	15 Winter	30	+10%	100/15 Summer				78.669	-0.045
S13.004	S54	15 Winter	30	+10%	30/15 Summer				76.817	1.392
S13.005	S55	15 Winter	30	+10%	30/15 Summer				74.612	1.075
S13.006	S56	15 Winter	30	+10%	30/15 Summer				74.230	0.965
S13.007	S57	15 Winter	30	+10%	30/15 Summer				73.842	0.890
S13.008	S58	15 Winter	30	+10%	30/15 Summer				73.427	0.790
S13.009	S59	15 Winter	30	+10%	30/15 Summer				73.019	0.697
S14.000	S60	15 Winter	30	+10%	30/15 Summer				72.226	0.331
S13.010	S61	15 Winter	30	+10%	30/15 Summer				72.217	0.616
S11.004	S62	15 Winter	30	+10%	30/15 Summer				72.104	0.554
S8.006	S63	15 Winter	30	+10%	30/15 Summer				71.551	0.311
S15.000	S64	15 Winter	30	+10%	30/15 Summer	100/15 Winter			69.654	0.929
S15.001	S65	15 Winter	30	+10%	30/15 Summer				69.582	2.098
S8.007	S66	15 Winter	30	+10%	30/15 Summer				69.555	2.354
S1.017	S67	15 Winter	30	+10%	1/15 Summer				68.200	2.377
S1.018	S68	15 Winter	30	+10%	1/15 Winter				66.422	0.860
S16.000	S68	15 Winter	30	+10%					69.769	-0.154
S16.001	S69	15 Winter	30	+10%	100/15 Summer				66.796	-0.068
S16.002	S70	15 Winter	30	+10%					66.588	-0.072
S16.003	S71	15 Winter	30	+10%					66.400	-0.079
S16.004	S72	15 Winter	30	+10%					66.085	-0.114
S1.019	S73	15 Winter	30	+10%	1/15 Summer				65.954	0.609
S1.020	S74	240 Winter	30	+10%	30/15 Summer				65.680	0.371
S1.021	S75	240 Winter	30	+10%	1/15 Winter				65.671	0.933
S1.022	S76	2160 Summer	30	+10%					63.976	-0.082

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S8.002	S33	0.000	0.50			49.8	OK	
S9.000	S34	0.000	0.81			34.2	OK	
S8.003	S35	0.000	0.95			98.2	OK	
S8.004	S36	0.000	1.72			97.5	SURCHARGED	
S10.000	S37	0.000	0.26			15.6	OK	
S8.005	S38	0.000	1.12			154.1	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S11.000	S39	0.000	0.45			44.1	OK	
S11.001	S40	0.000	0.65			47.5	OK	
S11.002	S41	0.000	0.76			54.8	OK	
S12.000	S42	0.000	1.04			51.9	SURCHARGED	
S12.001	S43	0.000	1.14			60.7	SURCHARGED	
S12.002	S44	0.000	0.95			76.4	SURCHARGED	
S12.003	S45	0.000	1.28			83.4	SURCHARGED	
S12.004	S46	0.000	2.18			79.6	SURCHARGED	
S12.005	S47	0.000	1.79			80.4	SURCHARGED	
S12.006	S48	0.000	1.34			85.6	SURCHARGED	
S11.003	S49	0.000	1.38			118.0	SURCHARGED	
S13.000	S50	0.000	0.30			29.9	OK	
S13.001	S51	0.000	0.52			47.1	OK	
S13.002	S52	0.000	0.58			53.0	OK	
S13.003	S53	0.000	0.97			82.2	OK	
S13.004	S54	0.000	1.16			92.9	SURCHARGED	
S13.005	S55	0.000	1.21			84.4	SURCHARGED	
S13.006	S56	0.000	1.13			83.8	SURCHARGED	
S13.007	S57	0.000	1.14			85.2	SURCHARGED	
S13.008	S58	0.000	1.18			88.1	SURCHARGED	
S13.009	S59	0.000	1.13			92.1	SURCHARGED	
S14.000	S60	0.000	0.16			7.6	SURCHARGED	
S13.010	S61	0.000	1.69			104.0	SURCHARGED	
S11.004	S62	0.000	1.40			221.5	SURCHARGED	
S8.006	S63	0.000	1.12			361.9	SURCHARGED	
S15.000	S64	0.000	0.47			50.4	SURCHARGED	3
S15.001	S65	0.000	0.72			53.9	SURCHARGED	
S8.007	S66	0.000	0.99			388.5	SURCHARGED	
S1.017	S67	0.000	2.64			527.2	SURCHARGED	
S1.018	S68	0.000	1.47			526.1	SURCHARGED	
S16.000	S68	0.000	0.22			28.9	OK	
S16.001	S69	0.000	0.79			27.6	OK	
S16.002	S70	0.000	0.77			26.7	OK	
S16.003	S71	0.000	0.72			25.5	OK	
S16.004	S72	0.000	0.49			25.4	OK	
S1.019	S73	0.000	2.68			549.4	SURCHARGED	
S1.020	S74	0.000	0.55			201.3	SURCHARGED	
S1.021	S75	0.000	0.71		188	25.5	SURCHARGED	
S1.022	S76	0.000	0.72			25.4	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	18.800
Region	Scotland and Ireland	Ratio R	0.250
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	10, 10, 10

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Winter	100	+10%	30/15 Summer				86.760	1.142
S1.001	S2	15 Winter	100	+10%	30/15 Summer				86.651	1.360
S1.002	S3	15 Winter	100	+10%	30/15 Summer				86.345	1.380
S1.003	S4	15 Winter	100	+10%	30/15 Summer				85.900	1.382
S2.000	S5	15 Winter	100	+10%	30/15 Summer				88.520	1.995
S2.001	S6	15 Winter	100	+10%	30/15 Summer				86.118	0.685
S2.002	S7	15 Winter	100	+10%	100/15 Summer				85.785	0.429
S1.004	S8	15 Winter	100	+10%	30/15 Summer				85.161	1.102
S3.000	S9	15 Winter	100	+10%					84.436	-0.166
S4.000	S10	15 Winter	100	+10%	100/15 Summer				83.215	0.308
S3.001	S11	15 Winter	100	+10%	100/15 Summer				83.175	0.468
S5.000	S12	15 Winter	100	+10%					83.916	-0.179
S3.002	S13	15 Winter	100	+10%	30/15 Summer				83.083	1.055
S3.003	S14	15 Winter	100	+10%	30/15 Summer				82.950	1.328
S3.004	S15	15 Winter	100	+10%	30/15 Summer				82.866	1.466
S3.005	S16	15 Winter	100	+10%	30/15 Summer				82.610	1.491
S1.005	S17	15 Winter	100	+10%	30/15 Summer				82.512	1.542
S6.000	S18	960 Winter	100	+10%	30/15 Summer				81.524	0.555
S1.006	S19	960 Winter	100	+10%	30/15 Summer				81.522	0.943
S1.007	S20	960 Winter	100	+10%	30/15 Summer				81.519	1.014
S1.008	S21	960 Winter	100	+10%	1/30 Winter				81.515	1.400
S1.009	S22	30 Summer	100	+10%	100/30 Summer				77.231	0.004
S1.010	S23	30 Summer	100	+10%	100/15 Summer				77.214	0.092
S1.011	S24	30 Summer	100	+10%	30/30 Summer				77.069	0.041
S1.012	S25	15 Winter	100	+10%					76.920	-0.065
S7.000	S26	15 Winter	100	+10%					76.434	-0.097
S1.013	S27	15 Winter	100	+10%	30/15 Summer				74.967	2.242
S1.014	S28	15 Winter	100	+10%	30/15 Summer				74.115	1.672
S1.015	S29	15 Winter	100	+10%	30/15 Summer				73.057	1.021
S1.016	S30	15 Winter	100	+10%	100/15 Summer				71.891	0.184
S8.000	S31	15 Winter	100	+10%					81.646	-0.145
S8.001	S32	15 Winter	100	+10%					78.922	-0.115

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.81			33.0	FLOOD RISK	
S1.001	S2	0.000	1.03			41.8	SURCHARGED	
S1.002	S3	0.000	1.15			99.2	SURCHARGED	
S1.003	S4	0.000	1.37			122.9	SURCHARGED	
S2.000	S5	0.000	1.49			84.7	FLOOD RISK	
S2.001	S6	0.000	2.16			84.5	SURCHARGED	
S2.002	S7	0.000	1.12			131.8	SURCHARGED	
S1.004	S8	0.000	0.93			235.2	SURCHARGED	
S3.000	S9	0.000	0.16			15.6	OK	
S4.000	S10	0.000	0.70			24.3	SURCHARGED	
S3.001	S11	0.000	0.56			42.9	SURCHARGED	
S5.000	S12	0.000	0.10			10.8	OK	
S3.002	S13	0.000	0.70			51.4	SURCHARGED	
S3.003	S14	0.000	0.66			43.6	FLOOD RISK	
S3.004	S15	0.000	0.96			71.4	FLOOD RISK	
S3.005	S16	0.000	0.81			78.8	SURCHARGED	
S1.005	S17	0.000	1.86			320.8	SURCHARGED	
S6.000	S18	0.000	0.11			4.3	SURCHARGED	
S1.006	S19	0.000	0.33			55.9	SURCHARGED	
S1.007	S20	0.000	0.25			55.8	SURCHARGED	
S1.008	S21	0.000	0.38		912	10.9	SURCHARGED	
S1.009	S22	0.000	0.30			11.3	SURCHARGED	
S1.010	S23	0.000	1.20			39.4	SURCHARGED	
S1.011	S24	0.000	1.44			42.6	SURCHARGED	
S1.012	S25	0.000	0.81			81.4	OK	
S7.000	S26	0.000	0.62			69.5	OK	
S1.013	S27	0.000	1.76			131.8	SURCHARGED	
S1.014	S28	0.000	1.62			132.7	SURCHARGED	
S1.015	S29	0.000	1.91			136.3	SURCHARGED	
S1.016	S30	0.000	1.04			176.9	SURCHARGED	
S8.000	S31	0.000	0.27			34.0	OK	
S8.001	S32	0.000	0.48			39.0	OK	

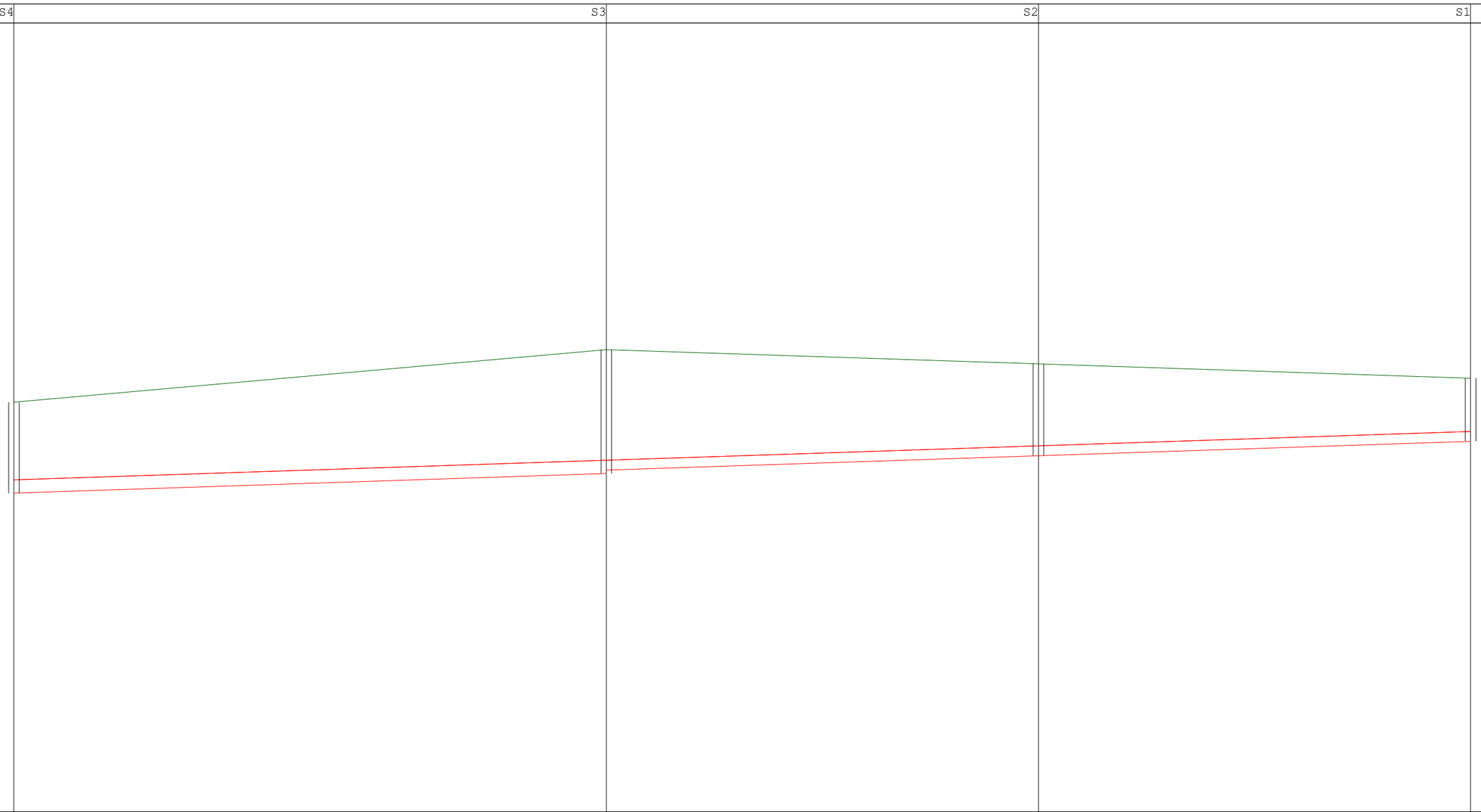
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S8.002	S33	15 Summer	100	+10%					78.618	-0.092
S9.000	S34	15 Winter	100	+10%	100/15 Summer				77.537	0.186
S8.003	S35	15 Winter	100	+10%	100/15 Summer				77.091	0.263
S8.004	S36	15 Winter	100	+10%	30/15 Summer				74.348	1.323
S10.000	S37	15 Winter	100	+10%					74.766	-0.135
S8.005	S38	15 Winter	100	+10%	30/15 Summer				73.768	0.904
S11.000	S39	15 Winter	100	+10%					76.761	-0.100
S11.001	S40	15 Winter	100	+10%	100/15 Summer				74.232	0.194
S11.002	S41	15 Winter	100	+10%	100/15 Summer				74.099	0.329
S12.000	S42	15 Winter	100	+10%	30/15 Summer				79.845	0.700
S12.001	S43	15 Winter	100	+10%	30/15 Summer				79.426	0.818
S12.002	S44	15 Winter	100	+10%	30/15 Winter				79.103	0.783
S12.003	S45	15 Winter	100	+10%	30/15 Summer				77.769	2.544
S12.004	S46	30 Winter	100	+10%	1/15 Summer				75.896	1.876
S12.005	S47	30 Winter	100	+10%	30/15 Summer				75.562	1.610
S12.006	S48	30 Winter	100	+10%	30/15 Summer				75.231	1.380
S11.003	S49	15 Winter	100	+10%	30/15 Summer				73.894	0.739
S13.000	S50	15 Winter	100	+10%					81.430	-0.128
S13.001	S51	15 Winter	100	+10%					79.786	-0.061
S13.002	S52	15 Winter	100	+10%	100/15 Summer				79.640	0.323
S13.003	S53	15 Winter	100	+10%	100/15 Summer				79.460	0.746
S13.004	S54	15 Winter	100	+10%	30/15 Summer				77.755	2.330
S13.005	S55	15 Winter	100	+10%	30/15 Summer				75.512	1.975
S13.006	S56	15 Winter	100	+10%	30/15 Summer				75.098	1.833
S13.007	S57	30 Winter	100	+10%	30/15 Summer				74.674	1.721
S13.008	S58	30 Winter	100	+10%	30/15 Summer				74.230	1.594
S13.009	S59	30 Winter	100	+10%	30/15 Summer				73.769	1.447
S14.000	S60	15 Winter	100	+10%	30/15 Summer				72.916	1.021
S13.010	S61	15 Winter	100	+10%	30/15 Summer				72.907	1.305
S11.004	S62	15 Winter	100	+10%	30/15 Summer				72.784	1.233
S8.006	S63	15 Winter	100	+10%	30/15 Summer				72.140	0.901
S15.000	S64	15 Winter	100	+10%	30/15 Summer	100/15 Winter			70.437	1.712
S15.001	S65	15 Winter	100	+10%	30/15 Summer				70.430	2.946
S8.007	S66	15 Winter	100	+10%	30/15 Summer				70.423	3.222
S1.017	S67	15 Winter	100	+10%	1/15 Summer				68.925	3.102
S1.018	S68	15 Winter	100	+10%	1/15 Winter				66.713	1.151
S16.000	S68	15 Winter	100	+10%					69.779	-0.144
S16.001	S69	15 Winter	100	+10%	100/15 Summer				66.885	0.021
S16.002	S70	15 Winter	100	+10%					66.634	-0.026
S16.003	S71	15 Winter	100	+10%					66.430	-0.049
S16.004	S72	15 Winter	100	+10%					66.180	-0.019
S1.019	S73	360 Winter	100	+10%	1/15 Summer				66.141	0.796
S1.020	S74	360 Winter	100	+10%	30/15 Summer				66.134	0.824
S1.021	S75	360 Winter	100	+10%	1/15 Winter				66.123	1.386
S1.022	S76	360 Winter	100	+10%					63.976	-0.082

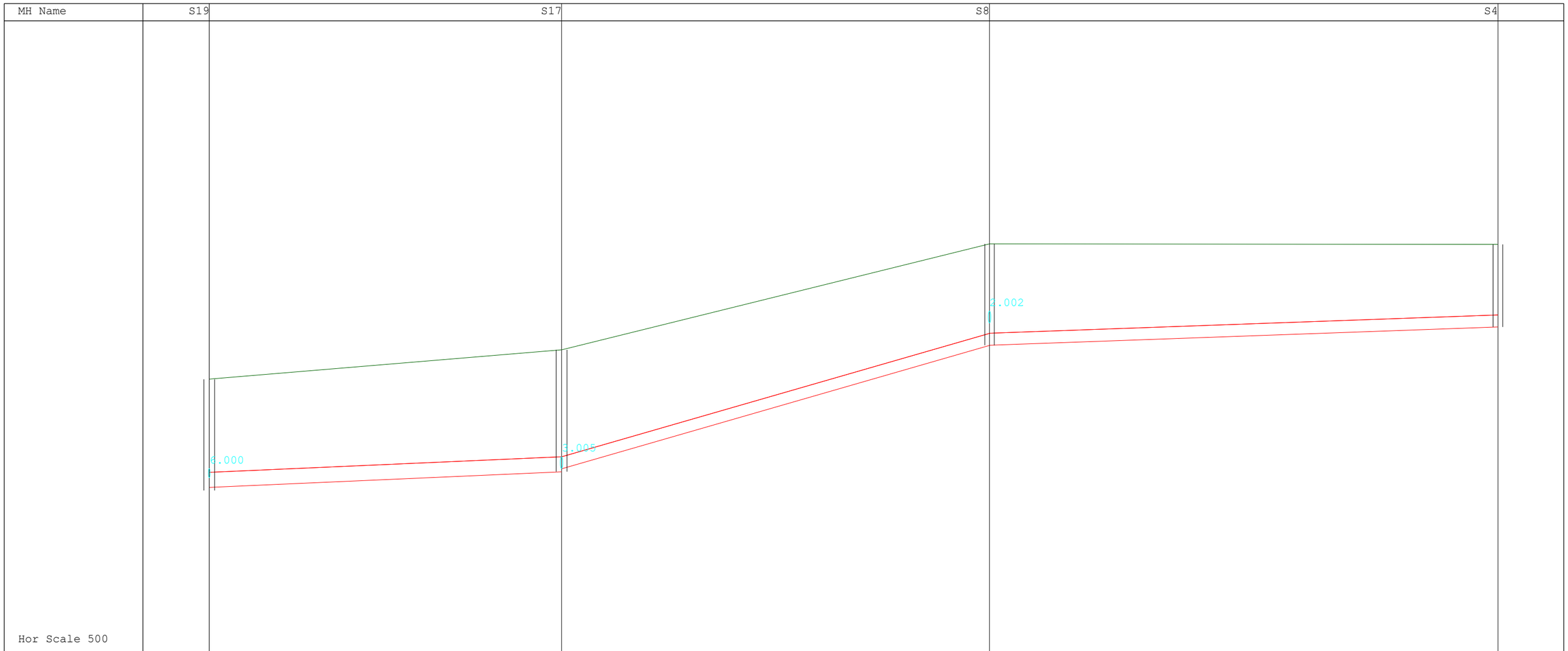
PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S8.002	S33	0.000	0.65			64.8	OK	
S9.000	S34	0.000	0.95			40.5	SURCHARGED	
S8.003	S35	0.000	1.06			109.4	SURCHARGED	
S8.004	S36	0.000	1.96			111.0	SURCHARGED	
S10.000	S37	0.000	0.34			20.2	OK	
S8.005	S38	0.000	1.32			180.6	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

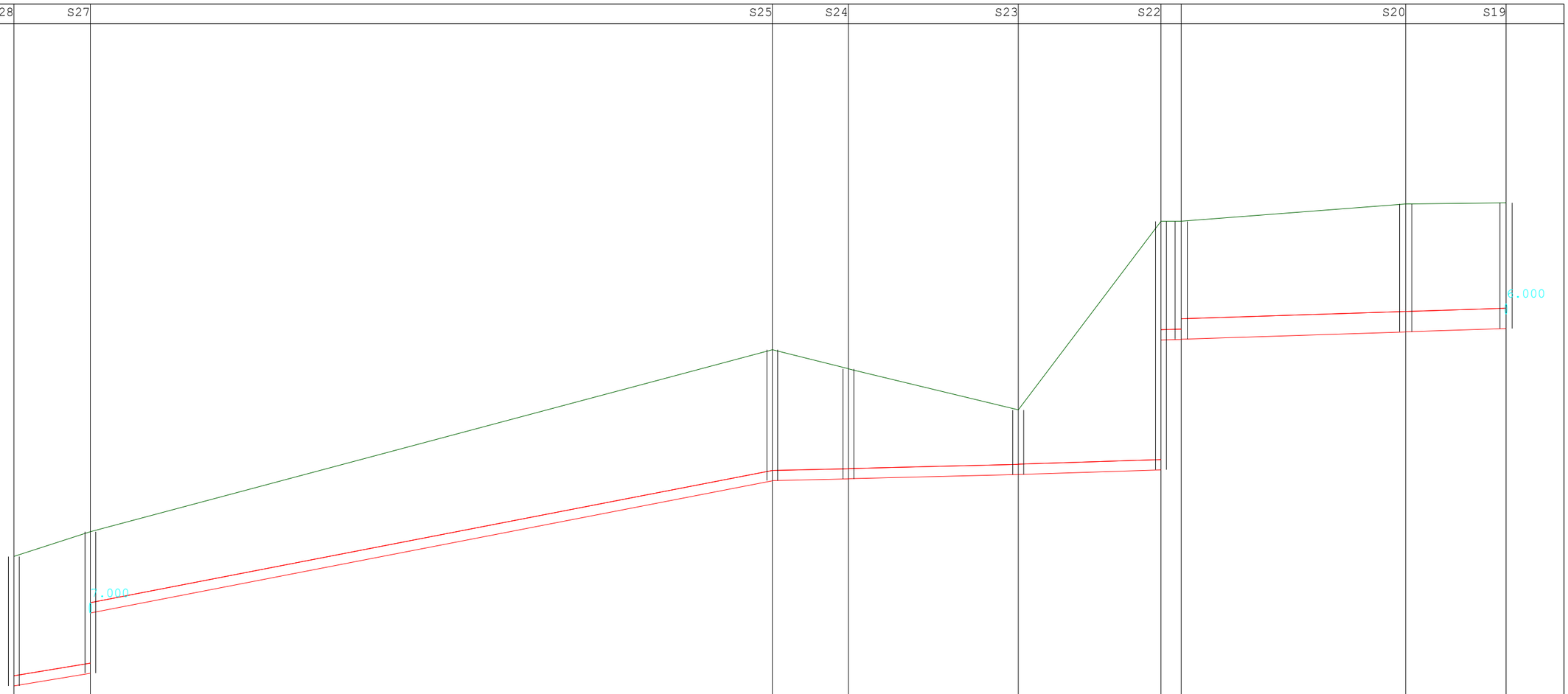
PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S11.000	S39	0.000	0.59			57.4	OK	
S11.001	S40	0.000	0.77			56.4	SURCHARGED	
S11.002	S41	0.000	0.86			61.8	SURCHARGED	
S12.000	S42	0.000	1.19			59.2	SURCHARGED	
S12.001	S43	0.000	1.12			60.0	SURCHARGED	
S12.002	S44	0.000	0.97			77.9	SURCHARGED	
S12.003	S45	0.000	1.33			86.6	FLOOD RISK	
S12.004	S46	0.000	2.24			81.9	FLOOD RISK	
S12.005	S47	0.000	1.86			83.8	SURCHARGED	
S12.006	S48	0.000	1.44			92.0	SURCHARGED	
S11.003	S49	0.000	1.58			135.1	SURCHARGED	
S13.000	S50	0.000	0.39			38.8	OK	
S13.001	S51	0.000	0.68			61.3	OK	
S13.002	S52	0.000	0.69			62.9	SURCHARGED	
S13.003	S53	0.000	1.02			86.2	SURCHARGED	
S13.004	S54	0.000	1.22			98.1	FLOOD RISK	
S13.005	S55	0.000	1.28			88.7	SURCHARGED	
S13.006	S56	0.000	1.18			88.0	SURCHARGED	
S13.007	S57	0.000	1.21			89.8	SURCHARGED	
S13.008	S58	0.000	1.28			95.6	SURCHARGED	
S13.009	S59	0.000	1.26			102.6	SURCHARGED	
S14.000	S60	0.000	0.21			10.2	FLOOD RISK	
S13.010	S61	0.000	1.98			121.5	SURCHARGED	
S11.004	S62	0.000	1.57			248.7	SURCHARGED	
S8.006	S63	0.000	1.22			391.3	SURCHARGED	
S15.000	S64	2.751	0.51			54.5	FLOOD	3
S15.001	S65	0.000	0.92			69.3	SURCHARGED	
S8.007	S66	0.000	1.09			428.1	SURCHARGED	
S1.017	S67	0.000	2.93			584.4	SURCHARGED	
S1.018	S68	0.000	1.63			582.9	SURCHARGED	
S16.000	S68	0.000	0.28			37.5	OK	
S16.001	S69	0.000	1.04			36.2	SURCHARGED	
S16.002	S70	0.000	0.99			34.3	OK	
S16.003	S71	0.000	0.93			32.8	OK	
S16.004	S72	0.000	0.61			31.8	OK	
S1.019	S73	0.000	0.94			192.9	SURCHARGED	
S1.020	S74	0.000	0.52			191.8	SURCHARGED	
S1.021	S75	0.000	0.71		270	25.6	SURCHARGED	
S1.022	S76	0.000	0.73			25.6	OK	



PN		S1.002	S1.001	S1.000	
Dia (mm)		300	225	225	
Slope (1:X)		150.0	150.0	150.0	
Cover Level (m)	86.284	87.474	87.149	86.823	
Invert Level (m)	84.218	84.665 84.740	85.067 85.067	85.393	
Length (m)		67.113	48.952	48.952	



PN		S1.005	S1.004	S1.003	
Dia (mm)		375	300	300	
Slope (1:X)		112.7	17.3	138.5	
Cover Level (m)	82.912	83.646	86.298	86.284	
Invert Level (m)	80.204	80.595	80.670 83.759	83.759 84.218	
Length (m)		44.065	53.526	63.601	

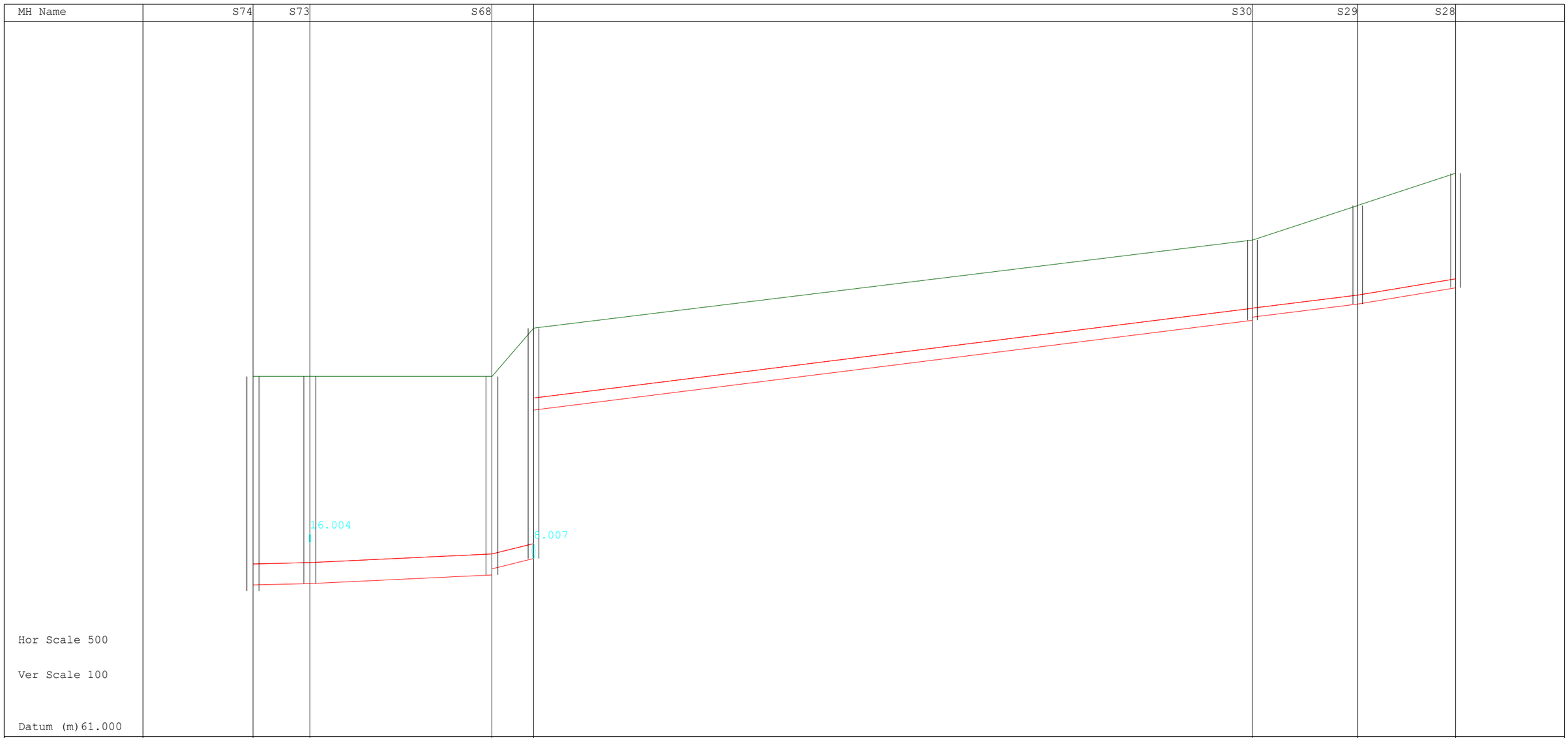


Hor Scale 500

Ver Scale 100

Datum (m) 69.000

MH Name		S28	S27	S25	S24	S23	S22		S20	S19	
PN		S1.013	S1.012	S1.011	S1.010	S1.009		S1.007	S1.006		
Dia (mm)		225	225	225	225	225		450	450		
Slope (1:X)		30.0	25.8	200.2	199.8	150.0		150.4	150.0		
Cover Level (m)	75.082	75.632	79.658	79.237	78.327	82.500	82.500	82.885	82.912		
Invert Level (m)	72.218	72.500	73.833	76.761	76.761	76.803	76.803	76.897	76.897	77.002	79.890	79.890	80.055	80.055	80.129	
Length (m)		8.452	75.418	8.408	18.782	15.780		24.820	11.099		

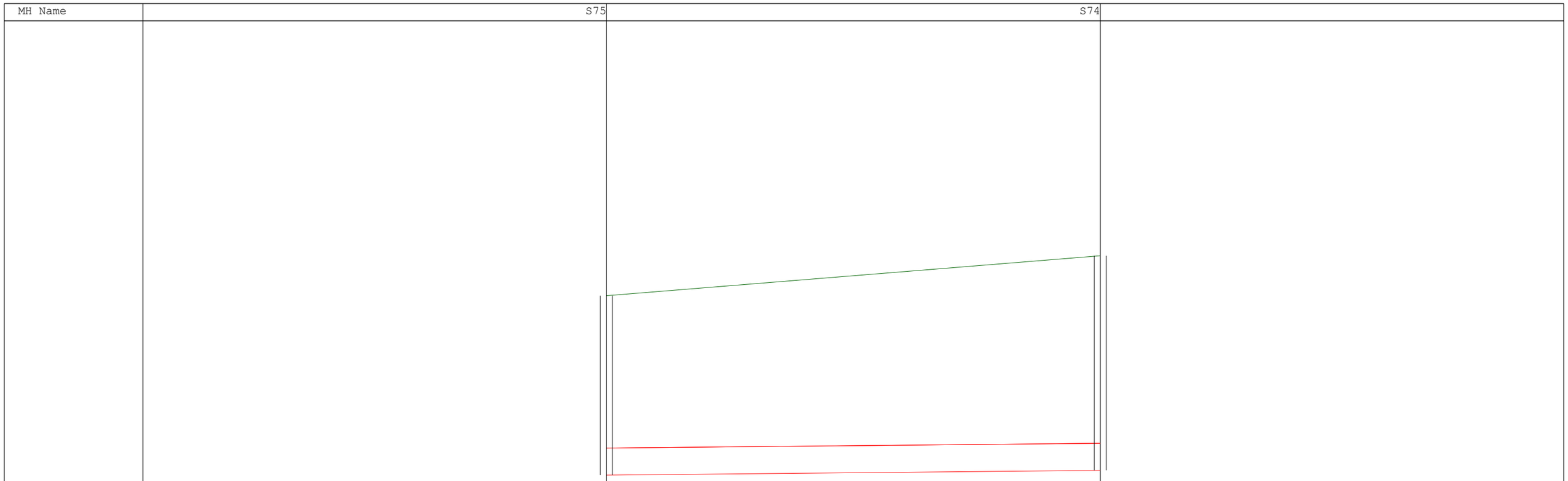


Hor Scale 500

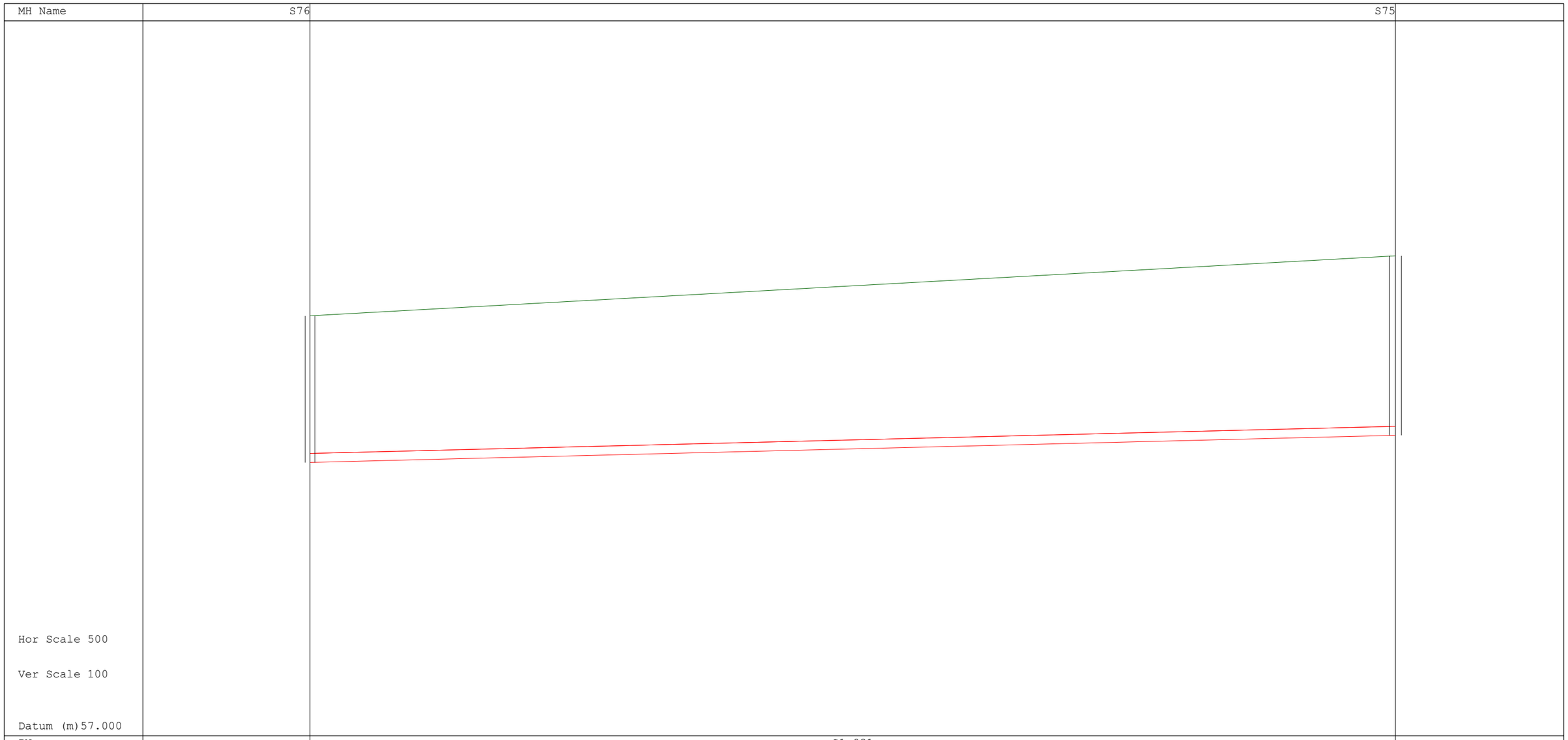
Ver Scale 100

Datum (m) 61.000

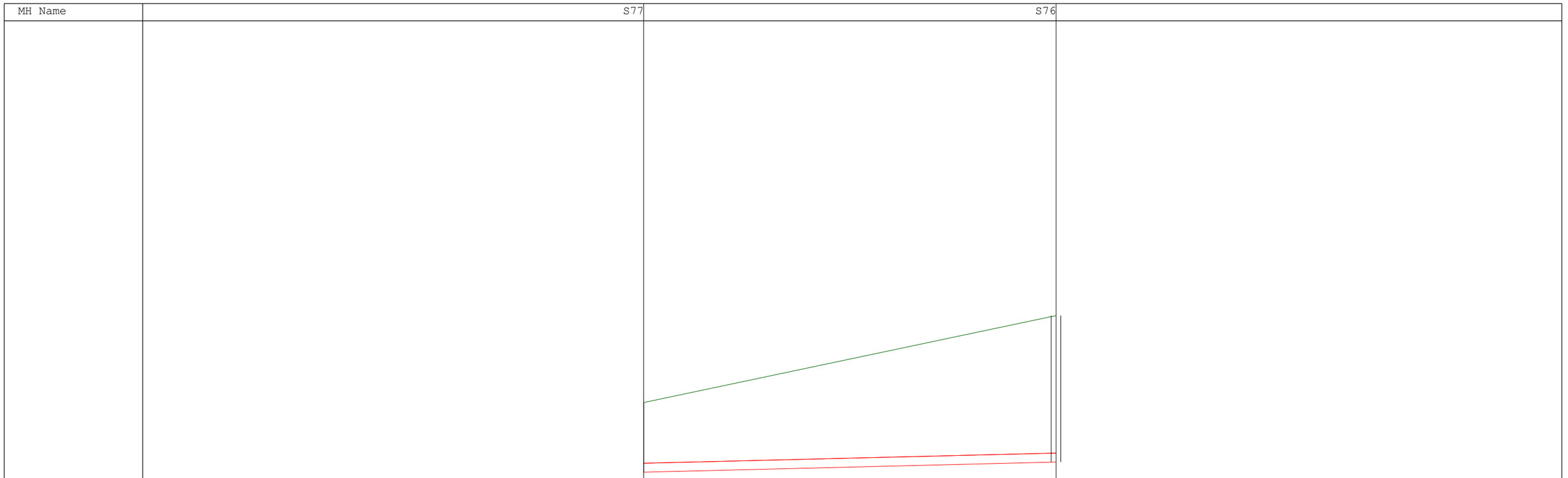
MH Name		S74	S73		S68		S30	S29	S28	
PN			S1.019	S1.018		S1.016		S1.015	S1.014	
Dia (mm)			525	525		300		225	225	
Slope (1:X)			197.6	105.0		40.0		40.0	30.0	
Cover Level (m)		70.000	70.000		70.000	71.208	73.410	74.277	75.082	
Invert Level (m)			64.784	64.820	64.820	65.037	65.187	65.448	69.159	71.406	71.481	71.810	71.810	72.218	
Length (m)			7.112	22.762		89.881		13.172	12.235	



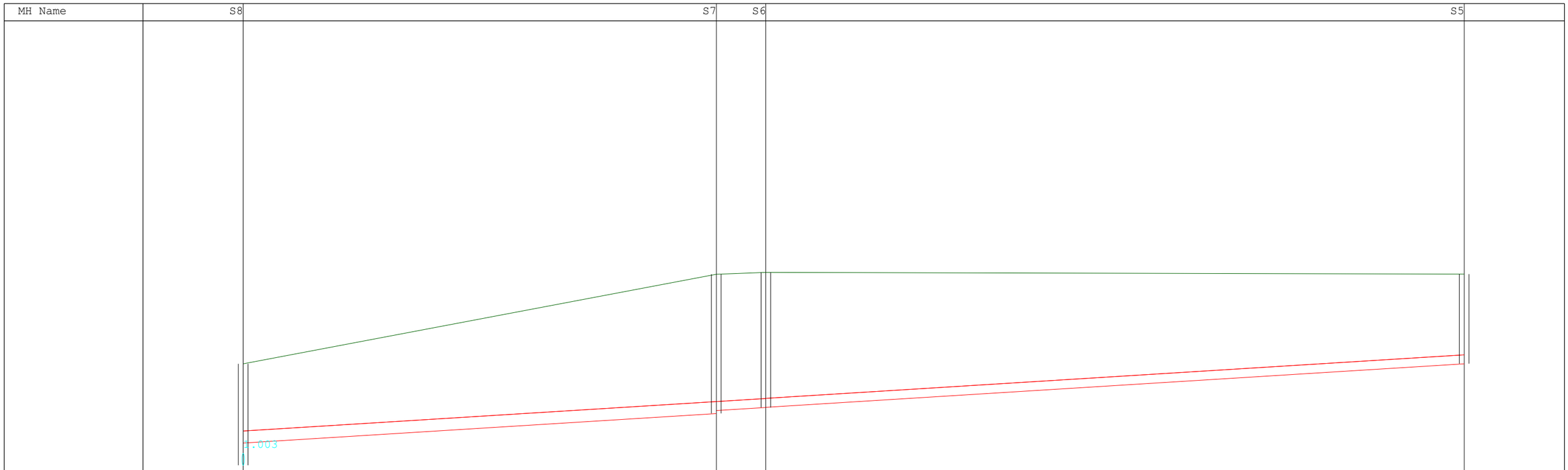
PN		S1.020	
Dia (mm)		675	
Slope (1:X)		506.4	
Cover Level (m)	69.000	70.000	
Invert Level (m)	64.512	64.634	
Length (m)		61.784	



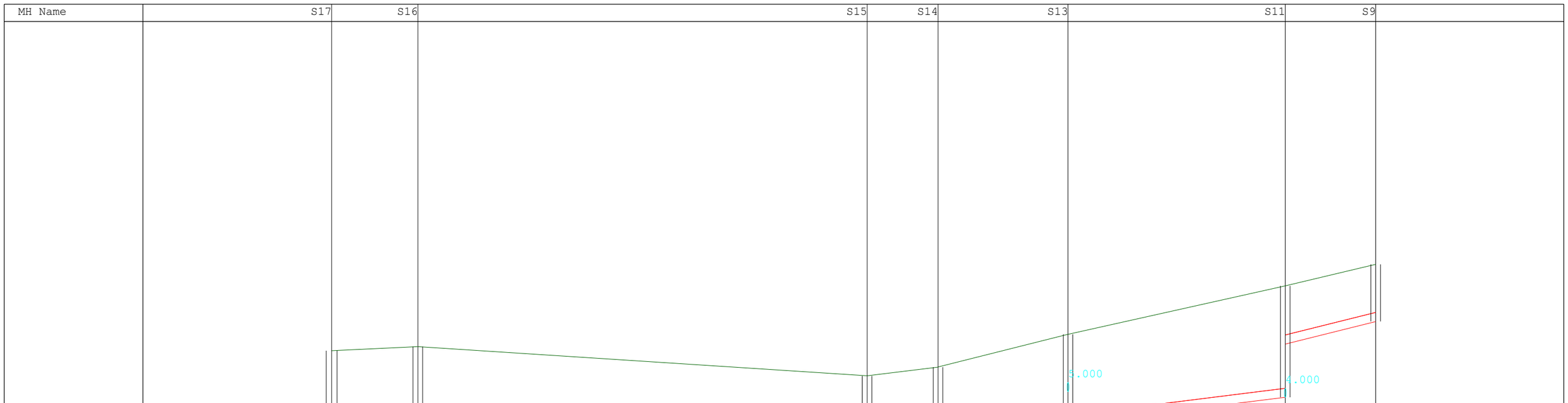
PN		S1.021	
Dia (mm)		225	
Slope (1:X)		200.0	
Cover Level (m)	67.500		69.000
Invert Level (m)	63.833		64.512
Length (m)		135.778	



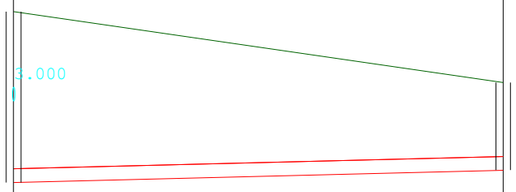
PN		S1.022	
Dia (mm)		225	
Slope (1:X)		200.0	
Cover Level (m)	65.323	67.500	
Invert Level (m)	63.575	63.833	
Length (m)		51.634	

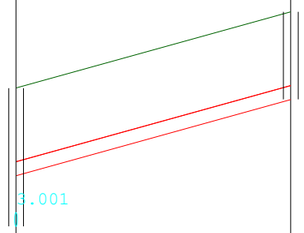


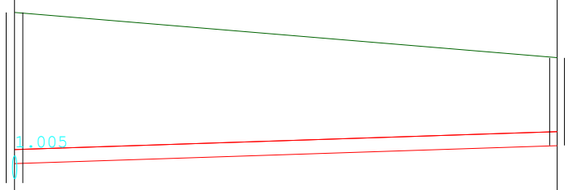
PN		S2.002	S2.001	S2.000	
Dia (mm)		300	225	225	
Slope (1:X)		80.0	80.0	80.0	
Cover Level (m)	86.298	88.539	88.588	88.542	
Invert Level (m)	84.316	85.056	85.131 85.208	85.208 86.300	
Length (m)		59.162	6.188	87.323	

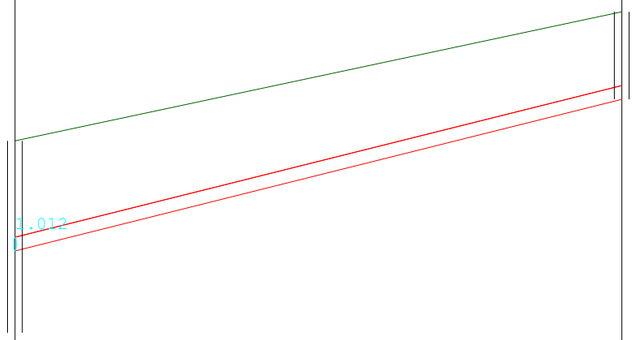


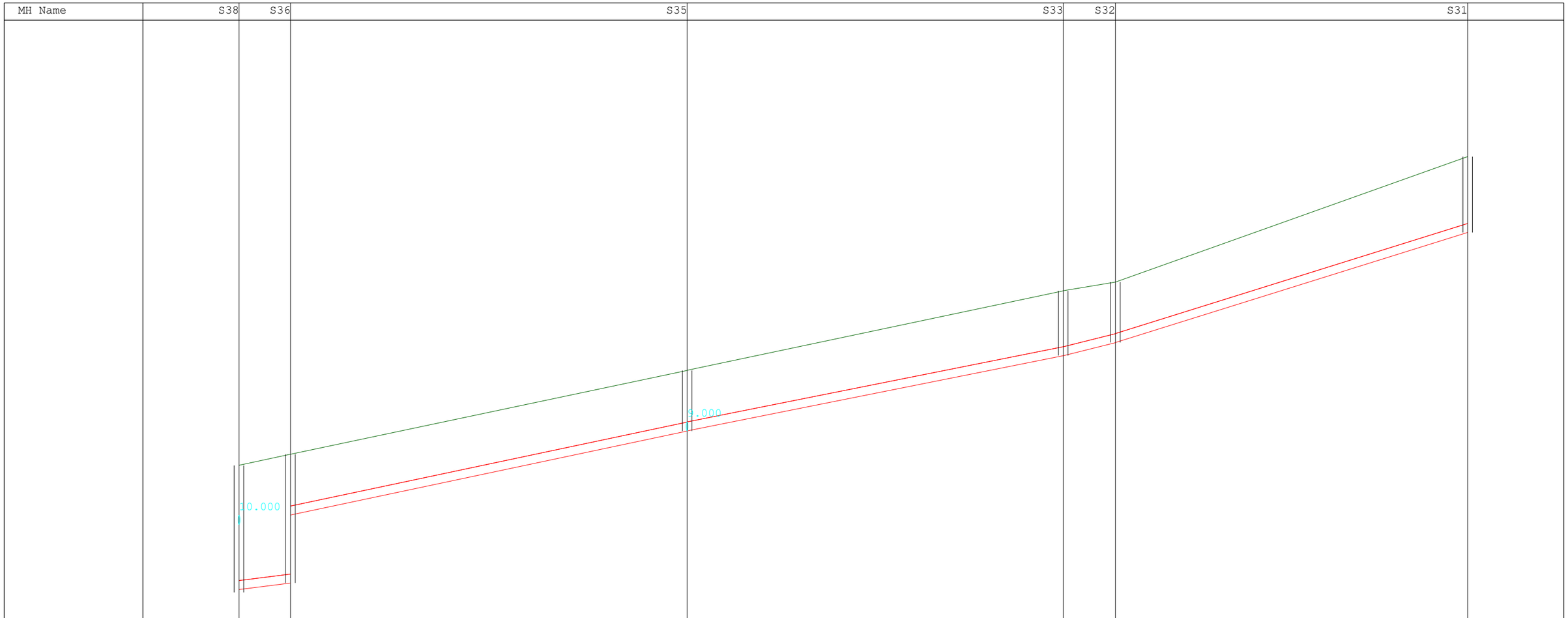
PN	S3.005	S3.004	S3.003	S3.002	S3.001	S3.000
Dia (mm)	300	300	225	225	225	225
Slope (1:X)	72.0	200.0	40.0	40.0	40.0	20.0
Cover Level (m)	83.646 / 83.748	83.018	83.237	84.056	85.269	85.807
Invert Level (m)	80.670 / 80.819	80.819 / 81.100	81.175 / 81.397	81.397 / 81.803	81.803 / 82.482	83.811 / 84.377
Length (m)	10.788	56.201	8.877	16.256	27.171	11.312

MH Name	S11	S10	
			
Hor Scale 500 Ver Scale 100 Datum (m) 75.000			
PN		S4.000	
Dia (mm)		225	
Slope (1:X)		200.0	
Cover Level (m)	85.269	84.112	
Invert Level (m)	82.482	82.682	
Length (m)		39.909	

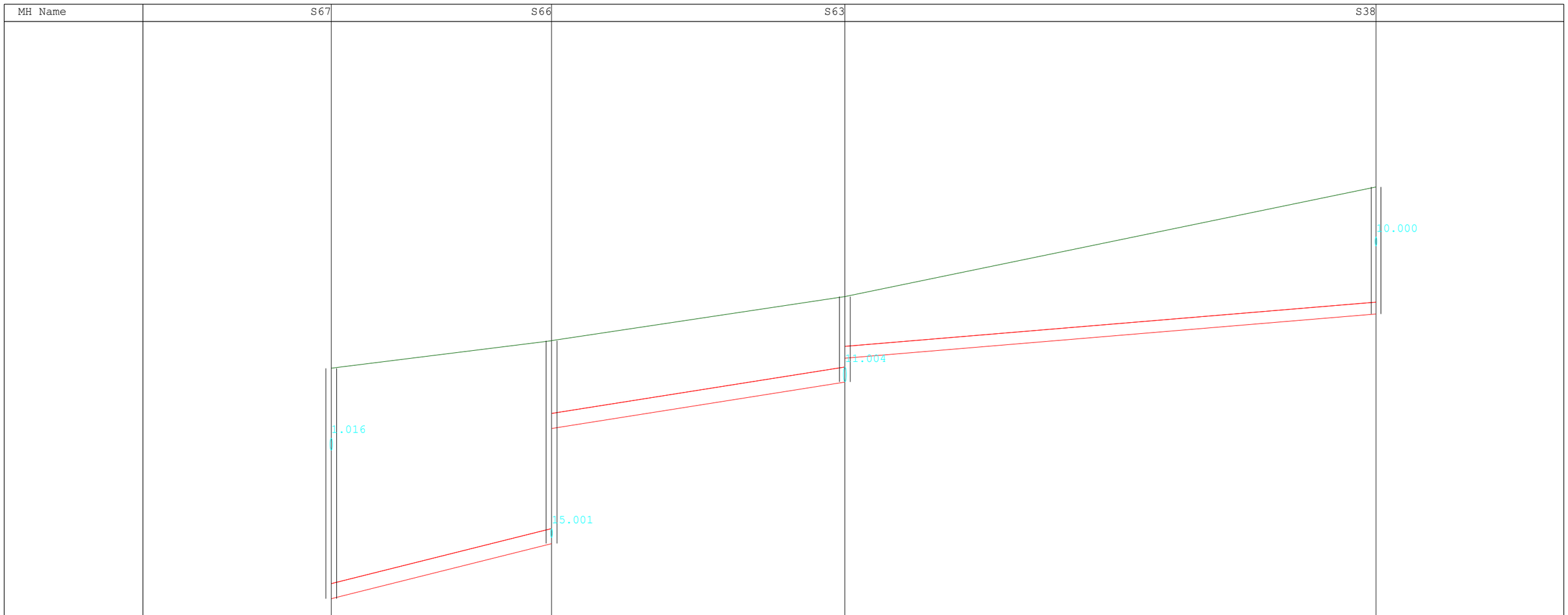
MH Name	S13	S12	
			
Hor Scale 500 Ver Scale 100 Datum (m)75.000			
PN		S5.000	
Dia (mm)		225	
Slope (1:X)		18.0	
Cover Level (m)	84.056	85.300	
Invert Level (m)	82.626	83.870	
Length (m)		22.392	

MH Name	S19	S18	
Hor Scale 500 Ver Scale 100 Datum (m)73.000			
PN		S6.000	
Dia (mm)		225	
Slope (1:X)		149.9	
Cover Level (m)	82.912	82.174	
Invert Level (m)	80.449	80.744	
Length (m)		44.233	

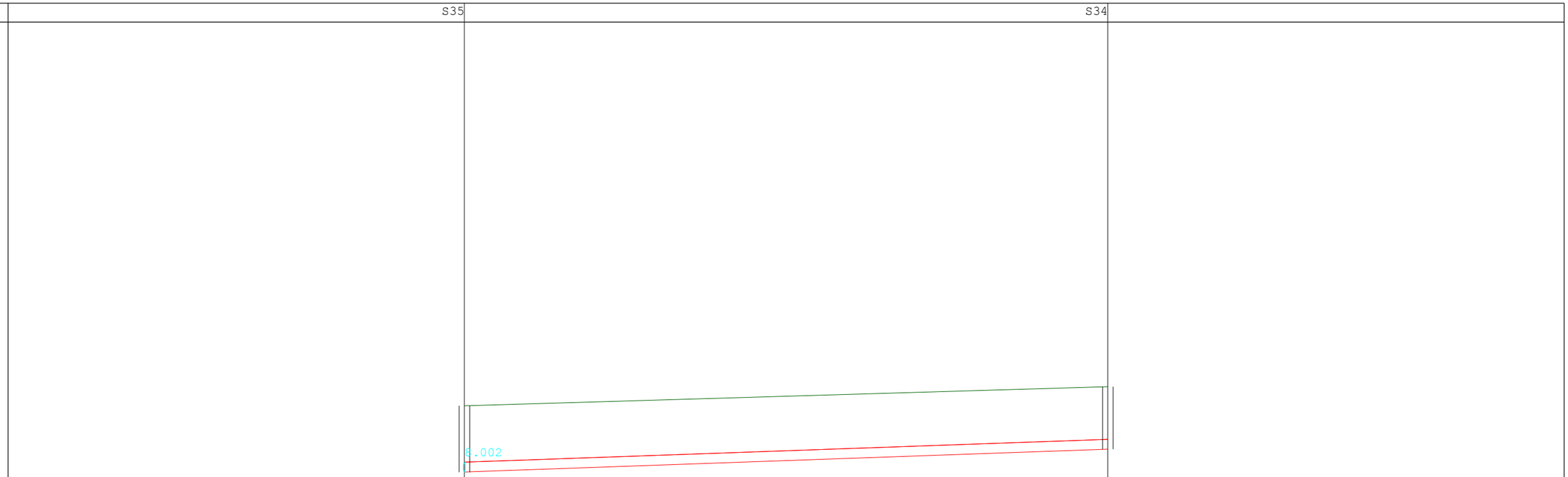
MH Name	S27	S26	
			
Hor Scale 500 Ver Scale 100 Datum (m) 66.000			
PN		S7.000	
Dia (mm)		225	
Slope (1:X)		20.0	
Cover Level (m)	75.632	77.736	
Invert Level (m)	73.833	76.306	
Length (m)		49.468	

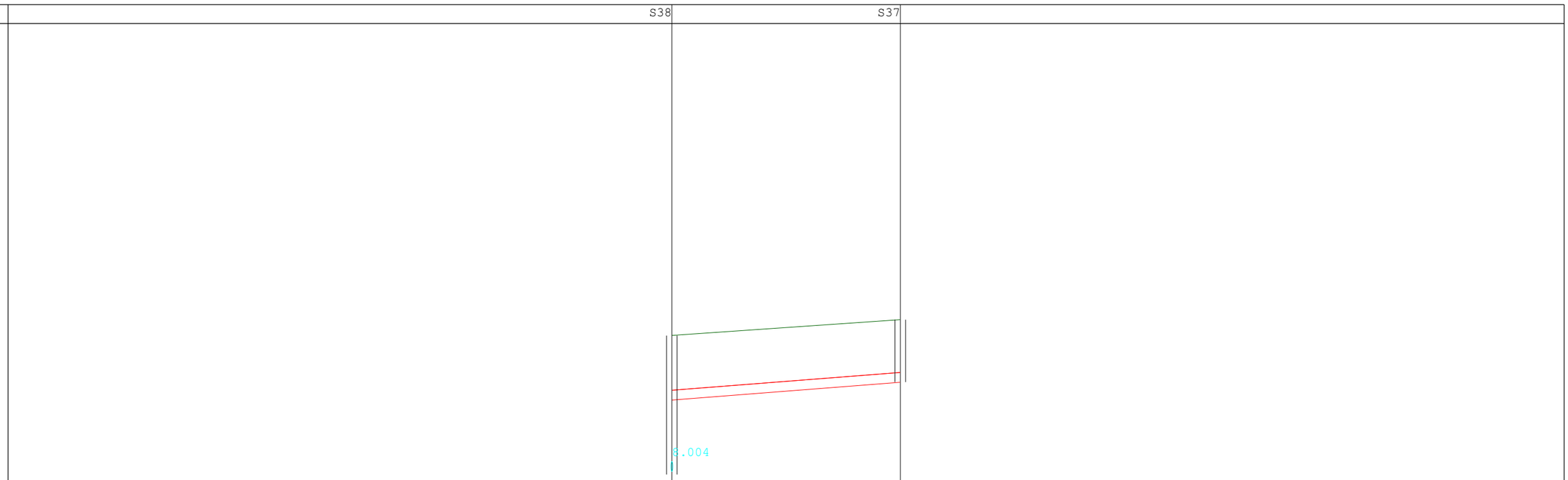


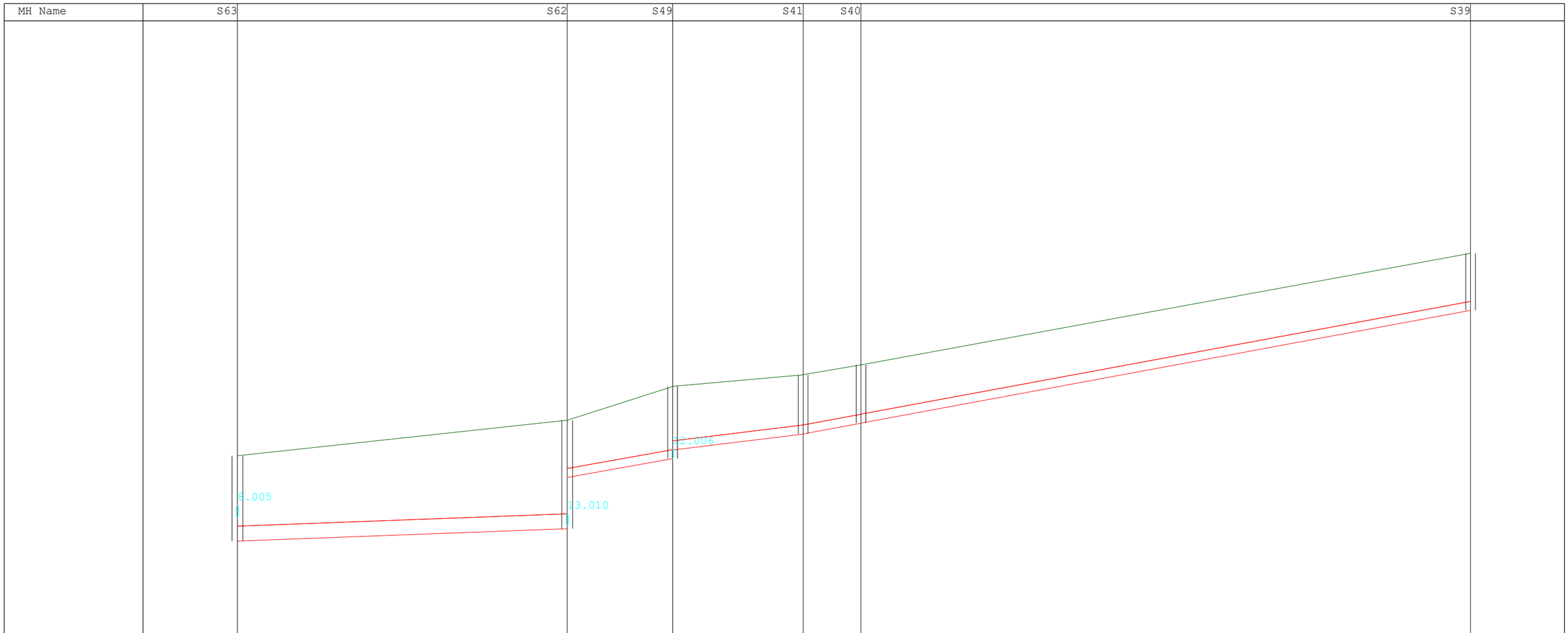
PN		S8.004	S8.003	S8.002	S8.001	S8.000	
Dia (mm)		225	225	225	225	225	
Slope (1:X)		40.0	23.6	25.0	20.0	16.0	
Cover Level (m)	75.742	76.021	78.119	80.106	80.326	83.466	
Invert Level (m)		72.639 72.800	74.500 76.603	76.603 78.485	78.485 78.812	78.812 81.566	
Length (m)		6.434	49.625	47.043	6.530	44.067	



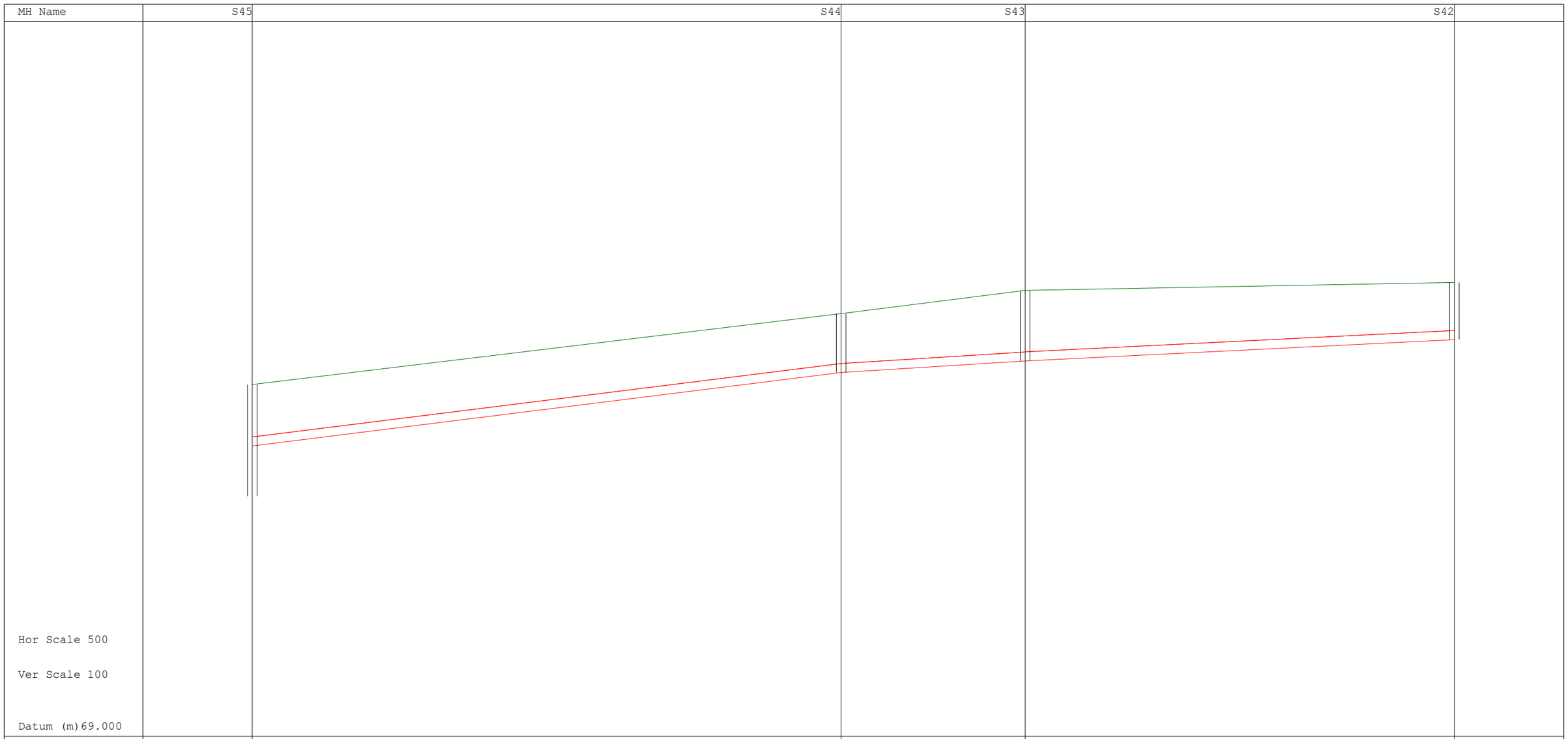
PN		S8.007	S8.006	S8.005	
Dia (mm)		375	375	300	
Slope (1:X)		20.0	31.6	60.0	
Cover Level (m)	71.208	71.896	73.000	75.742	
Invert Level (m)	65.448	66.826	69.704	70.865 71.457	72.564
Length (m)		27.569	36.684	66.442	

MH Name	S35	S34	
			
Hor Scale 500 Ver Scale 100 Datum (m) 69.000			
PN		S9.000	
Dia (mm)		225	
Slope (1:X)		140.8	
Cover Level (m)	78.119	78.556	
Invert Level (m)	76.604	77.126	
Length (m)		73.492	

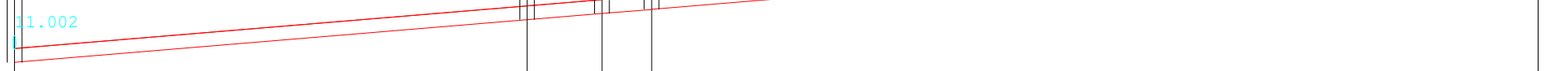
MH Name	S38	S37	
			
Hor Scale 500 Ver Scale 100 Datum (m) 65.000			
PN		S10.000	
Dia (mm)		225	
Slope (1:X)		64.0	
Cover Level (m)	75.742	76.106	
Invert Level (m)	74.268	74.676	
Length (m)		26.094	



PN		S11.004	S11.003	S11.002	S11.001	S11.000	
Dia (mm)		375	225	225	225	225	
Slope (1:X)		132.6	28.0	41.0	27.0	27.0	
Cover Level (m)	73.000	73.890	74.734	75.026	75.273	78.066	
Invert Level (m)	70.865	71.176 / 72.459	72.930	73.147 / 73.545	73.545 / 73.813	73.813 / 76.636	
Length (m)		41.246	13.174	16.321	7.226	76.223	



PN		S12.002	S12.001	S12.000	
Dia (mm)		225	225	225	
Slope (1:X)		40.0	79.9	100.0	
Cover Level (m)	77.792	79.569	80.149	80.350	
Invert Level (m)	76.254	78.095	78.095 78.383	78.383 78.920	
Length (m)		73.655	23.016	53.686	

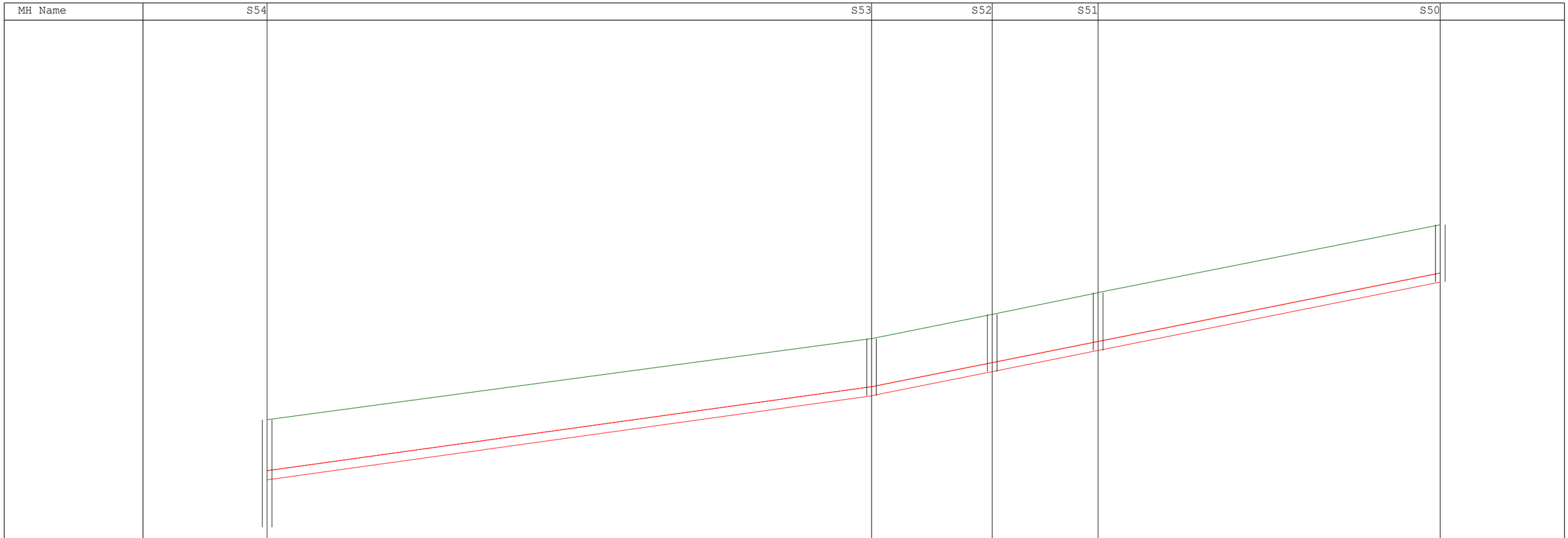


Hor Scale 500

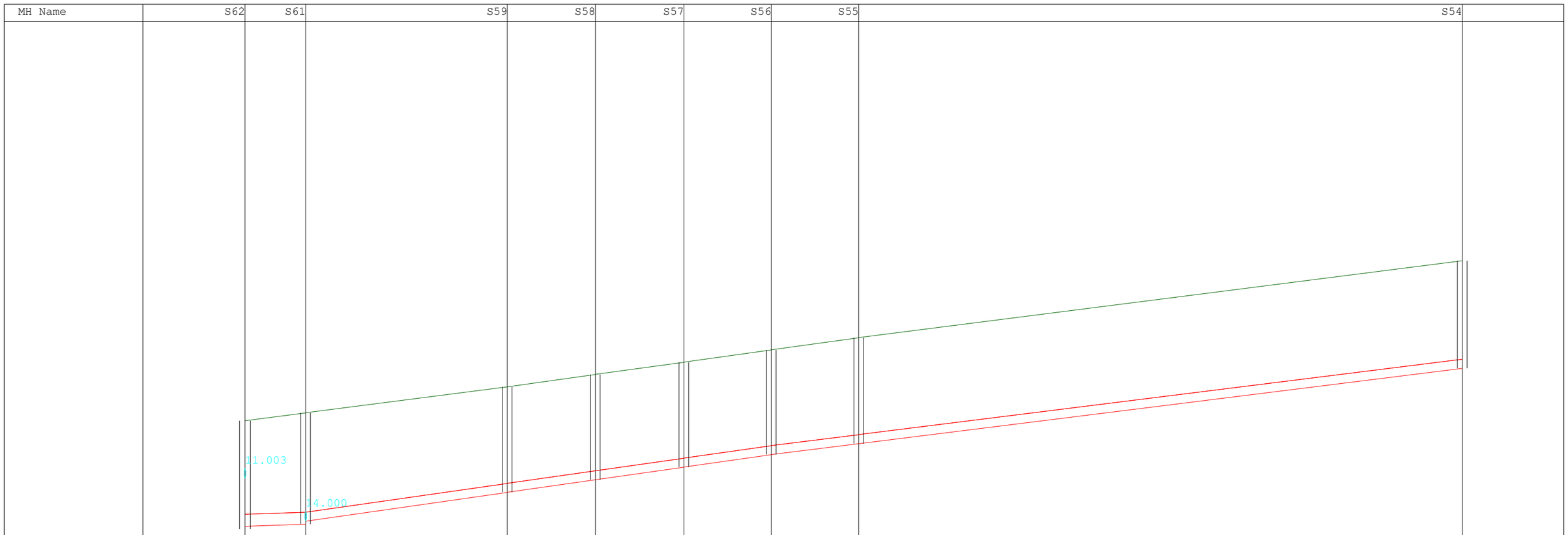
Ver Scale 100

Datum (m) 66.000

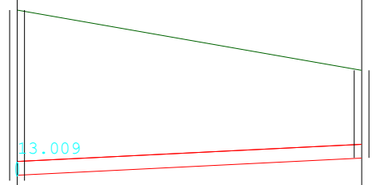
MH Name		S49		S48	S47		S45	
PN			S12.006		S12.005		S12.003	
Dia (mm)			225		225		225	
Slope (1:X)			60.0		60.0		60.0	
Cover Level (m)	74.734		75.764		75.914	76.007		77.792
Invert Level (m)		72.930		73.626	73.626 73.728	73.728 73.795	73.795	75.000
Length (m)			41.777		6.113		72.276	

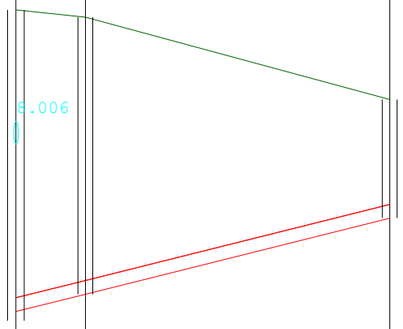


PN		S13.003	S13.002	S13.001	S13.000	
Dia (mm)		225	225	225	225	
Slope (1:X)		36.0	25.0	25.0	25.0	
Cover Level (m)	77.889	79.918	80.524	81.066	82.763	
Invert Level (m)	76.389	78.489	78.489 79.092	79.092 79.622	79.622 81.333	
Length (m)		75.583	15.081	13.242	42.778	

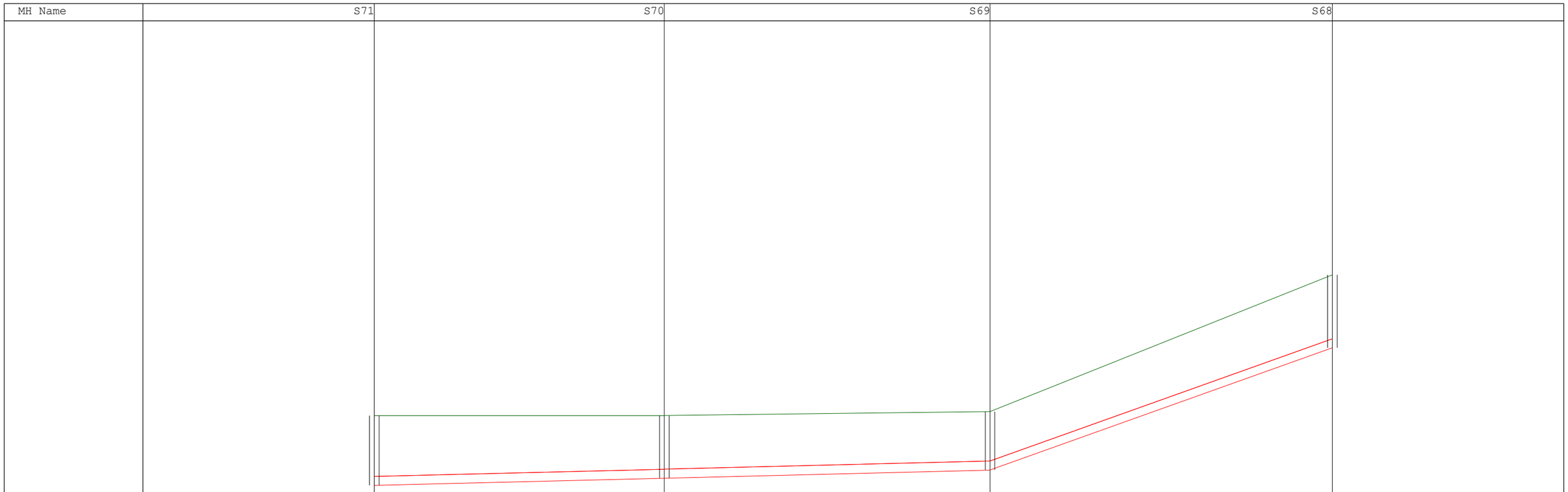


PN		S13.010	S13.009	S13.008	S13.007	S13.006	S13.005	S13.004	
Dia (mm)		300	225	225	225	225	225	225	
Slope (1:X)		148.8	35.0	35.0	35.0	35.0	40.1	40.0	
Cover Level (m)	73.890	74.085	74.735	75.046	75.350	75.659	75.963	77.889	
Invert Level (m)		71.251 71.302	71.377 72.097	72.097 72.412	72.412 72.728	72.728 73.040	73.040 73.313	73.313 75.200	
Length (m)		7.590	25.217	11.015	11.072	10.936	10.936	75.500	

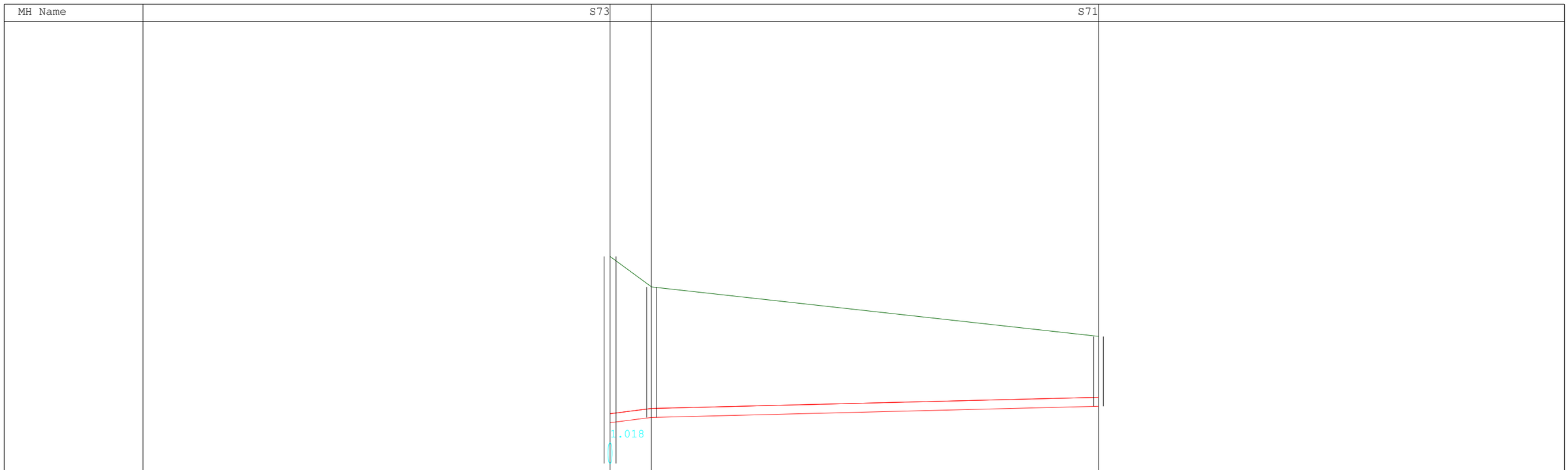
MH Name	S61	S60	
			
Hor Scale 500 Ver Scale 100 Datum (m) 64.000			
PN		S14.000	
Dia (mm)		225	
Slope (1:X)		100.0	
Cover Level (m)	74.085	73.100	
Invert Level (m)	71.389	71.670	
Length (m)		28.083	



MH Name	S66		S64	
Hor Scale 500 Ver Scale 100 Datum (m) 60.000				
PN			S15.000	
Dia (mm)			225	
Slope (1:X)			20.0	
Cover Level (m)	71.896	71.776	70.434	
Invert Level (m)	66.976	67.259	67.259 68.500	
Length (m)			24.813	



PN		S16.002	S16.001	S16.000	
Dia (mm)		225	225	225	
Slope (1:X)		200.4	199.7	14.0	
Cover Level (m)	68.000	68.000	68.101	71.523	
Invert Level (m)	66.254	66.435	66.639	69.698	
Length (m)		36.281	40.740	42.826	



PN			S16.003	
Dia (mm)			225	
Slope (1:X)			199.7	
Cover Level (m)	70.000	69.240	68.000	
Invert Level (m)	65.840	65.974	65.974	66.254
Length (m)			55.904	

Appendix 10:

ATTENUATION ESTIMATES, STORAGE TANK SIZING

CATCHMENT A

Summary of Results for 100 year Return Period (+10%)

Half Drain Time : 671 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	80.385	0.495	0.0	10.9	10.9	248.6	O K
30 min Summer	80.574	0.684	0.0	10.9	10.9	343.6	O K
60 min Summer	80.770	0.880	0.0	10.9	10.9	442.3	O K
120 min Summer	80.979	1.089	0.0	10.9	10.9	547.3	O K
180 min Summer	81.097	1.207	0.0	10.9	10.9	606.6	O K
240 min Summer	81.173	1.283	0.0	10.9	10.9	644.9	O K
360 min Summer	81.262	1.372	0.0	10.9	10.9	689.6	O K
480 min Summer	81.305	1.415	0.0	10.9	10.9	711.0	O K
600 min Summer	81.323	1.433	0.0	10.9	10.9	720.2	O K
720 min Summer	81.334	1.444	0.0	10.9	10.9	725.9	O K
960 min Summer	81.343	1.453	0.0	10.9	10.9	729.9	O K
1440 min Summer	81.328	1.438	0.0	10.9	10.9	722.5	O K
2160 min Summer	81.273	1.383	0.0	10.9	10.9	695.0	O K
2880 min Summer	81.203	1.313	0.0	10.9	10.9	659.8	O K
4320 min Summer	81.042	1.152	0.0	10.9	10.9	578.9	O K
5760 min Summer	80.833	0.943	0.0	10.9	10.9	473.7	O K
7200 min Summer	80.645	0.755	0.0	10.9	10.9	379.2	O K
8640 min Summer	80.501	0.611	0.0	10.9	10.9	306.9	O K
10080 min Summer	80.387	0.497	0.0	10.9	10.9	249.8	O K
15 min Winter	80.446	0.556	0.0	10.9	10.9	279.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	88.246	0.0	254.1	26
30 min Summer	61.397	0.0	354.8	40
60 min Summer	40.231	0.0	470.4	70
120 min Summer	25.673	0.0	600.8	128
180 min Summer	19.607	0.0	688.4	186
240 min Summer	16.152	0.0	756.2	246
360 min Summer	12.264	0.0	861.3	362
480 min Summer	10.076	0.0	943.4	480
600 min Summer	8.648	0.0	1011.9	560
720 min Summer	7.632	0.0	1071.5	616
960 min Summer	6.266	0.0	1172.0	746
1440 min Summer	4.737	0.0	1325.1	1016
2160 min Summer	3.575	0.0	1511.3	1436
2880 min Summer	2.925	0.0	1648.4	1852
4320 min Summer	2.202	0.0	1860.6	2688
5760 min Summer	1.800	0.0	2031.3	3464
7200 min Summer	1.540	0.0	2172.0	4120
8640 min Summer	1.356	0.0	2294.6	4840
10080 min Summer	1.218	0.0	2403.5	5544
15 min Winter	88.246	0.0	285.0	26

Summary of Results for 100 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	80.660	0.770	0.0	10.9	10.9	386.8	O K
60 min Winter	80.884	0.994	0.0	10.9	10.9	499.5	O K
120 min Winter	81.121	1.231	0.0	10.9	10.9	618.7	O K
180 min Winter	81.258	1.368	0.0	10.9	10.9	687.3	O K
240 min Winter	81.349	1.459	0.0	10.9	10.9	732.9	O K
360 min Winter	81.460	1.570	0.0	10.9	10.9	788.7	O K
480 min Winter	81.519	1.629	0.0	10.9	10.9	818.5	O K
600 min Winter	81.549	1.659	0.0	10.9	10.9	833.8	O K
720 min Winter	81.562	1.672	0.0	10.9	10.9	840.0	O K
960 min Winter	81.563	1.673	0.0	10.9	10.9	840.7	O K
1440 min Winter	81.536	1.646	0.0	10.9	10.9	827.0	O K
2160 min Winter	81.439	1.549	0.0	10.9	10.9	778.1	O K
2880 min Winter	81.318	1.428	0.0	10.9	10.9	717.6	O K
4320 min Winter	81.048	1.158	0.0	10.9	10.9	581.7	O K
5760 min Winter	80.688	0.798	0.0	10.9	10.9	401.0	O K
7200 min Winter	80.439	0.549	0.0	10.9	10.9	276.0	O K
8640 min Winter	80.275	0.385	0.0	10.8	10.8	193.6	O K
10080 min Winter	80.173	0.283	0.0	10.3	10.3	142.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	61.397	0.0	397.7	40
60 min Winter	40.231	0.0	527.0	68
120 min Winter	25.673	0.0	673.0	126
180 min Winter	19.607	0.0	771.1	184
240 min Winter	16.152	0.0	847.0	240
360 min Winter	12.264	0.0	964.6	356
480 min Winter	10.076	0.0	1056.5	468
600 min Winter	8.648	0.0	1133.2	576
720 min Winter	7.632	0.0	1199.6	680
960 min Winter	6.266	0.0	1311.7	778
1440 min Winter	4.737	0.0	1479.2	1088
2160 min Winter	3.575	0.0	1692.8	1556
2880 min Winter	2.925	0.0	1846.3	2016
4320 min Winter	2.202	0.0	2083.9	2904
5760 min Winter	1.800	0.0	2275.2	3624
7200 min Winter	1.540	0.0	2432.8	4256
8640 min Winter	1.356	0.0	2570.2	4848
10080 min Winter	1.218	0.0	2692.6	5464

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+10

Time Area Diagram

Total Area (ha) 1.568

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.523	4	8	0.523	8	12	0.523

Model Details

Storage is Online Cover Level (m) 82.500

Cellular Storage Structure

Invert Level (m) 79.890 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.67
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	750.0	0.0	1.300	750.0	0.0
0.100	750.0	0.0	1.400	750.0	0.0
0.200	750.0	0.0	1.500	750.0	0.0
0.300	750.0	0.0	1.600	750.0	0.0
0.400	750.0	0.0	1.680	750.0	0.0
0.500	750.0	0.0	1.681	0.0	0.0
0.600	750.0	0.0	1.900	0.0	0.0
0.700	750.0	0.0	2.000	0.0	0.0
0.800	750.0	0.0	2.100	0.0	0.0
0.900	750.0	0.0	2.200	0.0	0.0
1.000	750.0	0.0	2.300	0.0	0.0
1.100	750.0	0.0	2.400	0.0	0.0
1.200	750.0	0.0	2.500	0.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0141-1090-1680-1090
Design Head (m)	1.680
Design Flow (l/s)	10.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	141
Invert Level (m)	79.890
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.680	10.9
Flush-Flo™	0.489	10.9
Kick-Flo®	1.029	8.7
Mean Flow over Head Range	-	9.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Hydro-Brake® Optimum Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.1	1.200	9.3	3.000	14.3	7.000	21.5
0.200	9.6	1.400	10.0	3.500	15.4	7.500	22.2
0.300	10.4	1.600	10.7	4.000	16.5	8.000	22.9
0.400	10.8	1.800	11.3	4.500	17.4	8.500	23.6
0.500	10.9	2.000	11.8	5.000	18.3	9.000	24.3
0.600	10.8	2.200	12.4	5.500	19.2	9.500	24.9
0.800	10.3	2.400	12.9	6.000	20.0		
1.000	9.0	2.600	13.4	6.500	20.8		

STORMTECH Stormwater Management System Design Tool

ver: Jan18

PROJECT REF:	19215
LOCATION:	Kilbarry
DATE:	20-Jun-22
CREATED BY:	DOB

SYSTEM PARAMETERS

Required Total Storage	**841**	m^3
Stormtech chamber model	**MC3500**	
Filtration Permeable Geo or Impermeable Geo	Filter geo	
Number of Isolator Rows (IR)	1	

SITE PARAMETERS

Stone Porosity	43%		
Excavation Batter Angle (degrees)	60	°	*Minimum Requirement*
Stone Above Chambers	0.3	m	*0.30*
Stone Below Chambers	0.23	m	*0.23*
In-between Row Spacing	0.23	m	*0.23*
Additional Storage outside Excavation. E.g manholes, Header Pipe	0	m^3	

HEADER PIPE

Is Header pipe required within excavation	No	
Orientation of Header Pipe	Parrallel to IR	
Diameter of Header Pipe	0.6	m
Length of Header Pipe	0	m

CHAMBER SYSTEM DIMENSIONS

	Calculated	Adopted	
Number of Rows		15	ea
Number of units per Row		10	ea
System Installed Storage Depth (effective storage depth)	1.675		m
Tank overall installed Width at base	33.15	33.15	m
Tank overall installed Length at Base	23.54	23.54	m
Total Effective System Storage	**881.2**	**881.3**	m^3

STORMTECH SYSTEM DETAIL

StormTech Chamber Model	MC3500	
Unit Width	1.955	m
Unit Length	2.18	m
Unit Height	1.145	m
Min Cover Over System	0.3	m
Max Cover Over Chamber (see StormTech for greater cover)	2.4	m
Chamber Internal Storage Vol.	3.11	m^3
Header Pipe Internal Storage Vol in Excavation	0.0	m^3

STONE AND EXCAVATION DETAIL

Volume of Dig for System	1402	m^3
Width at base	33.15	m
Width at top	35.08	m
Length at base	23.54	m
Length at top	25.47	m
Depth Of System	1.68	m
Area of Dig at Base of System	780	m^2
Area of Dig at Top of System	894	m^2
Void Ratio	63%	
Stone Requirement - m3	921	m^3
Stone Requirement - tonne	1510	tonne

CATCHMENT B

Summary of Results for 100 year Return Period (+10%)

Half Drain Time : 204 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	65.206	0.694	24.4	15.4	39.8	381.3	O K
30 min Summer	65.461	0.949	24.4	15.4	39.8	521.7	O K
60 min Summer	65.695	1.183	24.4	15.4	39.8	649.9	O K
120 min Summer	65.871	1.359	24.4	15.4	39.8	746.5	O K
180 min Summer	65.921	1.409	24.4	15.4	39.8	774.4	O K
240 min Summer	65.937	1.425	24.4	15.4	39.8	783.0	O K
360 min Summer	65.933	1.421	24.4	15.4	39.8	780.9	O K
480 min Summer	65.912	1.400	24.4	15.4	39.8	769.0	O K
600 min Summer	65.881	1.369	24.4	15.4	39.8	752.3	O K
720 min Summer	65.846	1.334	24.4	15.4	39.8	732.8	O K
960 min Summer	65.765	1.253	24.4	15.4	39.8	688.2	O K
1440 min Summer	65.577	1.065	24.4	15.4	39.8	585.4	O K
2160 min Summer	65.284	0.772	24.4	15.4	39.8	424.0	O K
2880 min Summer	65.055	0.543	24.4	15.4	39.8	298.5	O K
4320 min Summer	64.778	0.266	24.4	14.4	38.8	146.3	O K
5760 min Summer	64.671	0.159	24.4	11.4	35.8	87.2	O K
7200 min Summer	64.622	0.110	24.4	7.0	31.4	60.6	O K
8640 min Summer	64.586	0.074	24.4	3.6	28.0	40.9	O K
10080 min Summer	64.561	0.049	24.0	1.7	25.7	27.0	O K
15 min Winter	65.298	0.786	24.4	15.4	39.8	431.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	88.246	0.0	426.3	24
30 min Summer	61.397	0.0	593.3	38
60 min Summer	40.231	0.0	777.9	66
120 min Summer	25.673	0.0	992.8	122
180 min Summer	19.607	0.0	1137.3	170
240 min Summer	16.152	0.0	1249.2	200
360 min Summer	12.264	0.0	1422.8	266
480 min Summer	10.076	0.0	1558.5	336
600 min Summer	8.648	0.0	1672.1	406
720 min Summer	7.632	0.0	1770.9	476
960 min Summer	6.266	0.0	1938.4	614
1440 min Summer	4.737	0.0	2198.4	884
2160 min Summer	3.575	0.0	2488.0	1256
2880 min Summer	2.925	0.0	2714.1	1596
4320 min Summer	2.202	0.0	3065.3	2260
5760 min Summer	1.800	0.0	3341.1	2944
7200 min Summer	1.540	0.0	3572.9	3680
8640 min Summer	1.356	0.0	3775.6	4408
10080 min Summer	1.218	0.0	3957.3	5040
15 min Winter	88.246	0.0	477.5	25

Summary of Results for 100 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	65.592	1.080	24.4	15.4	39.8	593.3	O K
60 min Winter	65.864	1.352	24.4	15.4	39.8	742.7	O K
120 min Winter	66.087	1.575	24.4	15.4	39.8	865.0	O K
180 min Winter	66.165	1.653	24.4	15.4	39.8	908.4	O K
240 min Winter	66.183	1.671	24.4	15.4	39.8	918.1	O K
360 min Winter	66.169	1.657	24.4	15.4	39.8	910.4	O K
480 min Winter	66.126	1.614	24.4	15.4	39.8	886.8	O K
600 min Winter	66.070	1.558	24.4	15.4	39.8	855.9	O K
720 min Winter	66.006	1.494	24.4	15.4	39.8	820.7	O K
960 min Winter	65.863	1.351	24.4	15.4	39.8	742.3	O K
1440 min Winter	65.542	1.030	24.4	15.4	39.8	565.7	O K
2160 min Winter	65.092	0.580	24.4	15.4	39.8	318.5	O K
2880 min Winter	64.812	0.300	24.4	14.7	39.1	164.6	O K
4320 min Winter	64.637	0.125	24.4	8.4	32.8	68.9	O K
5760 min Winter	64.575	0.063	24.4	2.6	27.0	34.6	O K
7200 min Winter	64.557	0.045	22.1	1.4	23.5	24.8	O K
8640 min Winter	64.552	0.040	19.6	1.1	20.8	22.0	O K
10080 min Winter	64.548	0.036	17.7	0.9	18.6	19.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	61.397	0.0	664.5	38
60 min Winter	40.231	0.0	871.2	66
120 min Winter	25.673	0.0	1111.9	122
180 min Winter	19.607	0.0	1273.7	176
240 min Winter	16.152	0.0	1399.1	228
360 min Winter	12.264	0.0	1593.5	286
480 min Winter	10.076	0.0	1745.6	364
600 min Winter	8.648	0.0	1872.8	442
720 min Winter	7.632	0.0	1983.4	518
960 min Winter	6.266	0.0	2171.0	666
1440 min Winter	4.737	0.0	2462.2	946
2160 min Winter	3.575	0.0	2786.9	1300
2880 min Winter	2.925	0.0	3040.0	1616
4320 min Winter	2.202	0.0	3433.1	2252
5760 min Winter	1.800	0.0	3742.2	2960
7200 min Winter	1.540	0.0	4001.7	3600
8640 min Winter	1.356	0.0	4228.6	4344
10080 min Winter	1.218	0.0	4432.3	5120

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Shortest Storm (mins)	15
Ratio R	0.250	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+10

Time Area Diagram

Total Area (ha) 2.578

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.859	4	8	0.859	8	12	0.859

Model Details

Storage is Online Cover Level (m) 69.000

Cellular Storage Structure

Invert Level (m) 64.512 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.21420 Porosity 0.67
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	820.0	820.0	1.300	820.0	968.9
0.100	820.0	831.5	1.400	820.0	980.4
0.200	820.0	842.9	1.500	820.0	991.8
0.300	820.0	854.4	1.600	820.0	1003.3
0.400	820.0	865.8	1.680	820.0	1012.4
0.500	820.0	877.3	1.681	0.0	1012.5
0.600	820.0	888.7	1.900	0.0	1037.6
0.700	820.0	900.2	2.000	0.0	1049.1
0.800	820.0	911.6	2.100	0.0	1060.5
0.900	820.0	923.1	2.200	0.0	1072.0
1.000	820.0	934.5	2.300	0.0	1083.4
1.100	820.0	946.0	2.400	0.0	1094.9
1.200	820.0	957.5	2.500	0.0	1106.4

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0167-1540-1680-1540
Design Head (m)	1.680
Design Flow (l/s)	15.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	167
Invert Level (m)	64.512
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.680	15.4
Flush-Flo™	0.492	15.4
Kick-Flo®	1.049	12.3
Mean Flow over Head Range	-	13.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Hydro-Brake® Optimum Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.9	1.200	13.1	3.000	20.3	7.000	30.5
0.200	13.5	1.400	14.1	3.500	21.8	7.500	31.5
0.300	14.7	1.600	15.0	4.000	23.3	8.000	32.5
0.400	15.3	1.800	15.9	4.500	24.6	8.500	33.5
0.500	15.4	2.000	16.7	5.000	25.9	9.000	34.4
0.600	15.3	2.200	17.5	5.500	27.1	9.500	35.3
0.800	14.7	2.400	18.2	6.000	28.3		
1.000	13.1	2.600	18.9	6.500	29.4		

STORMTECH Stormwater Management System Design Tool

ver: Jan18

PROJECT REF:	19215
LOCATION:	Kilbarry
DATE:	20-Jun-22
CREATED BY:	DOB

SYSTEM PARAMETERS

Required Total Storage	**918**	m^3
Stormtech chamber model	**MC3500**	
Filtration Permeable Geo or Impermeable Geo	Filter geo	
Number of Isolator Rows (IR)	1	

SITE PARAMETERS

Stone Porosity	43%		
Excavation Batter Angle (degrees)	60	°	*Minimum Requirement*
Stone Above Chambers	0.3	m	*0.30*
Stone Below Chambers	0.23	m	*0.23*
In-between Row Spacing	0.23	m	*0.23*
Additional Storage outside Excavation. E.g manholes, Header Pipe	0	m^3	

HEADER PIPE

Is Header pipe required within excavation	No	
Orientation of Header Pipe	Parrallel to IR	
Diameter of Header Pipe	0.6	m
Length of Header Pipe	0	m

CHAMBER SYSTEM DIMENSIONS

	Calculated	Adopted	
Number of Rows		6	ea
Number of units per Row		27	ea
System Installed Storage Depth (effective storage depth)	1.675		m
Tank overall installed Width at base	13.48	13.48	m
Tank overall installed Length at Base	60.6	60.6	m
Total Effective System Storage	**933.1**	**933.1**	m^3

STORMTECH SYSTEM DETAIL

StormTech Chamber Model	MC3500	
Unit Width	1.955	m
Unit Length	2.18	m
Unit Height	1.145	m
Min Cover Over System	0.3	m
Max Cover Over Chamber (see StormTech for greater cover)	2.4	m
Chamber Internal Storage Vol.	3.11	m^3
Header Pipe Internal Storage Vol in Excavation	0.0	m^3

STONE AND EXCAVATION DETAIL

Volume of Dig for System	1491	m^3
Width at base	13.48	m
Width at top	15.41	m
Length at base	60.60	m
Length at top	62.53	m
Depth Of System	1.68	m
Area of Dig at Base of System	817	m^2
Area of Dig at Top of System	964	m^2
Void Ratio	63%	
Stone Requirement - m3	981	m^3
Stone Requirement - tonne	1608	tonne

Appendix 11:

EXISTING WATER SUPPLY NETWORK

Irish Water Web Map

UISCE ÉIREANN : IRISH WATER

Print Date: 20/06/2022

Printed by:Irish Water

Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

ESB HV Lines
- HV Underground
- HV Overhead
- HV Abandoned

ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure