PUNCH
consulting engineers

182186 - Priorsland Cherrywood SHD

Stage 3 Site-Specific Flood Risk Assessment

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1 Introduction

1.1 Background

PUNCH Consulting Engineers were appointed by 1 Carrickmines Land Limited to carry out a Site-Specific Flood Risk Assessment (SSFRA) study for a proposed commercial and residential development on lands at Priorsland, Cherrywood, Carrickmines, Dublin. This SSFRA has been completed in full compliance with the requirements of "The Planning System & Flood Risk Management Guidelines" published by the Department of the Environment, Heritage and Local Government in November 2009.

The proposed site layout is detailed in a series of planning drawings provided by Urban Agency Architects (included in Appendix A of this report).

1.2 Existing Site

The subject site is currently a greenfield site, with low intensity agricultural use. The Carrickmines River runs through the site to the north of the proposed development, from west to east. The site is located on lands to the south of the Carrickmines Luas Park & Ride complex. To the south, the site is bordered by the M50 and to the east by undeveloped lands and a smaller tributary of the Carrickmines River, the Ticknick Stream. The Priorsland site within the Client's ownership has a total area of approximately 8.63 hectares.

Figure 1: Location of Proposed Development

1.3 Nature of the Proposed Development

The development will comprise a mixed-use village centre and residential development of 443 no. units comprising 6 no. blocks (A-F) of apartments (up to 5 storeys with basement/undercroft parking) providing

402 no. apartments units (146 no. 1-beds; 218 no. 2-beds and 38 no. 3-beds), and 41 no. houses (19 no. 3-beds and 22 no. 4-beds). All apartments provided with private balconies/terraces. Provision of indoor residential facilities to serve apartment residents.

The Village Centre and non-residential elements will comprise a supermarket, local retail/retail service units, non-retail commercial units, creche, gym, community space, and offices (High Intensity Employment) use.

Provision of car/bicycle/motorcycle parking; ESB sub-stations; bin storages areas, and all associated plant areas.

Provision of the first phase of Priorsland Park (on lands within the applicant's ownership) and other public and communal open spaces.

Construction of Castle Street through the subject lands and two road bridges across the Carrickmines Stream, one to serve the future school site/ park, the second to provide pedestrian and cyclist access to the Carrickmines Luas station and future Transport Interchange to the north. Provision of an additional pedestrian bridge to the park. Provision of an acoustic barrier along the southern/western edge of the site.

All associated site development works, landscaping, boundary treatments and services provision.

A more detailed description of the development is outlined in the statutory planning notices and Chapter 3 of the Environmental Impact Assessment Report (EIAR)

Finished floor levels of the proposed development range from 63.27 mAOD in the eastern portion of the site to 65.45 mAOD near the western boundary.

Figure 2: Proposed Site Layout (Masterplan)

The layout of the proposed scheme is detailed in a series of planning drawings prepared by Urban Agency Architects (see sample included in Appendix A).

2 Relevant Guidance

2.1 The Planning System and Flood Risk Management Guidelines

In September 2008, "The Planning System and Flood Risk Management" Guidelines were published by the Department of the Environment, Heritage and Local Government in Draft format. In November 2009, the adopted version of the document was published.

The Flood Risk Management Guidelines give guidance on flood risk and development. The guidelines recommend a precautionary approach when considering flood risk management in the planning system. The core principle of the guidelines is to adopt a risk based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for river and coastal flooding. The guidelines include definitions of Flood Zones A, B and C as noted below. It should be noted that these do not take into account the presence of flood defences, as there remain risks of overtopping and breach of the defences.

Table 1: Definition of Flood Zones

Flood Zone	Type of Flooding	Annual Exceedance Probability (AEP)	
Flood Zone A	Coastal	>0.5% AEP Event	Less than a 1 in 200-year event
	Fluvial	>1.0% AEP Event	Less than a 1 in 100-year event
Flood Zone B	Coastal	>0.1% AEP Event	Greater than a 1 in 200 and less than 1:1000-year event
	Fluvial	>0.1% AEP Event	Greater than a 1 in 100 and less than 1:1000-year event
Flood Zone C	Coastal	<0.1% AEP Event	Greater that a 1 in 1000-year event
	Fluvial	<0.1% AEP Event	Greater that a 1 in 1000-year event

Once a flood zone has been identified, the guidelines set out the different types of development appropriate to each zone. Exceptions to the restriction of development due to potential flood risks are provided for through the use of the **Justification Test**, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated. This recognises that there will be a need for future development in existing towns and urban centres that lie within flood risk zones, and that the avoidance of all future development in these areas would be unsustainable.

A three-staged approach to undertaking a FRA is recommended:

Stage 1: **Flood Risk Identification** – Identification of any issues relating to the site that will require further investigation through a Flood Risk Assessment;

Stage 2: **Initial Flood Risk Assessment** - Involves establishment of the sources of flooding, the extent of the flood risk, potential impacts of the development and possible mitigation measures;

Stage 3: **Detailed Flood Risk Assessment** - Assess flood risk issues in sufficient detail to provide quantitative appraisal of potential flood risk of the development, impacts of the flooding elsewhere and the effectiveness of any proposed mitigation measures.

This report addresses the requirements for Stage 3.

2.2 Dún Laoghaire-Rathdown County Development Plan

Policies relating to flood risk within the Dún Laoghaire-Rathdown County Development Plan (CDP) 2016-2022 are outlined in policies CC14 to CC17. The relevant excerpts from Section 5 (Physical Infrastructure Strategy) of the CDP are copied in the sections below:

Policy CC14: Catchment Flood Risk Assessment and Management (CFRAM)

It is Council policy to assist the Office of Public Works (OPW) in the preparation of the Regional Catchment Flood Risk Assessment and Management (CFRAM) Study being carried out for the Eastern District. Any recommendations and outputs arising from the CFRAM study for the Eastern District that are relevant for Dún Laoghaire-Rathdown will require to be incorporated into the Development Plan.

Policy CC15: Flood Risk Management

It is Council policy to support, in cooperation with the OPW, the implementation of the EU Flood Risk Directive (2007/60/EC) on the assessment and management of flood risks, the Flood Risk Regulations (SI No 122 of 2010) and the Department of the Environment, Heritage and Local Government and the Office of Public Works Guidelines on 'The Planning System and Flood Risk Management, (2009)' and relevant outputs of the Eastern District Catchment and Flood Risk Assessment and Management Study

Policy CC16: Cross-Boundary Flood Management

It is Council Policy to work with neighbouring Local Authorities when developing cross-boundary flood management work programmes and when considering cross boundary development.

Policy CC17: Coastal Defence

It is Council policy to implement and have regard to the recommendations of the Coastal Defence Strategy (2010) for the County where feasible. The Council will endeavour to obtain funding from the Office of Public works in order to undertake defence measures for specific areas as prioritised in the Strategy.

As part of the Dún Laoghaire-Rathdown County Development Plan 2016-2022, a Strategic Flood Risk Assessment has been prepared. This refers flood risk in the Priorsland area to the Cherrywood Planning Scheme Documents.

2.3 Cherrywood Planning Scheme

Dún Laoghaire-Rathdown County Council have prepared a Planning Scheme for the Cherrywood Strategic Development Zone (SDZ). It comprises a written document with maps, drawings and appendices. A Strategic Environmental Assessment Environmental Report, an Appropriate Assessment Screening Report and The Cherrywood Biodiversity Plan also accompany the scheme. The following policy relates to flooding in the Priorsland.

Policy 11

It is an objective to ensure that predicted flooding in the Priorsland area does not pose an unacceptable risk to persons or property. In this regard a flood containment zone shall be constructed in the Priorsland area by raising adjacent ground levels approx. 500mm and by incorporating a large diameter (1650mm) bypass culvert.

The flood containment zone and relief culvert are addressed in this SSFRA in the sections below.

2.4 Land Zoning

The land on which the development is proposed is currently zoned as "*Objective A1*" in the Dún Laoghaire-Rathdown County Council County Development Plan 2016-2022. This designation applies to lands which are 'to provide for new residential communities in accordance with approved Local Area Plans.

3 Existing Hydrogeological Environment

The existing hydrogeology is characterised by the Carrickmines River which through the site from west to east. The smaller Ticknick Stream joins the Carrickmines River immediately downstream of the site.

The site is at an elevation in excess of 60 mAOD and as such the hydrology in the area is not impacted by tidal changes. The surrounding environment has extensive man-made drainage features. These include surface and foul sewers both through the site and along the M50 to the south. A portion of the 1650 mm flood relief culvert has been constructed along the north of the site, however this has not been completed and currently serves no hydraulic purpose.

The watercourses around the site are shown in Figure 3 below.

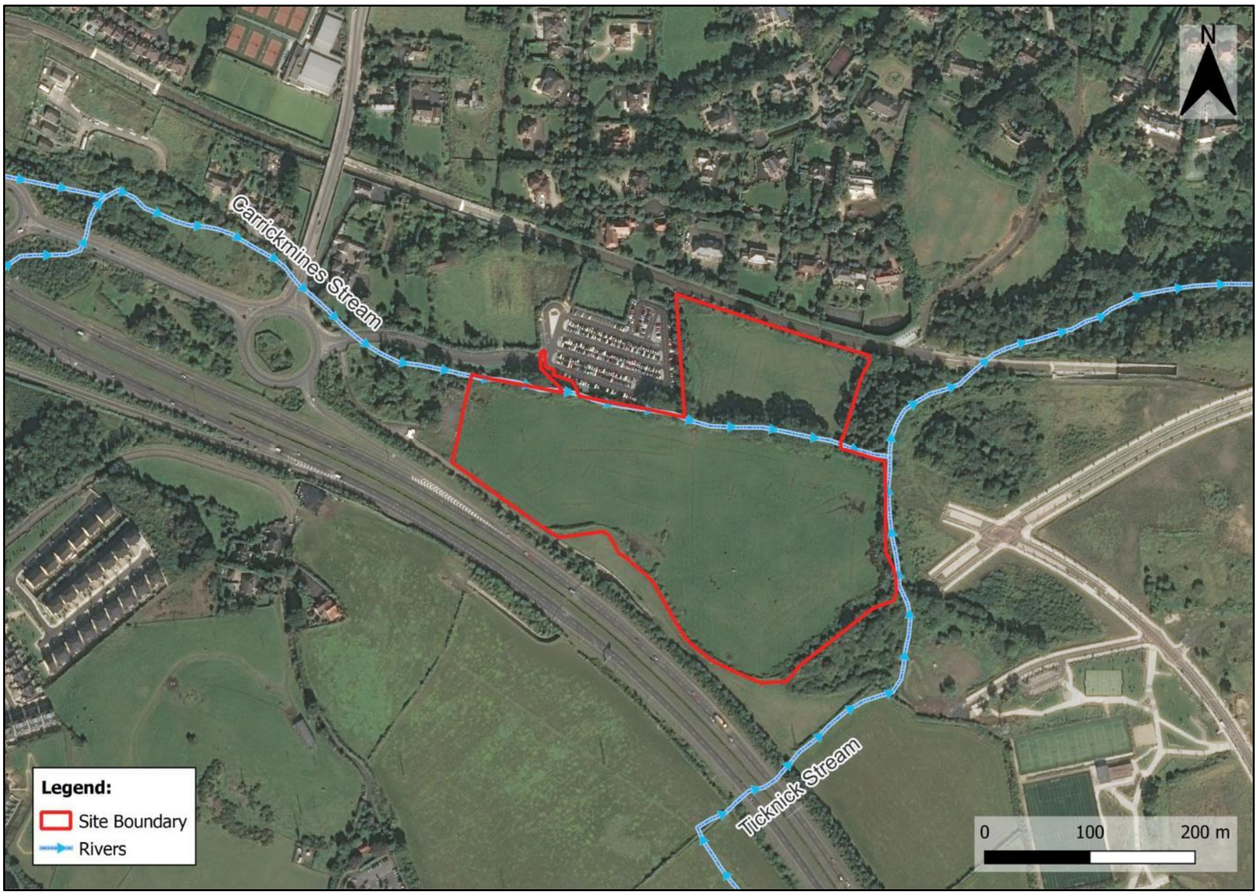


Figure 3: Hydrogeological environment around the site

3.1 Topographical & Walkover Surveys

A topographical survey of the site and its environs, including cross sections of the river through the site was procured by PUNCH Consulting Engineers to assist in the design and preparation of this Flood Risk Assessment. This survey was carried out in October and November 2018. Topographical survey which included additional river sections downstream was made available to PUNCH for this assessment. A copy of this survey is included in Appendix B of this report. The survey indicates that levels onsite range from 61.15 mAOD along the northern perimeter to 64.5 mAOD along the southern boundary adjacent to the M50.

PUNCH Consulting Engineers visited the site on August 22nd, 2018 in order to identify the key features of the site, to establish any potential sources of flooding and to identify the likely routes of flood waters. Appendix C contains a selection of key images taken during this site visit.

The following was established from the site visit and review of the topographical survey:

a) The site is very flat, and low-lying in nature;
b) Topographically it appears to be lower than the surrounding lands. The site is currently greenfield and is used for low-level agriculture;
c) Its bordered to the south by the M50;
d) The Carrickmines River dissects the site, running west to east;
e) The Ticknick Stream (referred to as the Laughanstown Stream in the EPA database) borders the site to the east;
f) There are mature trees bordering the site and along the Carrickmines River;
g) The Luas Green Line borders the site to the north;
h) The ground was dry at the time of site visit - sponging was not noted; and
i) Water compatible vegetation was not noted.

3.2 Site Geology

The geology of the site was reviewed using data from the Geological Survey of Ireland (available at www.gsi.ie). Within the site, the quaternary geological sediments were reviewed through this dataset, and it was observed that the site consists largely of "Till derived from Granites" with large deposits of Alluvium in the north and the south of the site.

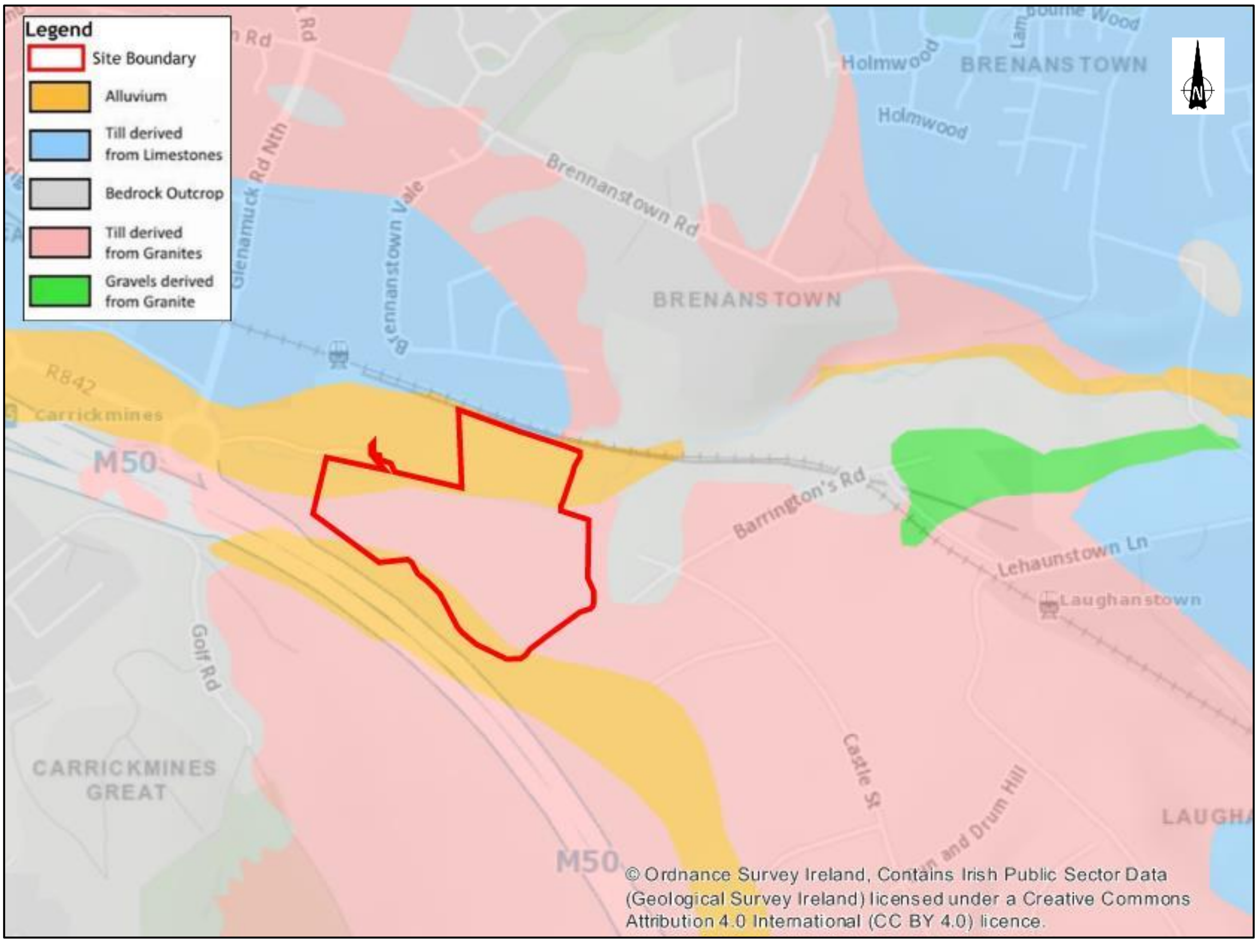


Figure 4: Site Quaternary Geology (source Geological Survey of Ireland (www.gsi.ie)

The presence of alluvium suggests that there is a history of flooding at the site. The surface geology of the site overlies a bedrock of granite, and groundwater vulnerability in the area is classified as 'High'.

A site investigation has been carried out by IGSL at the site. The investigation revealed weathered upper deposits, composed of gravelly silts and clays. These deposits were underlain by sandy gravel with cobbles and boulders.

The boreholes extended through coarse granular deposits and weathered rock, revealing intact granite at depths ranging from 5.0 m to 6.3 m below ground level. Granite, generally in medium strong to strong condition, was cored to depths of 14.5 m to 14.9 m.

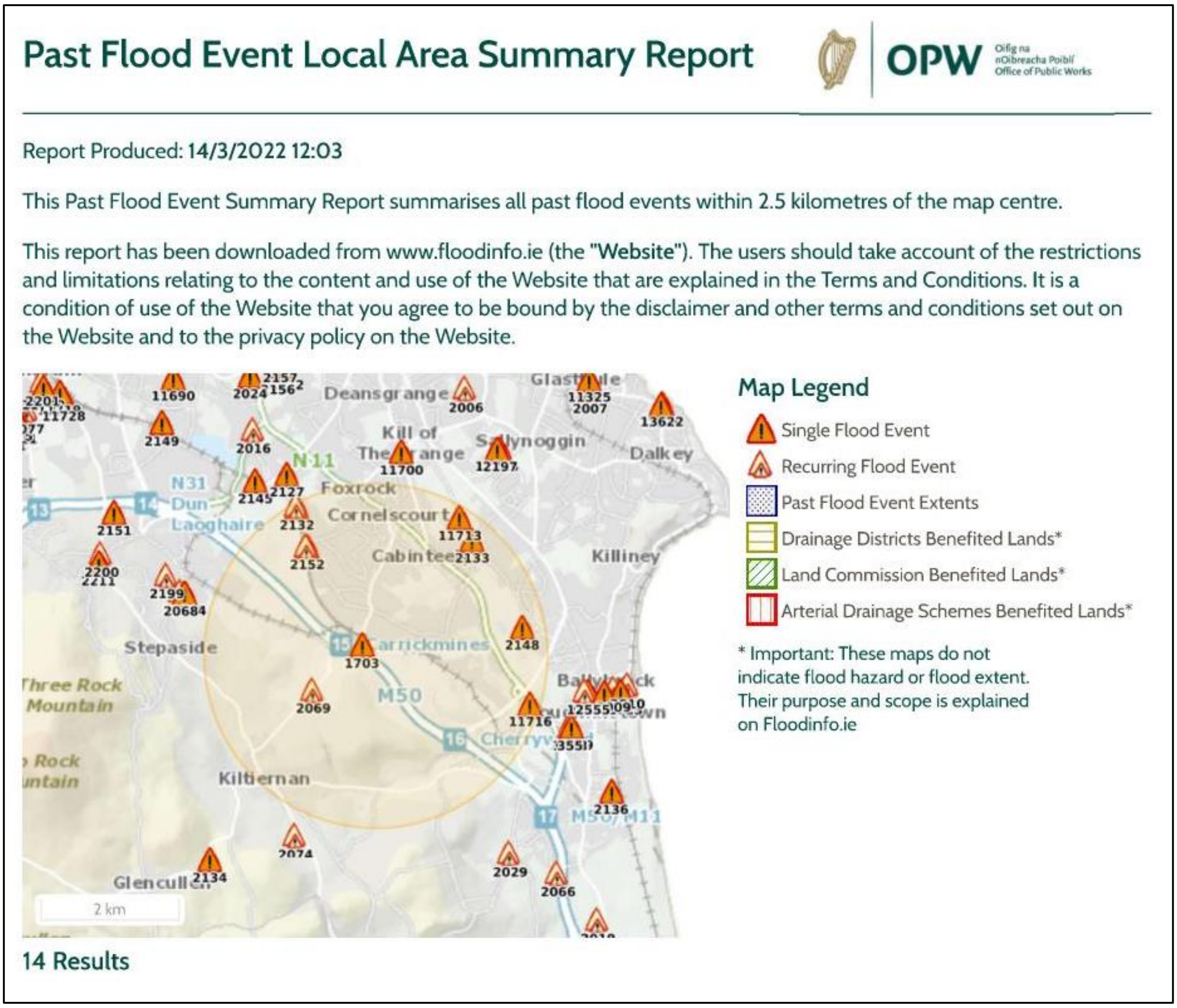
Groundwater was encountered at various depths in the boreholes, rising to within 0.6 m of the surface in places. Water ingress was also noted in the core holes. Standpipes were installed in selected locations to facilitate long-term monitoring.

3.3 Review of Existing Surface Water Infrastructure

There is an existing surface network located along the M50 motorway and discharges to an existing drain located to the south of the site of the proposed development.

3.4 History of Flooding

The office of Public Works (OPW) Flood Hazard Mapping website holds a record of historic flood events. A review of this database indicated that there have been reported incidences of flooding in the local area (Appendix D), however, none of these records report a flooding incident at the site of the proposed development. Please note that OPW records are not a guaranteed record of all flooding.



Past Flood Event Local Area Summary Report

OPW Oifig na nOibreacha Poiblí Office of Public Works

Report Produced: 14/3/2022 12:03

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the "Website"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.

Map Legend

- ⚠ Single Flood Event
- ⚠ Recurring Flood Event
- ▨ Past Flood Event Extents
- ☐ Drainage Districts Benefited Lands*
- ▨ Land Commission Benefited Lands*
- ☐ Arterial Drainage Schemes Benefited Lands*

* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

14 Results

Figure 5: OPW Flood Hazard Mapping

There were four instances of flooding recorded upstream of the site of the proposed development. These occurred in:

a) November 2002;
b) December 1997;
c) May 1993 and
d) November 1982.

Please refer to Appendix D for the record of OPW flood history at the site.

3.5 Review of Historic Mapping

A review of the OSI 6-inch historical maps was completed, see Figure 6 below.

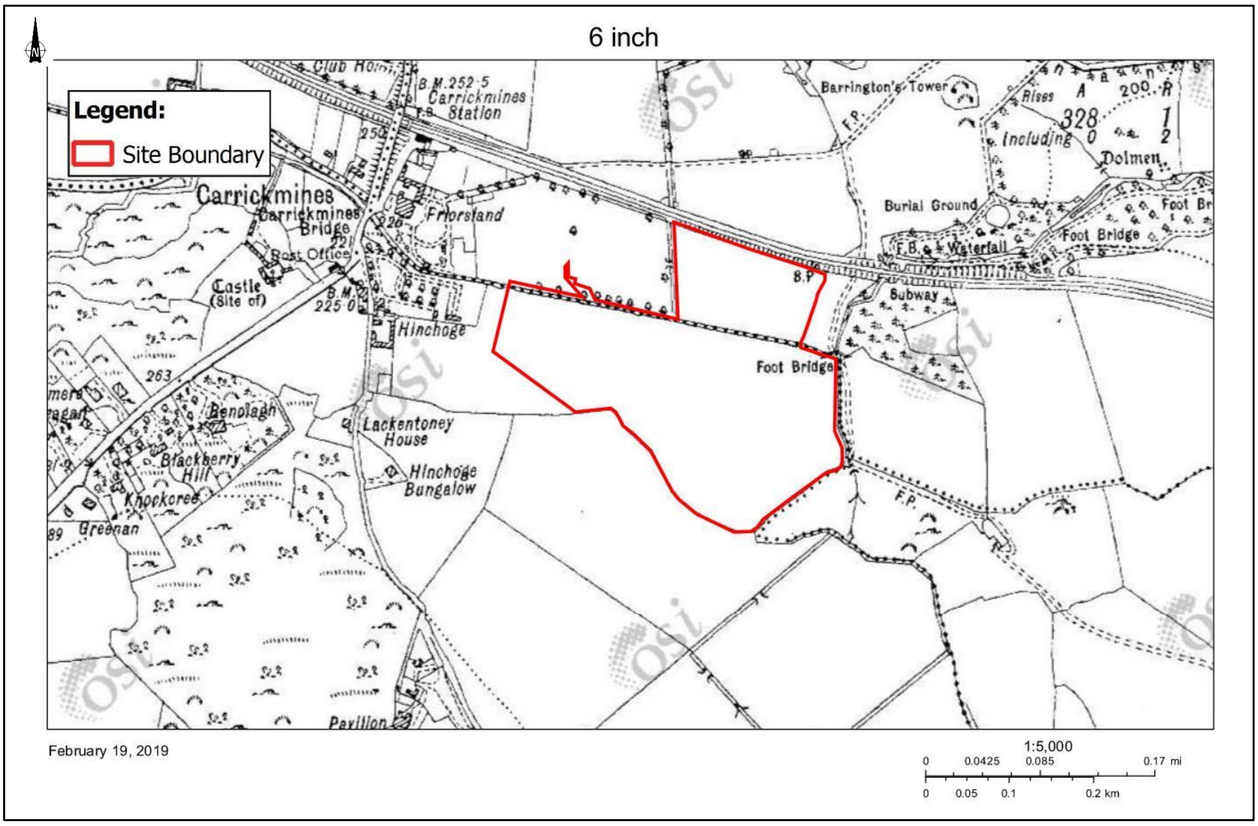


Figure 6: OSI Historical 6-inch map (1829-1841)[1]

Historic mapping shows that the site was historically undeveloped and in a rural area. In the last number of decades, the surrounding area has become significantly more urbanised, potentially leading to greater pluvial and fluvial flooding because of increased runoff from hardstanding areas.

Aerial photography from 2000 (presented in Figure 7 below) shows the surrounding area to be rural. The construction of the M50 Motorway near the site location included a number of watercourse crossings and structures over the Carrickmines River. These structures are not considered to impact on flooding to the vicinity of the site.

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[1] Sourced online at http://maps.osi.ie/publicviewer/#V2,635397,694487,12,9

Figure 7: Site Aerial Photography from 2000

3.6 Existing Flood Defences

As part of the Luas Park and Ride development to the north of the proposed development site, a permitted raised defence is located upstream of the proposed site which has been considered as part of this SSFRA. This defence is designed to prevent floodwater from flowing eastwards to the site. The defence works in tandem with a 1200 mm diameter circular pipe which drains the floodwaters back into the Carrickmines River upstream of the road culvert. The details and location of this defence are shown in Figure 8.

Figure 8: Flood Bund as indicated on Roughan O'Donovan drawing

This defence has been taken into account as part of the wider assessment completed in this SSFRA and is discussed in Section 5.5.

3.7 DLRCC Commissioned Feasibility Study

It is noted that DLRCC commissioned Consulting Engineers RPS in 2018 to carry out a feasibility assessment and determine the most effective flood mitigation option to alleviate flooding in the Priorsland development area which forms part of the Cherrywood Strategic Development Zone. A total number of nine flood mitigation options were assessed and one option, deemed the preferred option, was recommended on the basis of providing the most favourable outcome.

Following review of the outline RPS proposals by PUNCH, we note that the proposed works associated with the preferred option would contravene a number of key ecological/environmental requirements associated with the SDZ and the DLRCC Development Plan.

The proposed destruction of the riparian habitat represented by the Carrickmines River, and the protected mature Turkey Oaks by way of their proposed dredging and introduction of berms. The preferred option also negatively impacts the protected species associated with the Carrickmines River watercourse.

This is contrary to Specific Objectives of the Cherrywood Planning Scheme, including the following:

> ***GI 43*** *To require the retention and protection (in accordance with BS5837) of trees and hedgerows which are of particular signifcance to amenity and biodiversity or listed for retention. These are highlighted on Map 5.2. These include but are not necessarily limited to the following:*
>
> - *Turkey Oaks, Priorsland (within proposed SUDS provision)…*
>
> ***GI 59*** *Require the protection of existing hedgerows, treelines, woodland, scrub and other semi-natural habitats. Retention of habitats should take into account the environmental conditions required to maintain their condition (e.g. shading, drainage). In these areas, the applicant shall provide a Habitat Management Plan detailing how this will be achieved.*

It is noted in the Cherrywood Biodiversity Plan that otters are present/active in the Carrickmines River (refer to Section 2.6 and Figure 6 of the Biodiversity Plan). Otters are protected by the Wildlife Acts and the EC Habitats Directive. The preferred option identified in the RPS Feasibility Study would therefore contravene the following CPS specific objective:

> ***GI 60*** *Ensure the protection of the biodiversity associated with watercourses and their riparian (bankside) habitats through detailed design and protective measures during construction. Where diversion and food relief measures are required then best practice will apply and consultation with Inland Fisheries Ireland will take place to agree on the methodology for such works so as to minimise impacts on the watercourse and its ecology, in accordance with the requirements of the Water Framework Directive. No projects shall give rise to significant erosion and deposition of soil into natural watercourses.*

It is further noted that the preferred option identified in the RPS Feasibility Study also contravenes DLRCC Development Plan policy as reproduced below:

DLRCC Development Plan Chapter 4, Section 4.1.3.7 - Policy LHB25: Rivers and Waterways:

"It is Council policy to maintain and protect the natural character and ecological value of the river and stream corridors in the County and where possible to enhance existing channels and to encourage diversity of habitat. It is also policy (subject to the sensitivity of the riverside habitat) to provide public access to riparian corridors to promote improved passive recreational activities.

Development proposals in riparian corridors will be considered providing they:

- *Dedicate a minimum of 10m each side of the water's edge for amenity, biodiversity and walkway purposes (where practical).*
- *Where practical ensure no development – including clearance and storage of materials - takes place within a minimum distance of 10m measured from each bank of any river, stream or watercourse.*

- *Preserve the biodiversity of the site.*
- *Involve no land filling, diverting, culverting or realignment of river or stream corridors.*
- *Have no negative effects on the distinctive character and appearance of the waterway corridor and/or the characteristic and landscape elements of the specific site and its context.*
- *Do not impact on important wetland sites within river/stream catchments which provide an important function in terms of regulating the flow of water in these catchments and often support habitats and species of high nature conservation value.*
- *Take cognisance of any adverse impacts on the populations of protected species including otters and bat."*

4 Flood Zone Assessment

4.1 Preliminary Flood Risk Assessment (PFRA) Mapping

The Catchment Flood Risk Assessment and Management Study (CFRAMS) is a national programme which to date has produced both a series of Preliminary Flood Risk Assessments (PFRA) which cover the entire country, as well as more detailed flood maps in certain catchments across the country.

Prior to the publication of the detailed CFRAMS flood mapping, a series of Preliminary Flood Risk Assessment (PFRA) maps were published. These maps indicated preliminary pluvial, fluvial and coastal flood zones for 1 in 100 year (Indicative) and 1 in 1000 year (Extreme) return period events. The PFRA flood extents in the vicinity of the proposed site are shown in See Figure 9 below.

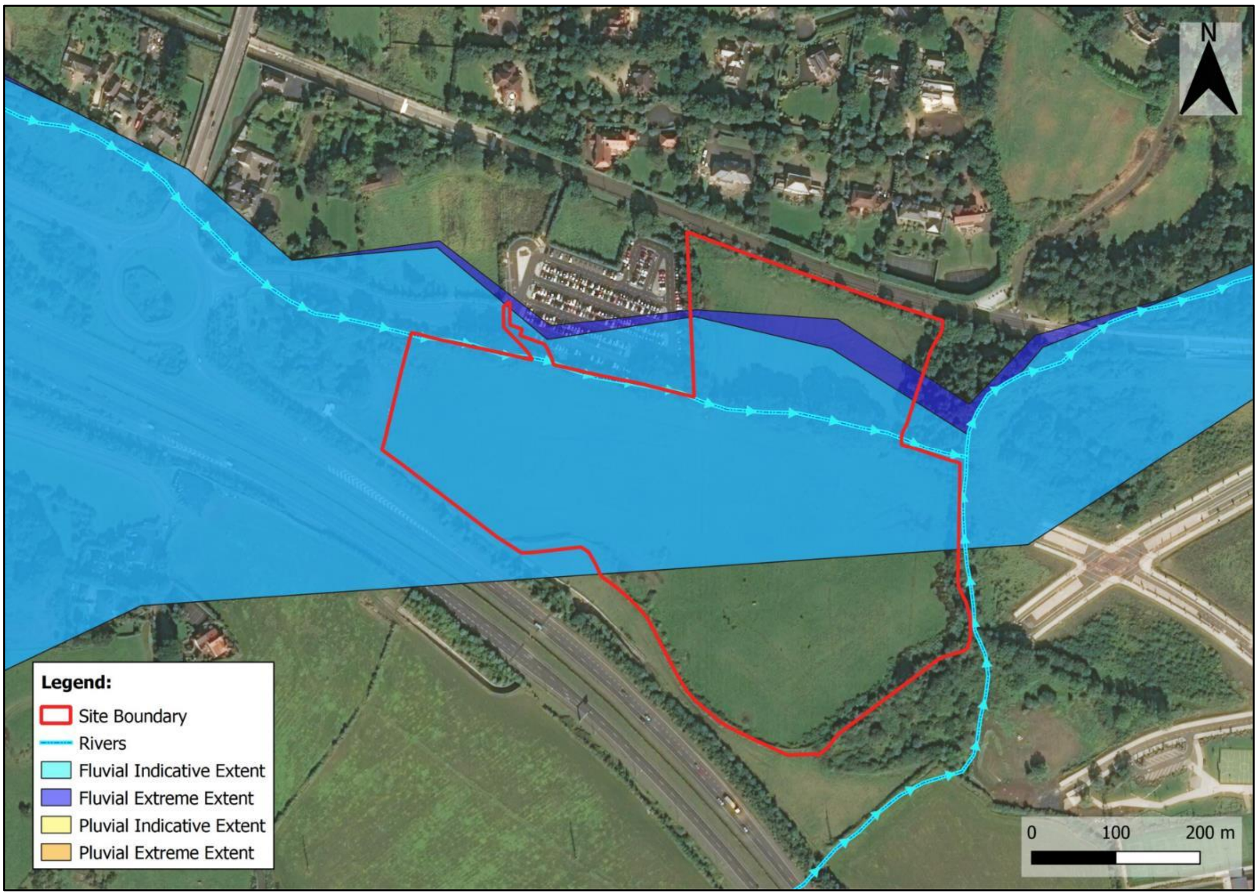

Figure 9: PFRA Flood zone map indicating pluvial flood extents

The PFRA mapping shown in Figure 9 indicates that the site is within the fluvial floodplain of the Carrickmines River. There are no areas of land subject to pluvial flooding noted within or immediately adjacent to the site. It is noted that the PFRA modelling is a high-level study which uses a coarse grid to represent the topography of the country and does not take flood defences into account. As such PFRA fluvial, pluvial and coastal flood extents are to be utilised as an initial assessment only.

In the case of this site, CFRAMS mapping is available and has been used to assess the extent of the flooding on the site more accurately.

4.2 CFRAMS Mapping

As part of the CFRAMS programme, mapping is available online for public viewing, and the local area has been assessed as part of the Eastern CFRAMS study. The OPW has published detailed flood hazard mapping for the Dublin southern environs based on the results of the Eastern CFRAM Study. This includes flood extent mapping for a number of return period events and flood depth mapping for each of the potential flood events.

Figure 10 below is an extract of the Eastern CFRAMS map for the Priorsland area. The CFRAMS assessment is based on hydraulic modelling of the Carrickmines River. Full CFRAMS mapping for the area is presented in Appendix E.

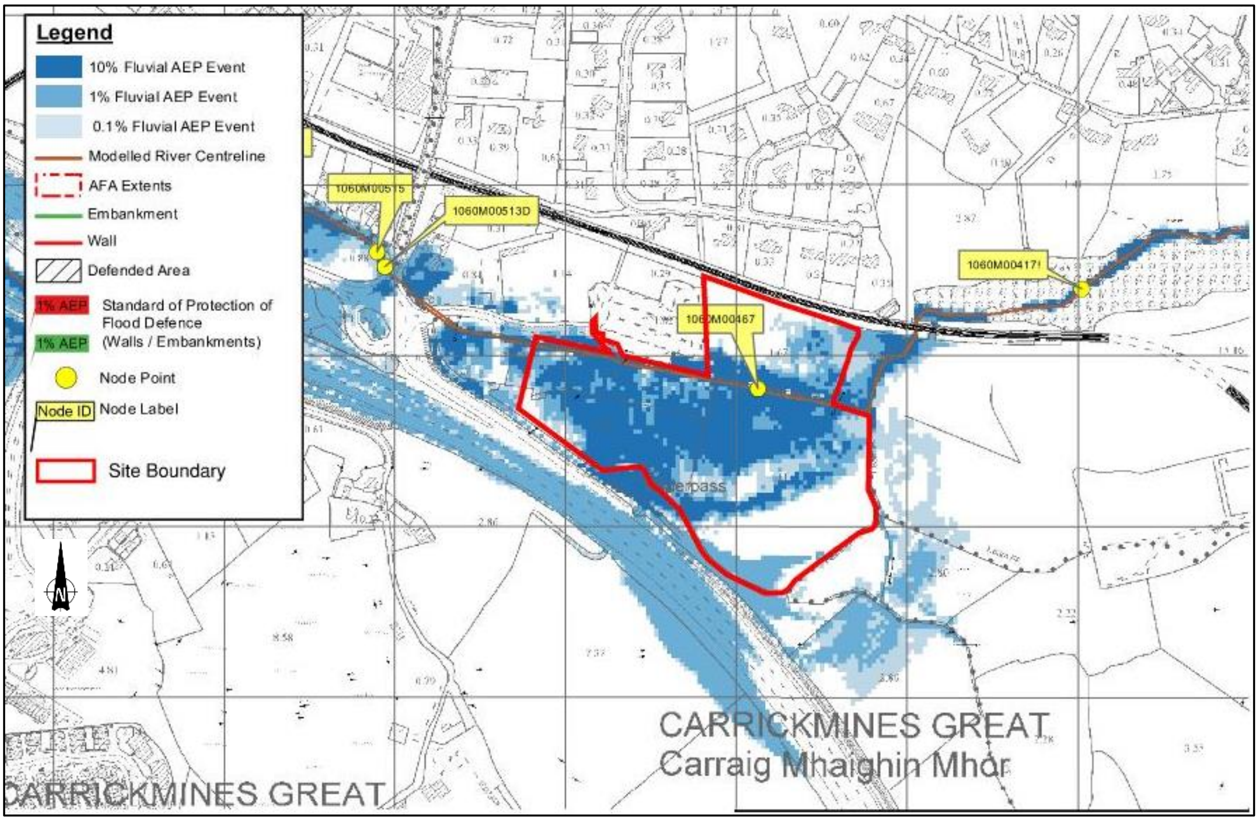

Figure 10: Extract from CFRAMS Fluvial Flood Map for Priorsland Area

As can be seen from the map above, the site of the proposed development is shown as being located in the fluvial Flood Zone A (the 1 in 100-year flood zone).

This flooding emanates from the Carrickmines River and flows across the site in a southerly direction.

Flood depth mapping shows floodwaters to be less than 250 mm at the site during a 1 in 100-year event, as shown in Figure 11 below, and less than 500 mm for the 1 in 1000-year event.

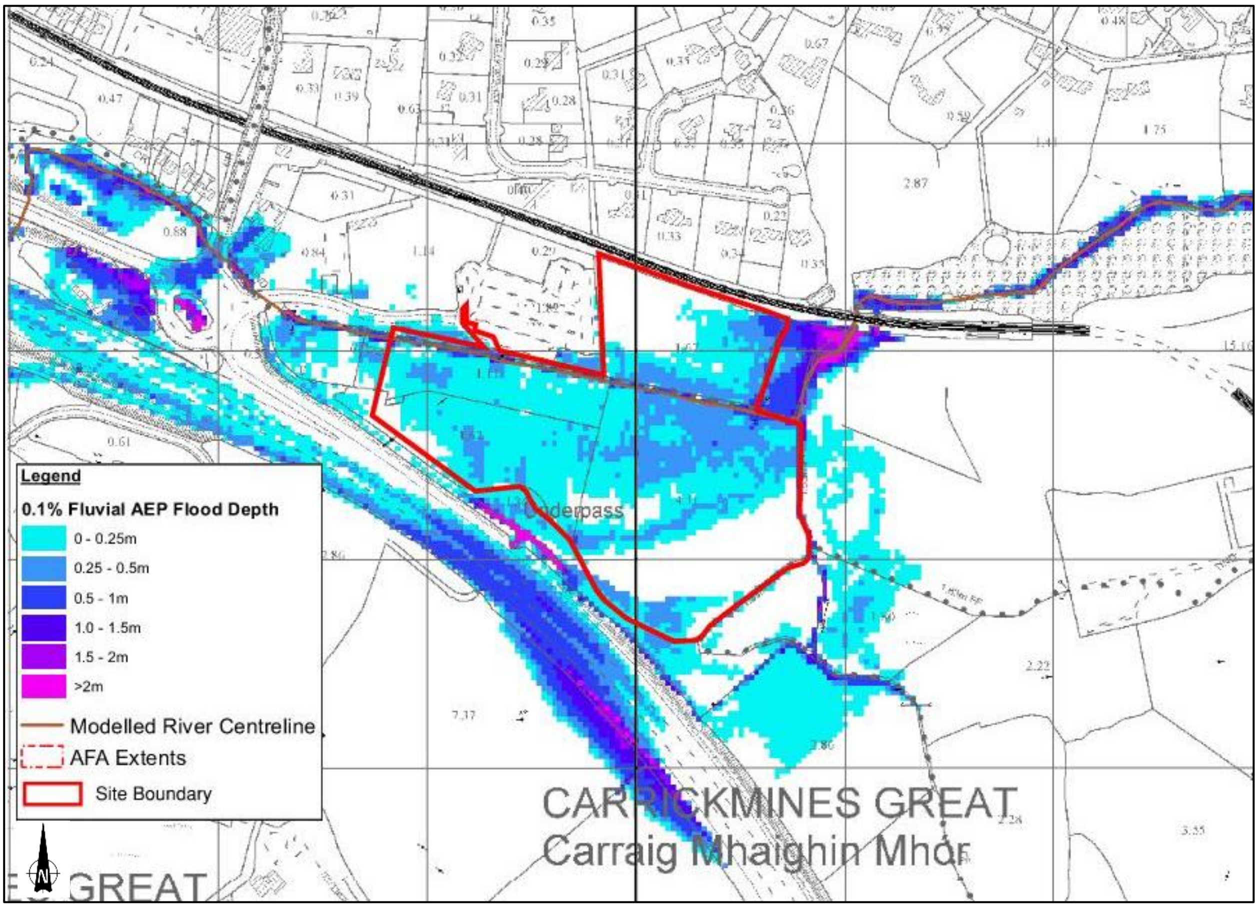

Figure 11: Extract from 1 in 1000-year CFRAMS flood depth map for Priorsland

A summary of the flooding to which the site is subject for all modelled scenarios is presented in Table 2 below.

Table 2: Flood levels for various return periods at Node 1060M00467

Flood Event	Flood Level (mAOD)
1 in 10-year	62.43
1 in 100-year	62.52
1 in 1000-year	62.62

4.3 Estimate of Flood Zone

Due to the nature of flooding predicted at the site, PUNCH Consulting Engineers have developed a hydraulic model of the area as part of this Site-Specific Flood Risk Assessment (SSFRA). The purpose of this model is to accurately assess the flood risk to the site and determine the impact that the proposed development may have on flooding in the surrounding lands. This model varies from the CFRAMS model, in that it includes more detailed topographical survey information and accounts for flood defences and other developments in the area.

The hydraulic model prepared as part of this SSFRA will be used to determine the Flood Zones at the site with further details provided in Section 5 below.

It is noted that the CFRAMS mapping in Figure 10 and Figure 11 do not include an allowance for climate change. As per the *The Planning System and Flood Risk Management Guidelines*, flood zones are defined using current scenario predicted flood extents without the inclusion of climate change.

5 Hydraulic Flood Model

5.1 Introduction

The CFRAMS mapping, as described in Section 4.2 above, shows the site to be partially within the 1 in 100-year fluvial floodplain of the Carrickmines River. Consequently, a hydraulic model was prepared as part of this SSFRA to carry out a detailed assessment of the flood levels, extents and floodwater flow paths. In addition, a hydraulic model allows the assessment of any changes to flow paths and flood storage following completion of the proposed development

The approach taken was to develop a 1D-2D linked hydraulic model which is the standard for such studies and is similar to the approach taken in the CFRAMS project. The software packages of choice were Flood Modeller and TUFLOW which can be linked to assess a combined 1D-2D hydraulic model.

A hydraulic model cannot work in isolation for generating predictive flood maps; it must also be accompanied by a hydrological assessment of a catchment. In general, for a natural river channel methodology such as the Flood Studies Updates (FSU) (see http://opw.hydronet.com/) and the Institute of Hydrology Report No. 124 (Flood Estimation for Small Catchments, 1994) would be the methods of choice for predicting possible future flow rates based on given return periods. In general, the method of flow rate used is based on the catchment size:

a) Catchment <25 km^2: Institute of Hydrology report IH124;
b) Catchment > 25 km^2: FSU Webportal Application.

5.2 Catchment Hydrology

5.2.1 Carrickmines River

The Carrickmines River is a relatively minor watercourse draining a small section of South County Dublin. It rises in a number of tributaries in the Dublin Mountains south of Sandyford and flows in an easterly direction towards Blackrock where it outfalls to the sea. The CFRAMS mapping notes that the risk to the site of the proposed development is generated from a lack of capacity of the channel and the structures along the reach in the vicinity of the proposed development.

The Carrickmines River flows from west to east within the site of the proposed development and then crosses underneath the existing LUAS railway line. There are further capacity issues downstream of this LUAS culvert however these are not linked and do not pose a flood risk to the site of the proposed development and as such they have not been considered in the assessment of this section of the Carrickmines River. As a result, only the catchment up until the eastern point of the site has been used in this assessment as shown in Figure 12 below. This has resulted in a catchment size of 14.45 km^2. This Catchment is based on Node 10_1152_1 of the FSU Webportal and incorporates all relevant tributaries.

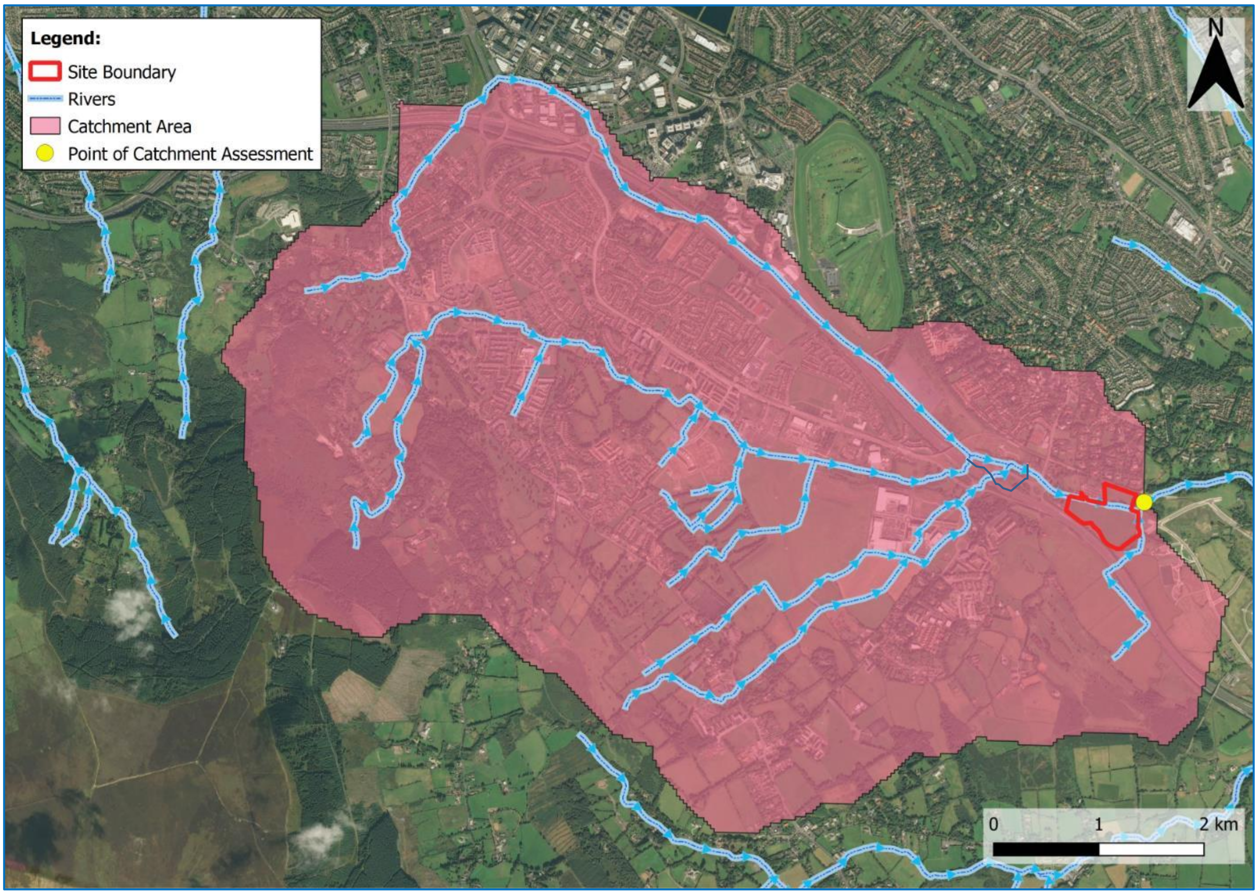

Figure 12: Contributing Catchment Area

In order to carry out an estimation of flow rates, the IH124 methodology was employed, which requires inputs describing the rainfall, catchment area and soil descriptor. The IH 124 Report examined the response of small catchment (less than 25 km^2) to rainfall and derived a flood estimation equation. The report developed a new equation to estimate the mean annual flood, Q_{BAR} (m^3/s) for small catchments as follows:

$$Q_{BAR\ rural} = 0.00108\ x\ Area^{0.89}\ SAAR^{1.17} SOIL^{2.17}$$

Table 3: Q_{BAR} estimated using IH124

QBAR Estimation	
Catchment Area (km^2)	14.447
SAAR (mm)	815
SOIL	TYPE4 (factor = 0.45)
Q_{BAR} (m^3/s)	5.238

The SOIL factor of 0.45 was utilised to ensure that the runoff rate from the catchment was accurately represented. The catchment is a combination of urban and rural. Publicly available mapping shows the SOIL to be Type 1, however due to the mountainous nature of the upstream catchment, it was considered appropriate to use a higher SOIL value in this case.

The fluvial flood flows for various return periods were then estimated using growth factors applied to the Q_{BAR} value calculated. The estimated flow rates are increased by 20% to allow for Climate Change as per the OPW Climate Change Sectoral Adaptation Plan for the Mid-Range Future Scenario.

A Factor of Safety (FoS) of 1.65 is applied to all calculated flows to account for the uncertainties associated with Qbar estimates from catchment descriptors. The resulting flow rates are shown in Table 4.

Table 4: Summary of IH124 Fluvial Flow Estimates

	Growth Factor	Qt (m^3/s)	+ Climate Change (m^3/s)	+ FoS of 1.65 (m^3/s)
Q100	1.96	10.27	12.319	20.327
Q1000	2.60	13.62	16.342	26.964

It is noted that the flow rates presented in Table 4 have been calculated at the downstream end of the site but applied at the upstream end of the hydraulic model thus providing a conservative estimate of the flood extents.

5.2.2 CFRAMS Flow Rates

The CFRAMS mapping referred to in 4.2 above provides flow rates for nodes along the length of the Carrickmines River. The flow rates at the nodes nearest the site are presented in Table 5.

Table 5: CFRAMS Flow Rates

NODE	Return Period (Years)	Modelled Flow (m^3/s)
1060M00538J	100	19.06
	1,000	28.95
1060M00515	100	23.91
	1,000	36.73

It is noted that the flows calculated using the IH124 method are 6.6% higher than the Q100 flow at 1060M00538J and 15% lower than the flow at 1060M00515. For the Q1000 flows, the IH124 calculated values are 93.1% and 73.4% respectively of the CFRAMS Q1000 flows at the reported nodes.

Sensitivity testing was carried out on the model using CFRAMS flow rates which were increased for 20% to allow for climate change. The model was not deemed sensitive to changes in the flow for flows in the order of magnitude of the Q1000 rates considered. Please note that further sensitivity testing is being carried out in conjunction with RPS and Dun Laoghaire-Rathdown County Council.

5.2.3 Hydraulic Model Design Flow rates

Following a review of the flows as noted above, the flows used in this hydraulic model are presented in Table 6. These flows were derived using the IH124 equation and are inclusive of climate change.

Table 6: Design Flow rates

	Flow (m3/s)
Q100	20.327
Q1000	26.964

The design flow rates were applied to a hydrograph which was generated by the FSU Webportal. This hydrograph is considered appropriate for the Carrickmines River based on the size and the runoff characteristics of the catchment. The peak of the hydrograph was adjusted to match the peek flow of the Q100 or Q1000 respectively (see hydrographs in Figure 13 and Figure 14).

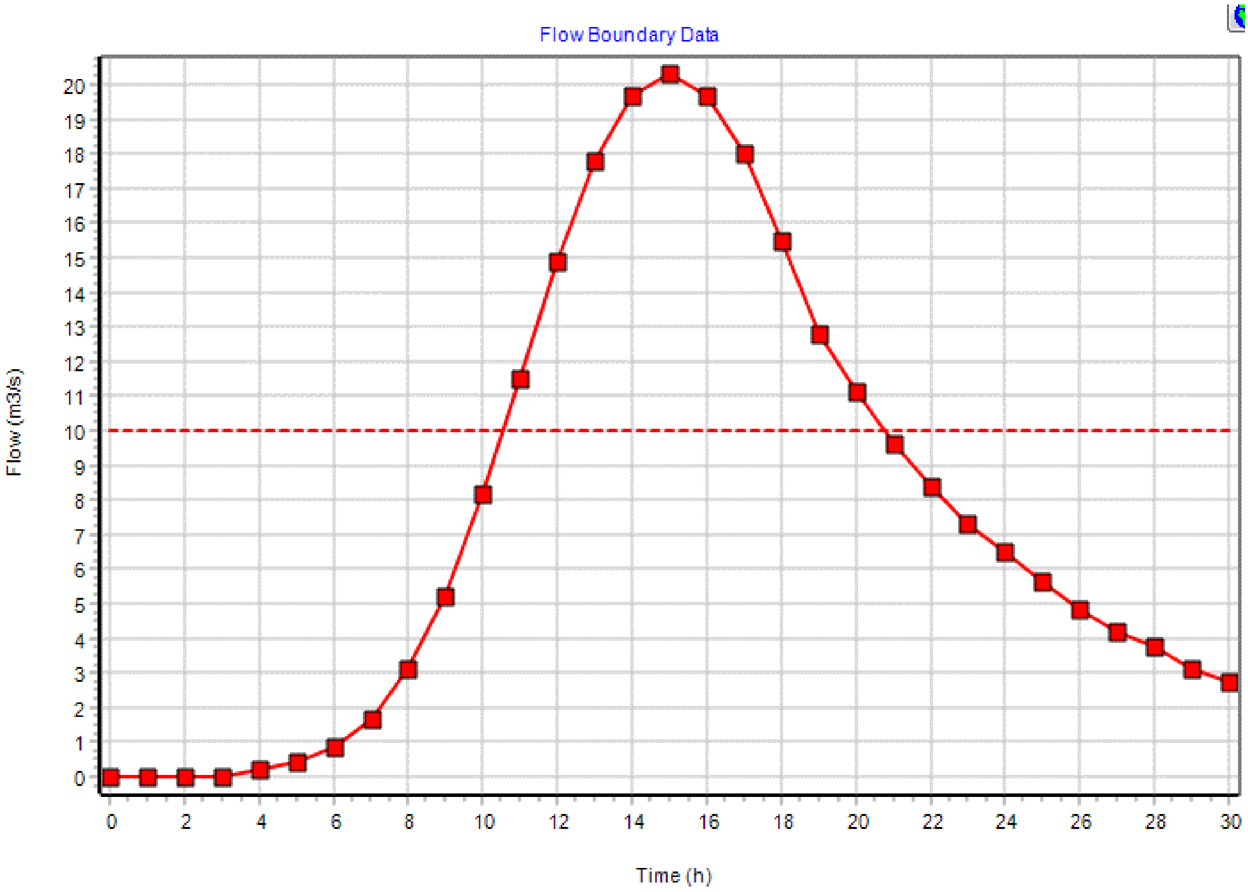

Figure 13: Sample hydrograph for the modelled Q100 event

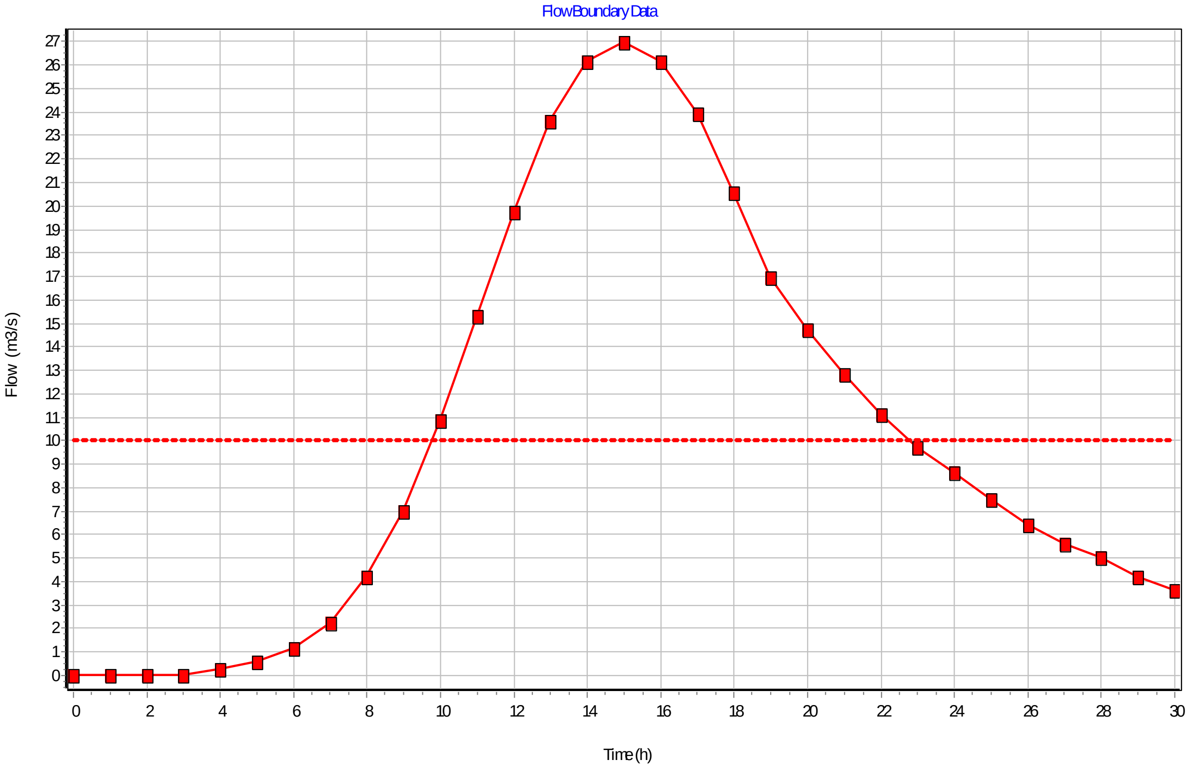

Figure 14: Sample hydrograph for the modelled Q1000 event

A minimum flow of 10 m^3/s was applied to the Carrickmines River in the model in order to ensure computational stability of the model.

A Note on Flow Rates Following Proposed Development:

The catchment area used to calculate flood model flows includes the area of the subject site which will be drained by the proposed surface water drainage system. Flows from the subject site have been calculated using greenfield runoff rates. The surface water drainage for the site has been designed to restrict flow to 1 l/s/ha with appropriate attenuation provided to ensure no flooding for a 1 in 100-year storm event with allowance for climate change. Exceedance of the surface water network will only occur for storms greater than the 1 in 100-year rainfall event and any potential overland flow from exceedance of the storm water network will be less than the flow rate from the site that has been allowed for in the catchment calculated for the flood model flow rates.

5.3 Flood Modeller - 1D Network

5.3.1 Introduction

For the purposes of modelling in-channel flows in the Carrickmines River, PUNCH Consulting Engineers constructed a one-dimensional model (1D) of the watercourse using Flood Modeller. The river channel details (including culvert size and inverts) were taken from river survey data provided to and procured by PUNCH Consulting Engineers. The model extends from upstream of the M50/Glenamuck Road Roundabout to 1.3km downstream of the watercourse crossing under the LUAS light rail culvert. Normally such an extended downstream reach would not be included in the model, however as the information was made available to PUNCH, it was utilised in the model. The 1D modelling demonstrated that flooding extents at the site are not impacted by the downstream reaches of the modelled river. The location of all 1D cross-sections is shown in Figure 15.

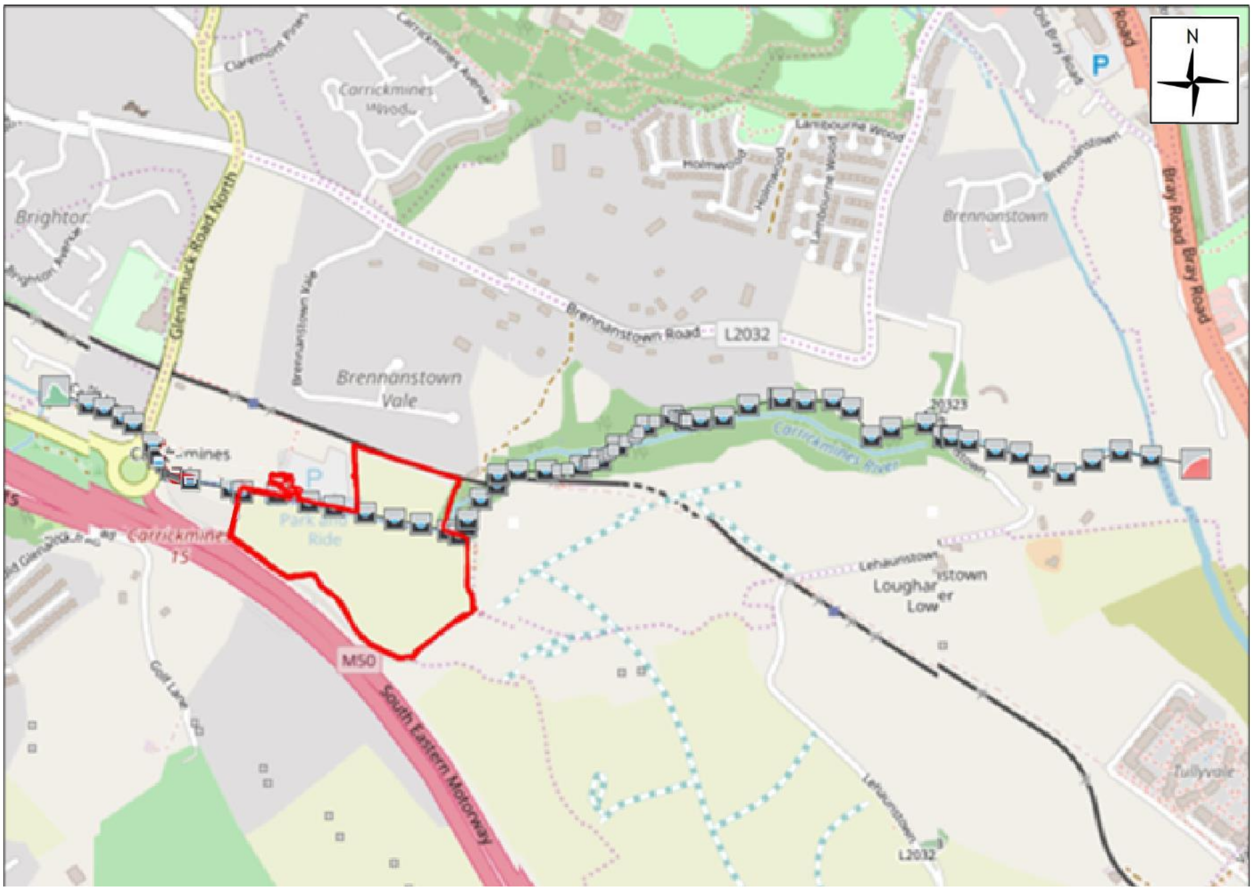

Figure 15: Locations of 1D nodes in 1D Flood Modeller

The 1D river cross-sections were set with a roughness value of 0.055 in order to represent a channel and banks with weeds, stones and other vegetation. The linkage of the 1D model with the 2D floodplain model, which allows for waters to 'spill' from the river to the floodplain, is described further below.

The long-section presented in Figure 16 below demonstrates that the 1D model covers the watercourse from an elevation of approximately 64.5 mAOD to 23.5 mAOD. However, due to the steep section of watercourse downstream of the site, the results of much of the 1D model are not relevant to the floodplain at the site of the proposed development.

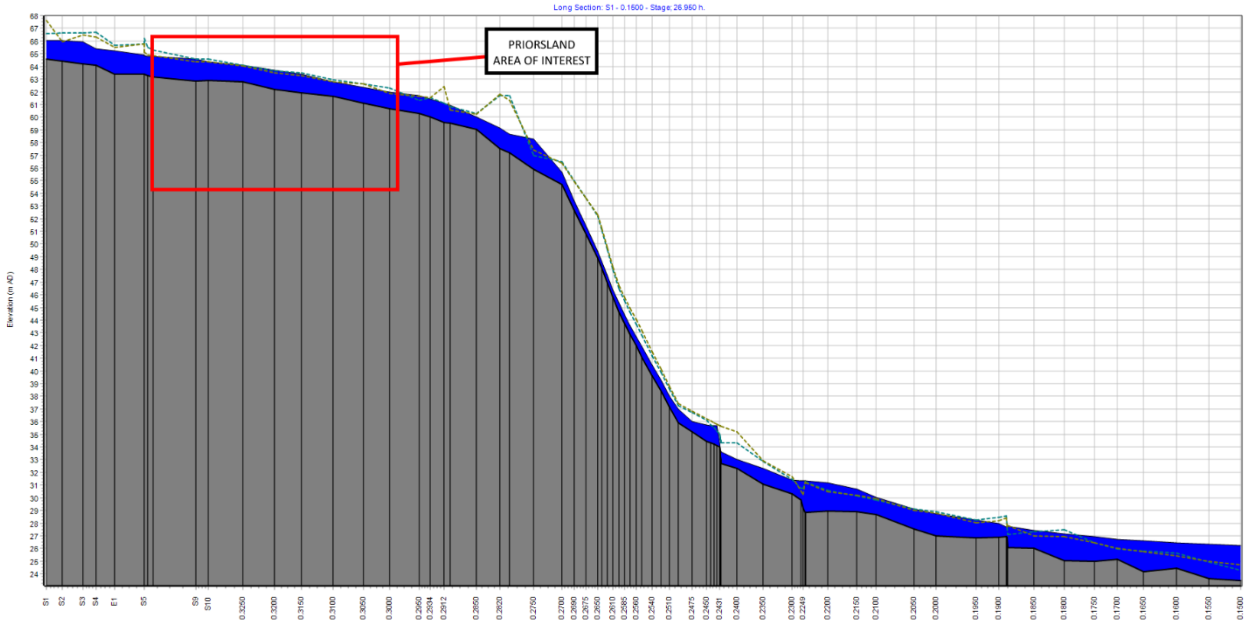

Figure 16: Long Section of 1D Network

5.3.2 Structures in Model

Within the 1D model, 2 no. structures were included upstream of the site which were considered to have the potential to impact the flow in the Carrickmines River. These were box culvert sections which carry the Carrickmines River under the northern and eastern arms of the roundabout which lies to the west of the site. These were included in the 1D model.

Downstream of the site, a watercourse crossing exists which carries the LUAS track over the Carrickmines River. Due to the steep longitudinal gradient of the river at this location, including this structure caused instability in the model. Because of this instability, and the fact that water levels downstream of the site were not impacted by structures, this structure was not included in the model.

The flood relief culvert to the north of the Carrickmines River has been partially constructed as part of the LUAS Park and Ride works completed to date. As this culvert does not yet have a completed discharge point, it was not modelled as part of the existing scenario. While it is understood that a degree of storage is provided by this culvert, it does not provide the flood conveyance mechanism for which the full and completed structure is designed.

Refer to the topographical and river survey in Appendix B for dimensions of surveyed structures upstream of the site.

5.4 TuFLOW – 2D Network

In order to assess the out-of-channel flood flow paths and flood risk in the vicinity of the proposed development, PUNCH constructed a 2D hydraulic model. The software of choice was TUFLOW, and the ground model used in the 2D model was generated using a combination of LiDAR and topographical survey data. The grid size chosen for this model was 2 m. The extent of the 2D model can be seen in Figure 17.

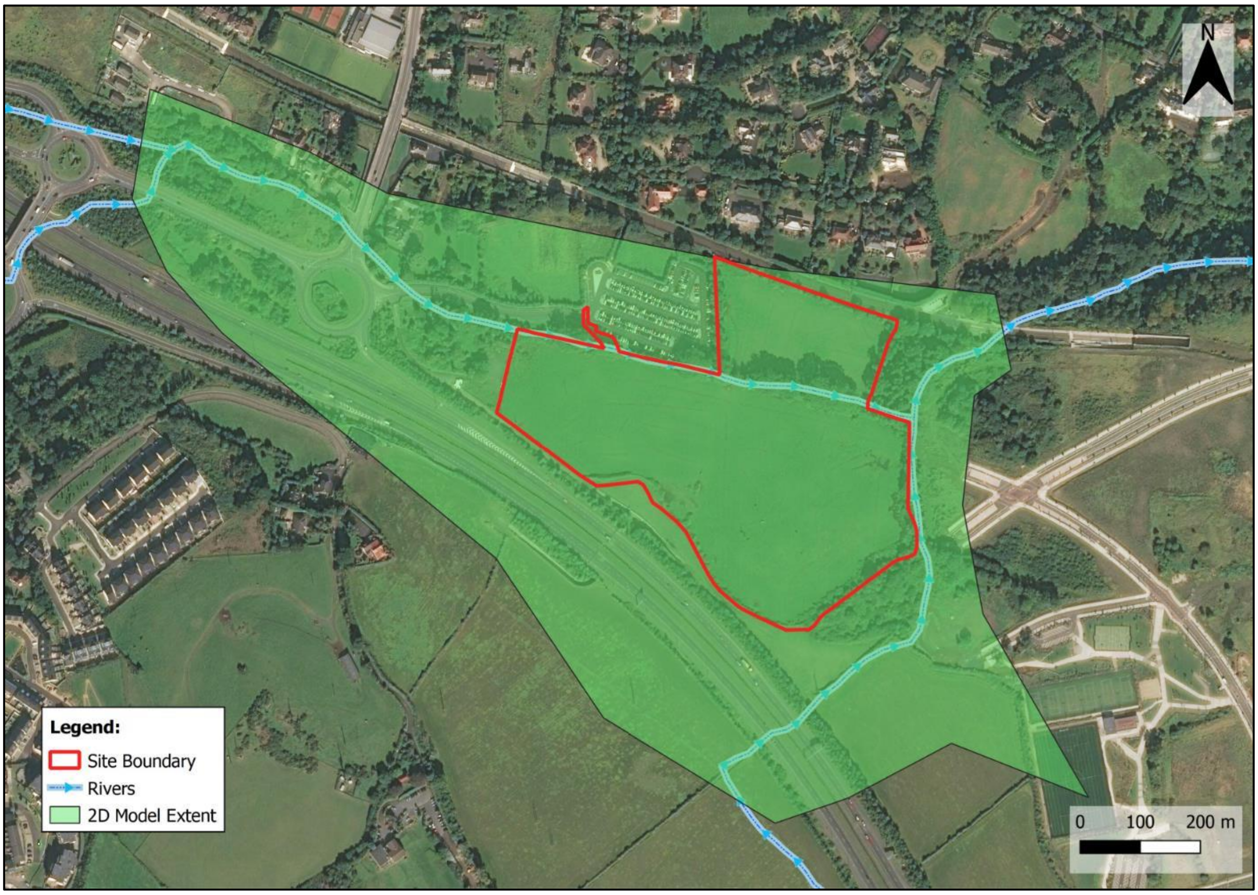

Figure 17: Extent of TuFLOW 2D Model

5.4.1 Ground Model

In order to assess the out-of-channel flow paths, a detailed three-dimensional (3D) ground model was a required input for the Tuflow 2-D flood model. One of the principle sources of data used to generate the ground model was LiDAR (Light Detection and Ranging) data. LiDAR data was supplied to PUNCH Consulting Engineers by the OSI[2]. The extent of the LiDAR obtained is shown in Figure 18.

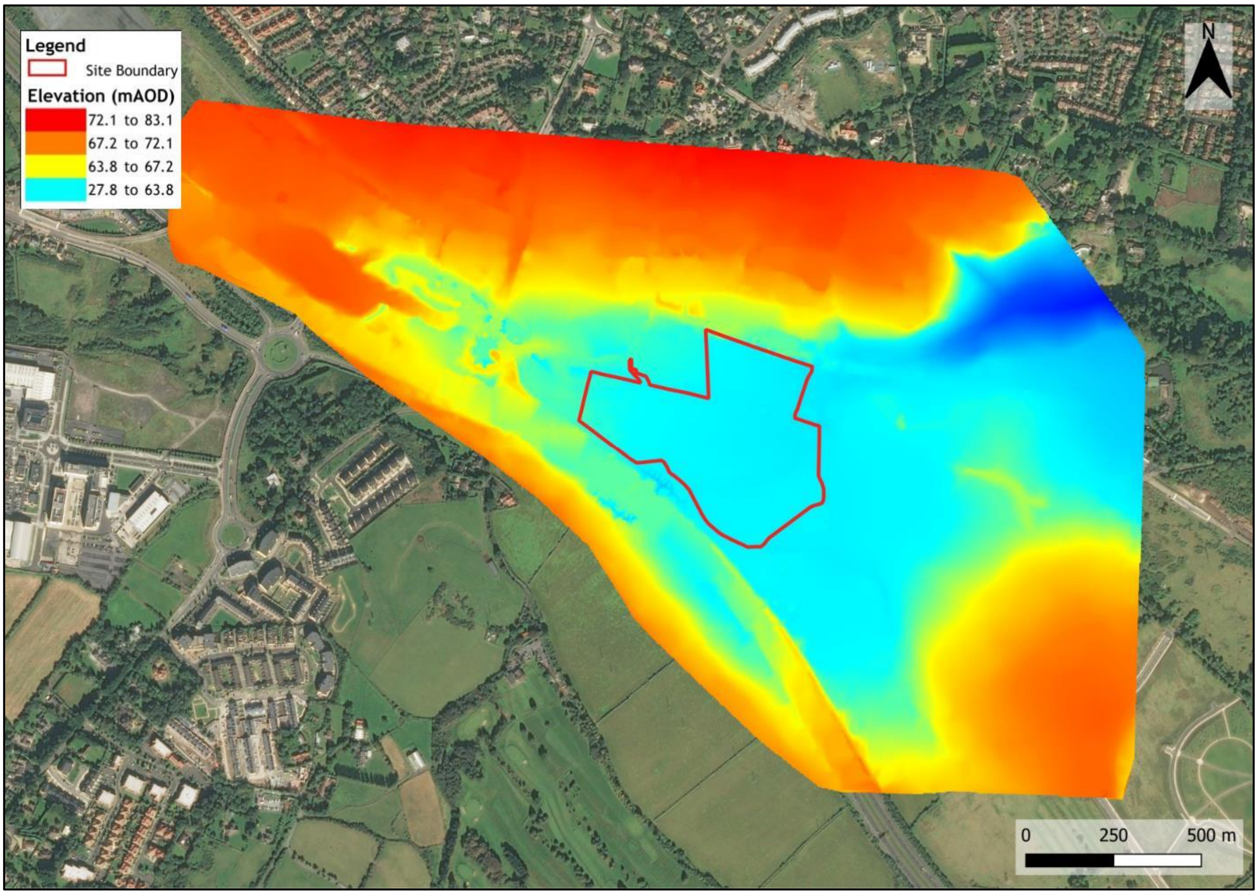

Figure 18: Extent of LiDAR Survey indicating ground elevations in the model

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[2] further details on LiDAR data in Ireland are available at http://www.osi.ie/Products/Professional-Mapping/Height-Data.aspx

Additional topographical survey data was obtained, which was found to tie-in well with the LiDAR survey. This additional survey was incorporated into the model for the Existing and Proposed scenarios in order to refine the accuracy of the model in the vicinity of the proposed development (see Figure 19).

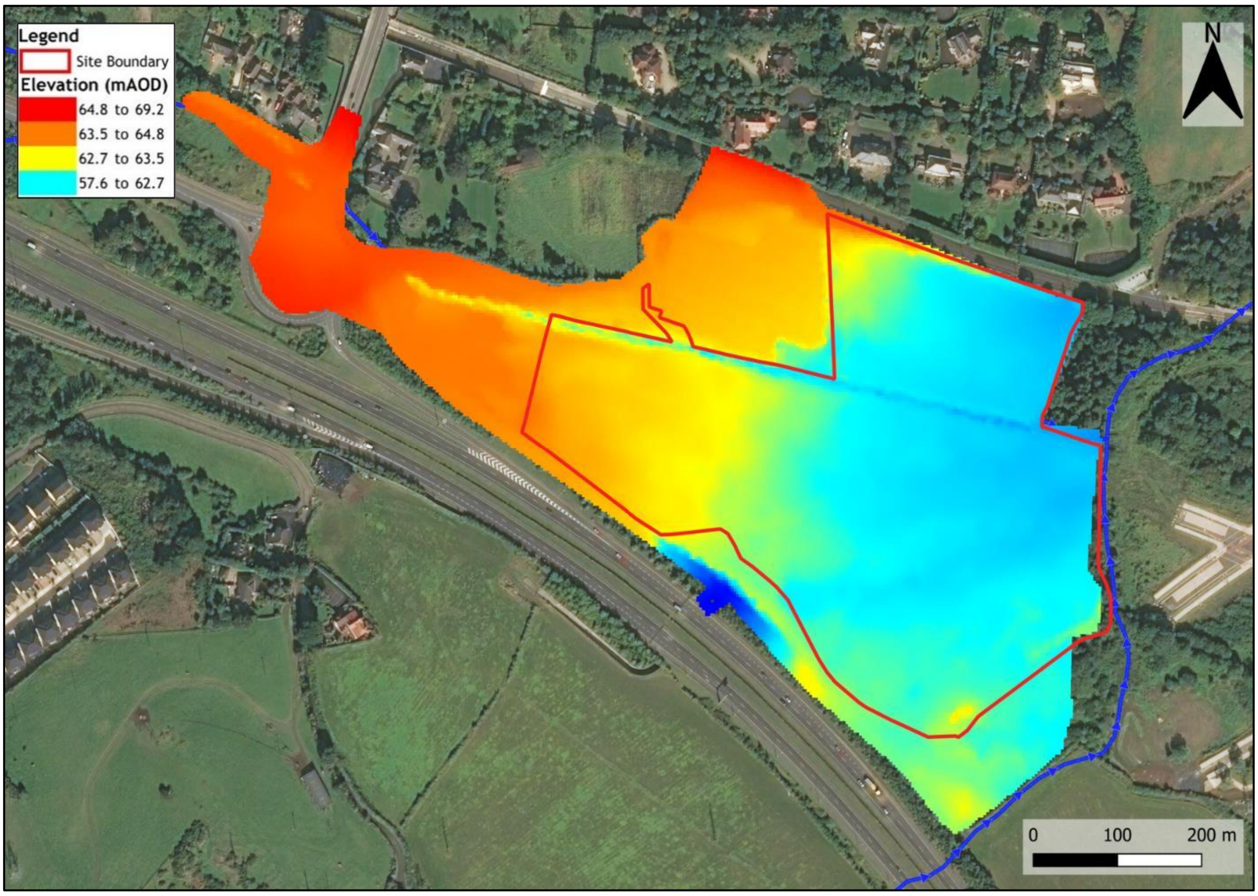


Figure 19: Ground model prepared using topographical survey

5.4.2 Roughness

The study area was classified into broad land use types based on the survey information, photographs of the surrounding area and aerial imagery. Each land classification was then assigned an appropriate Manning's '*n*' roughness value based on the ground surface or the density of the vegetation present. Table 7 summarises the roughness values selected. The buildings within the study area were assigned a higher Manning's '*n*' value to simulate the impediment to flow at the buildings. Roads, footpaths and other hard-standing areas within the floodplain were represented within the model using a Manning's '*n*' value of 0.02.

Table 7: Manning's n values applied in 2D domain

Location	Value
Roads	0.02
Grass	0.08
Buildings	3.0

The distribution of roughness values used in the 2D domain of the hydraulic flood model can be seen in Figure 20 below. Within the TuFLOW materials file, all areas not identified as roads or buildings were defined as Grass.

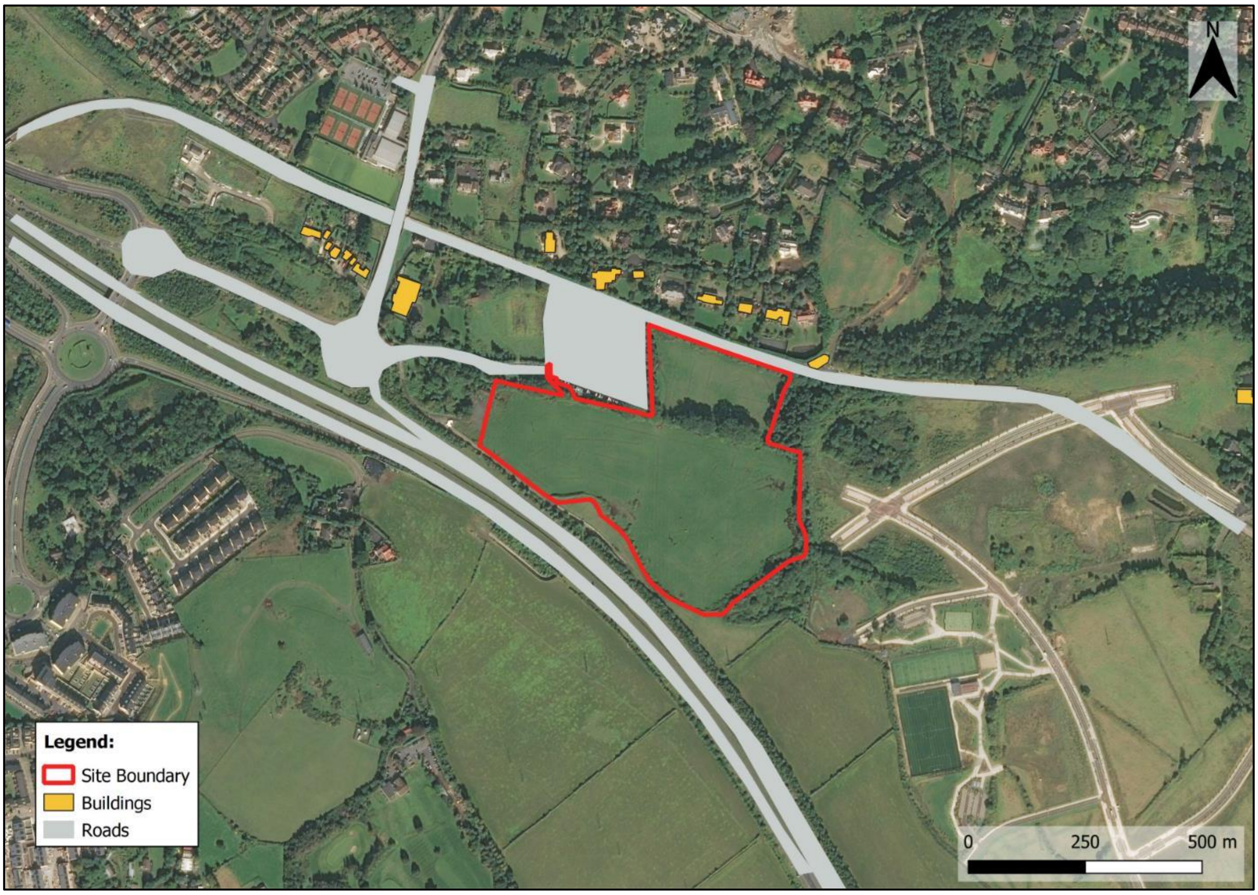


Figure 20: Roughness values of 2D Model

5.5 2-D Model Configuration

The existing scenario model 2-D configuration incorporates the combined LiDAR and topographical survey surface data. In addition it includes the flood defence embankment proposed as part of the LUAS Park and Ride located to the north of the site (see Figure 21). For the purposes of this flood risk assessment, we have assumed that this embankment has been assessed and designed by Roughan O'Donovan and will defend the lands up to and including the 1 in 1000-year flood. This is a conservative view as any flood waters will be diverted towards our site. The existing scenario reflects the provision of the permitted flood defence measures contained in the planning permission for TII's Multi-Storey Car Park (planning reference DZ17A/0114), which the PUNCH model assumes provides protection to the development lands to the north in a 1000-year flood event.

The planning permission granted under planning reference DZ17A/0114, provides a suite of measures including flood walls, bunds, slight raising of lands to the south of the car park access road (to effectively create the flood containment zone described in the Cherrywood SDZ Planning Scheme), along with other measures, to provide flood protection (in a 1000 year event) to TII's access road and the adjoining development lands to the north of the Carrickmines River. These measures were not included in the PUNCH hydraulic model.

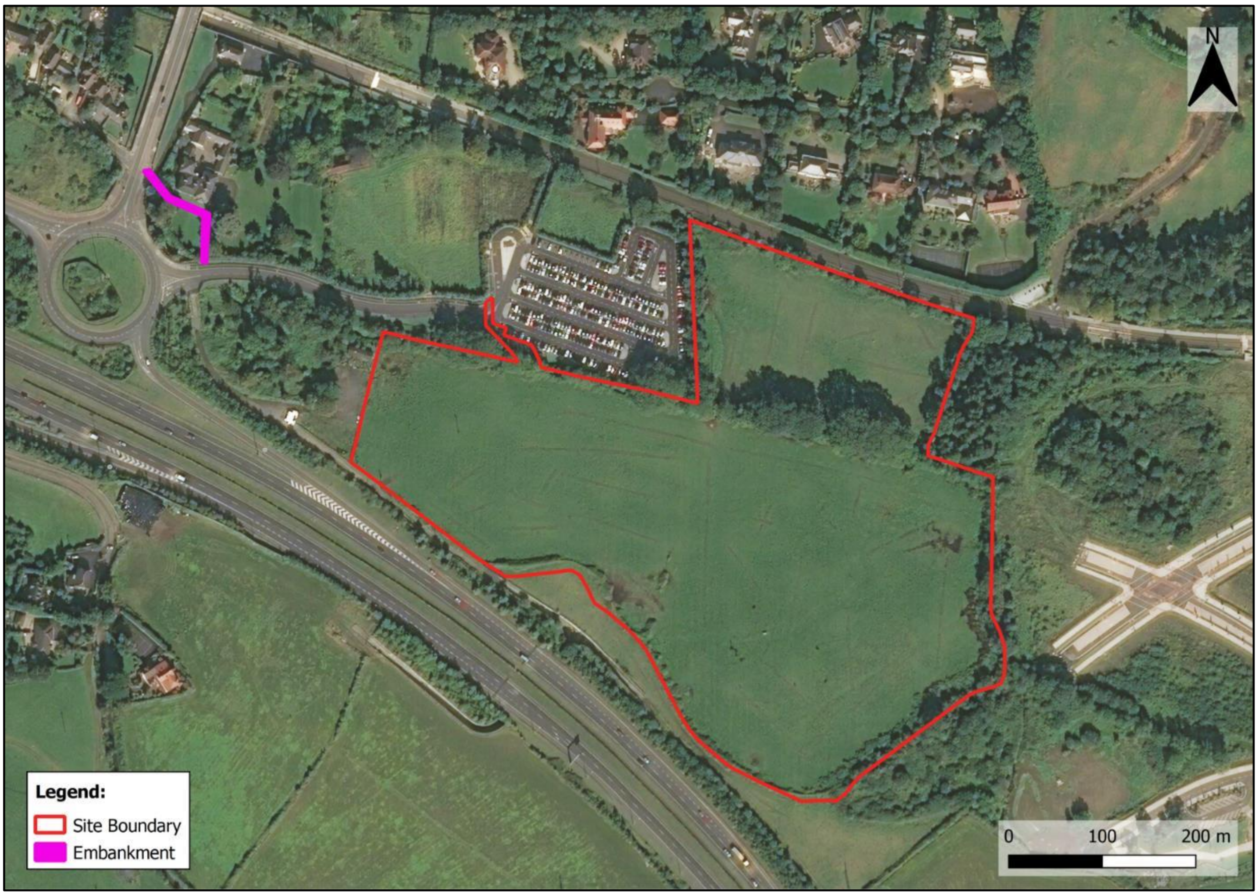


Figure 21: Embankment Location Relative to the Site of Proposed Development

5.5.1 Model Linkage

The 1D and 2D models were constructed separately and were then linked and run as a single model within the Flood Modeller software. This 1D-2D Flood Modeller-TUFLOW linked model approach is considered industry standard. All model linkage is configured within the 2D domain. Water was permitted to flow from the 1D model to the 2D model and vice-versa using HX (model connection) lines. These lines are connected to the locations of the 1D model cross-sections (nodes) and configure the 2D model cells through which they pass to allow flows to pass between the 1D and 2D models.

The elevation of the ground model in the 2D model must be greater than the bed level in the 1D model at each of these connection points.

These lines are configured such that when the water level in the 1D model exceeds the ground level in the 2D model, these waters enter the 2D model and become overland flows.

Likewise, when flows from the 2D model are higher than in the 1D model, these overland flows will re-enter the 1D model and be computed by the 1D solver (flood modeller)

The locations of all HX cells where flows may transfer between models are on either side of the Carrickmines River. The locations of these cells are shown in Figure 22 below.

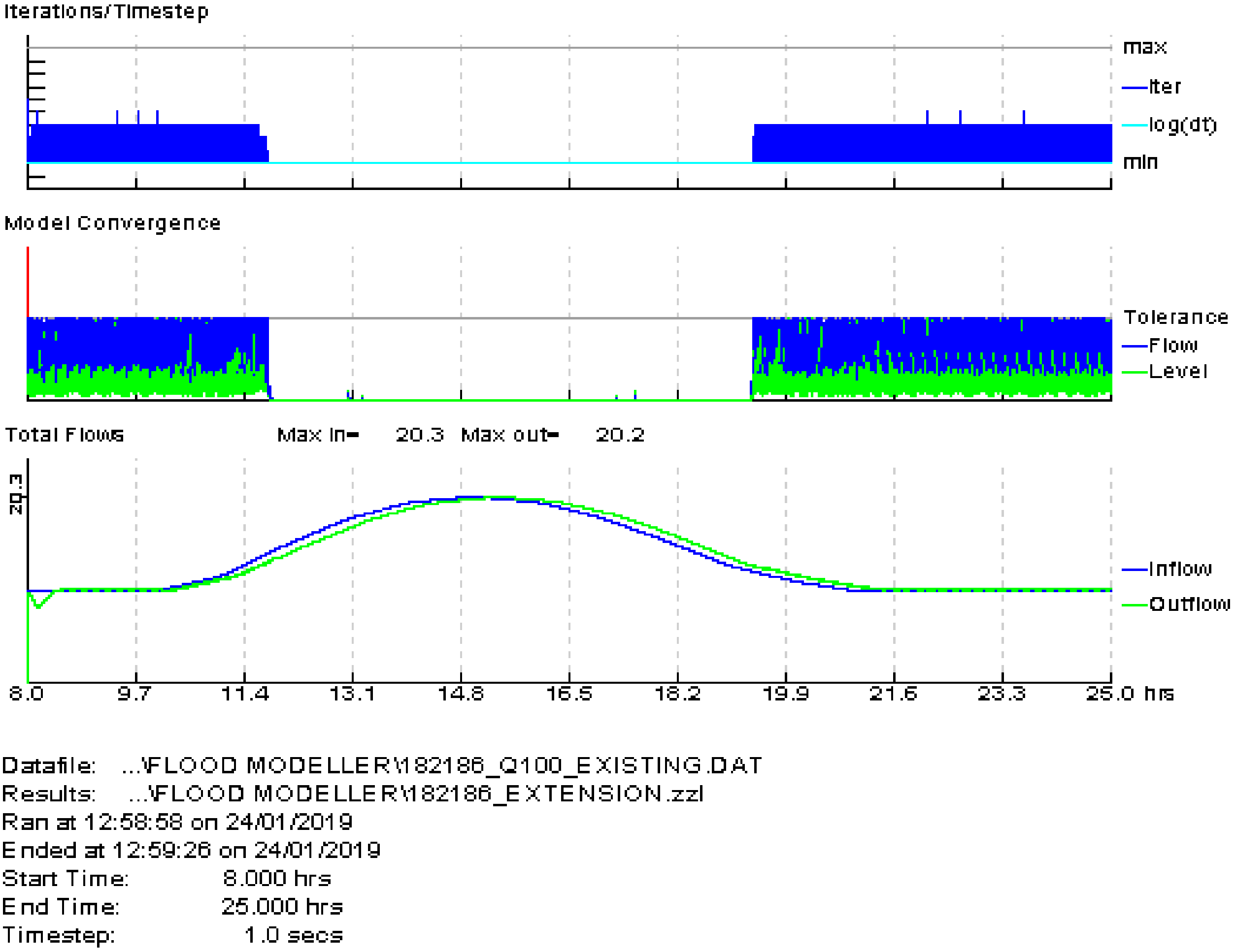
Figure 22: 2D Model cells which allow flow transfer from 1D to 2D models

The locations of the 1D model nodes as they are read in to the 2D model are presented in Figure 23 as shown below. The nodes were connected to the adjacent HX lines and this is what allowed connectivity between the 1D and the 2D models.

Figure 23: 1D model nodes as represented in the 2D TUFLOW model

5.6 Model Stability

A relatively simple assessment of the stability and performance of a Flood Modeller model can be made by inspecting Figure 24. This is the output of the pre-development (existing) scenario model and it can be seen that during low flows there were issues with convergence of the model. However, during higher flows (flows which were of interest in this analysis) there is no rapid fluctuation in flows or poor modelling convergence at any stage of the model run. The areas where instability occurred were downstream of the subject site and were not relevant to the flood extents at the area of interest. For the periods of the model which were of interest for this SSFRA (the higher flows), the 1D and 2D models were performing satisfactorily. The post-development model produced similar results.



Datafile: ...\FLOOD MODELLER\182186_Q100_EXISTING.DAT
Results: ...\FLOOD MODELLER\182186_EXTENSION.zzl
Ran at 12:58:58 on 24/01/2019
Ended at 12:59:26 on 24/01/2019
Start Time: 8.000 hrs
End Time: 25.000 hrs
Timestep: 1.0 secs

Figure 24: 1D Flood Modeller Model Stability

For the stability of the 2D model, the Mass Error output from TUFLOW is checked following a model run. TUFLOW. As can be seen, the Mass Error reduces from approximately -1% at the start of the model to approximately 0.4% for the remaining duration of the model. This is within the acceptable range of ±3% stipulated in the TUFLOW guidelines.

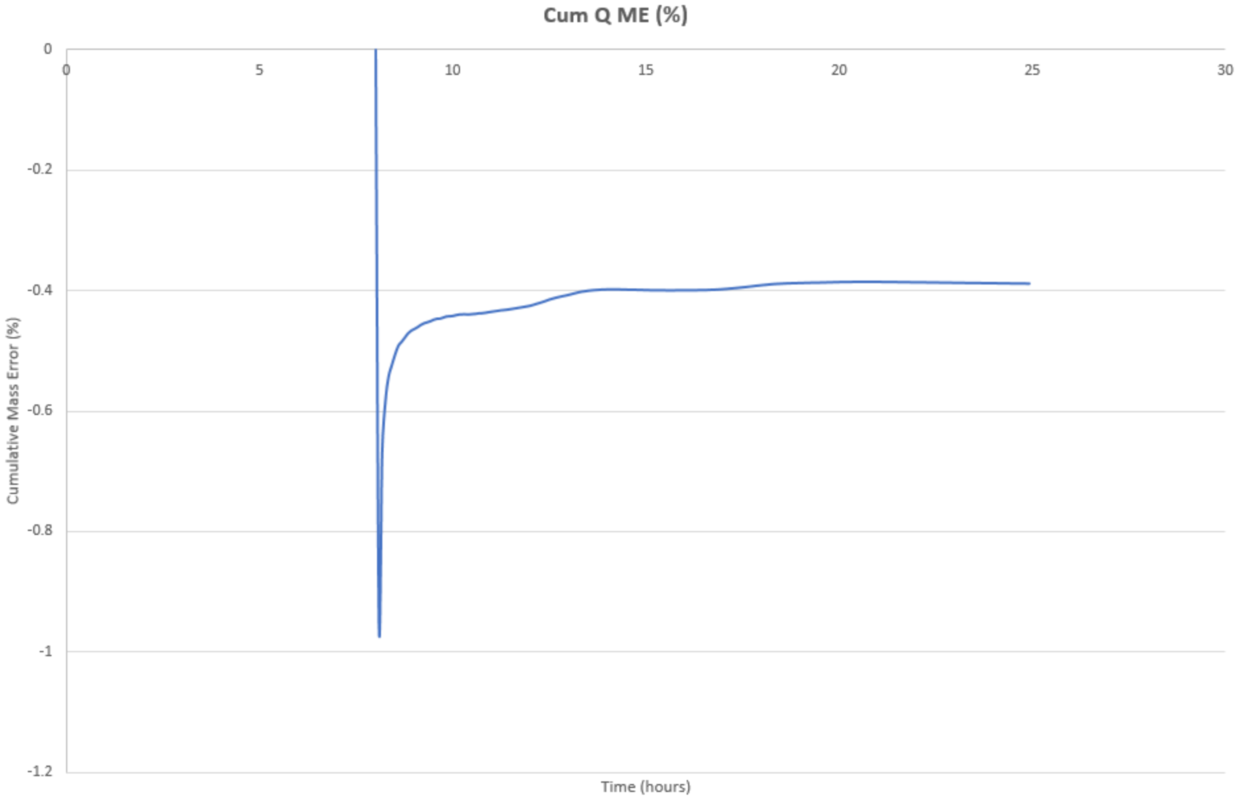


Figure 25: Cumulative Mass Balance Error Plot for post development model (1:1000-year event) (TUFLOW stability check)

5.7 Model Results

5.7.1 Existing Scenario Results

The results of the Flood Modeller/TUFLOW model constructed for this SSFRA provide flood depths and extents in greater detail that those in the CFRAMS and PFRA maps. The existing scenario flood extents for the 1 in 100 (Flood Zone A) and 1 in 1000-year (Flood Zone B) events are presented below in Figure 26. As can be seen from the figure below, a large portion of the site falls within Flood Zone A and B. The 1 in 1000 year levels within the site ranges from 62.054 mAOD to 64.331 mAOD.

These results can be seen to match the flood extents of the CFRAMS mapping well; with flood extents extending across the site and along the M50 motorway via a slip road.

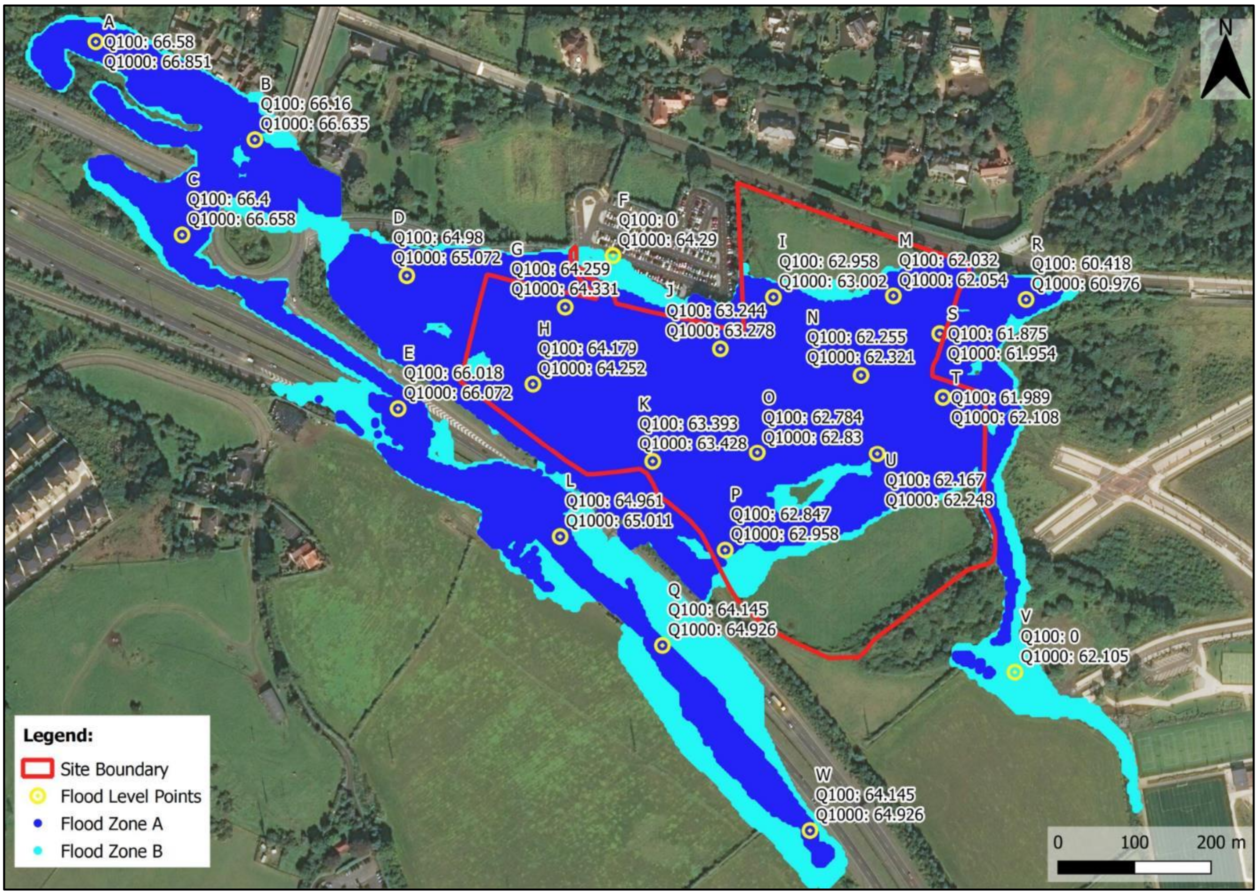


Figure 26: Existing Scenario Flood Extents and Levels Map

Flooding at the site of the proposed development results from overland flow from the west travelling in an easterly direction before returning to the channel.

Table 8 below presents the flood levels estimated as part of the CFRAMS and those from the hydraulic model analysis undertaken for this SSFRA. As can be seen, the SSFRA levels are relatively close to those from the CFRAM Study. Please note that the exact location of the CFRAMS node differs slightly from the location of the node used in the PUNCH model tabled below.

Table 8: Flood Levels from the CFRAMS and PUNCH model

Flood Event	CFRAMS Node 1060M00647 (mAOD)	PUNCH Model (mAOD)
1 in 100-year	62.52	62.68
1 in 1000-year	62.62	62.738

The river long-section is relatively steep through the site and the models are seen to strongly agree in terms of flood level. It is noted that the CFRAMS flood extents do not include an allowance for climate change while the flood extents derived from the hydraulic model do. However, given that the extents and levels are a good match, it is deemed appropriate to use the hydraulic model flood extents inclusive of climate change to define the flood zones.

As noted in Section 5.5, the existing scenario reflects the provision of the permitted flood defence measure contained in the planning permission for TII's Multi-Storey Car Park (planning reference DZ17A/0114), but does not include the defences to the south of the car park access road.

5.7.2 Flood Zones

From examination of Figure 26 it can be seen that the site is currently partially located in Flood Zones A and B for fluvial flooding.

Overland Flow from M50 Motorway

As part of the hydraulic modelling for this study, PUNCH completed a 2D overland flow model to review the extent of flooding on the site from a flow which passes along the M50 motorway. This was undertaken to assess if the upstream extent of the flood model was sufficient to capture all significant flow paths This was a 2D model run using the flood model created as part of the FRA. This was a 2D only model and was run using TuFLOW modelling software. The same model extents as the FRA were used and an input hydrograph was placed on the M50 to the west of the site. This allowed a flow to enter the model on the M50 to simulate the overland flow that would occur if flooding were to occur upstream of the site.

The model was run for a 100-year flood with climate change allowance. The results of the model run are shown in **Figure 27** below.

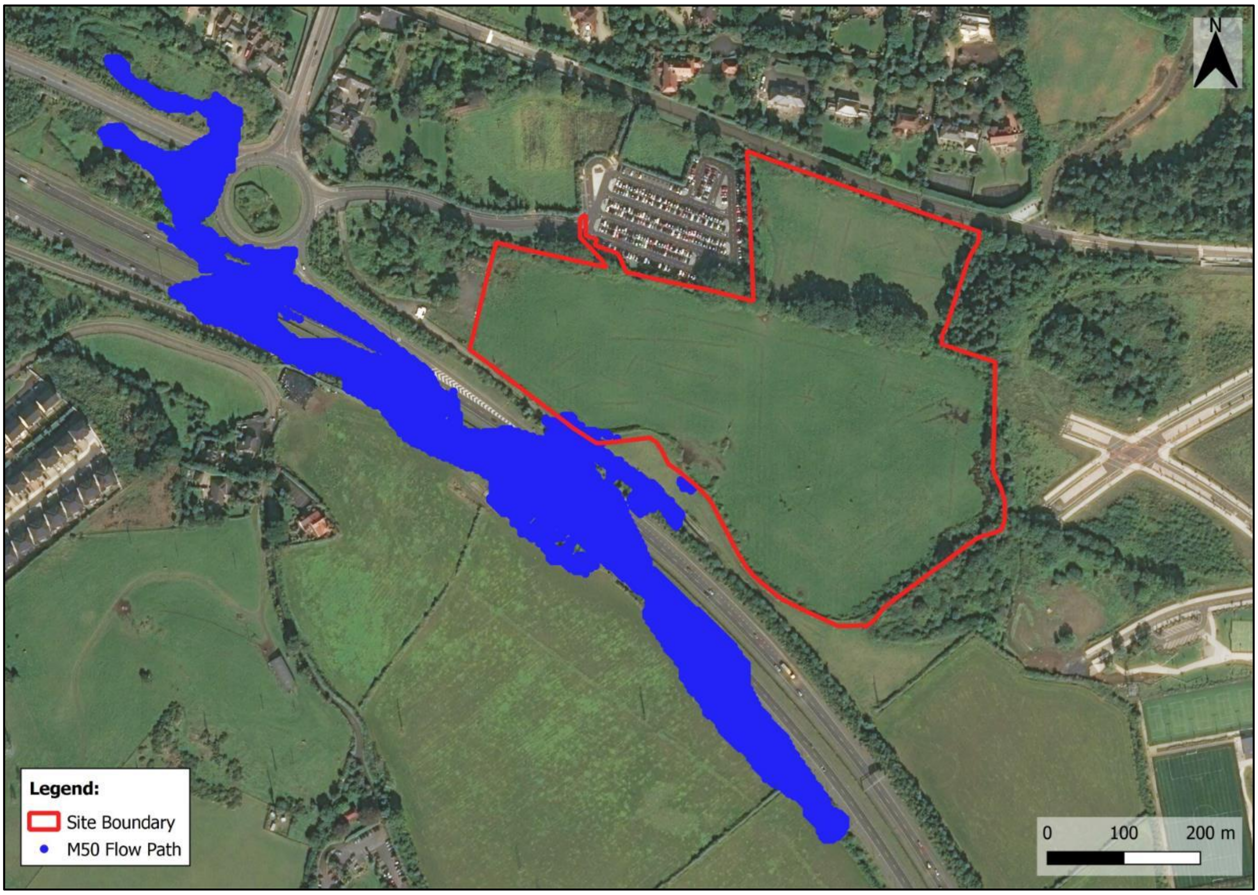


Figure 28: Overland Flow from M50 Motorway

It was found that flooding from the M50 does not impact the site of the proposed development. There is minor overland flow from the M50 to the southern boundary of the site which then passes through an underpass and does not impact upon the areas of the site where development is proposed. On this basis, it was considered that the upstream extent of the 1D model was adequate for the purpose and scale of this assessment.

5.8 Proposed Permanent Scenario – Model Alterations

The Proposed Permanent Scenario includes the following changes to the model:

1. Raising of lands in the vicinity of the proposed development to the south of the Carrickmines River (existing levels retained within the Flood Containment Zone) in the 2D domain;
2. An area designated as RES2 (as zoned in the Cherrywood Planning Scheme) to the west of the Priorsland development was included as raised and as such as a blockage to flows in the 2D domain. These lands are raised to match our proposed development levels. This is justified on the basis that Castle Street will be providing connectivity from these residential lands to the Priorsland Village Centre. Therefore, the Castle Street road levels will dictate the raising of these adjacent lands in accordance with our flood model. Changes to the 2-D model are illustrated in Figure 29 below;
3. The existing 1650 mm diameter circular flood relief culvert was extended along the full length of the proposed development. Due to stability issues with the 1D model, this culvert was modelled as a singular pipe along the full reach. The losses from manholes constructed to date were modelled by including for losses at the outlet at the downstream end of the culvert. The gradient of this culvert is approximately 0.009 m/m. It is noted that the downstream section of this flood relief culvert will need to be completed by others, however this scenario has been included as part of this assessment to demonstrate the impact that it has on flood risk in the area. This is referred to in the proposed model results as the "Proposed Permanent Scenario".

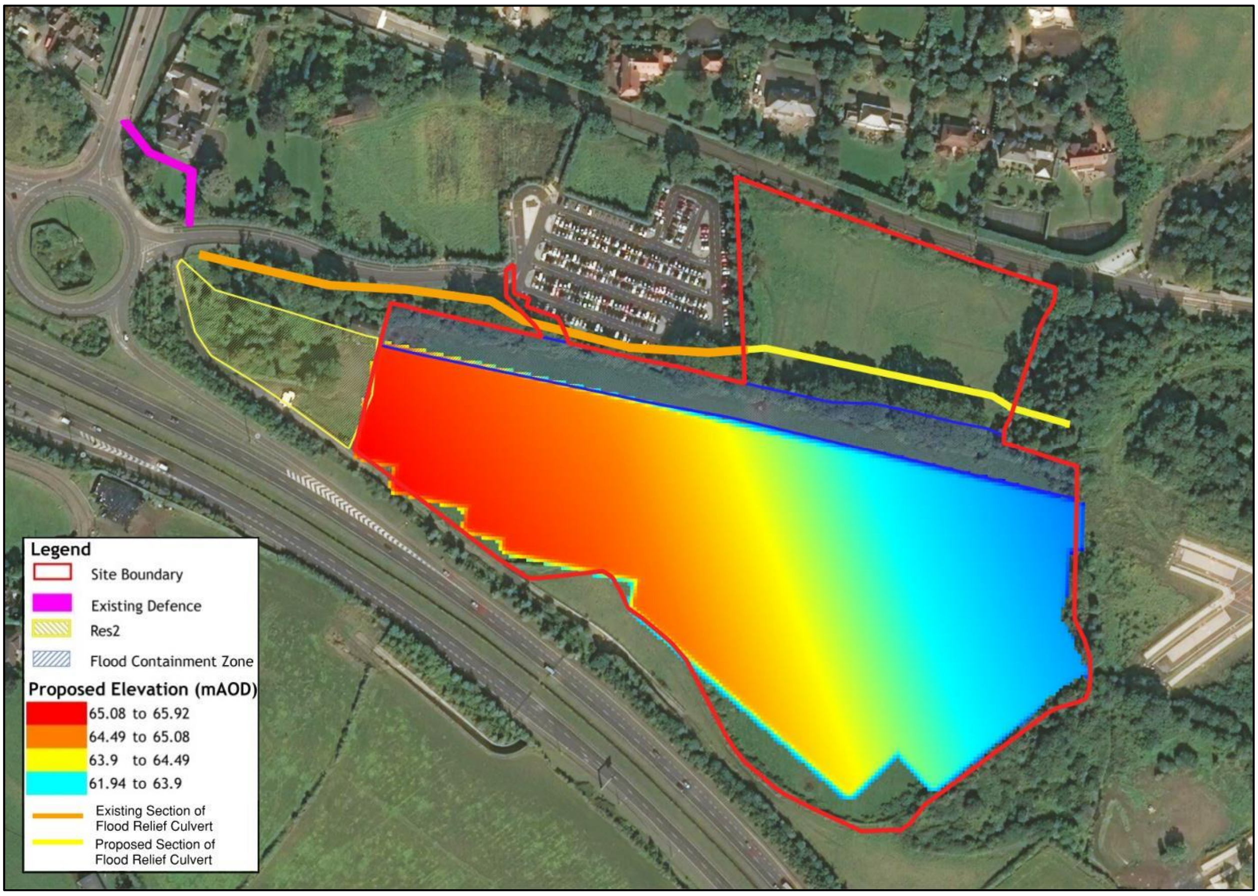


Figure 29: Proposed Permanent Scenario Model Configuration

5.8.1 Proposed Permanent Scenario – Model Results

The results of the proposed permanent scenario are shown in Figure 30. This shows the extent of Flood Zone A (1 in 100-year event) and Flood Zone B (1 in 1000-year event). As can be seen from the figure below, an area in the northern portion of the site is located in Flood Zone B while the remainder of the site of the proposed development is no longer located within Flood Zone A or B, and is considered to be within Flood Zone C. The area where any development will take place is located in Flood Zone C. There will be no development in the areas of the site located in Flood Zones A or B.

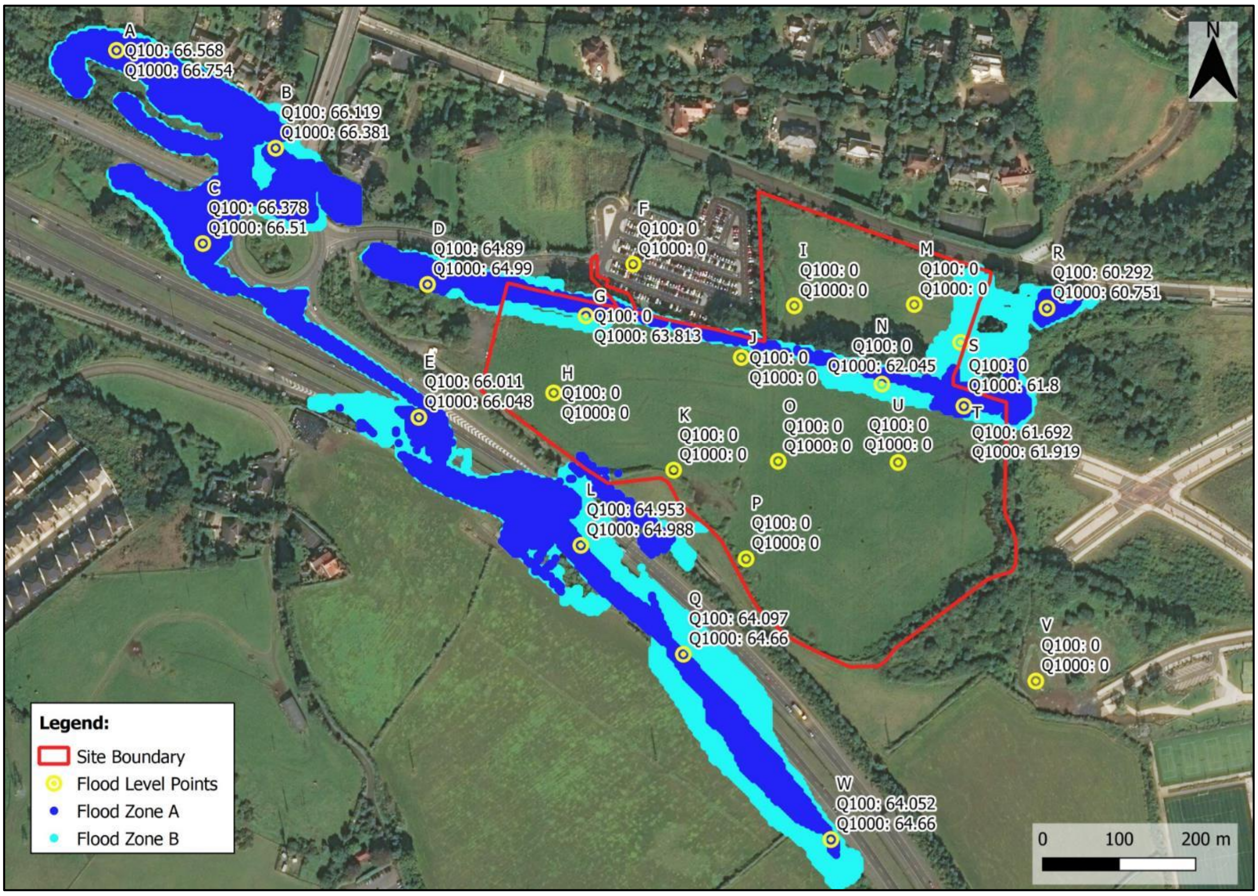


Figure 30: Proposed Permanent Scenario Flood Extents and Levels Map

The Flood Containment Zone is not utilised fully in the Permanent Proposed Scenario. However, towards the eastern and western boundary of the site the containment zone is utilised during the 1 in 1000-year event. For sections through the Flood Containment Zone, see Appendix G.

The incorporation of raised lands on the site of the proposed development and the lands to the west in the RES2 area prevent overland flows from passing across the site. This, coupled with the incorporation of the complete flood relief culvert to the north of the Carrickmines River, result in limited use of the flood containment zone in the Proposed Permanent scenario.

5.8.2 Proposed Interim Scenario – Model Alterations

The Proposed Interim Scenario includes the following changes to the model:

As it is not possible to complete the 1650mm dia. flood relief culvert to the north of the river due to land ownership restrictions, an alternative route is proposed as an interim measure. As such an interim flood relief culvert route was included in the model. This culvert is also a 1650mm circular section and will cross underneath the Carrickmines River near the site entrance (within the red line boundary) before turning eastwards and discharging into the river to the east of the site, as shown in PUNCH drawing 182-186-060 (extract shown here as Figure 31). This is referred to in the proposed model results as the "Proposed Interim Scenario". This culvert has a gradient of approximately 0.005 m/m which is flatter than that in the Proposed Permanent Scenario and as such does not provide an equivalent conveyance capacity and level of flood relief. Other than this change to the culvert, all other aspects of the model are the same as in the Permanent Proposed Scenario. The Proposed Interim Scenario model configuration is shown in Figure 32.

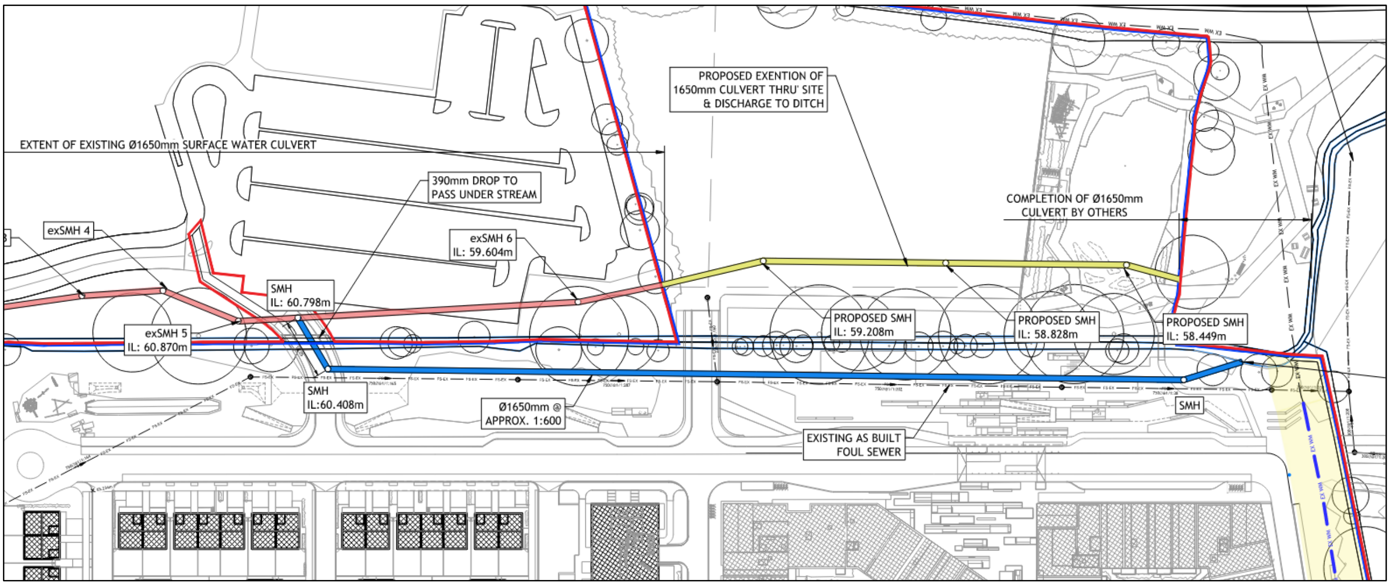


Figure 31: Extract from Drawing 182-186-060 highlighting culvert for interim scenario

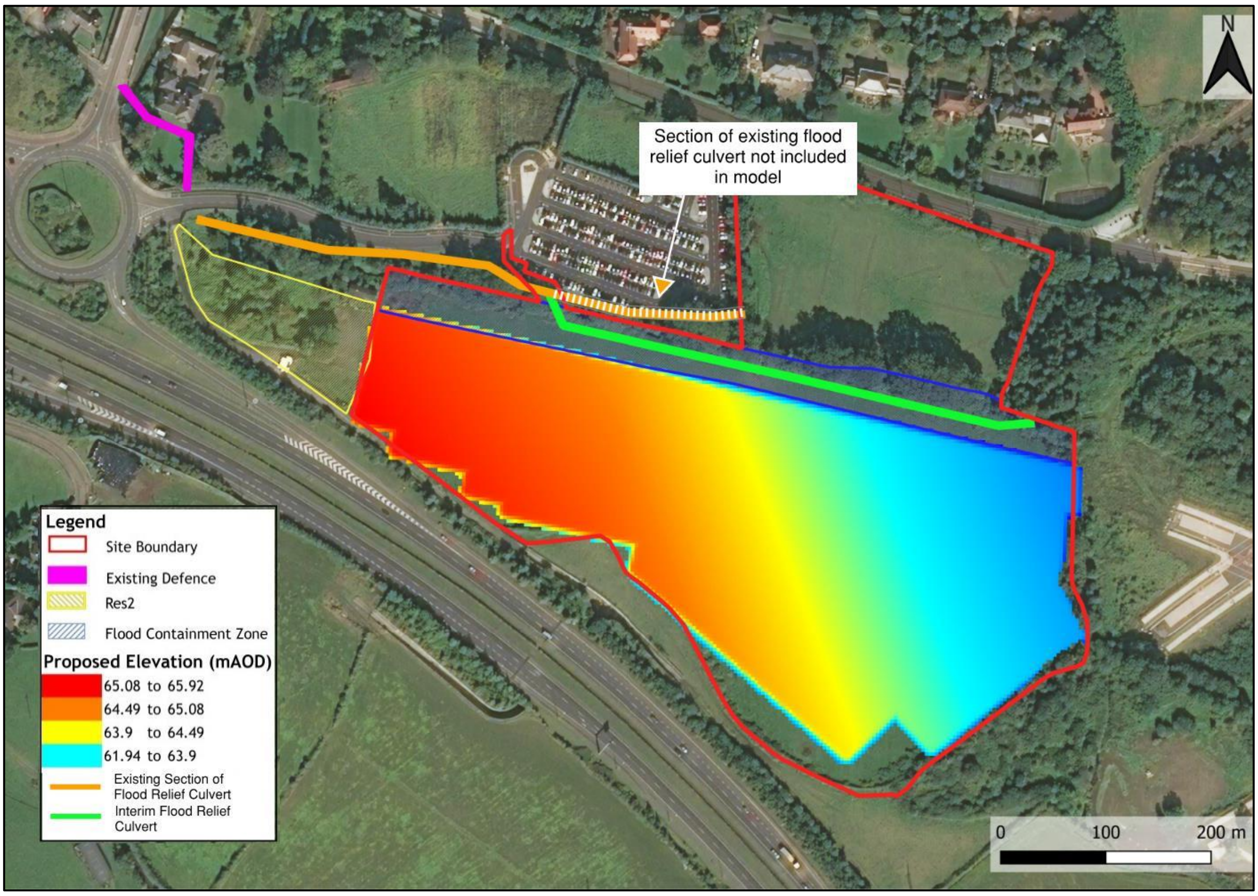


Figure 32: Proposed Interim Scenario Model Configuration

5.8.3 Proposed Interim Scenario – Model Results

The Proposed Interim Scenario flood extents are presented in Figure 33. It can be seen that an area in the northern portion of the site is located in Flood Zone A (1 in 100 Year) and Flood Zone B (1 in 1000 Year), while the remainder of the site of the proposed development is no longer located within Flood Zone A or B, and is considered to be within Flood Zone C. The area where any development will take place is located in Flood Zone C. There will be no development in the areas of the site located in Flood Zones A or B.

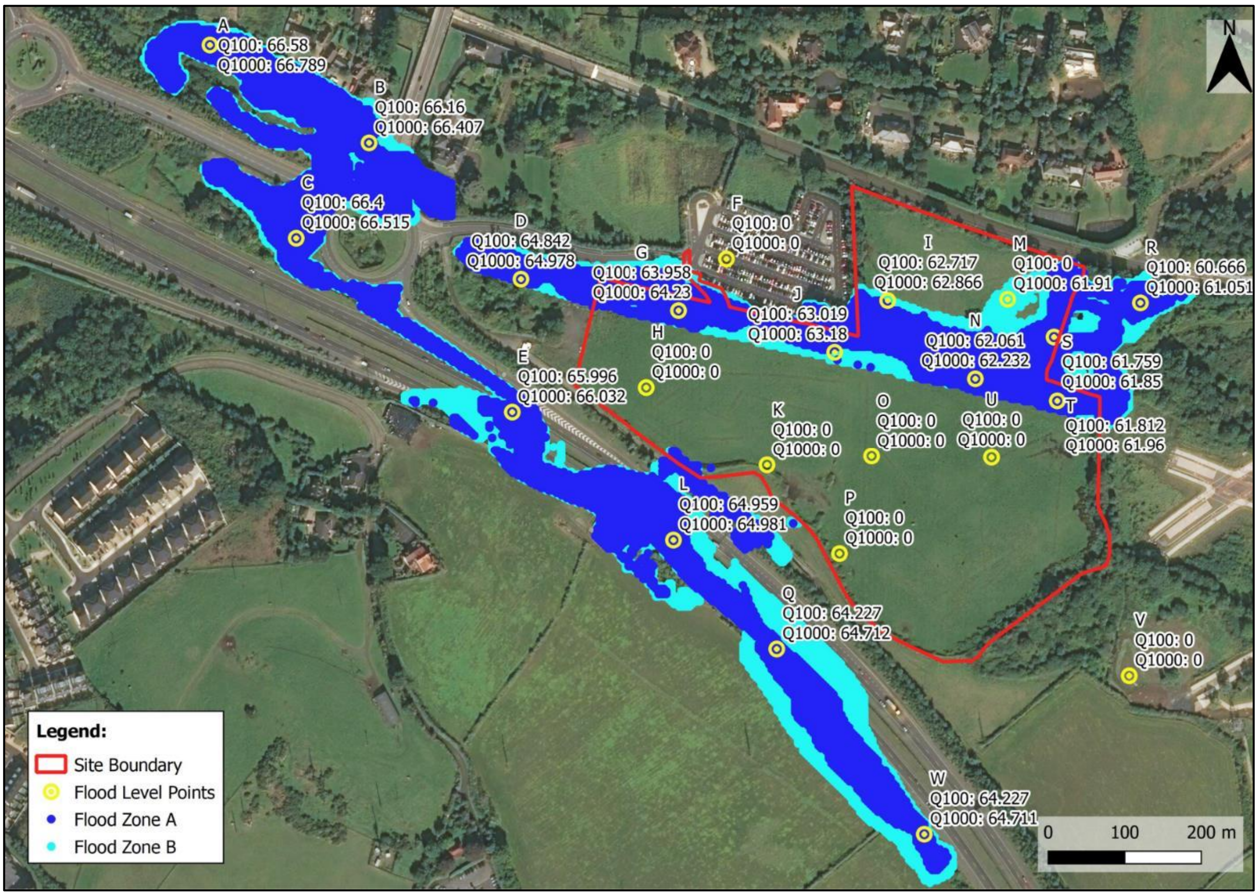


Figure 33: Proposed Interim Scenario Flood Extents Map and Levels

The Flood Containment Zone is utilised to a greater extend in the Proposed Interim Scenario, in both the 1 in 100 year and 1 in 1000 year events. For proposed sections through the Flood Containment Zone, see Appendix G.

As per the Proposed Permanent Scenario, the incorporation of raised lands on the site of the proposed development and the lands to the west in the RES2 area prevent overland flows from passing across the site. However, due to the Interim Flood Relief culvert's shallow gradient it cannot convey as much flow as the Proposed Permanent Scenario culvert. This has resulted in water levels closer to those in the existing scenario and a greater use of the flood containment zone.

5.9 Flood Levels and Finished Floor Levels

A comparison has been made between the 1 in 100 year and 1 in 1000 year flood levels and the Finished Floor Levels (FFL) in the proposed development as shown in Table 9 below. It can be seen that there is significant freeboard of between 800mm and > 1m available across the whole development.

Table 9: FFL and Flood Level Comparison

Plot	Lowest FFL (mOD)	Flood Level Point	Q100 Flood Level (mOD)		Q1000 Flood Level (mOD)	
A	64.000	J	Interim	63.019	Interim	63.18
			Permanent	In Channel	Permanent	In Channel
B	63.270	T	Interim	61.812	Interim	61.96
			Permanent	61.692	Permanent	61.919
C	63.800	T	Interim	61.812	Interim	61.96
			Permanent	61.692	Permanent	61.919
D	63.950	T	Interim	61.812	Interim	61.96
			Permanent	61.692	Permanent	61.919
E	64.425	J	Interim	63.019	Interim	63.18
			Permanent	In Channel	Permanent	In Channel
F	64.610	J	Interim	63.019	Interim	63.18
			Permanent	In Channel	Permanent	In Channel
G	64.625	J	Interim	63.019	Interim	63.18
			Permanent	In Channel	Permanent	In Channel

5.10 Discussion on Delivery of Flood Bund

As discussed in Sections 3.6 and 5.5 of this report, it is assumed that the flood bund relating to the Luas Park and Ride development (planning permission granted under planning reference DZ17A/0114) is fully constructed. However, PUNCH has also assessed the impact on the surrounding area if the flood bund is not delivered.

The Existing, Proposed Interim and Proposed Permanent Scenario hydraulic models were run with the flood bund removed and the 1 in 100 Year flood extents are shown in Figure 37, Figure 38 and Figure 39. The associated 1 in 100 Year flood levels for each scenario are presented in tabular format in Table 10.

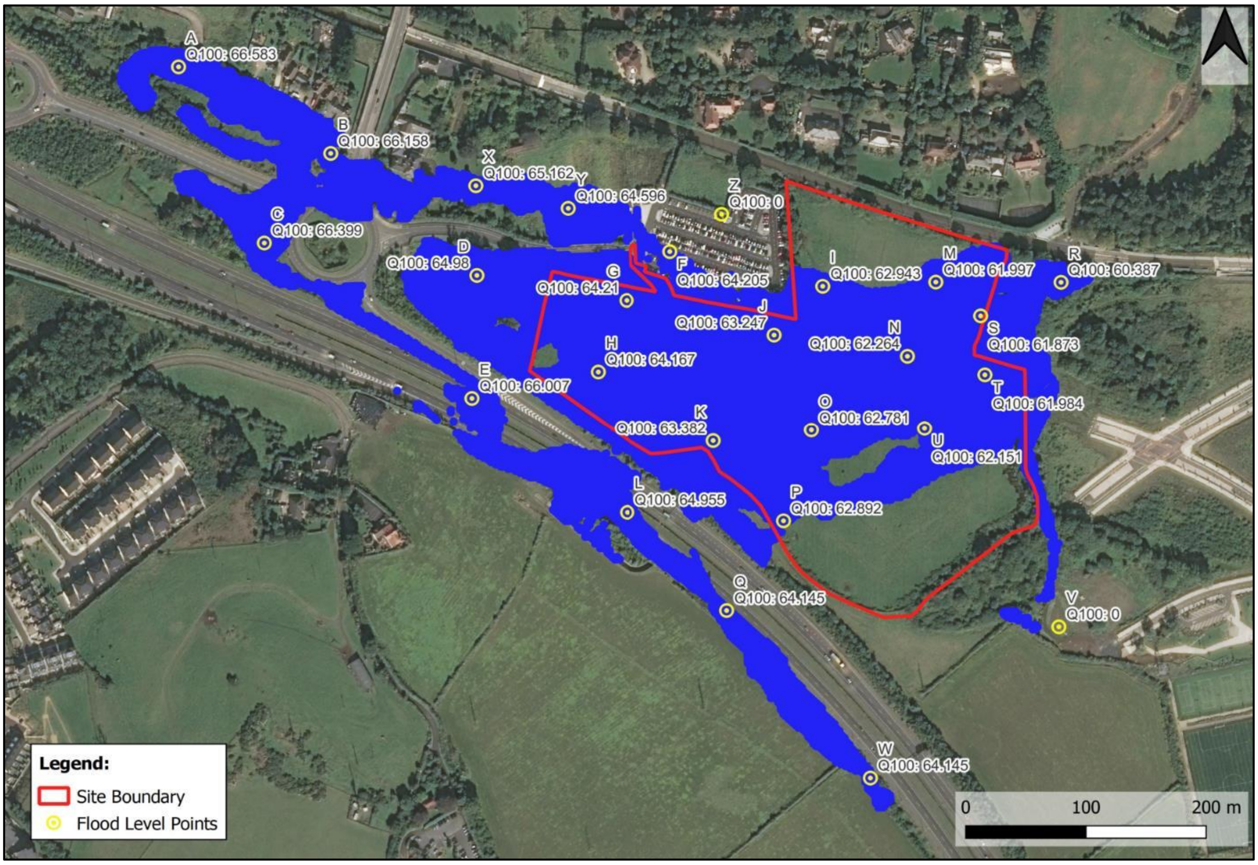


Figure 34: Existing Scenario Without Flood Bund - Flood Extents Map and Levels

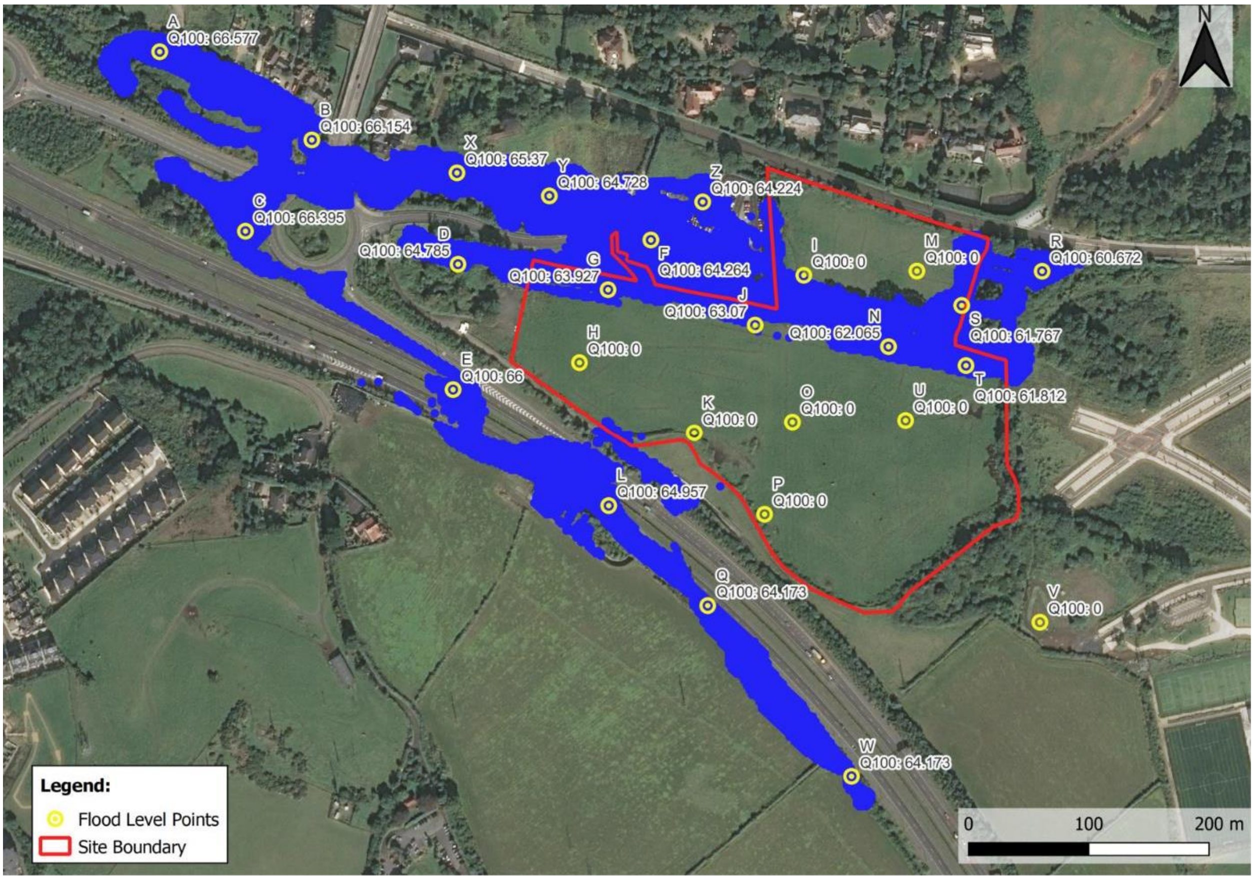


Figure 35: Proposed Interim Scenario Without Flood Bund - Flood Extents Map and Levels

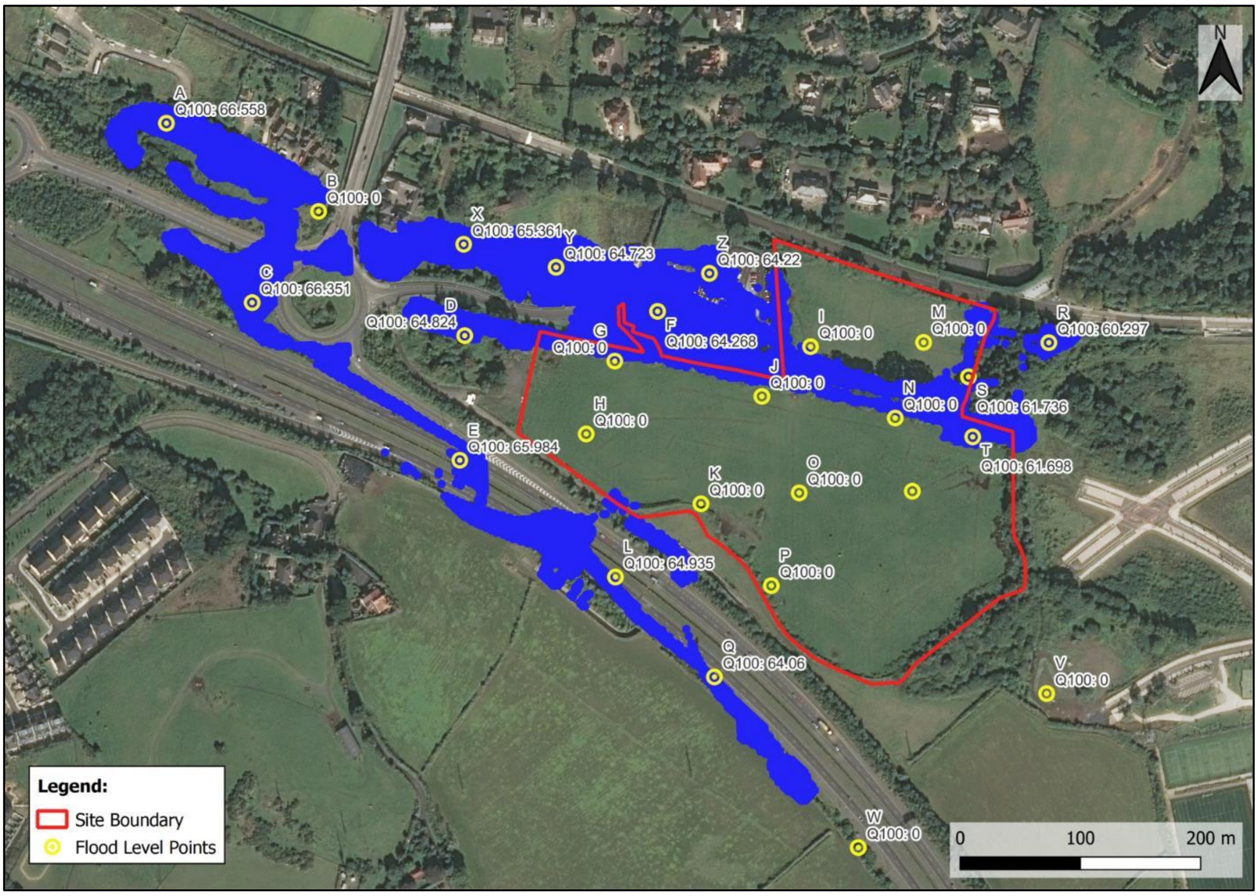


Figure 36: Proposed Permanent Scenario Without Flood Bund - Flood Extents Map and Levels

Table 10: 1 in 100 Year Flood Levels (No Flood Bund)

	Q100		
ID	Existing	Interim	Permanent
A	66.58	66.58	66.56
B	66.16	66.15	0
C	66.40	66.40	66.35
D	64.98	64.79	64.82
E	66.01	66.00	65.98
F	64.21	64.26	64.27
G	64.21	63.93	0
H	64.17	0	0
I	62.94	0	0
J	63.25	63.07	0
K	63.38	0	0
L	64.96	64.96	64.94
M	61.99	0	0
N	62.26	62.07	0
O	62.78	0	0
P	62.89	0	0
Q	64.15	64.17	64.06
R	60.39	60.67	60.30
S	61.873	61.77	61.74
T	61.98	61.81	61.70
U	62.15	0	0
V	0	0	0
W	64.15	64.17	0
X	65.16	65.37	65.36
Y	64.60	64.73	64.72
Z	0	64.22	64.22

It can be seen from the flood extent figures above that the permitted flood bund will provide protection to the lands relating to the Luas Park & Ride development. The addition of the proposed development will increase the flood risk to this carpark without the implementation of the flood bund. It should be noted that the only lands adversely affected (flood points F and Z in table) by the proposed development in this scenario is the existing carpark which would be acceptable given its low vulnerability land use and shallow flood depths (<100mm in the 1 in 100 Year event).

The lands required for the flood bund construction are out of the control of the client, however given that planning permission has been granted, it is appropriate to assume that the bund can be delivered in a timeframe suitable for the proposed development. The client favours engagement with DLRCC and other relevant bodies for the purposes of the delivery of this flood bund to the collective benefit and enabling delivery of Development Area 3 Priorsland.

5.11 Conclusion

Following a review of all model results, we consider that the area where development is proposed within the site boundary is located in Flood Zone C in the post-development scenario (both in the interim and permanent scenarios). The construction of the proposed development is not deemed to have an adverse impact on flooding to neighbouring properties. When the 1650mm culvert to the north of the Carrickmines River is completed, the northern portion of this development will also be within Flood Zone C.

6 Flood Risk Assessment

6.1 Sources of Flooding

When carrying out a flood risk assessment, one should consider all the potential flood risks and sources of flood water at the site. In general, the relevant flood sources are:

Fluvial Flooding

Fluvial flooding is the result of a river exceeding its capacity and excess water spilling out onto the adjacent floodplain. The roads adjacent to the site are at risk of fluvial flooding from the Carrickmines River which causes waters to flow overland along roads and lands in the area. The hydraulic model developed for this SSFRA demonstrated that the site of the proposed development falls outside Flood Zone A and B due to proposed ground levels being raised. It is proposed to attenuate all runoff onsite, and there will be a pumped drainage system in the basement. There will be no additional runoff from the site, please refer to Engineering Report for further details.

The Ticknick Stream also bounds the site of the proposed development to the east. Fluvial flood risk from this watercourse was not considered to be significant and the water levels in the Ticknick Stream during an exceedance event are governed by a backwater effect from the Carrickmines River to which it discharges. Given that the catchment assessed as part of this SSFRA included the area drained by the Ticknick Stream, it was not considered necessary or appropriate to separately assess this sub-catchment due to its relatively negligible impact in comparison to the Carrickmines River.

As part of the hydraulic modelling for this study, PUNCH completed a 2D overland flow model to review the extent of flooding on the site from a flow which passes along the M50 motorway. It was found that flooding from the M50 does not impact the site of the proposed development. There is minor overland flow from the M50 to the southern boundary of the site which then passes through an underpass and does not impact upon the areas of the site where development is proposed. On this basis, it was considered that the upstream extent of the 1D model was adequate for the purpose and scale of this assessment.

Pluvial Flooding

Pluvial flooding is the result of rainfall-generated overland flows which arise before run-off can enter any watercourse or sewer. It is usually associated with high intensity rainfall. There are no locations on the site which are noted in PFRA mapping as being at risk of pluvial flooding as shown on Figure 9. The proposed storm network (as part of this development) has been designed to ensure there is no flood risk to the development from extreme precipitation events.

Coastal Flooding

Coastal flooding is the result of sea levels which are higher than normal and result in sea water overflowing onto the land during high tides or storm surges. The study area is over 60m above sea level and is not at risk of coastal flooding.

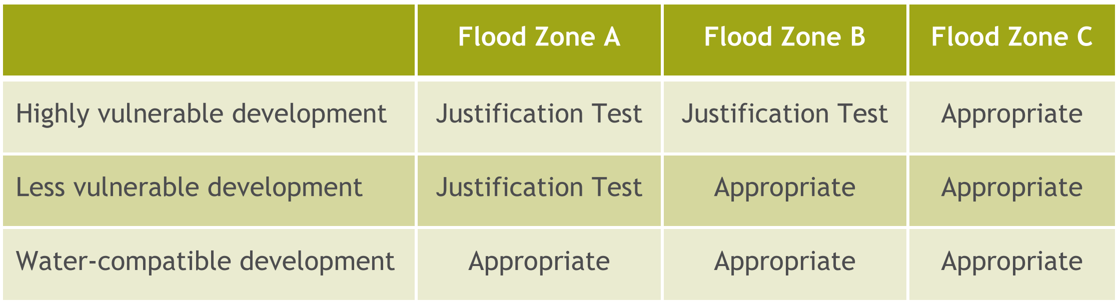
Groundwater Flooding

Groundwater flooding occurs when the level of the water stored in the ground rises as a result of prolonged rainfall. The study area is not at risk of groundwater flooding.

6.2 Site Vulnerability

The proposed development is combined residential/commercial in nature. The ground floor of the development will include both commercial and residential level; as such the ground floor proportion of the development is classified as a “Highly Vulnerable Development” in the Planning System and Flood

Risk Management guidelines. As the site is currently located in Flood Zone A, it is required to apply the Justification Test as demonstrated in Figure 37 below.



	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Figure 37: Matrix of vulnerability versus flood zone to indicate Justification Test requirement

This SSFRA has addressed the three aims as outlined for the Dun Laoghaire SFRA as follows:

a) The extents of flood risk in the area have been refined in the hydraulic model as described in Section 5.7 above and it has been demonstrated that the proposed development is not at risk of flooding during the Q100 or Q1000 flood events;
b) The introduction of the proposed development does not increase the risk of flooding in the surrounding area;
c) Flood mitigation measures have been proposed which are appropriate for this development. These are described further in Section 6.5 below.

6.3 Justification Test

The proposed site and infrastructure is in accordance with the Cherrywood Planning Sceheme SDZ. The Justification Test for the site itself is presented in Table 11 below.

Table 11 Justification Test Box 5.1

Item		Response
1.0	The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.	Section 2.4 of this report states that the land is not currently zoned for a specific land use, however it lies within the Riverstick Settlement Boundary. The proposed development is a residential development which is in line with the land use.
2.0	The proposal has been subject to an appropriate flood risk assessment that demonstrates:	
2.1	The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk.	Run-off from the development will be discharged to a surface water network and will not increase the flow rate to the Carrickmines River. There will be no change in flood risk to the areas downstream of the site. The hydraulic modelling has demonstrated that the Q100 and Q1000 flood event water levels are reduced across the site as a result of the proposed development in the Proposed Interim and Permanent Scenarios. Q100 and Q1000 flood event water levels are also shown to be reduced upstream and downstream of the site, thus reducing overall flood risk.

2.2	The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible.	Section 6.5 of this document states the mitigation measures. No materials which are hazardous to the environment will be stored in the sections of the site which may be within Flood Zone B. People, property, the economy and the environment will as such not be affected by flooding.
2.3	The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access.	The hydraulic modelling undertaken as part of this study has assessed the existing infrastructure and proposed defences in the area. Due to the scale and nature of upstream culverts it is not considered necessary to assess the residual risk of blockage of these structures. Emergency access to the development is maintained during both the 1 in 100-year and 1 in 1000-year flood events.
2.4	The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.	It is PUNCH Consulting Engineers opinion that the proposed development complies with item 2.4. This is discussed in greater detail in other documents submitted as part of the planning application for the proposed development.

6.4 Climate Change

The design flows calculated as part of this SSFRA include an allowance for climate change and the flood extents generated using these flows match well with the CFRAMS flood extents. However, given that the CFRAMS flood extents do not include an allowance for climate change, it was deemed prudent to further examine this topic.

Advice on the expected impacts of climate change and the allowances to provide for future flood risk management in Ireland is given in the "OPW Assessment of Potential Future Scenarios, Flood Risk Management Draft Guidance", 2009. Two climate change scenarios are considered. These are the Mid-range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). The MRFS is intended to represent a "likely" future scenario based on the wide range of future predictions available. The HEFS represents a more "conservative" future scenario at the upper boundaries of future projections. Based on these two scenarios the OPW recommended allowances for climate change are given in Table 12.

Table 12 Recommended allowances for climate change (Taken from OPW – Assessment of Potential Future Scenarios for Flood Risk Management)

Parameter	MRFS	HEFS
Extreme Rainfall Depths	+20%	+30%
Flood Flows	+20%	+30%
Land Movement	-0.5 mm/year*	-0.5 mm/year*
Urbanisation	No general allowance – Review on Case by Case Basis	No General allowance – Review on Case by Case Basis
Forestation	-1/6Tp**	-1/3Tp** +10% SPR***
Notes: * Applicable to the southern part of the country (Dublin – Galway and south of this) ** Reduce the time to peak (Tp) by a third; this allows for potential accelerated runoff that may arise as a result of drainage of afforested land *** Add 10% to the Standard Percentage Runoff (SPR) rate; this allows for increased runoff rates that may arise flowing felling of forestry		

The design flows calculated using the IH124 method include a 20% allowance for climate change as per Table 12 above.

Further analysis of the design flows show that the 1 in 1000 year event design flow used in this assessment is 33% greater than the 1 in 100 year event flow. Based on Table 12 above, the 1 in 1000 year flow could be seen as a conservative estimate of the 1 in 100 year flow including climate change.

The 1 in 1000 year Proposed Interim and the Proposed Permanent Scenarios show reduced flood levels when compared with the Existing Scenario across the whole hydraulic model extent (see Table 13 in Section 6.7).

6.5 Flood Mitigation Measures

With reference to Section 4.2 above, a review of flood maps produced as part of the CFRAMS indicate that the site of the development falls inside the extents of Flood Zone A for fluvial events. As demonstrated in Section 5, the site can be removed from this floodplain and set above the Q1000 flood levels.

a) The ground floor Finished Floor Levels (FFLs) for the proposed development buildings have been set above the Q1000 modelled flood levels for the adjacent Carrickmines River. Hydraulic modelling has shown that none of the proposed buildings are at risk of flooding in the Q1000 scenario. Basements are included in the development and entrance levels to these basements will be above the Q1000 flood level. A comparison of flood levels and FFLs is presented in Section 5.9 of this assessment;

b) Surface water flows shall be attenuated on site and the runoff rate from the site will not be greater than the runoff rate agreed with DLRCC in order to reduce the risk of flooding elsewhere. Runoff from the site will be limited to 1 l/s/ha as per the Cherrywood SDZ;

c) The surface water from the basements include an attention tank to limit flows to the existing network. Block A and B will be a pumped, while other units will discharge by gravity;

d) It is planned that the proposed development will incorporate a mixture of extensive and intensive green roof systems. This will provide a degree of attenuation for incident rainfall and additionally will manage surface waters through evapotranspiration;

e) In the Proposed Interim scenario, a 1650mm dia. culvert will be constructed which crosses underneath the Carrickmines River and then flow eastwards before discharging back to the watercourse. As this diversion route is not laid at a gradient which matches the proposed route to the north of the river, it does not provide the same conveyance capacity and as such is to be regarded as an interim measure only;

f) As part of this development the unfinished 1650mm dia. Flood Relief Culvert to the north of the Carrickmines River will be extended to the east within the proposed site red line boundary insofar as is possible by the developers, as shown on PUNCH drawing 182-186-060. This culvert will not have an outfall. This outfall will need to be completed by others and as such the culvert will not serve any hydraulic function as part of the proposed development. Upon its completion by others, this culvert will improve conveyance of floodwaters away from the site. It will, in its proposed interim configuration, provide a degree of floodwater storage although no benefit to the flooding in the area is assumed. The completed permanent scenario has been modelled as part of this SSFRA and is included in the results in Section 6, however this scenario will not be achieved by the development of which this SSFRA is the subject;

g) Emergency access to the proposed development will be maintained via Glenamuck Road and onto the M50, which are located in Flood Zone C.

6.6 Flood Risk Management

Flood risk management under the EU Floods Directive aims to minimise the risks arising from flooding to people, property and the environment. Minimising risk can be achieved through structural measures that block or restrict the pathways of floodwaters, such as river defences or non-structural measures that are often aimed at reducing the vulnerability of people and communities such as flood warning, effective flood emergency response, or resilience measures for communities or individual properties.

Given that the site of the proposed development is currently located inside Flood Zone A and Flood Zone B, successful mitigation measures will be implemented to ensure that the proposed development is not at risk of flooding. Following the implementation of the mitigation measures outlined in Section 6.5 above, the flooding risk to the properties or to people will be minimised during an extreme flood event.

6.7 Impact of the Proposed Development

The 1D modelling results from the Flood Modeller simulation are presented below in Figure 38 which demonstrate that, following the implementation of the flood relief culvert parallel to the Carrickmines River, peak modelled water levels across the proposed site drop from the existing scenario in both the interim and permanent scenarios. The output shown in this figure does not include the flood relief culvert and shows only the Carrickmines River channel itself.

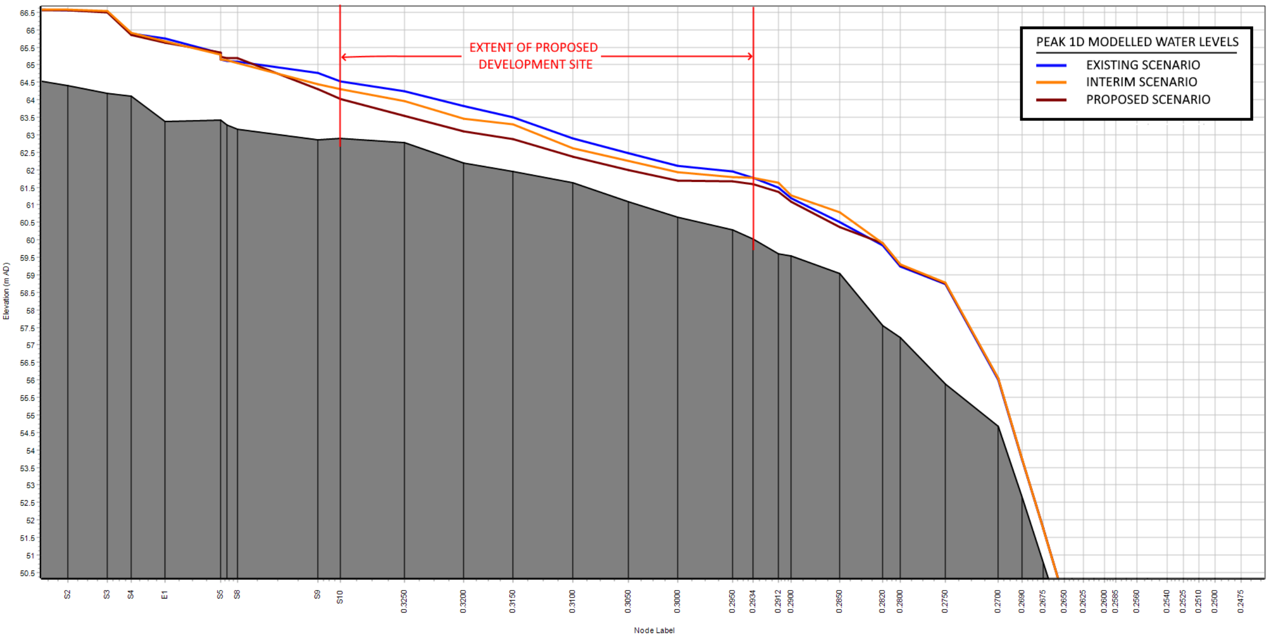


Figure 38: Longsection of 1D modelling results

The Existing Scenario flood extents prepared as part of this SSFRA indicate that the site is currently partially located in Flood Zones A and B. An assessment of the impacts of displacement of floodwaters during the 1 in 100-year event is a necessary requirement of the Flood Risk Guidelines. We can compare the flood extents and levels from the Existing, Interim and Permanent Scenarios in Figure 39.

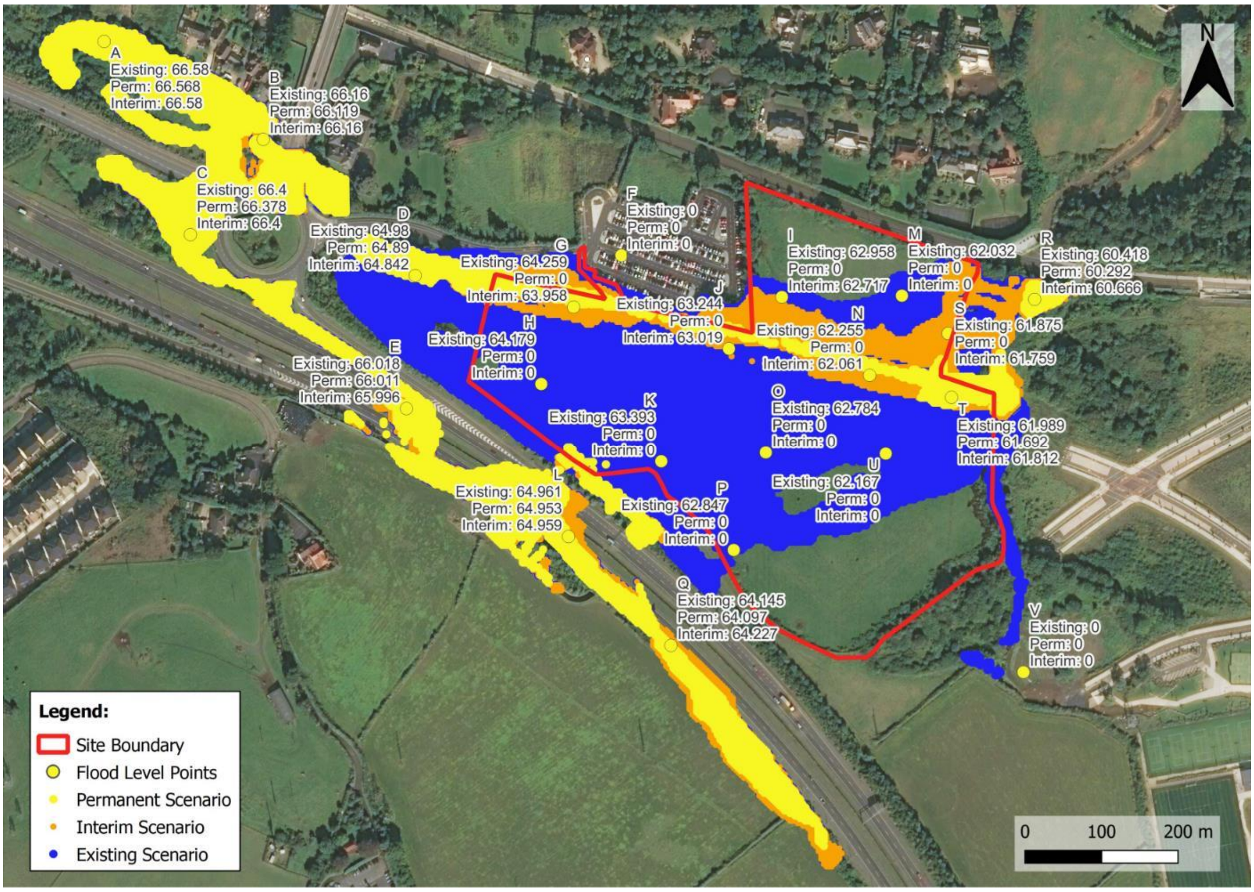


Figure 39: Existing, Interim and Permanent Q100 Flood Extents

As can be seen form the flood extents above, the proposed development reduces the flood extents significantly, and the site of the proposed development is now located in Flood Zone C. However, an assessment of the flood levels must be undertaken to determine the impact of the proposed development on flood levels outside of the site boundary (please refer to Appendix F for details of the 1 in 1000 Year levels). The modelled flood levels for the 1 in 100 and 1 in 1000-year events are presented in Table 13.

Table 13: Flood Levels

	Q100			Q1000		
ID	Existing	Interim	Permanent	Existing	Interim	Permanent
A	66.580	66.580	66.568	66.851	66.789	66.754
B	66.160	66.160	66.119	66.635	66.407	66.381
C	66.400	66.400	66.378	66.658	66.515	66.511
D	64.98	64.842	64.89	65.072	64.978	64.99
E	66.018	65.996	66.011	66.072	66.0315	66.048
F	0	0	0	64.29	0	0
G	64.259	63.958	0	64.331	64.23	63.813
H	64.179	0	0	64.252	0	0
I	62.958	62.717	0	63.002	62.866	0
J	63.244	63.019	0	63.278	63.18	0
K	63.393	0	0	63.428	0	0
L	64.961	64.959	64.953	65.011	64.981	64.988
M	62.032	0	0	62.054	61.91	0
N	62.255	62.061	0	62.321	62.232	62.045
O	62.784	0	0	62.832	0	0
P	62.847	0	0	62.958	0	0
Q	64.145	64.227	64.097	64.926	64.712	64.66
R	60.418	60.666	60.292	60.976	61.051	60.751
S	61.875	61.759	0	61.954	61.85	61.8
T	61.989	61.812	61.692	62.108	61.96	61.919
U	62.167	0	0	62.248	0	0
V	0	0	0	62.105	0	0

As can be seen from the table above, the proposed development reduces flood levels outside the site boundary for the 1 in 100 year and 1 in 1000 year Proposed Permanent and Interim flood events. This is due to the increased ground levels proposed as part of this development acting as a flood barrier to flows and directing flow through the flood containment zone. The flood containment zone thus acts as a wider channel along the Carrickmines River in extreme flood scenarios. In addition, the proposed flood relief culvert contains and conveys flood waters across the site, further reducing flood levels in the area.

The 1 in 1000 flood year event is the most extreme event modelled in this assessment and all flood water levels associated with this event are reduced in the Proposed Interim and Permanent Scenarios.

7 Conclusion

PUNCH Consulting Engineers have been appointed by 1 Carrickmines Land Ltd. to carry out a Site-Specific Flood Risk Assessment (SSFRA) study for a proposed commercial and residential development in Priorsland, Cherrywood, Carrickmines. A review of flooding and flood risk in the area was carried out and it was noted that there was a fluvial flood risk to the site of the proposed development.

PUNCH Consulting Engineers developed a hydraulic model of the area as part of this Site-Specific Flood Risk Assessment (SSFRA). The purpose of this model was to accurately assess the flood risk to the site and determine the impact that the proposed development would have on flooding in the surrounding lands. The hydraulic model was used to determine the Flood Zones at the site and the resultant flood extent mapping showed the site to be partially located in Flood Zones A and B. The site was assessed on this basis.

Two proposed scenarios are explored in this assessment. The first involves the extension of the existing 1650mm dia. Flood Relief Culvert, north of the Carrickmines River, to a discharge point east of the site. This scenario is referred to as the “Proposed Permanent Scenario”. The final downstream portion of this culvert will need to be completed by others and for this reason a second scenario is proposed. This “Proposed Interim Scenario” involves continuing the existing 1650mm culvert underneath the Carrickmines River and then eastwards before discharging back into the river within the site boundary. This will improve conveyance of floodwaters away from the site but will not alleviate flooding issues to the north of the watercourse. The proposed scenarios involve raising of the proposed development lands to the south of the Carrickmines River, thus bringing the proposed development outside of Flood Zones A and B.

The site is not at risk of pluvial, coastal or groundwater flooding.

The ground floor Finished Floor Levels (FFLs) of the proposed buildings on the site have been set above the 1 in 1000 year flood levels from the adjacent Carrickmines River. Basements are included in the development and entrance levels to these basements will also be set above the 1 in 1000 year flood level.

Appropriate measures have been taken to ensure that the proposed development will not be at risk of flooding, and also to ensure that impacts related to flooding elsewhere will not worsen as a result of the development. The proposed mitigation measures will ensure that the development is in compliance with the relevant sections of the Dún Laoghaire-Rathdown County Development Plan as outlined in Section 2.2 as well as in full compliance with SFRA Dún Laoghaire-Rathdown County Council and The Planning System & Flood Risk Management Guidelines.

Appendix A Proposed Site Layout

NOTES / LEGEND

🟥 SITE BOUNDARY

OSI LICENCE NUMBER REF: CYAL50178201

GENERAL NOTES:
- DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS AND REPORTS PREPARED BY MOLA AND DESIGN TEAM MEMBERS.
- REFER TO 'ARCHITECTS DESIGN REPORT' FOR FURTHER INFORMATION ON PROPOSED MATERIALS.
- LANDSCAPING SHOWN IS INDICATIVE. REFER TO LANDSCAPE ARCHITECTS DRAWINGS FOR DETAILED INFORMATION.
- GREEN ROOF SHOW IS INDICATIVE. PROVISION TO MEET MINIMUM OF 60% OF TOTAL PLOT ROOF AREA.

Key Plan:

Rev:	Date:	Description:	By:
P-01	25/03/2022	ISSUED FOR PLANNING	MOLA

MOLA
2 Donnybrook Road,
Donnybrook,
Dublin 4, Ireland
Telephone +353 1 218 3900
www.molaarchitecture.com

Notes
Do not scale.
Use figured dimensions only.
This drawing is to be read in conjunction with all relevant specifications and drawings.
All dimensions to be checked on site.
In the event of any discrepancies between drawings, the contractor is to inform the Architect immediately.

Stage:
PLANNING

Client:
1 CARRICKMINES LAND LIMITED

Project:
PRIORSLAND CHERRYWOOD SHD

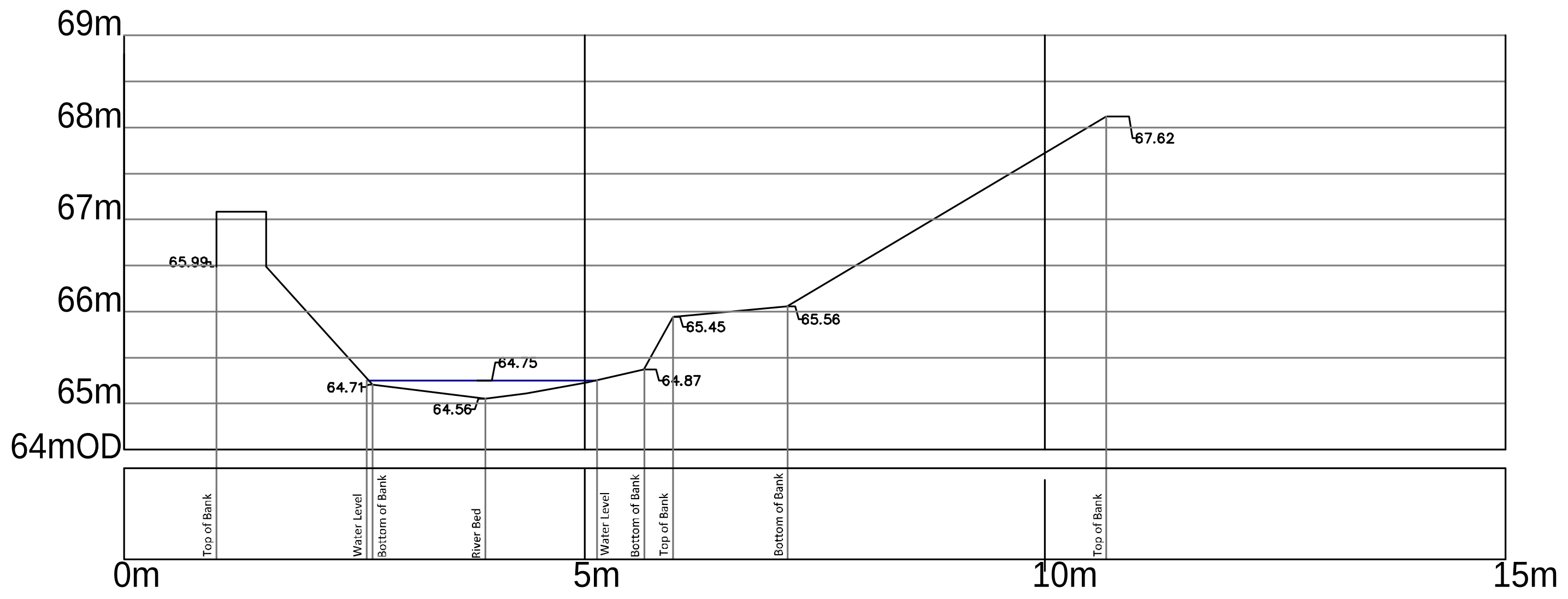
Drawing:
PROPOSED SITE LAYOUT PLAN

Date: MARCH 2022
Scale: 1:500 @A0
Int. Job No: 18029

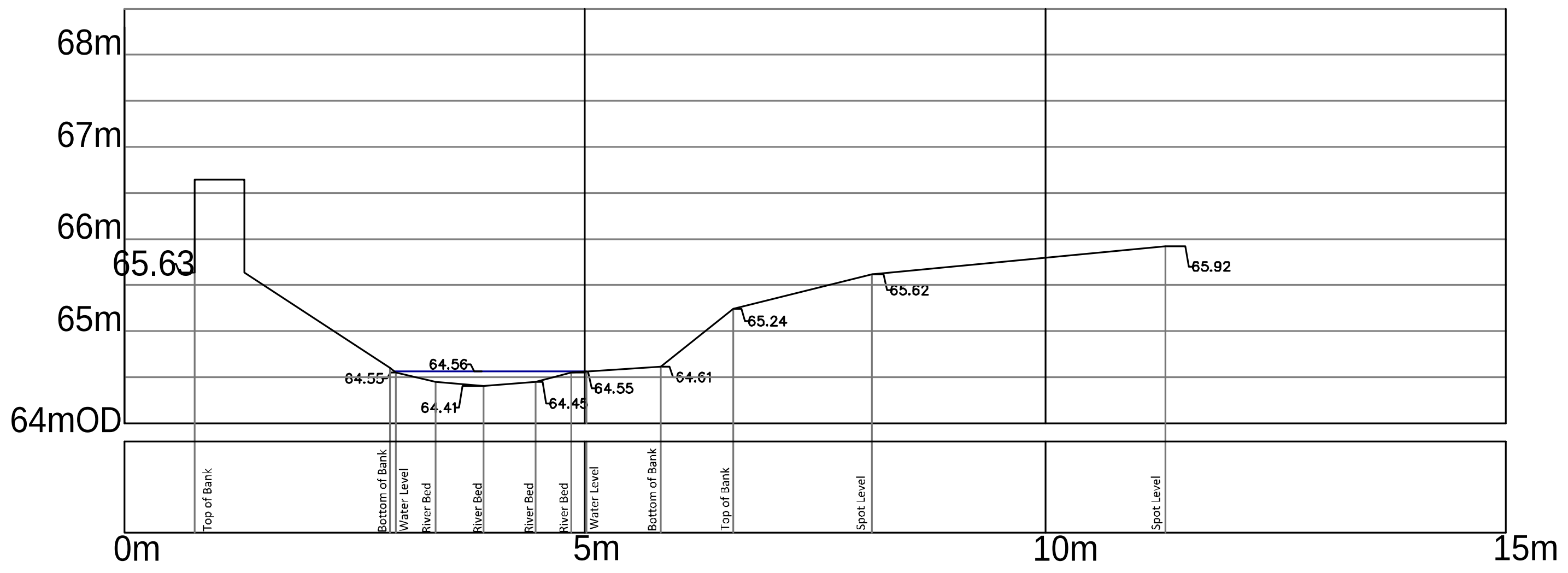
Drawing No.: PLD18-MOLA-XX-XX-DR-A-10-XX101
Status: -
Revision: P-01

Appendix B Site Topographical Survey

Section 1 CH=0+0.000



Section 2 CH=0+027.950



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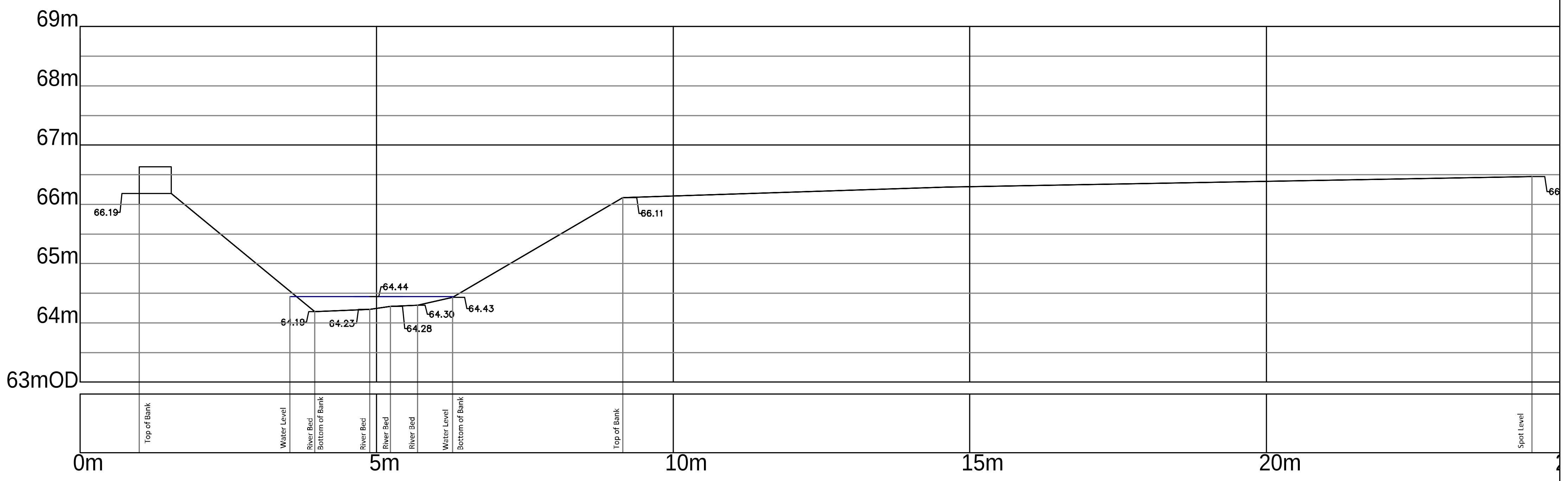

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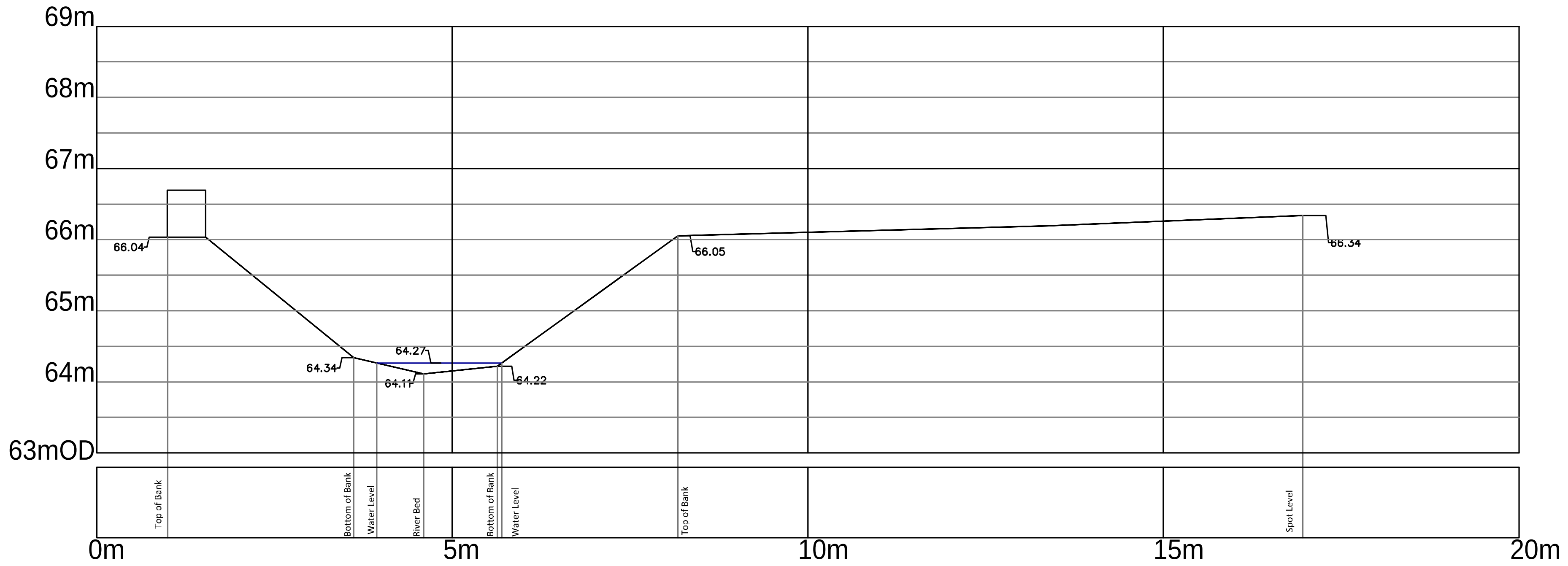
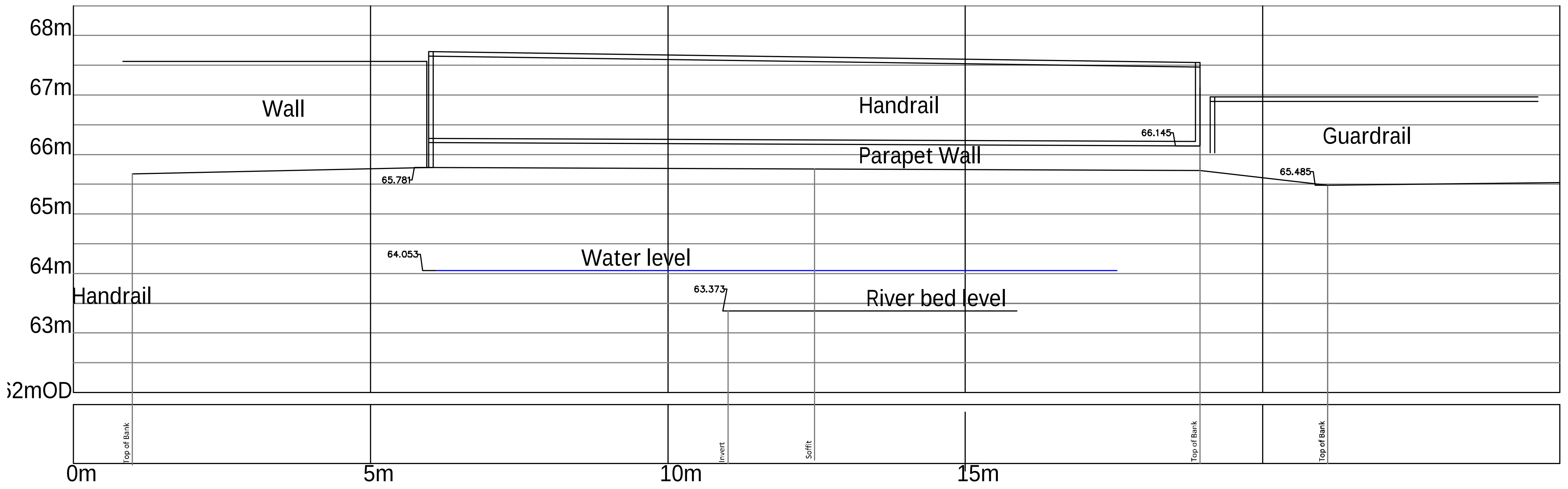
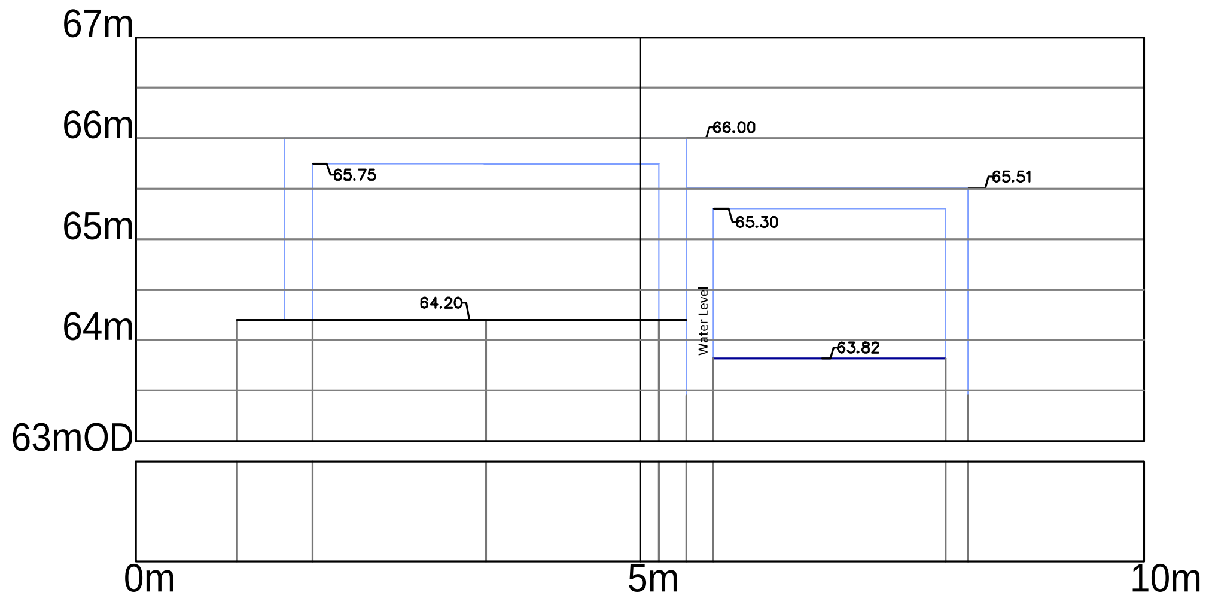


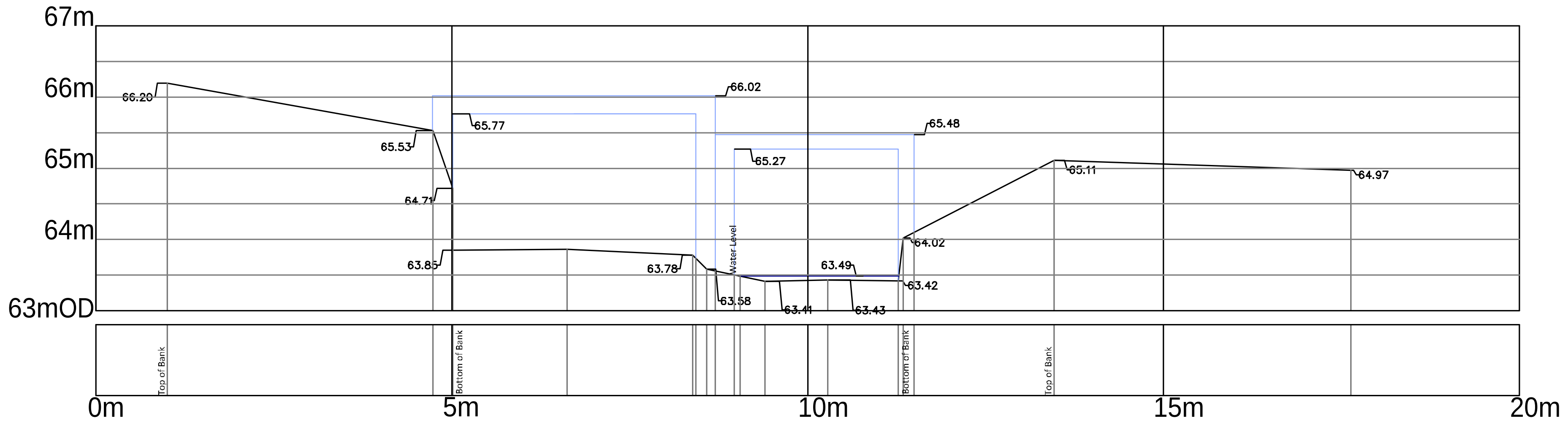
Elevation 1 CH=0+188.0



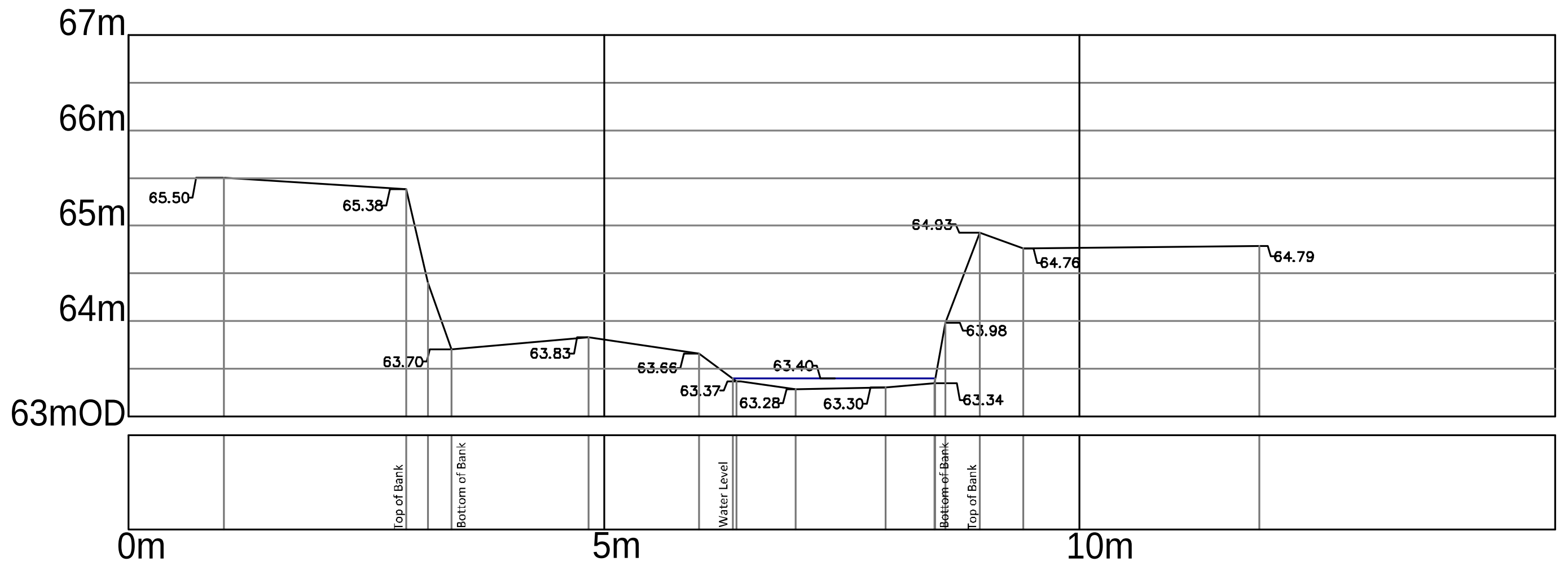
Section 5 CH 0+170.148



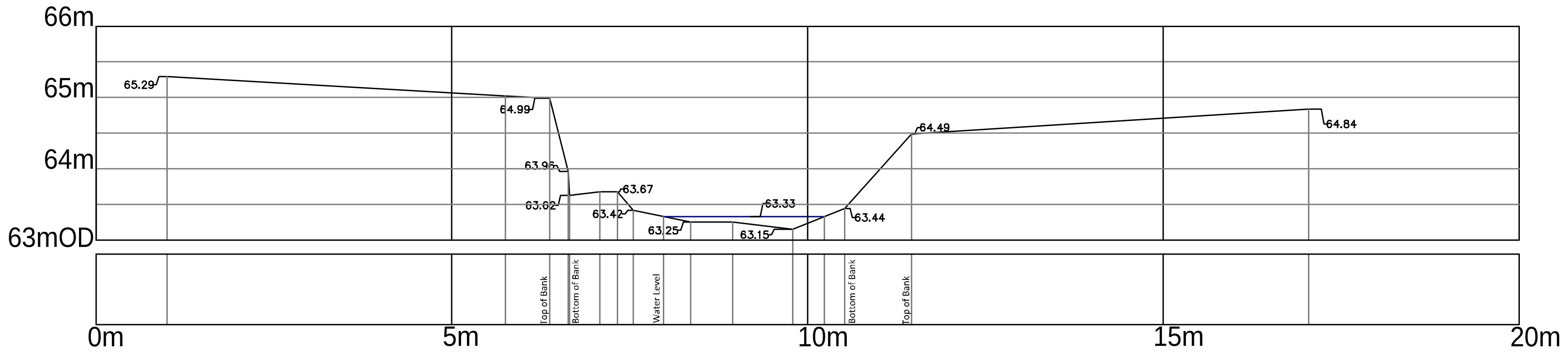
Section 6 CH 0+208.553

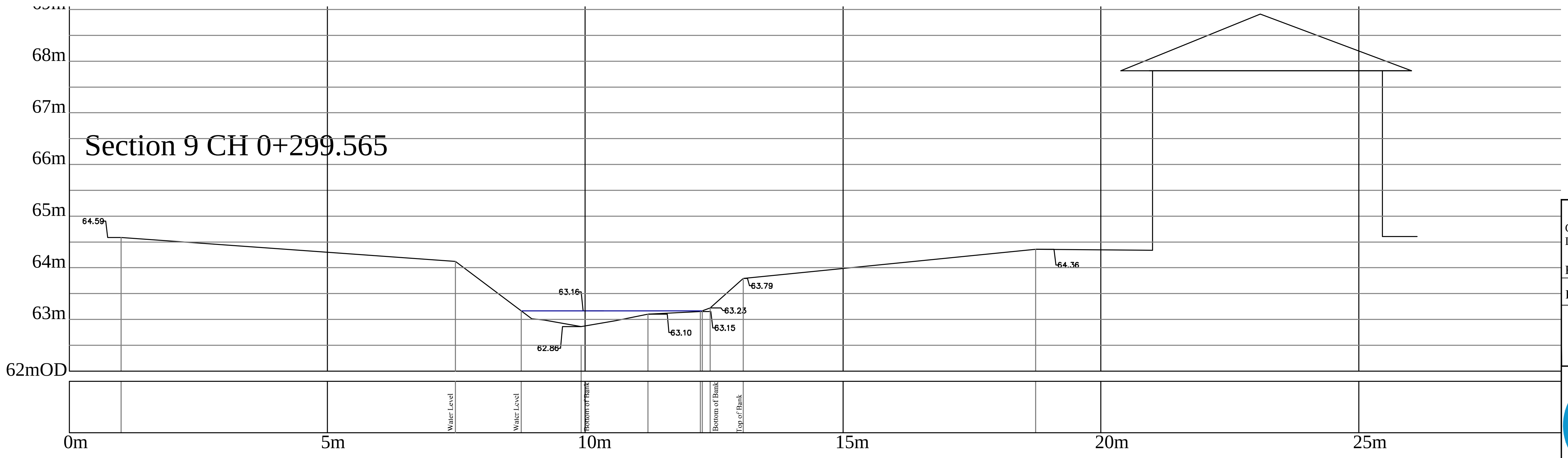


Section 7 CH 0+214.677



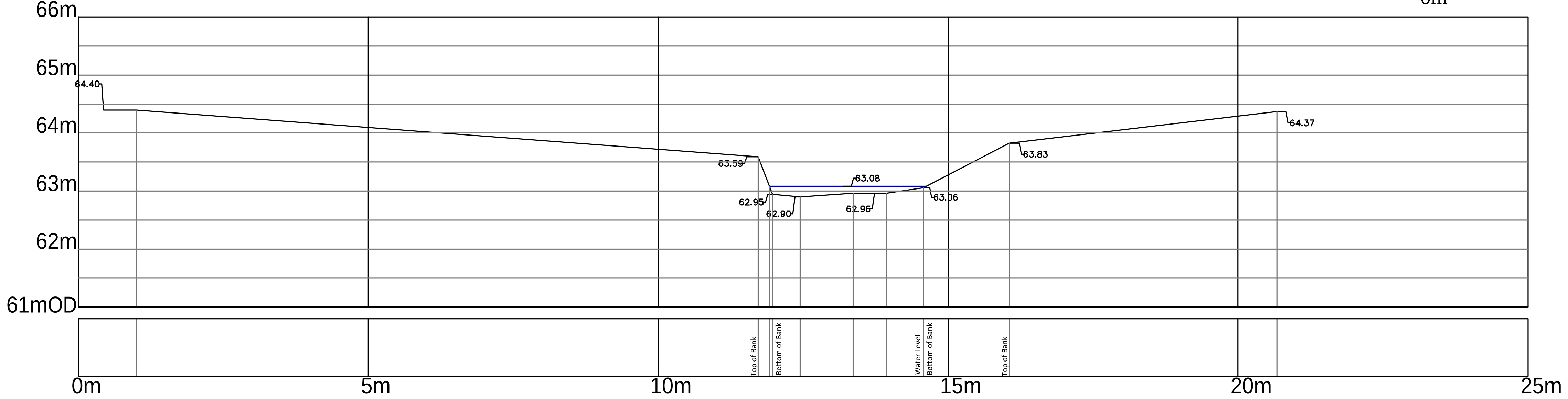
Section 8 CH 0+225.221

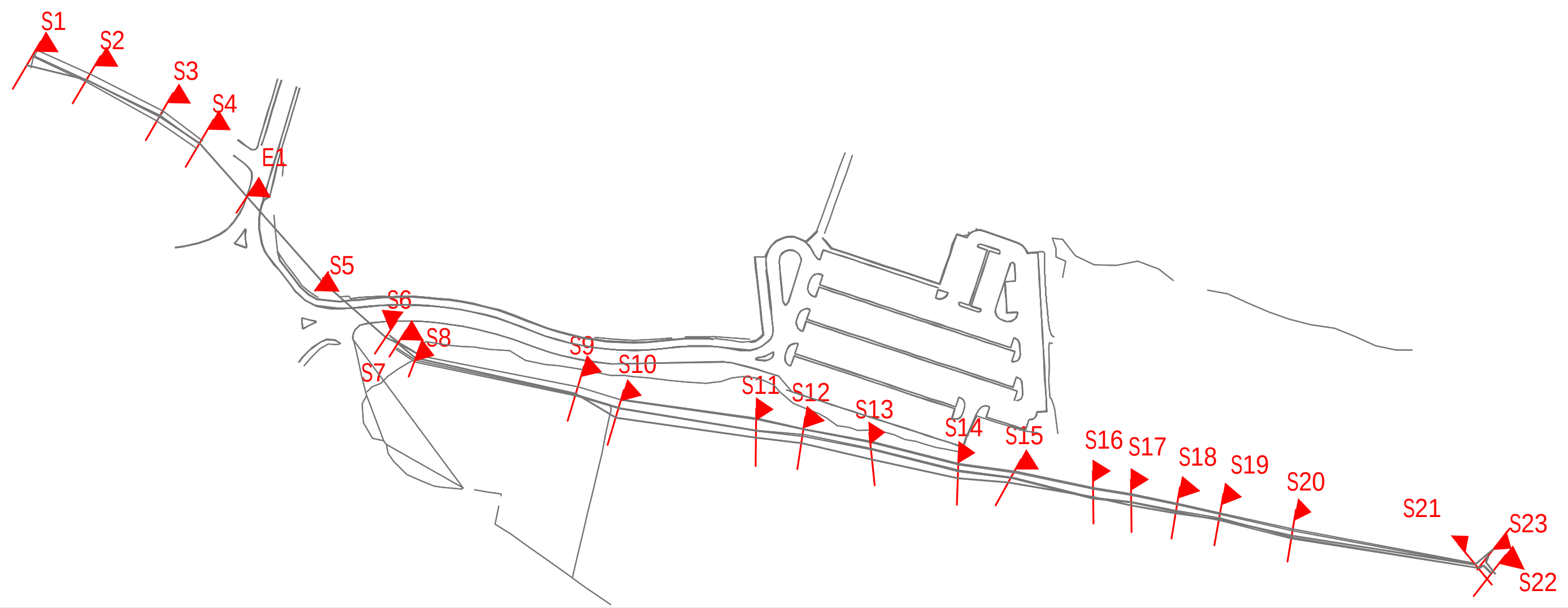




Section 9 CH 0+299.565

Section 10 CH=0+320.681





Co-ordinate system is Irish National Grid / Irish Transverse Mercator (ITM)
Levels are related to Malin Head Datum

Revisions

REVISION	DESCRIPTION	DATE

COASTWAY Surveys

www.coastwaysurveys.ie

Head Office: The Grainstore, Singletons Lane, Bagenalstown, Co. Carlow,
R21 XA66, Ireland;
Tel: +353 (0)59 97 23333 **Email:** info@coastway.net

UK office: The Custard Factory, Studio 116, Gibb Street, Birmingham, B9 4AA UK
Tel : +44 121 7735497 **Email:** info@coastway.net

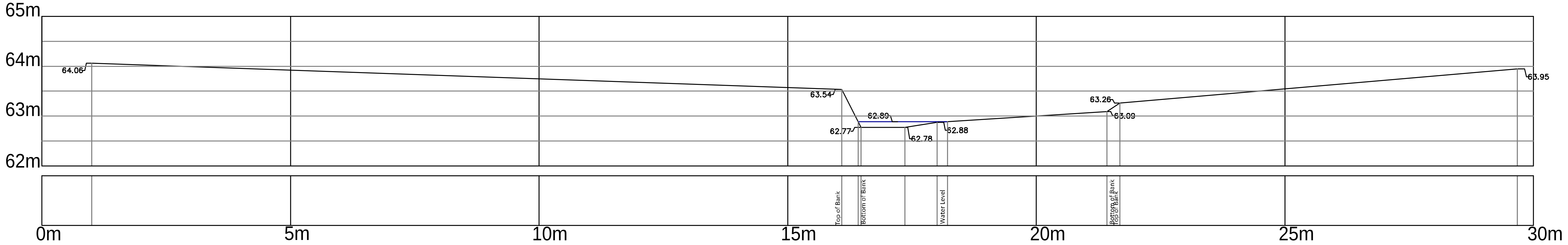
Client: Scantech

Location: Carrickmines Co.Dublin

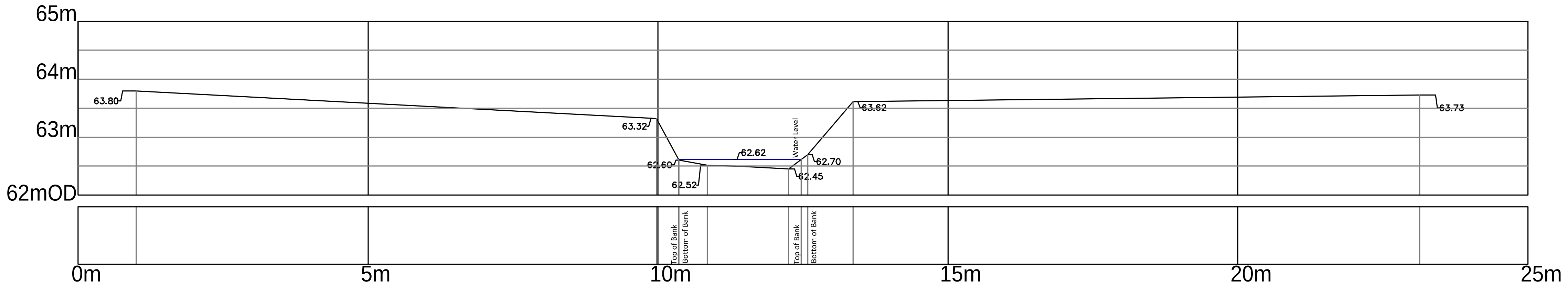
Job: Priorsland Topographic Survey - Sections 11-23

Drawing Number: 1889-002 B	Scale: 1:75 / A1
Surveyed By: DE/JL	Drawn By: DE/RB
Date: Surveyed 05/10/2018 Issued 23/10/2018	Checked By: LM

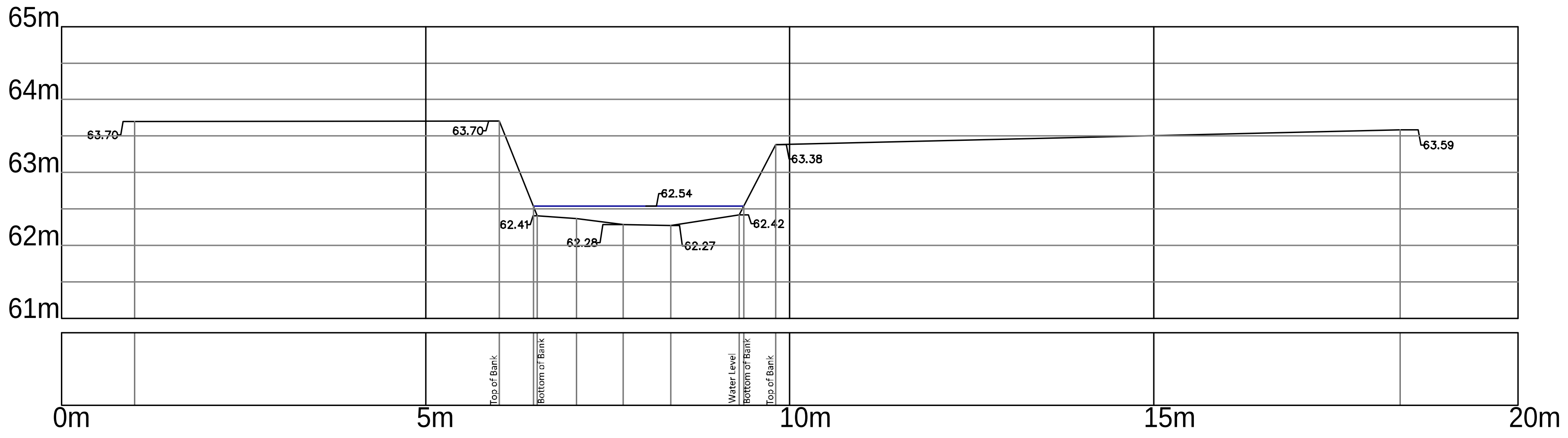
Section 11 CH 0+384.887



Section 12 CH 0+405.629



Section 13 CH 0+438.370



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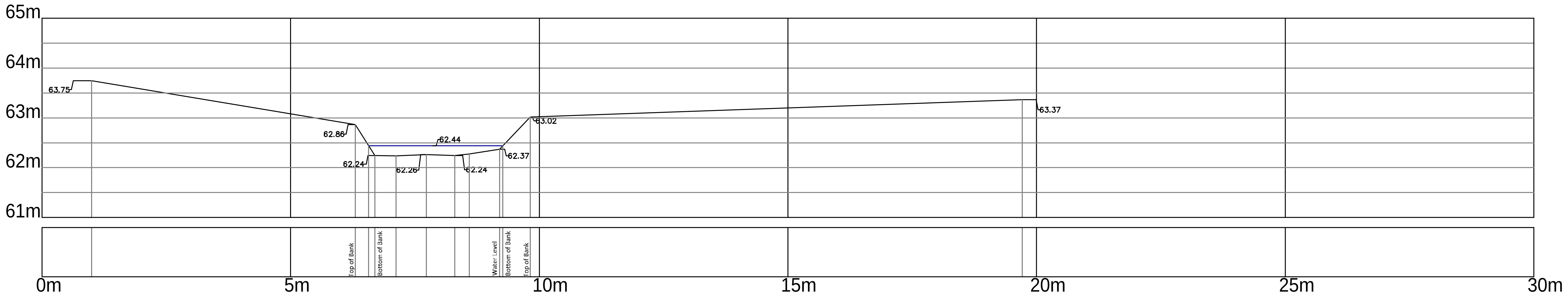
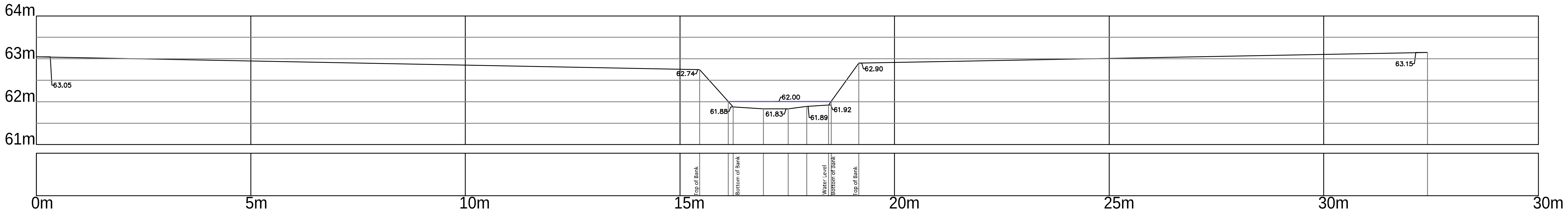
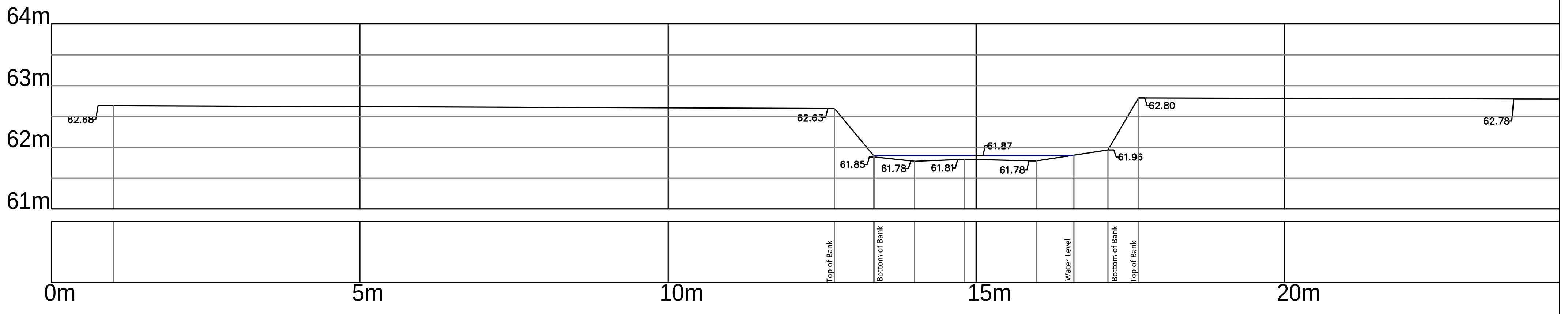


Section 15 CH 0+501.276



Section 16 CH 0+540.215



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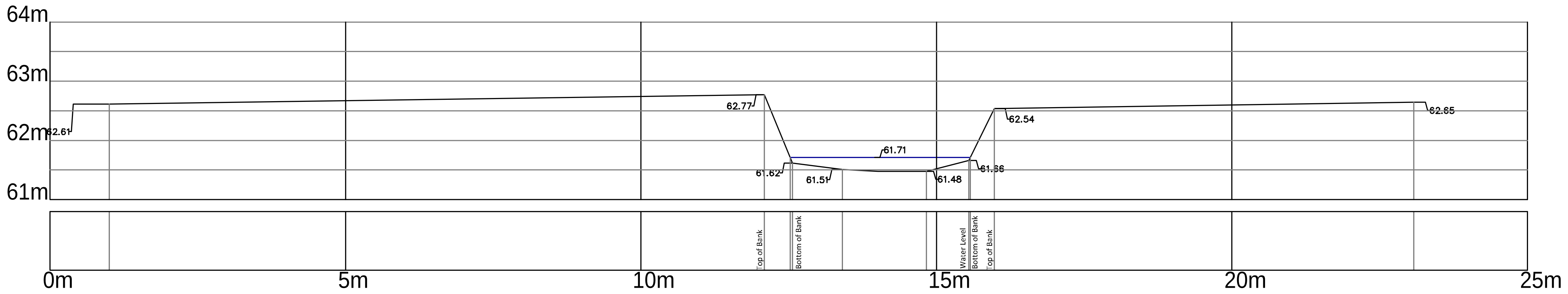

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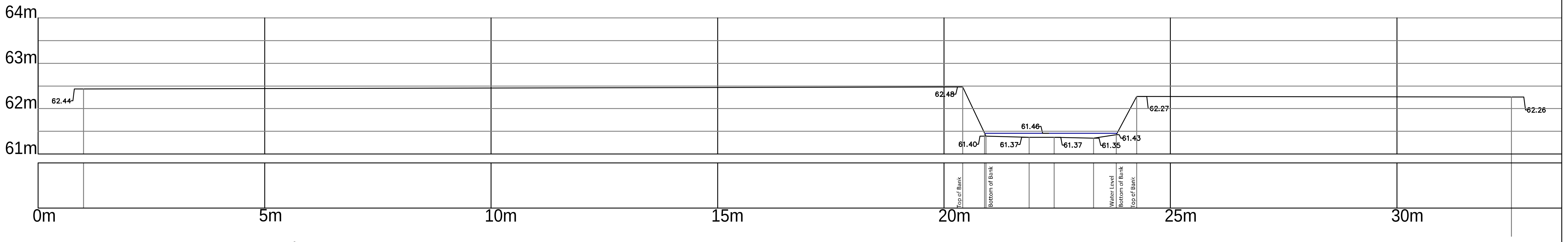
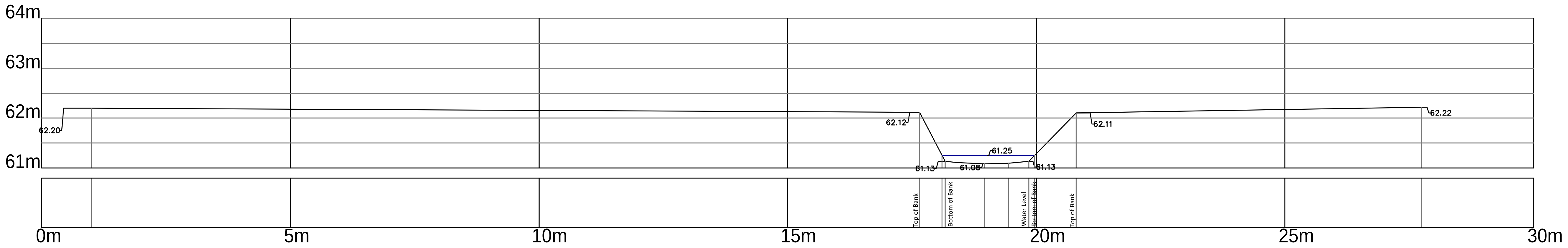


Section 19 CH 0+598.113



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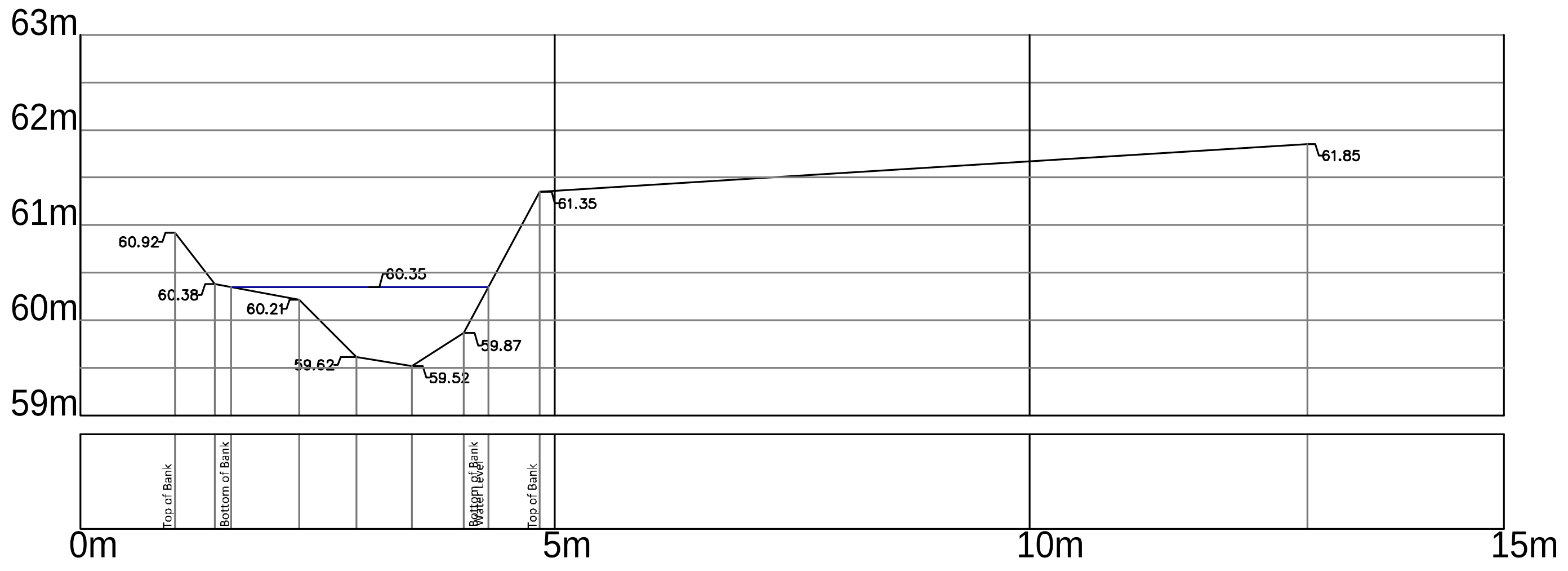

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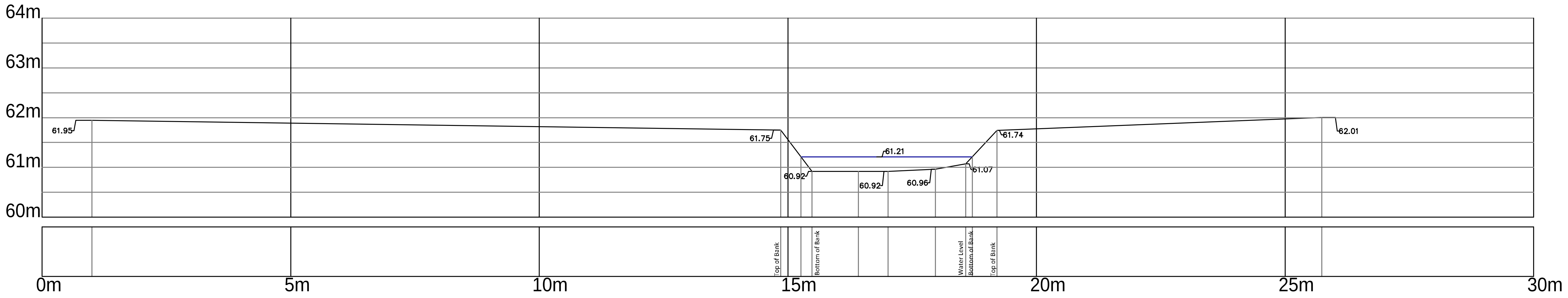

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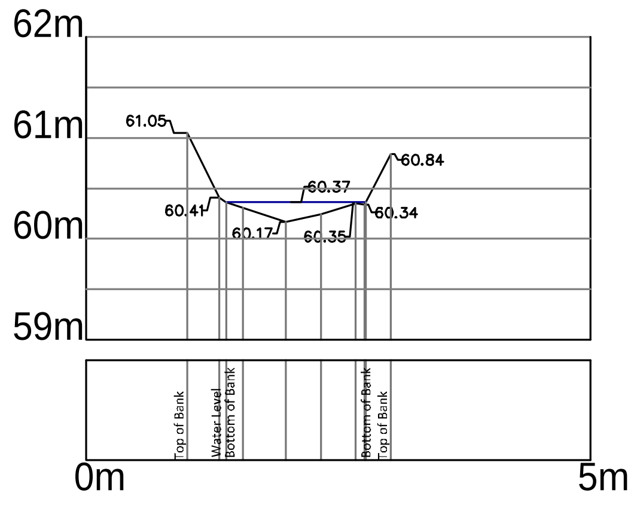

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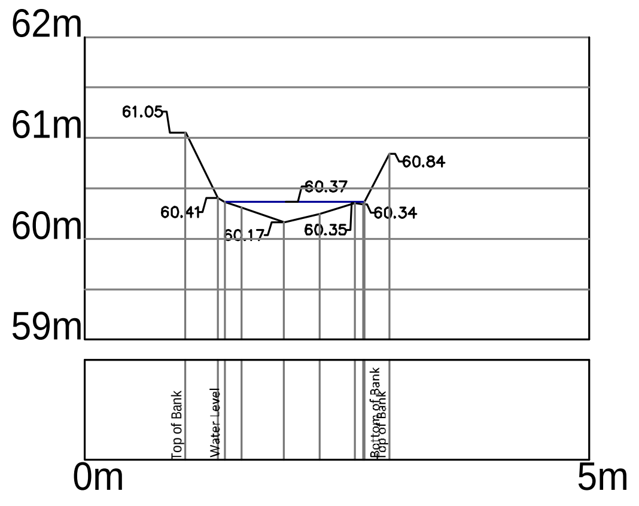


Co-ordinate system is Irish National Grid / Irish Transverse Mercator (ITM)
Levels are related to Malin Head Datum

Revisions

REVISION	DESCRIPTION	DATE

COASTWAY
Surveys

www.coastwaysurveys.ie

Head Office: The Grainstore, Singletons Lane, Bagenalstown, Co. Carlow,
R21 XA66, Ireland;
Tel: +353 (0)59 97 23333 **Email:** info@coastway.net

UK office: The Custard Factory, Studio 116, Gibb Street, Birmingham, B9 4AA UK
Tel : +44 121 7735497 **Email:** info@coastway.net

Client: Scantech	
Location: Carrickmines Co.Dublin	
Job: Priorsland Topographic Survey - Sections 11-23	
Drawing Number: 1889-002 B	Scale: 1:75 / A1
Surveyed By: DE/JL	Drawn By: DE/RB
Date: Surveyed 05/10/2018 Issued 23/10/2018	Checked By: LM

Appendix C Site Visit Images

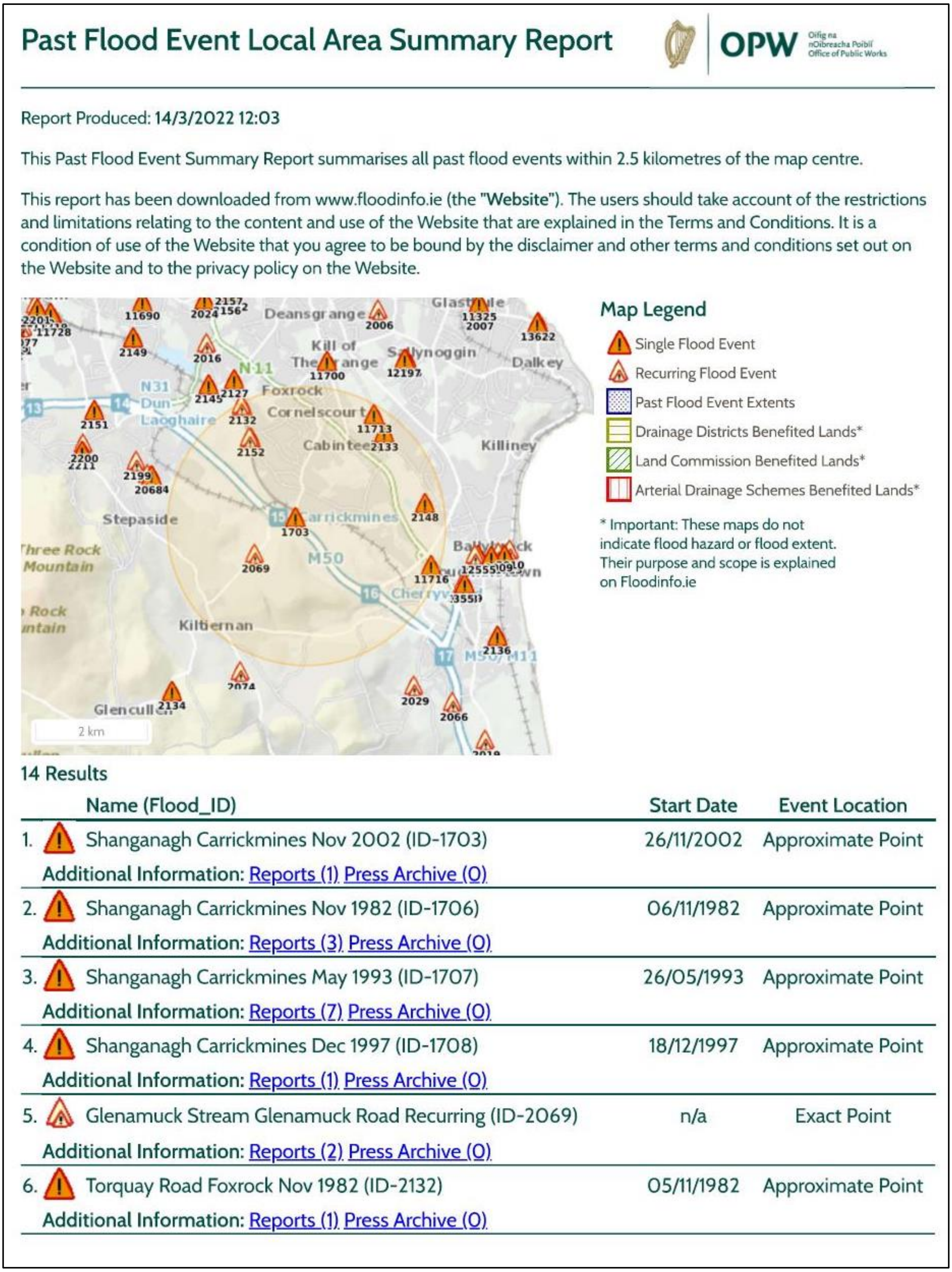

22/AUG/2018


22/AUG/2018


22/AUG/2018


22/AUG/2018

Appendix D OPW Historic Flood Events Record



Past Flood Event Local Area Summary Report

OPW Oifig na nOibreacha Poiblí Office of Public Works

Report Produced: **14/3/2022 12:03**

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the "**Website**"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.

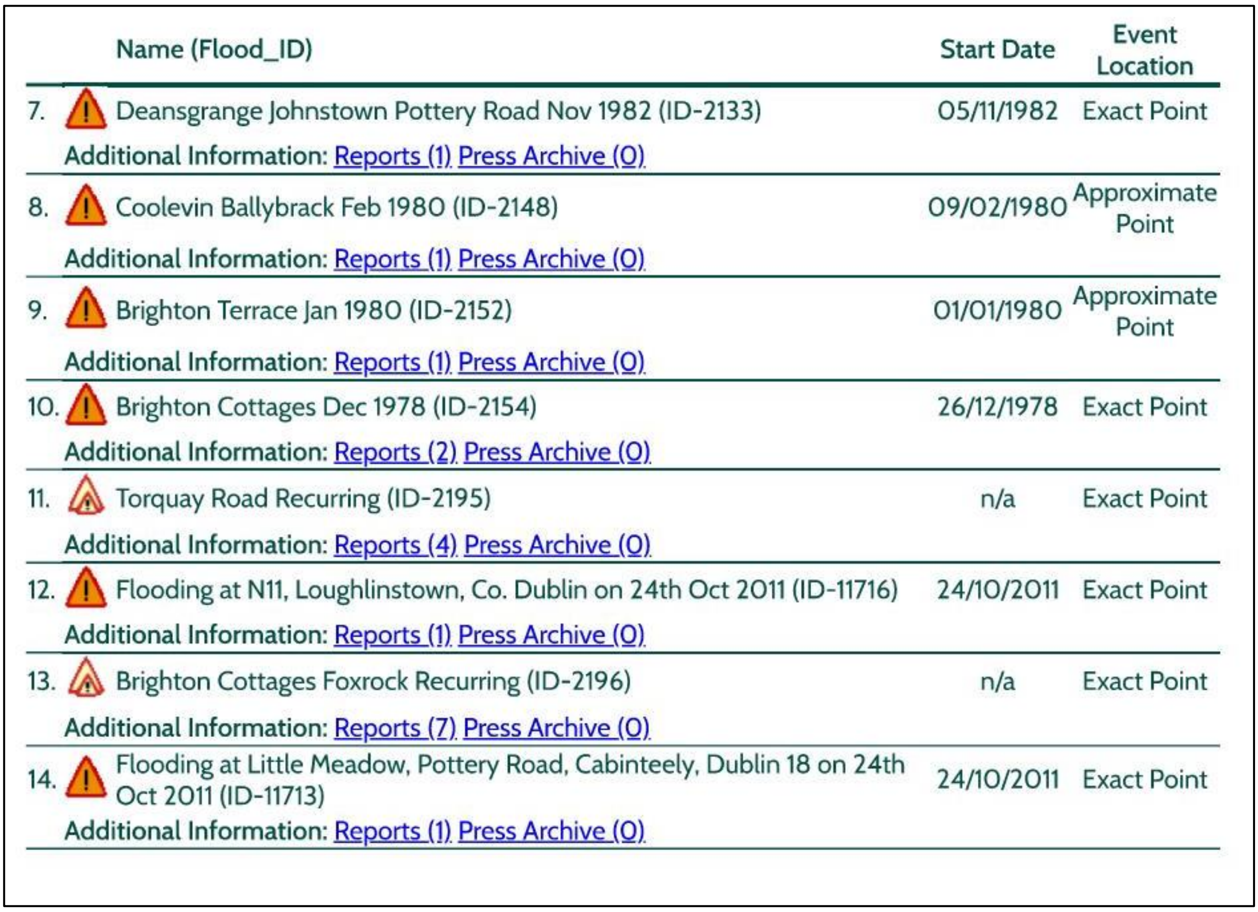
Map Legend

- ⚠ Single Flood Event
- ⚠ Recurring Flood Event
- ▨ Past Flood Event Extents
- ▤ Drainage Districts Benefited Lands*
- ▨ Land Commission Benefited Lands*
- ▥ Arterial Drainage Schemes Benefited Lands*

* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

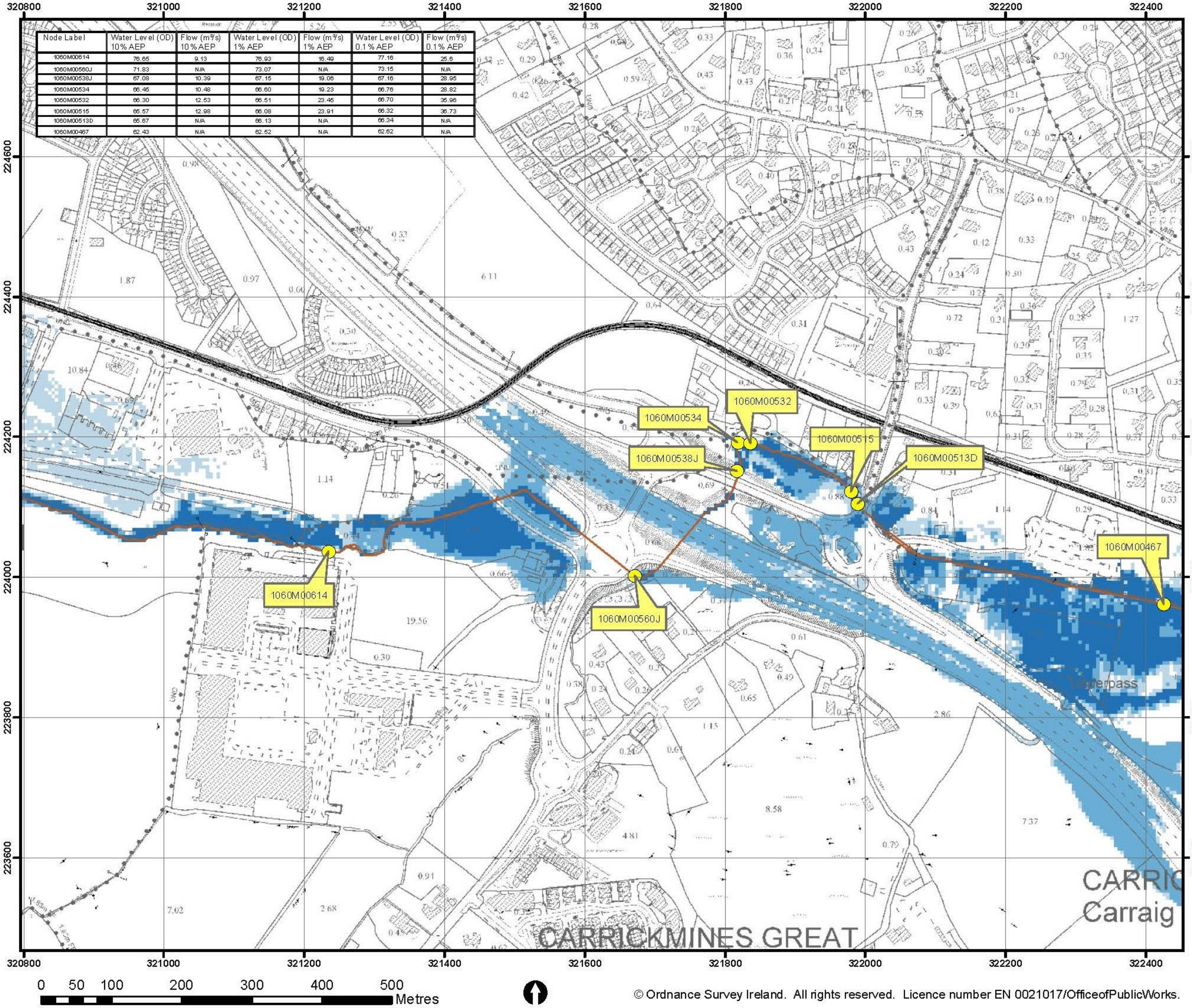
14 Results

	Name (Flood_ID)	Start Date	Event Location
1. ⚠	Shanganagh Carrickmines Nov 2002 (ID-1703)	26/11/2002	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
2. ⚠	Shanganagh Carrickmines Nov 1982 (ID-1706)	06/11/1982	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		
3. ⚠	Shanganagh Carrickmines May 1993 (ID-1707)	26/05/1993	Approximate Point
	Additional Information: Reports (7) Press Archive (0)		
4. ⚠	Shanganagh Carrickmines Dec 1997 (ID-1708)	18/12/1997	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
5. ⚠	Glenamuck Stream Glenamuck Road Recurring (ID-2069)	n/a	Exact Point
	Additional Information: Reports (2) Press Archive (0)		
6. ⚠	Torquay Road Foxrock Nov 1982 (ID-2132)	05/11/1982	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		



	Name (Flood_ID)	Start Date	Event Location
7. ⚠	Deansgrange Johnstown Pottery Road Nov 1982 (ID-2133) **Additional Information:** Reports (1) Press Archive (0)	05/11/1982	Exact Point
8. ⚠	Coolevin Ballybrack Feb 1980 (ID-2148) **Additional Information:** Reports (1) Press Archive (0)	09/02/1980	Approximate Point
9. ⚠	Brighton Terrace Jan 1980 (ID-2152) **Additional Information:** Reports (1) Press Archive (0)	01/01/1980	Approximate Point
10. ⚠	Brighton Cottages Dec 1978 (ID-2154) **Additional Information:** Reports (2) Press Archive (0)	26/12/1978	Exact Point
11. ⚠	Torquay Road Recurring (ID-2195) **Additional Information:** Reports (4) Press Archive (0)	n/a	Exact Point
12. ⚠	Flooding at N11, Loughlinstown, Co. Dublin on 24th Oct 2011 (ID-11716) **Additional Information:** Reports (1) Press Archive (0)	24/10/2011	Exact Point
13. ⚠	Brighton Cottages Foxrock Recurring (ID-2196) **Additional Information:** Reports (7) Press Archive (0)	n/a	Exact Point
14. ⚠	Flooding at Little Meadow, Pottery Road, Cabinteely, Dublin 18 on 24th Oct 2011 (ID-11713) **Additional Information:** Reports (1) Press Archive (0)	24/10/2011	Exact Point

Appendix E CFRAMS Mapping



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
1060M00614	76.65	9.13	76.93	16.49	77.16	25.6
1060M00560J	71.83	N/A	73.07	N/A	73.15	N/A
1060M00538J	67.08	10.39	67.15	19.06	67.16	28.95
1060M00534	66.45	10.48	66.60	19.23	66.76	28.82
1060M00532	66.30	12.53	66.51	23.45	66.70	35.96
1060M00515	65.57	12.98	66.08	23.91	66.32	36.73
1060M00513D	65.67	N/A	66.13	N/A	66.34	N/A
1060M00467	62.43	N/A	62.52	N/A	62.62	N/A

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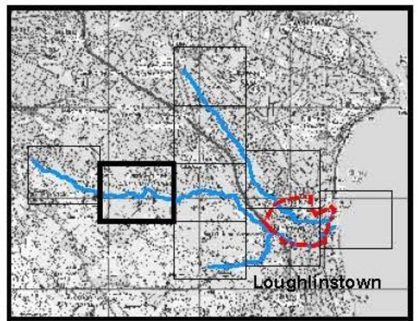

IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- ▇ 10% Fluvial AEP Event
- ▇ 1% Fluvial AEP Event
- ▇ 0.1% Fluvial AEP Event
- — Modelled River Centreline
- ▭ AFA Extents
- — Embankment
- — Wall
- ▨ Defended Area
- 1% AEP Standard of Protection of Flood Defence (Walls / Embankments)
- ● Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:
01	Removal of Embankments (Pg 5)	03/11/17

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Co Meath

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W www.rpsgroup.com
E ireland@rpsgroup.com

Map: Shanganagh-Carrickmines River Fluvial Flood Extents

Map Type: EXTENT

Source: FLUVIAL

Map Area: HPW

Scenario: CURRENT

Drawn By : C.C. **Date :** 3 November 2017

Checked By : A.S. **Date :** 3 November 2017

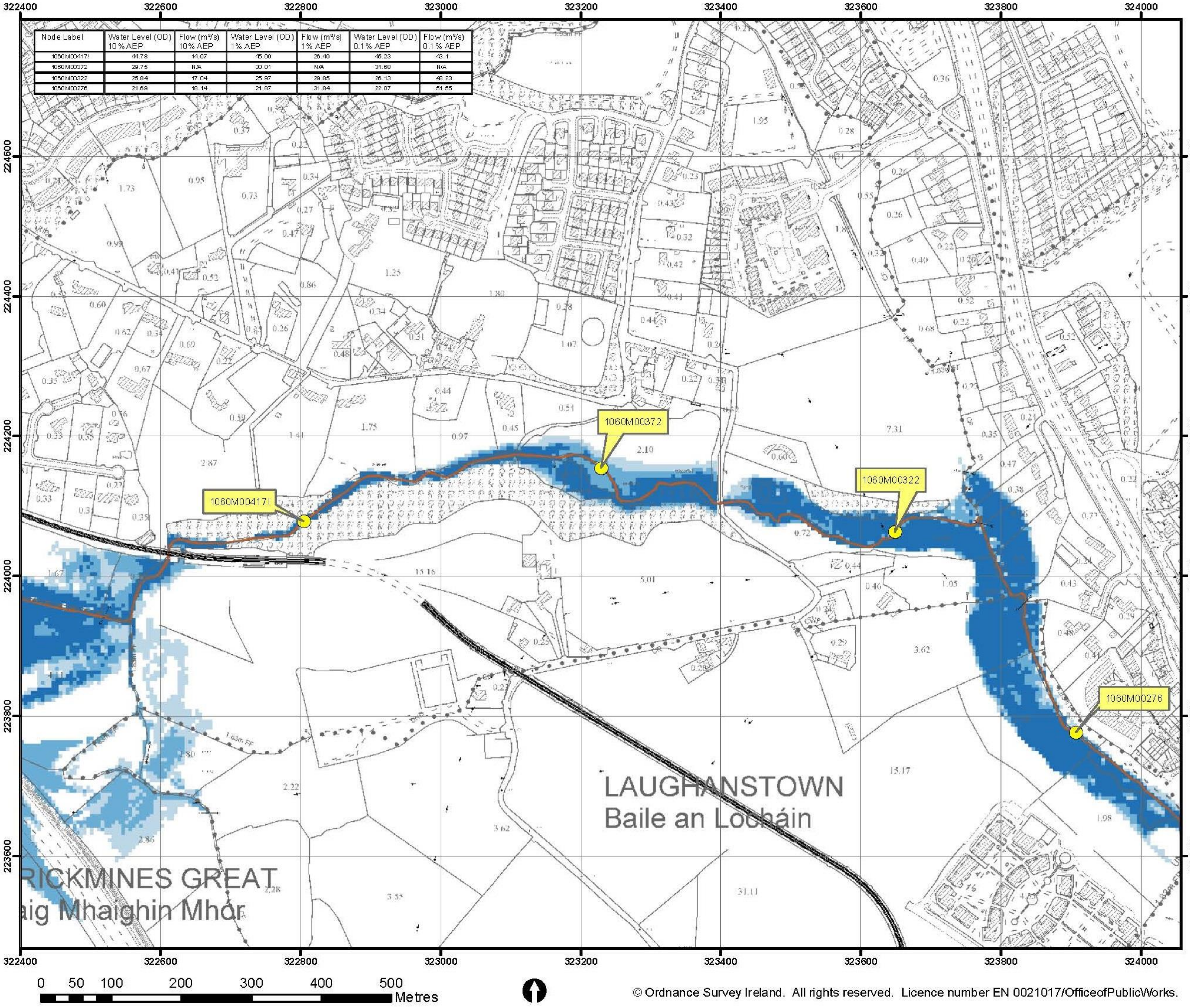
Approved By : G.G. **Date :** 3 November 2017

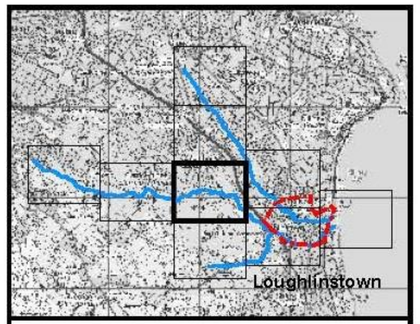
Drawing No. : E10LOU_EXFCD_F1_02

Map Series : Page 2 of 9

Drawing Scale : 1:5,000 @A3

Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
1060M00417!	44.78	14.97	45.00	26.49	45.23	43.1
1060M00372	29.75	N/A	30.01	N/A	31.68	N/A
1060M00322	25.84	17.04	25.97	29.85	26.13	48.23
1060M00276	21.69	18.14	21.87	31.84	22.07	51.55





IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Fluvial AEP Event
- 1% Fluvial AEP Event
- 0.1% Fluvial AEP Event
- Modelled River Centreline
- AFA Extents
- Embankment
- Wall
- Defended Area
- 1% AEP / 1% AEP Standard of Protection of Flood Defence (Walls / Embankments)
- ● Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:
01	Removal of Embankments (Pg 5)	03/11/17

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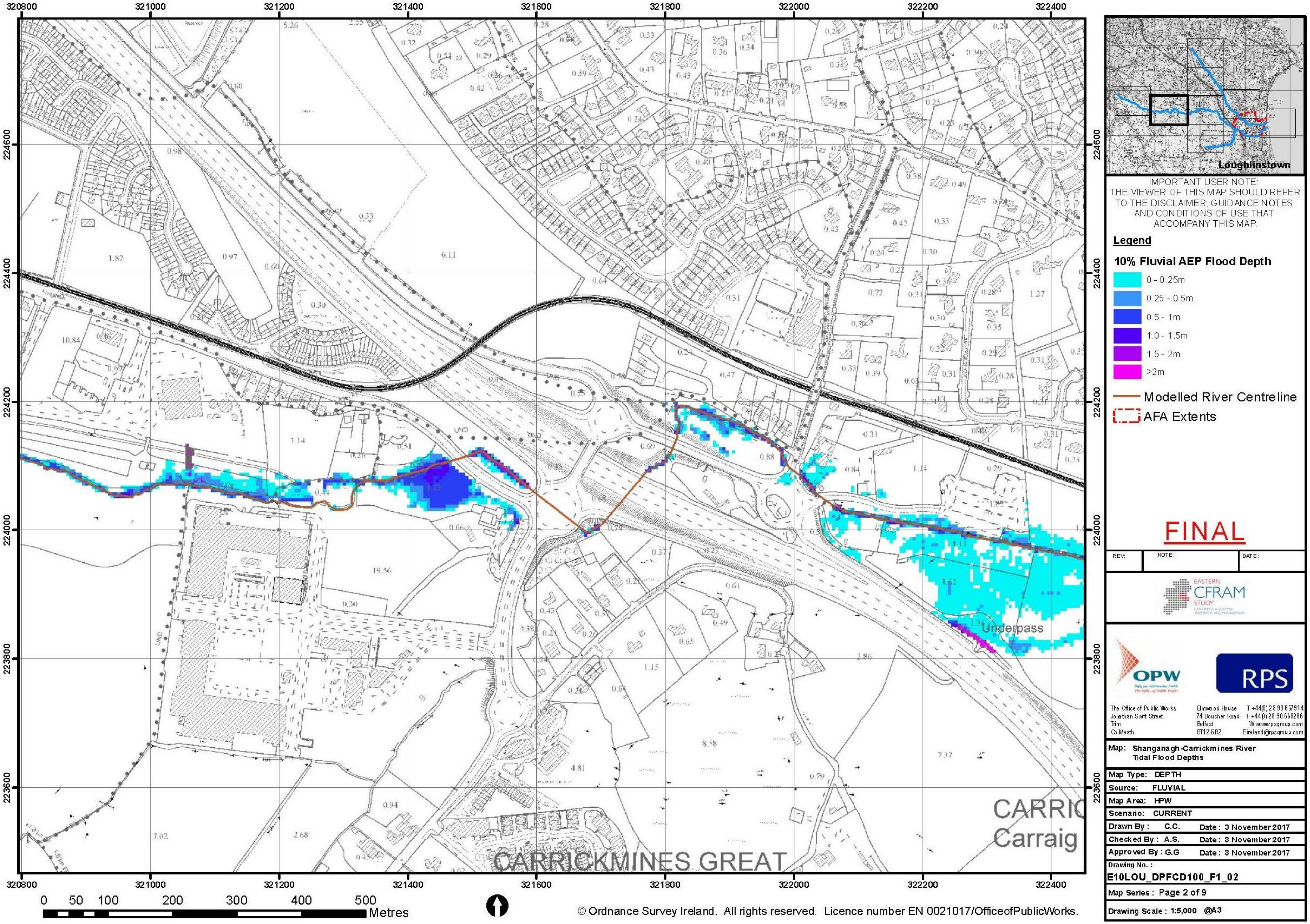
W www.rpsgroup.com
E ireland@rpsgroup.com

Map: Shanganagh-Carrickmines River Fluvial Flood Extents
Map Type: EXTENT
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT
Drawn By : C.C. **Date :** 3 November 2017
Checked By : A.S. **Date :** 3 November 2017
Approved By : G.G. **Date :** 3 November 2017
Drawing No. : E10LOU_EXFCD_F1_03
Map Series : Page 3 of 9
Drawing Scale : 1:5,000 @A3



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

FINAL

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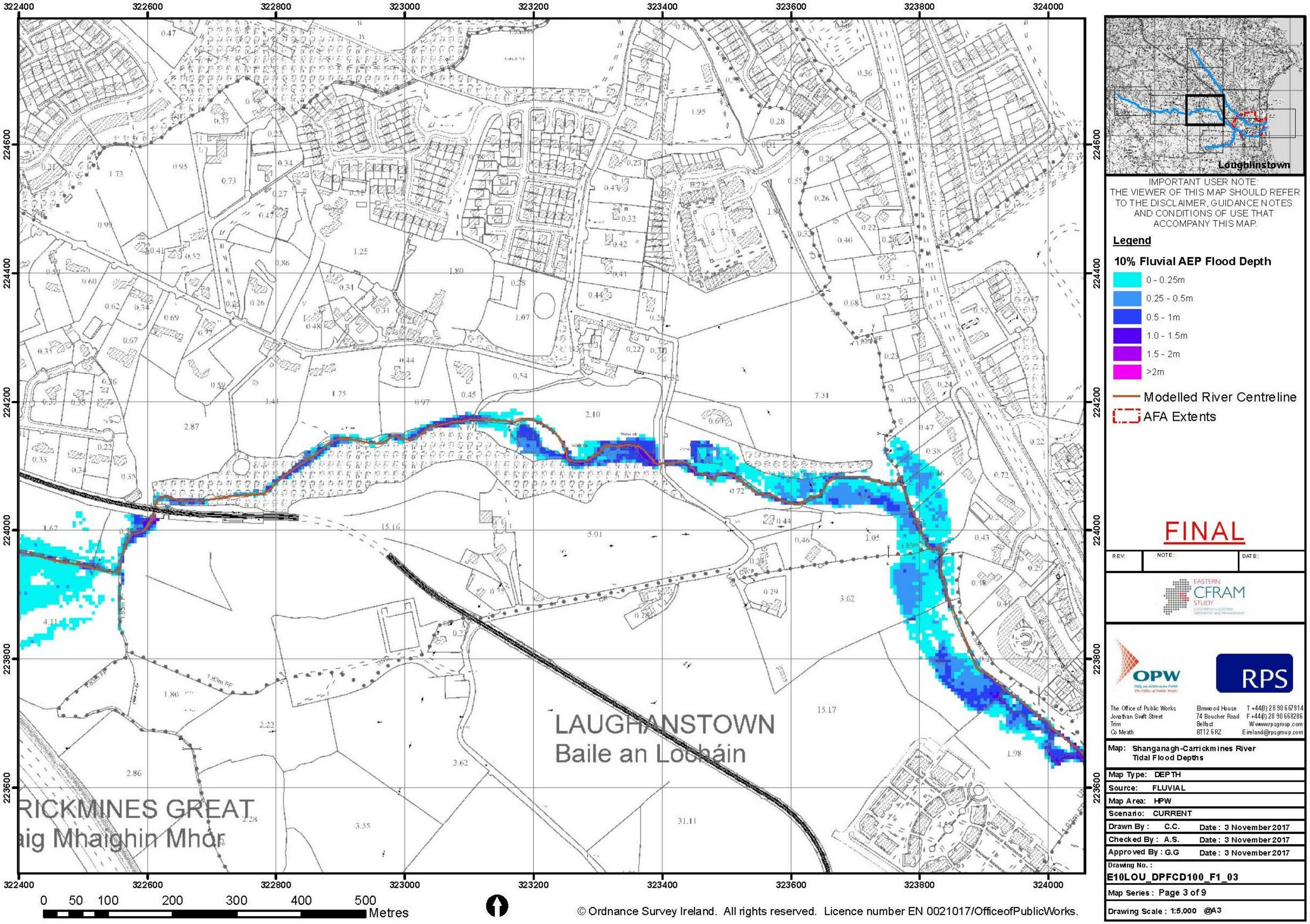
E ireland@rpsgroup.com

Map: Shanganagh-Carrickmines River Tidal Flood Depths
Map Type: DEPTH
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT
Drawn By : C.C. Date : 3 November 2017
Checked By : A.S. Date : 3 November 2017
Approved By : G.G Date : 3 November 2017
Drawing No. : E10LOU_DPFCD100_F1_02
Map Series : Page 2 of 9
Drawing Scale : 1:5,000 @A3



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

10% Fluvial AEP Flood Depth

🟦	0 - 0.25m
🟦	0.25 - 0.5m
🟦	0.5 - 1m
🟪	1.0 - 1.5m
🟪	1.5 - 2m
🟪	>2m
—	Modelled River Centreline
⬚	AFA Extents

REV:	NOTE:	DATE:

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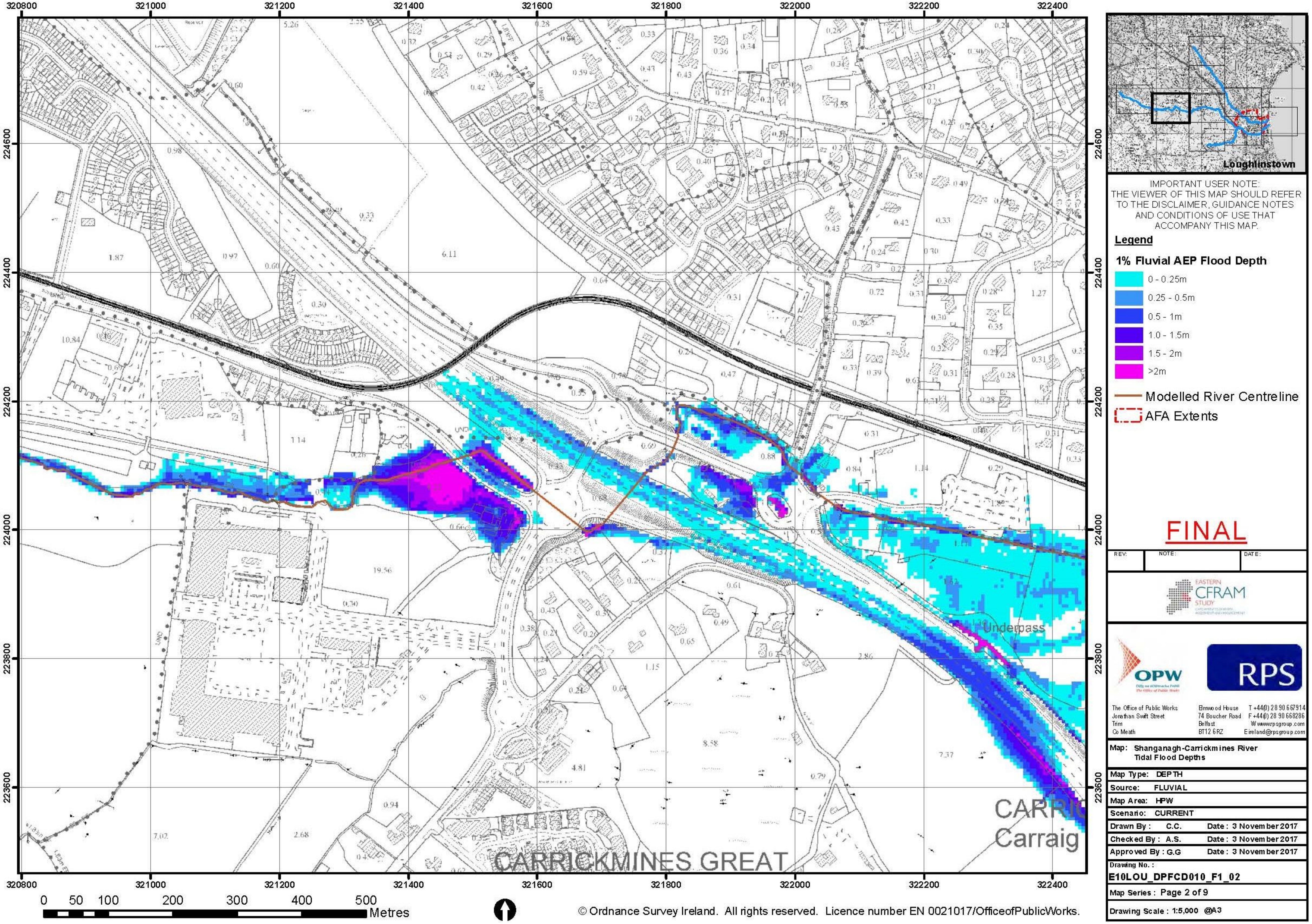
W www.rpsgroup.com
E ireland@rpsgroup.com

Map: Shanganagh-Carrickmines River Tidal Flood Depths
Map Type: DEPTH
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT
Drawn By: C.C. Date: 3 November 2017
Checked By: A.S. Date: 3 November 2017
Approved By: G.G Date: 3 November 2017
Drawing No.:
E10LOU_DPFCD100_F1_03
Map Series: Page 3 of 9
Drawing Scale: 1:5,000 @A3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224400
224200
224000
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223600
Underpass
CARRICKMINES GREAT
CARRIC
Carraig
Loughlinstown
IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.
Legend
1% Fluvial AEP Flood Depth
0 - 0.25m
0.25 - 0.5m
0.5 - 1m
1.0 - 1.5m
1.5 - 2m
>2m
Modelled River Centreline
AFA Extents
FINAL
REV:
NOTE:
DATE:
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Map: Shanganagh-Carrickmines River Tidal Flood Depths
Map Type: DEPTH
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT
Drawn By : C.C. Date : 3 November 2017
Checked By : A.S. Date : 3 November 2017
Approved By : G.G Date : 3 November 2017
Drawing No. :
E10LOU_DPFCD010_F1_02
Map Series : Page 2 of 9
Drawing Scale : 1:5,000 @A3
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Metres
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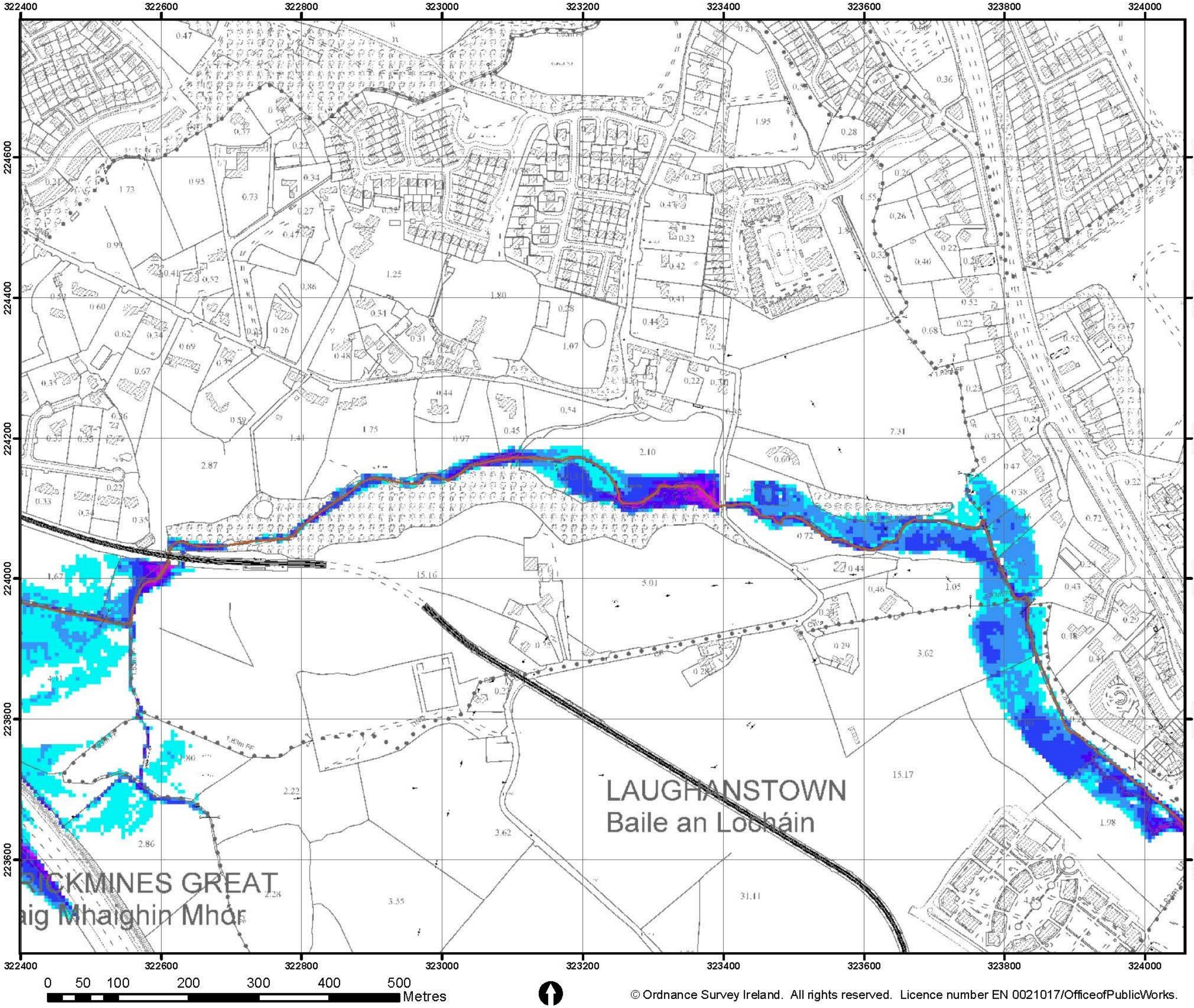

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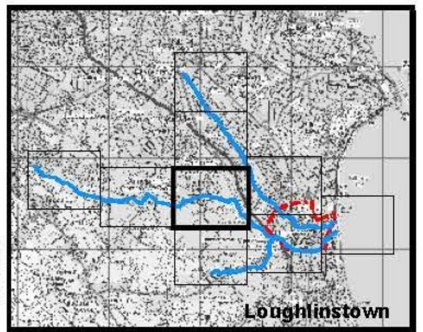

IMPORTANT USER NOTE:
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Legend

1% Fluvial AEP Flood Depth

🟦	0 - 0.25m
🟦	0.25 - 0.5m
🟦	0.5 - 1m
🟪	1.0 - 1.5m
🟪	1.5 - 2m
🟪	>2m

Modelled River Centreline
AFA Extents

FINAL

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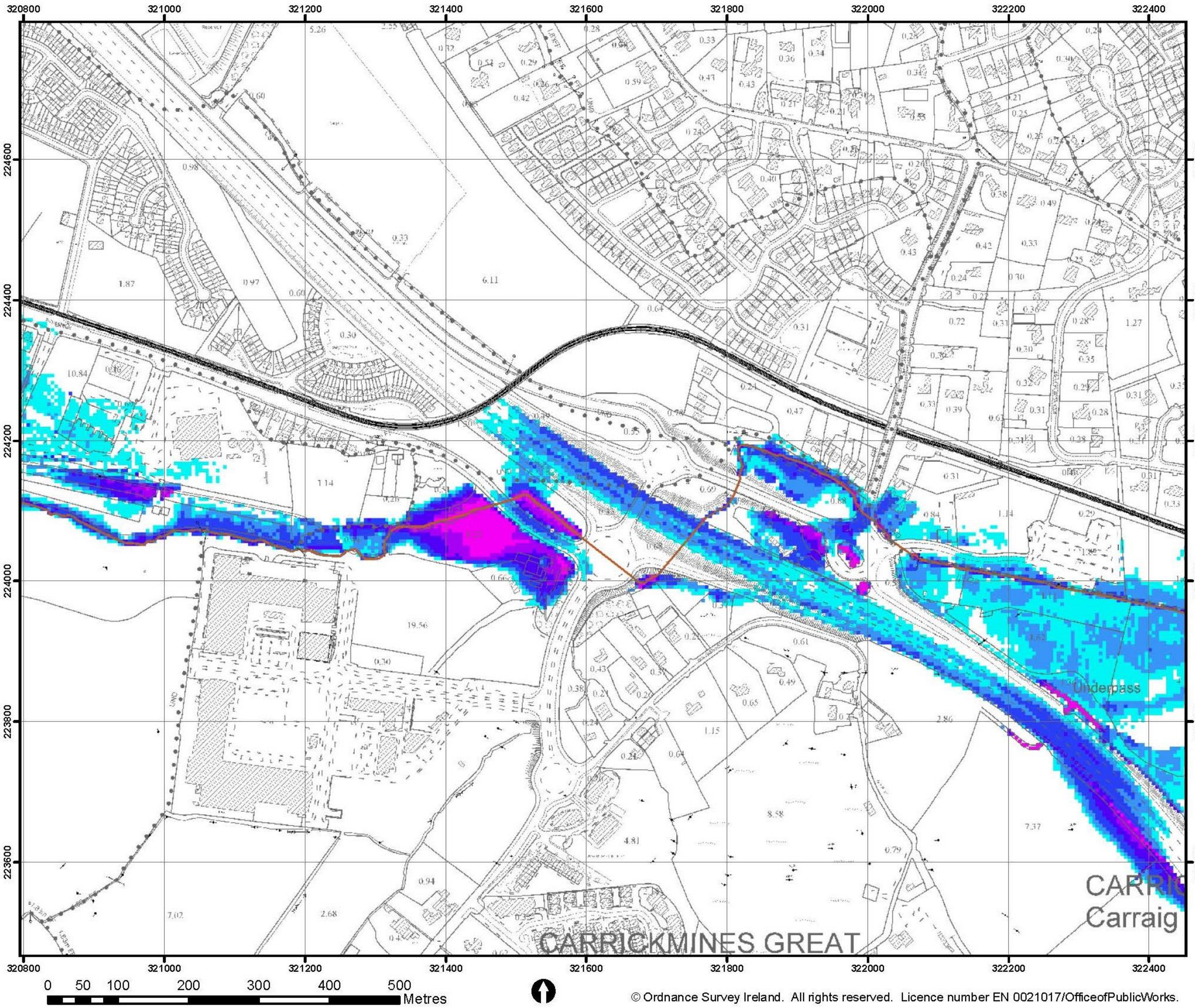
Map: Shanganagh-Carrickmines River Tidal Flood Depths

Map Type: DEPTH
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT
Drawn By : C.C. Date : 3 November 2017
Checked By : A.S. Date : 3 November 2017
Approved By : G.G Date : 3 November 2017
Drawing No. : E10LOU_DPFCD010_F1_03
Map Series : Page 3 of 9
Drawing Scale : 1:5,000 @A3



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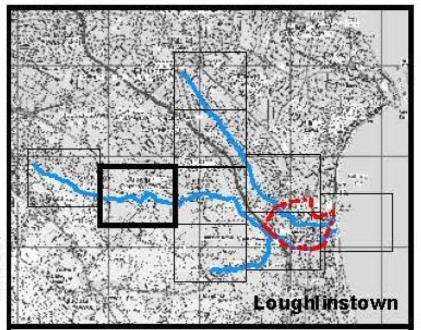

IMPORTANT USER NOTE:
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Legend

0.1% Fluvial AEP Flood Depth

- 0 - 0.25m
- 0.25 - 0.5m
- 0.5 - 1m
- 1.0 - 1.5m
- 1.5 - 2m
- >2m
- Modelled River Centreline
- AFA Extents

FINAL

REV:	NOTE:	DATE:

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Map: Shanganagh-Carrickmines River Tidal Flood Depths

Map Type: DEPTH

Source: FLUVIAL

Map Area: HPW

Scenario: CURRENT

Drawn By : C.C. **Date :** 3 November 2017

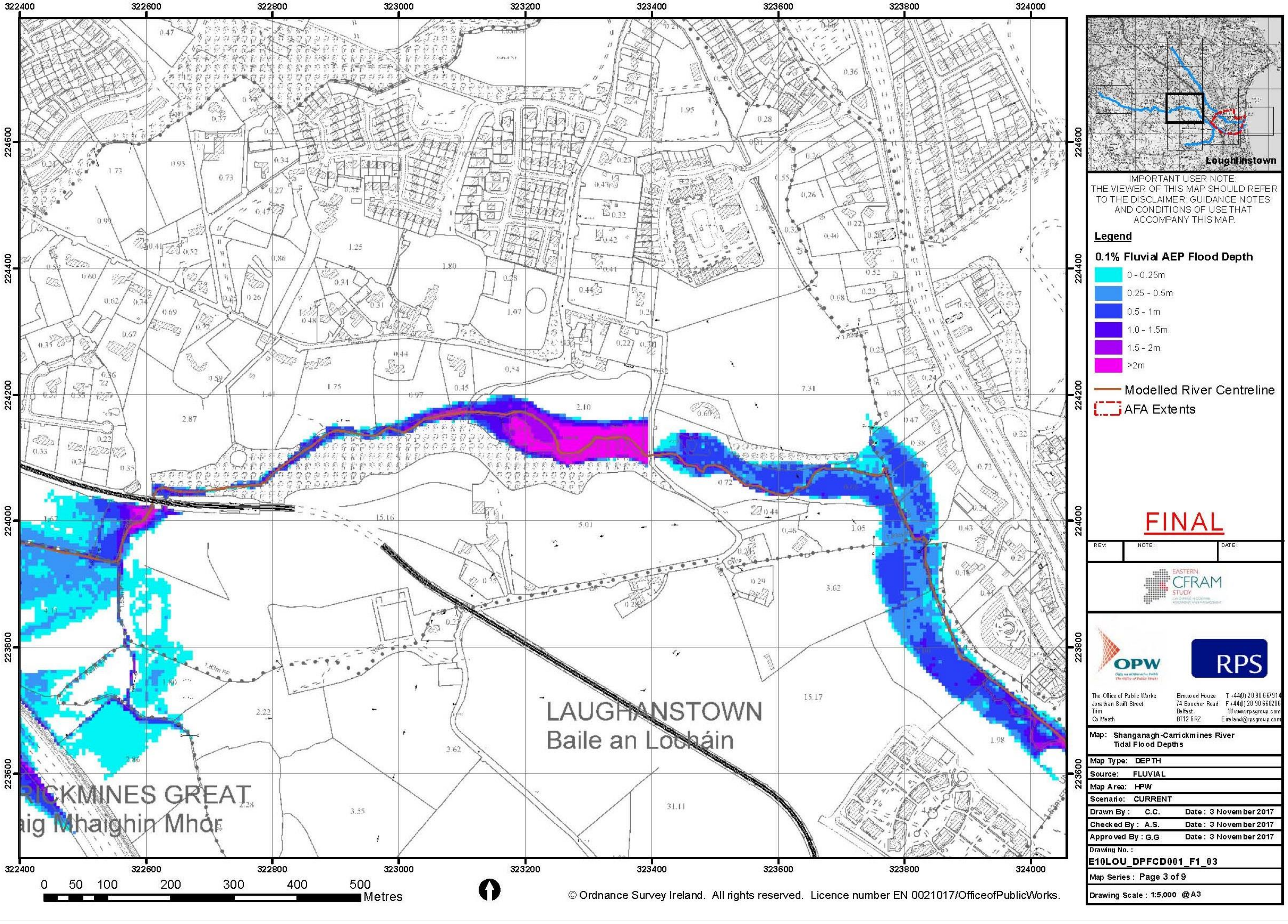
Checked By : A.S. **Date :** 3 November 2017

Approved By : G.G **Date :** 3 November 2017

Drawing No. : E10LOU_DPFCD001_F1_02

Map Series : Page 2 of 9

Drawing Scale : 1:5,000 @A3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224400
224200
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223800
223600
LAUGHANSTOWN
Baile an Locháin
RICKMINES GREAT
aig Mhaighin Mhor
0 50 100 200 300 400 500
Metres
© Ordnance Survey Ireland. All rights reserved. Licence number EN 0021017/OfficeofPublicWorks.
Loughlinstown
IMPORTANT USER NOTE:
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Legend
0.1% Fluvial AEP Flood Depth
0 - 0.25m
0.25 - 0.5m
0.5 - 1m
1.0 - 1.5m
1.5 - 2m
>2m
Modelled River Centreline
AFA Extents
FINAL
REV:
NOTE:
DATE:
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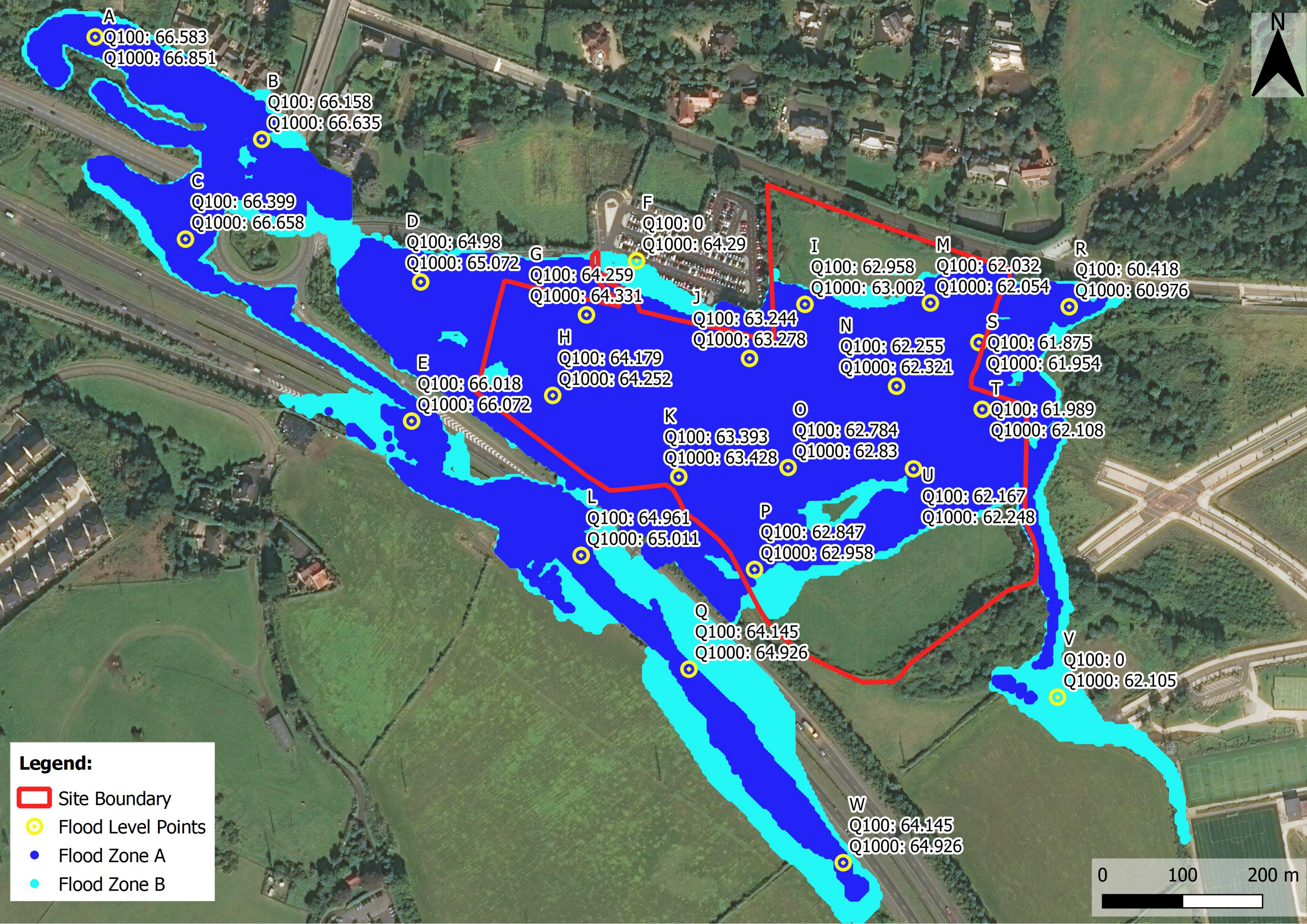
Map: Shanganagh-Carrickmines River Tidal Flood Depths
Map Type: DEPTH
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT
Drawn By : C.C. Date : 3 November 2017
Checked By : A.S. Date : 3 November 2017
Approved By : G.G Date : 3 November 2017
Drawing No. :
E10LOU_DPFCD001_F1_03
Map Series : Page 3 of 9
Drawing Scale : 1:5,000 @A3

Appendix F PUNCH Hydraulic Model Flood Risk Mapping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B
Q100: 66.158
Q1000: 66.635
C
Q100: 66.399
Q1000: 66.658
D
Q100: 64.98
Q1000: 65.072
F
Q100: 0
Q1000: 64.29
G
Q100: 64.259
Q1000: 64.331
I
Q100: 62.958
Q1000: 63.002
M
Q100: 62.032
Q1000: 62.054
R
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J
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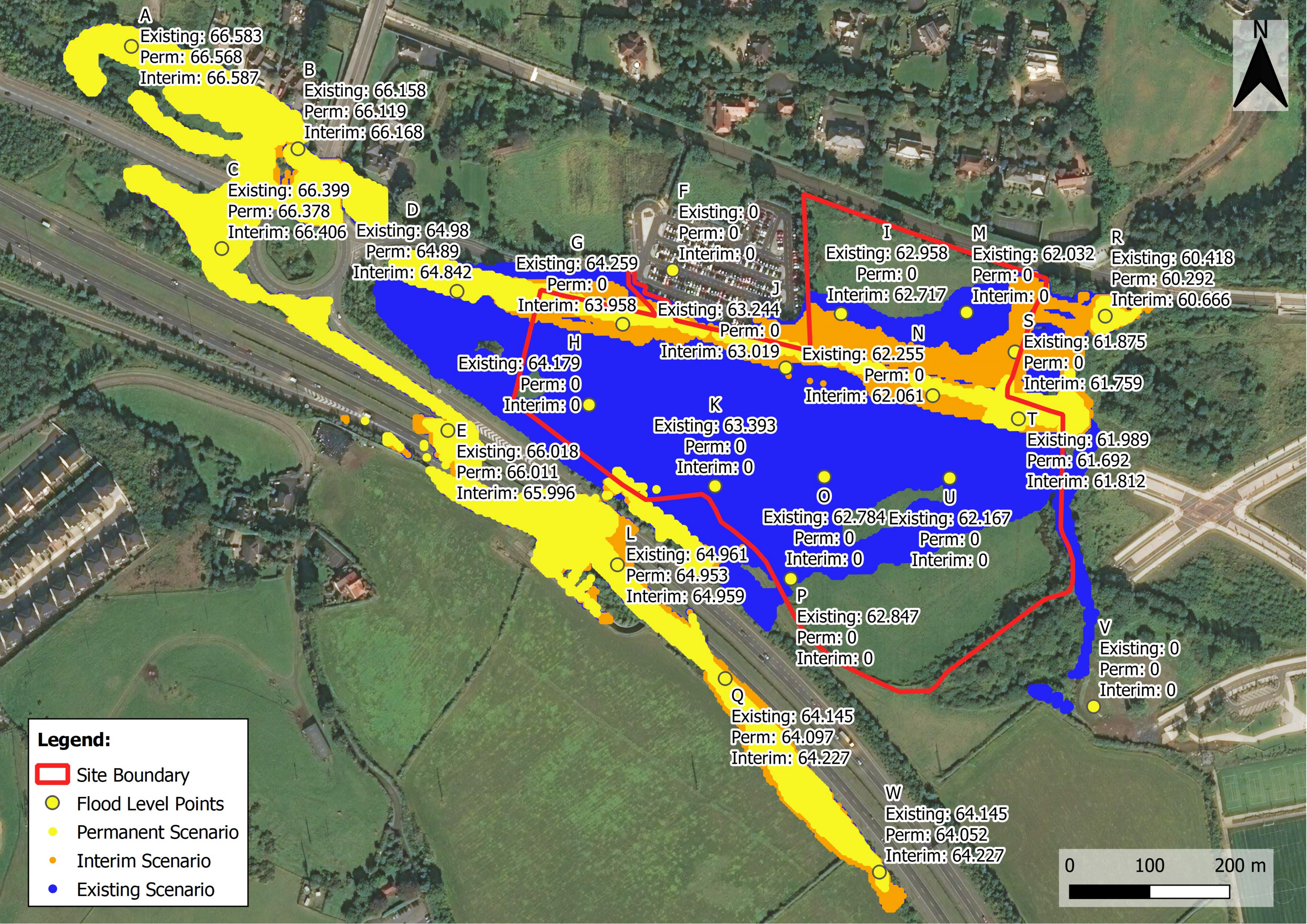
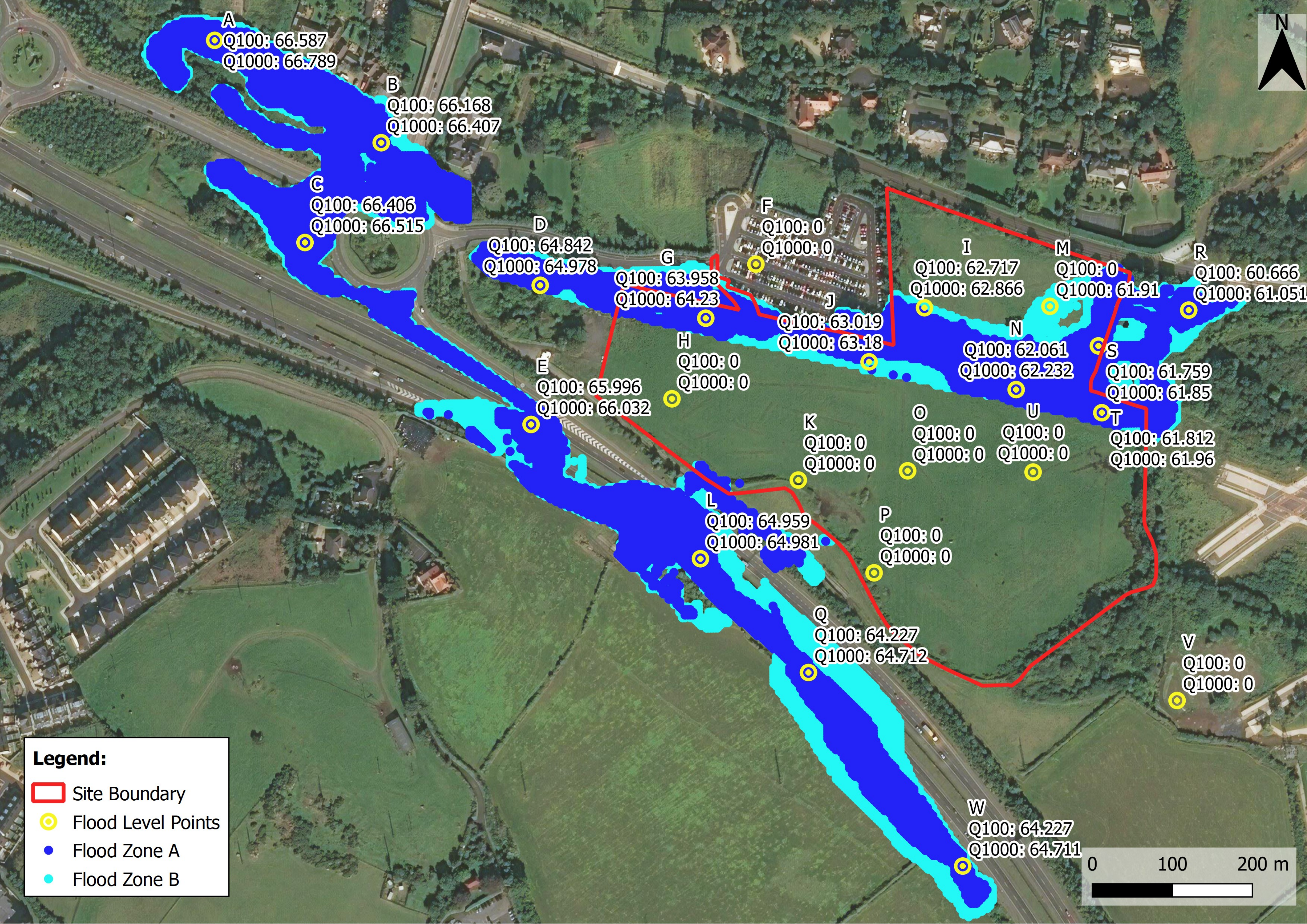
Q100: 61.989
Q1000: 62.108
K
Q100: 63.393
Q1000: 63.428
O
Q100: 62.784
Q1000: 62.83
U
Q100: 62.167
Q1000: 62.248
L
Q100: 64.961
Q1000: 65.011
P
Q100: 62.847
Q1000: 62.958
Q
Q100: 64.145
Q1000: 64.926
V
Q100: 0
Q1000: 62.105
W
Q100: 64.145
Q1000: 64.926
Legend:
Site Boundary
Flood Level Points
Flood Zone A
Flood Zone B
0
100
200 m


N
A
Existing: 66.583
Perm: 66.568
Interim: 66.587
B
Existing: 66.158
Perm: 66.119
Interim: 66.168
C
Existing: 66.399
Perm: 66.378
Interim: 66.406
D
Existing: 64.98
Perm: 64.89
Interim: 64.842
E
Existing: 66.018
Perm: 66.011
Interim: 65.996
F
Existing: 0
Perm: 0
Interim: 0
G
Existing: 64.259
Perm: 0
Interim: 63.958
H
Existing: 64.179
Perm: 0
Interim: 0
I
Existing: 62.958
Perm: 0
Interim: 62.717
J
Existing: 63.244
Perm: 0
Interim: 63.019
K
Existing: 63.393
Perm: 0
Interim: 0
L
Existing: 64.961
Perm: 64.953
Interim: 64.959
M
Existing: 62.032
Perm: 0
Interim: 0
N
Existing: 62.255
Perm: 0
Interim: 62.061
O
Existing: 62.784
Perm: 0
Interim: 0
P
Existing: 62.847
Perm: 0
Interim: 0
Q
Existing: 64.145
Perm: 64.097
Interim: 64.227
R
Existing: 60.418
Perm: 60.292
Interim: 60.666
S
Existing: 61.875
Perm: 0
Interim: 61.759
T
Existing: 61.989
Perm: 61.692
Interim: 61.812
U
Existing: 62.167
Perm: 0
Interim: 0
V
Existing: 0
Perm: 0
Interim: 0
W
Existing: 64.145
Perm: 64.052
Interim: 64.227
Legend:
Site Boundary
Flood Level Points
Permanent Scenario
Interim Scenario
Existing Scenario
0
100
200 m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A
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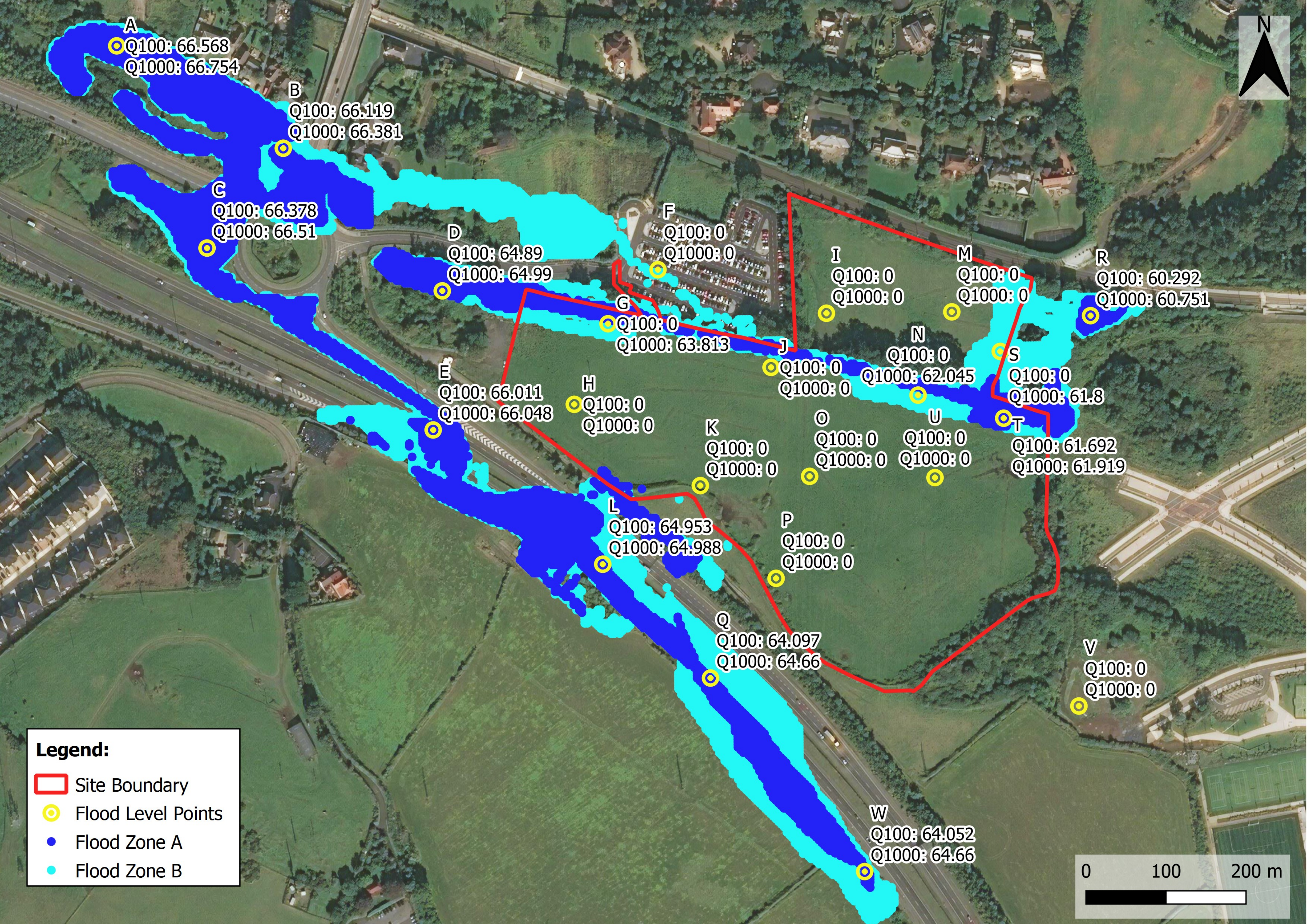
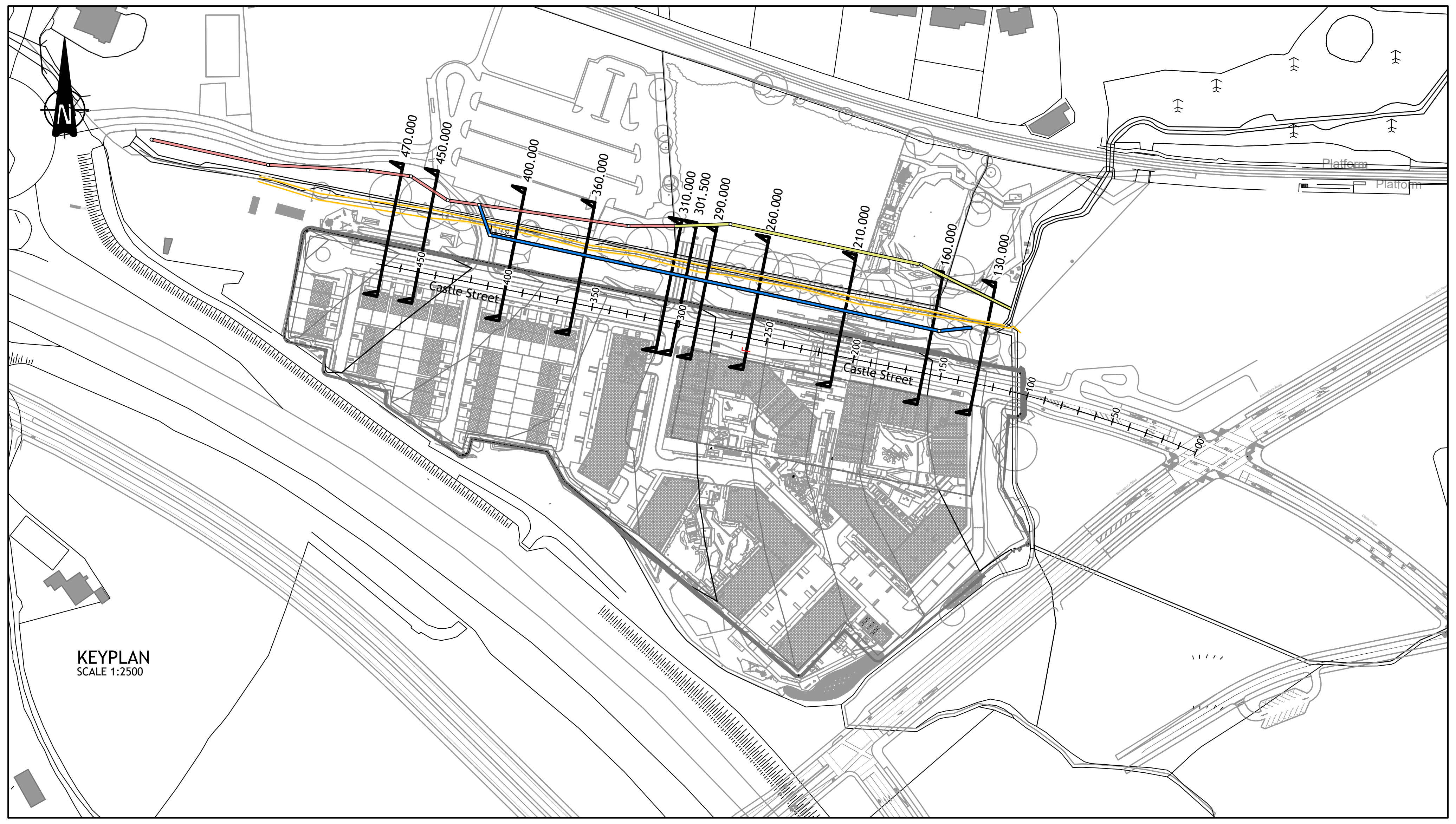
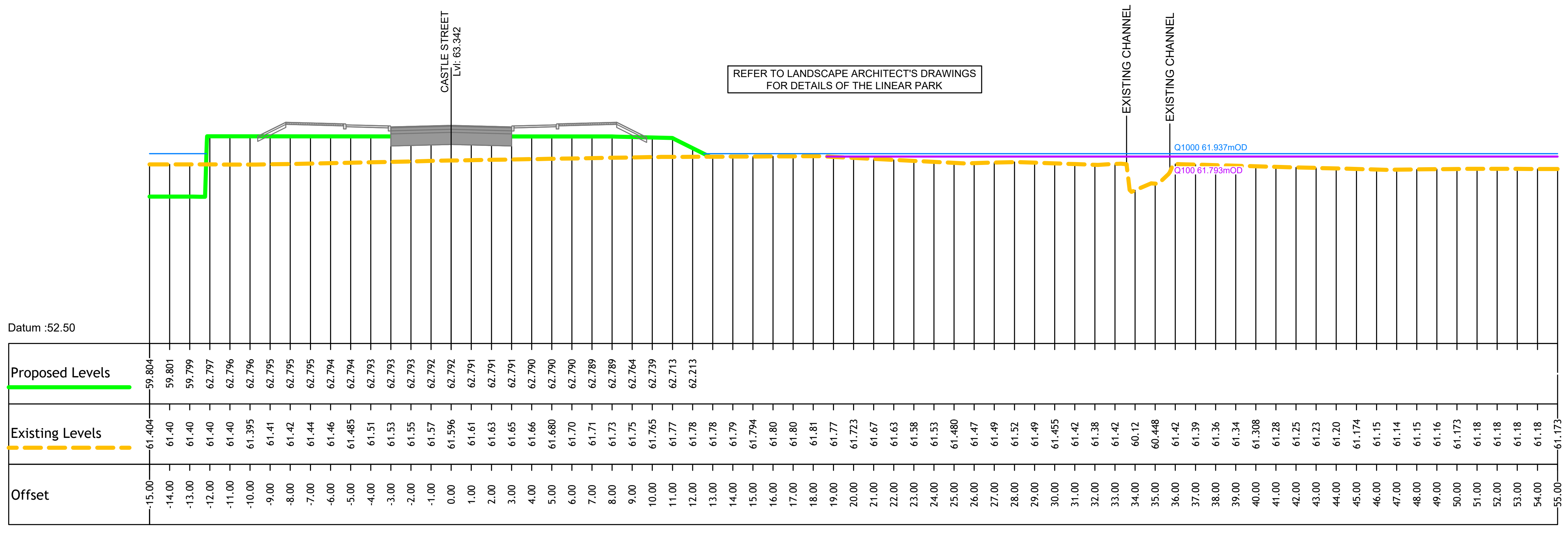
Q1000: 66.789
B
Q100: 66.168
Q1000: 66.407
C
Q100: 66.406
Q1000: 66.515
D
Q100: 64.842
Q1000: 64.978
F
Q100: 0
Q1000: 0
G
Q100: 63.958
Q1000: 64.23
I
Q100: 62.717
Q1000: 62.866
M
Q100: 0
Q1000: 61.91
R
Q100: 60.666
Q1000: 61.051
J
Q100: 63.019
Q1000: 63.18
H
Q100: 0
Q1000: 0
N
Q100: 62.061
Q1000: 62.232
S
Q100: 61.759
Q1000: 61.85
E
Q100: 65.996
Q1000: 66.032
K
Q100: 0
Q1000: 0
O
Q100: 0
Q1000: 0
U
Q100: 0
Q1000: 0
T
Q100: 61.812
Q1000: 61.96
L
Q100: 64.959
Q1000: 64.981
P
Q100: 0
Q1000: 0
Q
Q100: 64.227
Q1000: 64.712
V
Q100: 0
Q1000: 0
W
Q100: 64.227
Q1000: 64.711
0
100
200 m
Legend:
Site Boundary
Flood Level Points
Flood Zone A
Flood Zone B


N
A
Q100: 66.568
Q1000: 66.754
B
Q100: 66.119
Q1000: 66.381
C
Q100: 66.378
Q1000: 66.51
D
Q100: 64.89
Q1000: 64.99
E
Q100: 66.011
Q1000: 66.048
F
Q100: 0
Q1000: 0
G
Q100: 0
Q1000: 63.813
H
Q100: 0
Q1000: 0
I
Q100: 0
Q1000: 0
J
Q100: 0
Q1000: 0
K
Q100: 0
Q1000: 0
L
Q100: 64.953
Q1000: 64.988
M
Q100: 0
Q1000: 0
N
Q100: 0
Q1000: 62.045
O
Q100: 0
Q1000: 0
P
Q100: 0
Q1000: 0
Q
Q100: 64.097
Q1000: 64.66
R
Q100: 60.292
Q1000: 60.751
S
Q100: 0
Q1000: 61.8
T
Q100: 61.692
Q1000: 61.919
U
Q100: 0
Q1000: 0
V
Q100: 0
Q1000: 0
W
Q100: 64.052
Q1000: 64.66
Legend:
Site Boundary
Flood Level Points
Flood Zone A
Flood Zone B
0
100
200 m

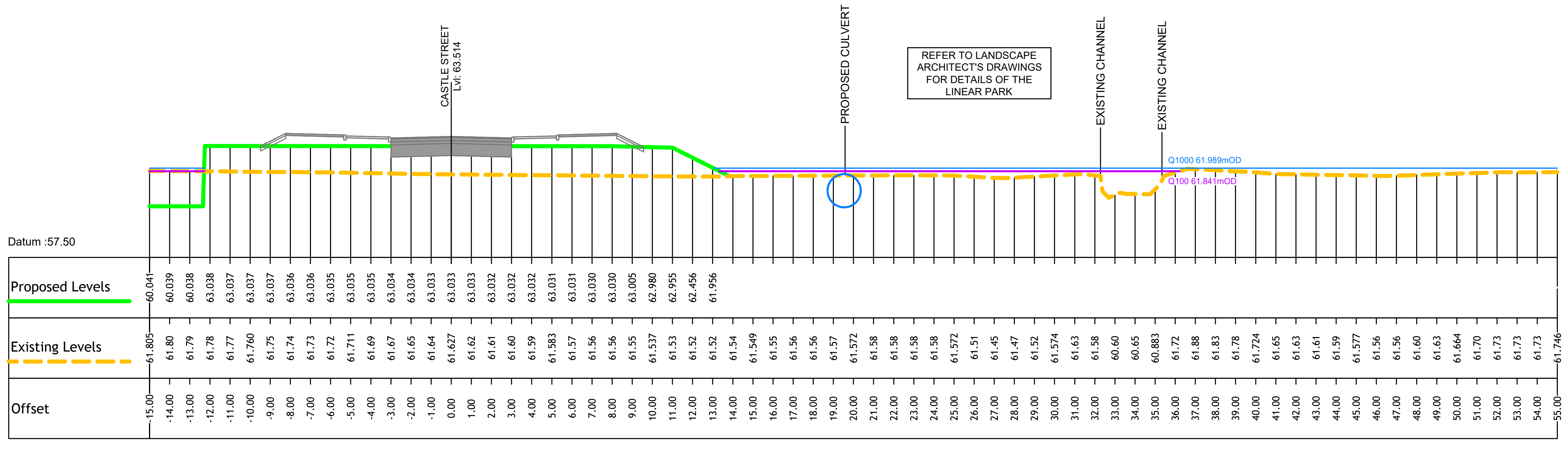
Appendix G Flood Containment Zone Sections



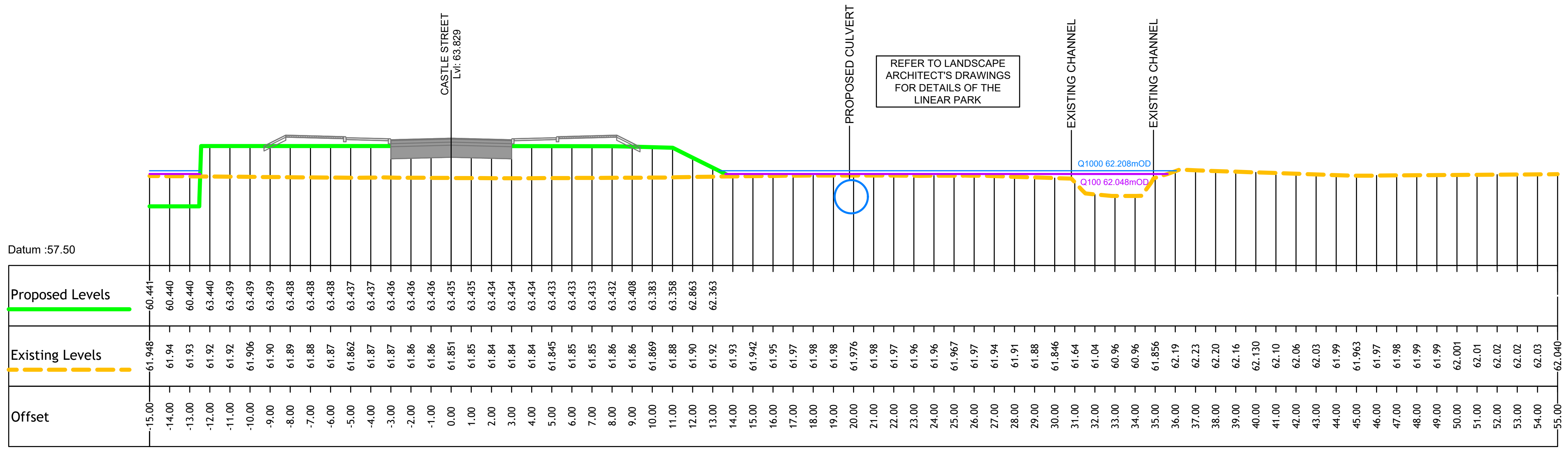
KEYPLAN
SCALE 1:2500



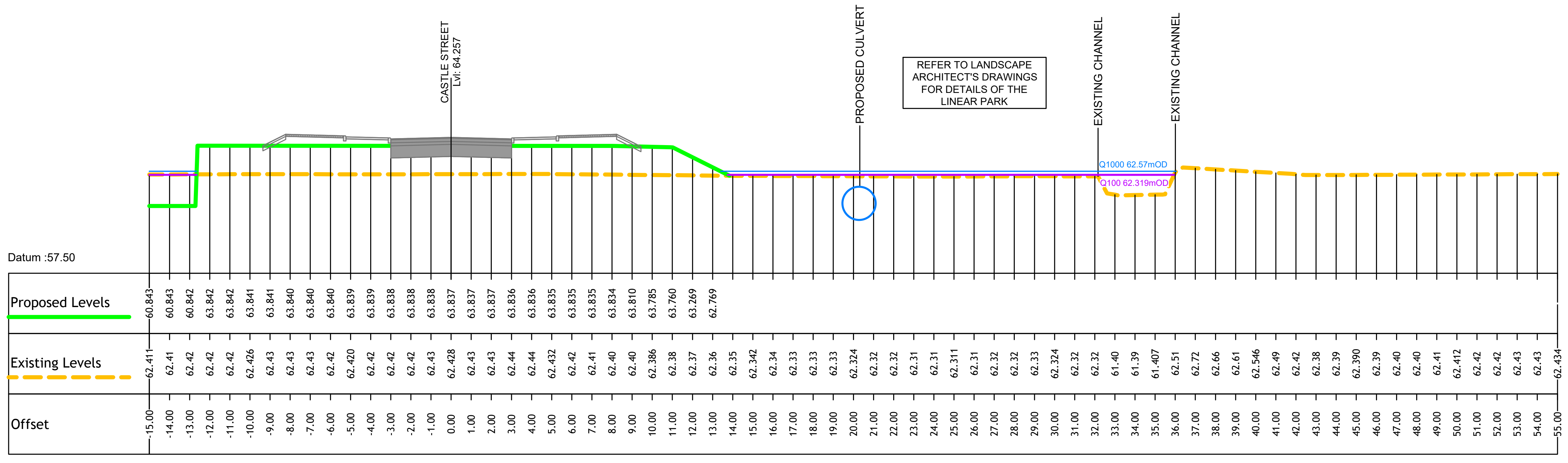
Section 130.000



Section 160.000



Section 210.000



Section 260.000

COLOUR DRAWING ☒

Date Drawn: 2018/12/03
Drawn By: KOBrien
Date Issued: 2021-03-01
Issued By: IBS

Rev	Amendment	By	Date
PL0	PLANNING ISSUE	IBS	2022/03/28

Client:
1 CARRICKMINES LAND LTD.

Job: PRIORSLAND CHERRYWOOD SHD - PERMANENT PROPOSAL
Title: CHANNEL UPGRADE WORKS SHEET 1

PUNCH consulting engineers
Dublin|Limerick|Cork|Galway|Glasgow
Carnegie House, Library Road, Dun Laoghaire, Co. Dublin, A96 C7W7
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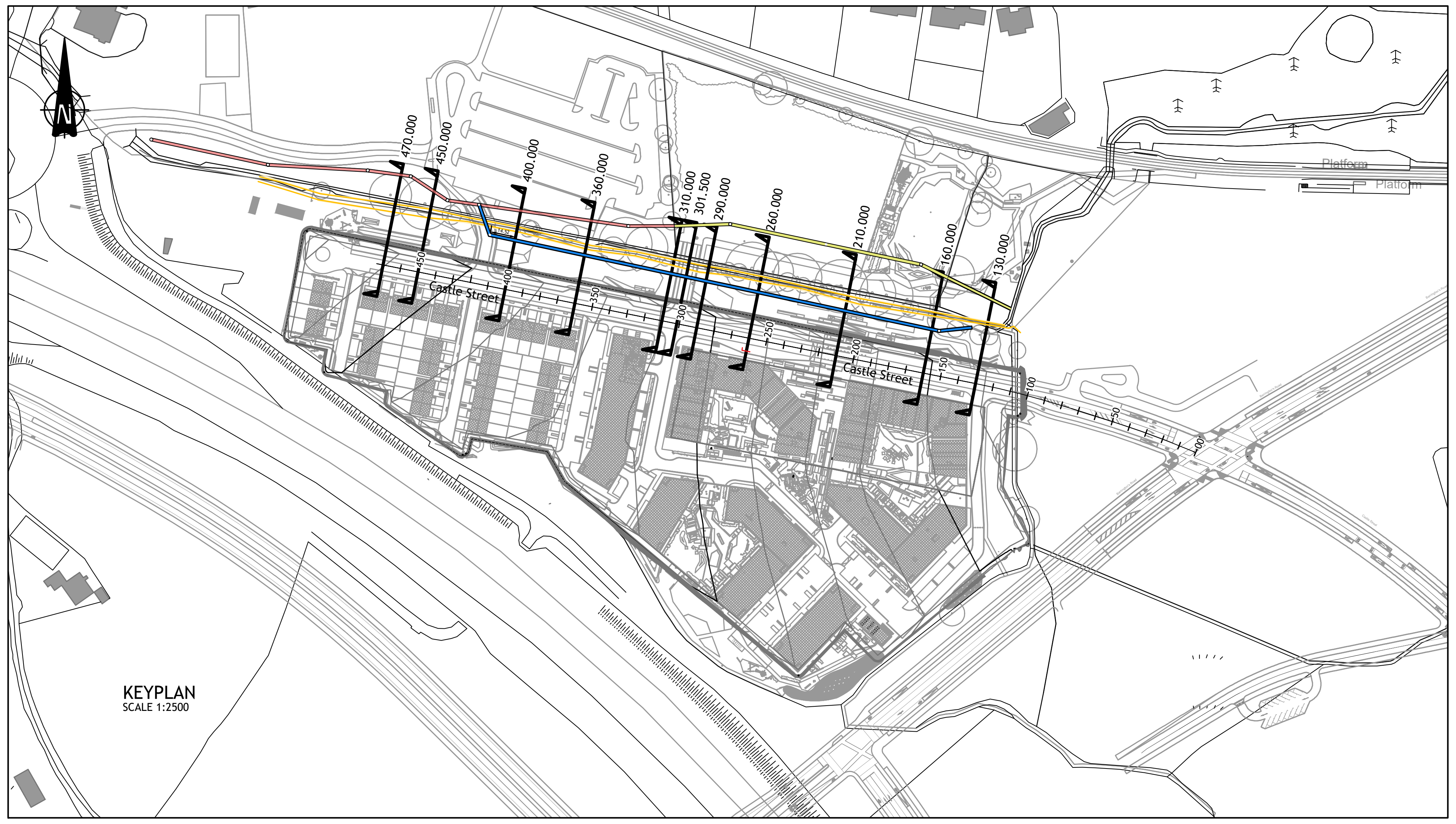
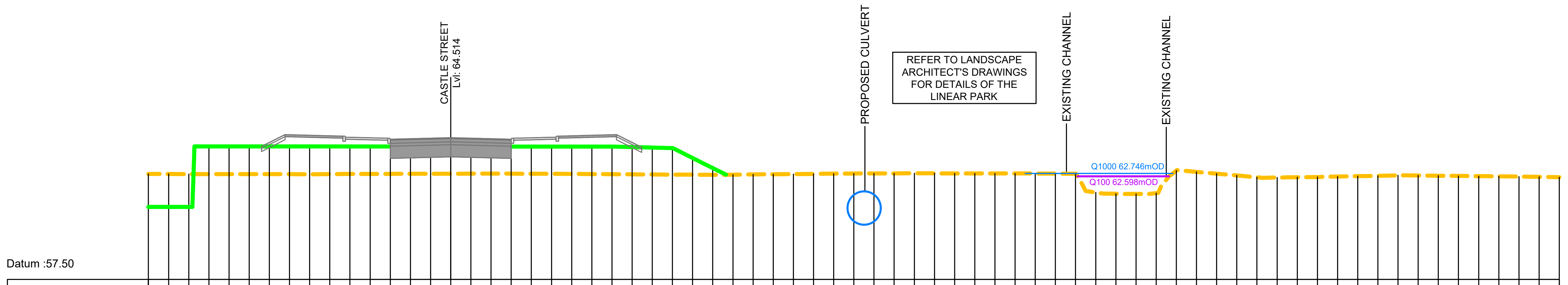
Stage: PLANNING
Scale @ A1: 1:200
Technician Check: IBS
Engineer Check: PC
Approved:
Drawing No: 182-186-035
Rev: PL0





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-12.00	64.083	62.71
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-10.00	64.082	62.711
-9.00	64.082	62.71
-8.00	64.082	62.71
-7.00	64.081	62.71
-6.00	64.081	62.71
-5.00	64.081	62.718
-4.00	64.080	62.72
-3.00	64.080	62.72
-2.00	64.079	62.73
-1.00	64.079	62.73
0.00	64.079	62.731
1.00	64.078	62.73
2.00	64.078	62.74
3.00	64.078	62.73
4.00	64.077	62.73
5.00	64.077	62.728
6.00	64.076	62.72
7.00	64.076	62.71
8.00	64.076	62.71
9.00	64.051	62.70
10.00	64.026	62.695
11.00	64.001	62.69
12.00	63.513	62.68
13.00	63.013	62.68
14.00		62.69
15.00		62.695
16.00		62.70
17.00		62.71
18.00		62.72
19.00		62.73
20.00		62.741
21.00		62.74
22.00		62.75
23.00		62.75
24.00		62.75
25.00		62.750
26.00		62.75
27.00		62.75
28.00		62.75
29.00		62.74
30.00		62.735
31.00		62.73
32.00		61.80
33.00		61.74
34.00		61.73
35.00		61.768
36.00		62.89
37.00		62.82
38.00		62.73
39.00		62.65
40.00		62.556
41.00		62.54
42.00		62.56
43.00		62.57
44.00		62.59
45.00		62.609
46.00		62.63
47.00		62.65
48.00		62.64
49.00		62.63
50.00		62.623
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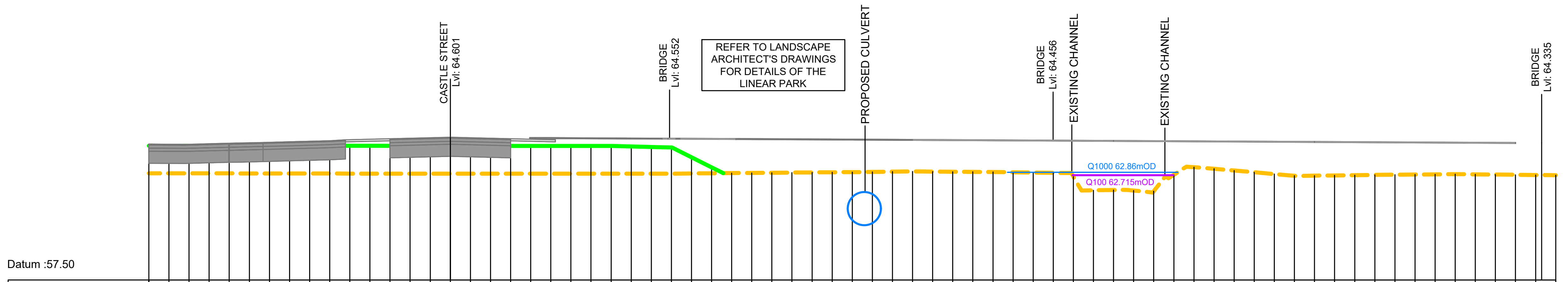
55.00		62.561

Section 290.000



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-14.00	64.176	62.80
-13.00	64.176	62.81
-12.00	64.176	62.80
-11.00	64.175	62.80
-10.00	64.175	62.800
-9.00	64.175	62.80
-8.00	64.174	62.80
-7.00	64.174	62.80
-6.00	64.173	62.79
-5.00	64.173	62.792
-4.00	64.173	62.79
-3.00	64.172	62.79
-2.00	64.172	62.79
-1.00	64.172	62.79
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1.00	64.171	62.79
2.00	64.170	62.79
3.00	64.170	62.79
4.00	64.170	62.79
5.00	64.169	62.790
6.00	64.169	62.79
7.00	64.169	62.79
8.00	64.168	62.79
9.00	64.144	62.79
10.00	64.119	62.791
11.00	64.094	62.79
12.00	63.606	62.80
13.00	63.106	62.81
14.00		62.82
15.00		62.826
16.00		62.83
17.00		62.84
18.00		62.85
19.00		62.86
20.00		62.864
21.00		62.88
22.00		62.89
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24.00		62.89
25.00		62.884
26.00		62.88
27.00		62.87
28.00		62.86
29.00		62.84
30.00		62.830
31.00		62.64
32.00		61.96
33.00		61.98
34.00		61.95
35.00		61.917
36.00		62.73
37.00		63.11
38.00		63.03
39.00		62.94
40.00		62.857
41.00		62.77
42.00		62.68
43.00		62.69
44.00		62.70
45.00		62.714
46.00		62.73
47.00		62.74
48.00		62.74
49.00		62.75
50.00		62.763
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52.00		62.74
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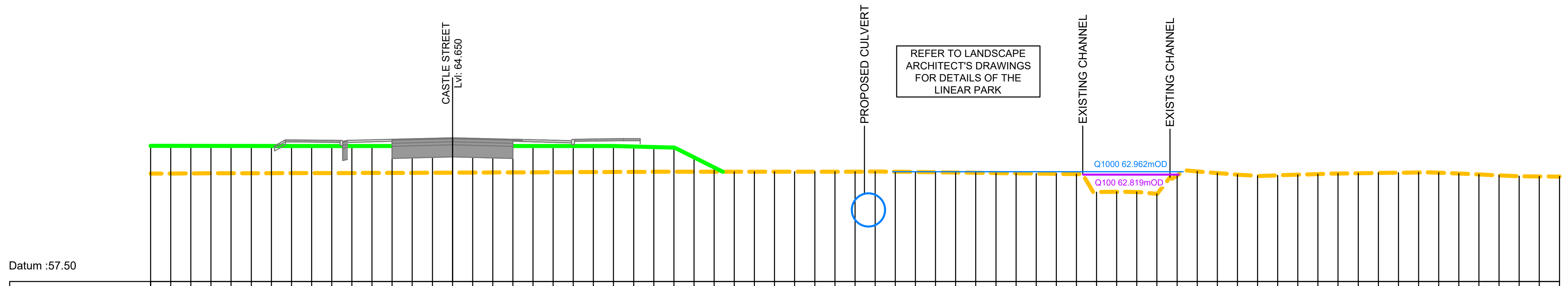
54.00		62.72
55.00		62.712

Section 301.5



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-13.00	64.244	62.88
-12.00	64.244	62.88
-11.00	64.244	62.88
-10.00	64.243	62.886
-9.00	64.243	62.89
-8.00	64.242	62.89
-7.00	64.242	62.89
-6.00	64.242	62.89
-5.00	64.241	62.897
-4.00	64.241	62.90
-3.00	64.241	62.90
-2.00	64.240	62.91
-1.00	64.240	62.91
0.00	64.239	62.913
1.00	64.239	62.92
2.00	64.239	62.92
3.00	64.238	62.93
4.00	64.238	62.93
5.00	64.238	62.935
6.00	64.237	62.94
7.00	64.237	62.94
8.00	64.236	62.95
9.00	64.212	62.95
10.00	64.187	62.958
11.00	64.162	62.96
12.00	63.675	62.96
13.00	63.175	62.96
14.00		62.96
15.00		62.961
16.00		62.96
17.00		62.96
18.00		62.96
19.00		62.96
20.00		62.965
21.00		62.97
22.00		62.96
23.00		62.95
24.00		62.94
25.00		62.922
26.00		62.91
27.00		62.90
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33.00		61.96
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35.00		61.860
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45.00		62.886
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48.00		62.92
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50.00		62.868
51.00		62.82
52.00		62.78
53.00		62.74
54.00		62.73
55.00		62.722

Section 310.000

COLOUR DRAWING ☒

Date Drawn: 2019-01-22
Drawn By: T. Hanley
Date Issued: 2021-03-01
Issued By: IBS

BM TRADA ISO 14001 · BM TRADA ISO 9001 · BM TRADA OHSAS 18001

Rev	Amendment	By	Date
PL0	PLANNING ISSUE	IBS	2022/03/28

Client:
1 CARRICKMINES LAND LTD.

Job: PRIORSLAND CHERRYWOOD SHD - PERMANENT PROPOSAL
Title: CHANNEL UPGRADE WORKS SHEET 2

PUNCH consulting engineers
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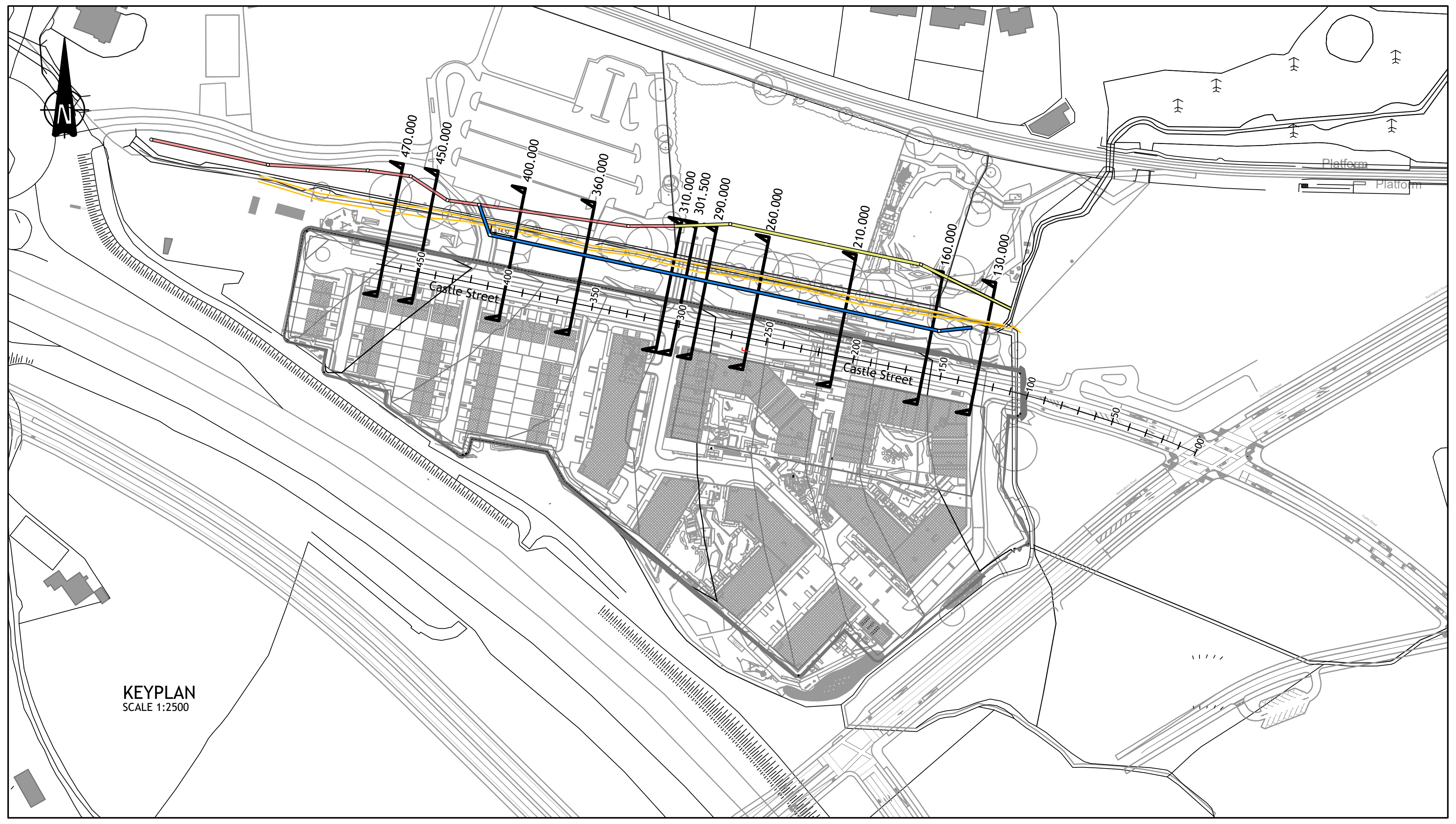
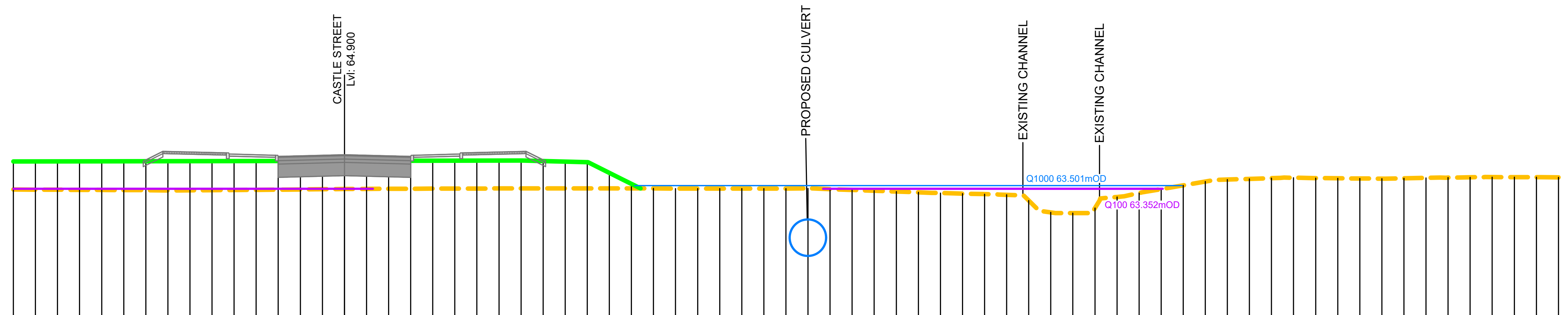
Stage: PLANNING
Scale @ A1: 1:200
Technician Check:
Engineer Check:
Approved:
Drawing No: 182-186-036
Rev: PL0



KEYPLAN
SCALE 1:2500



Datum :57.50

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-13.00	64.597	63.31
-12.00	64.599	63.31
-11.00	64.601	63.30
-10.00	64.603	63.299
-9.00	64.604	63.29
-8.00	64.606	63.28
-7.00	64.608	63.29
-6.00	64.609	63.29
-5.00	64.611	63.299
-4.00	64.613	63.31
-3.00	64.615	63.32
-2.00	64.616	63.33
-1.00	64.618	63.33
0.00	64.620	63.344
1.00	64.622	63.35
2.00	64.623	63.35
3.00	64.625	63.36
4.00	64.627	63.36
5.00	64.629	63.366
6.00	64.630	63.37
7.00	64.632	63.37
8.00	64.634	63.37
9.00	64.610	63.37
10.00	64.585	63.374
11.00	64.560	63.38
12.00	64.077	63.38
13.00	63.577	63.37
14.00		63.37
15.00		63.368
16.00		63.36
17.00		63.36
18.00		63.36
19.00		63.37
20.00		63.368
21.00		63.37
22.00		63.34
23.00		63.30
24.00		63.27
25.00		63.232
26.00		63.20
27.00		63.16
28.00		63.14
29.00		63.11
30.00		63.081
31.00		62.83
32.00		62.29
33.00		62.26
34.00		62.48
35.00		62.987
36.00		63.16
37.00		63.34
38.00		63.51
39.00		63.68
40.00		63.773
41.00		63.80
42.00		63.84
43.00		63.85
44.00		63.84
45.00		63.832
46.00		63.82
47.00		63.81
48.00		63.83
49.00		63.85
50.00		63.860
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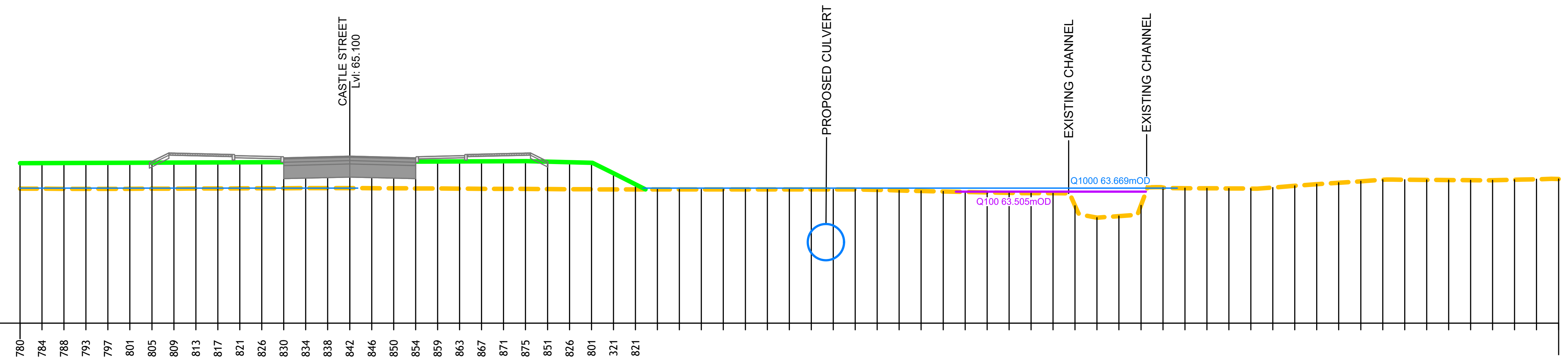
Section 360.000



Datum :57.50

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-13.00	64.788	63.62
-12.00	64.793	63.61
-11.00	64.797	63.61
-10.00	64.801	63.617
-9.00	64.805	63.62
-8.00	64.809	63.62
-7.00	64.813	63.63
-6.00	64.817	63.63
-5.00	64.821	63.636
-4.00	64.826	63.64
-3.00	64.830	63.64
-2.00	64.834	63.64
-1.00	64.838	63.65
0.00	64.842	63.647
1.00	64.846	63.64
2.00	64.850	63.64
3.00	64.854	63.63
4.00	64.859	63.63
5.00	64.863	63.623
6.00	64.867	63.62
7.00	64.871	63.61
8.00	64.875	63.61
9.00	64.851	63.60
10.00	64.826	63.598
11.00	64.801	63.59
12.00	64.321	63.59
13.00	63.821	63.59
14.00		63.59
15.00		63.591
16.00		63.59
17.00		63.59
18.00		63.59
19.00		63.59
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23.00		63.58
24.00		63.56
25.00		63.541
26.00		63.52
27.00		63.50
28.00		63.47
29.00		63.45
30.00		63.429
31.00		63.42
32.00		63.41
33.00		62.85
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35.00		62.374
36.00		62.86
37.00		63.68
38.00		63.64
39.00		63.64
40.00		63.631
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42.00		63.67
43.00		63.75
44.00		63.82
45.00		63.891
46.00		63.96
47.00		64.03
48.00		64.03
49.00		64.02
50.00		64.014
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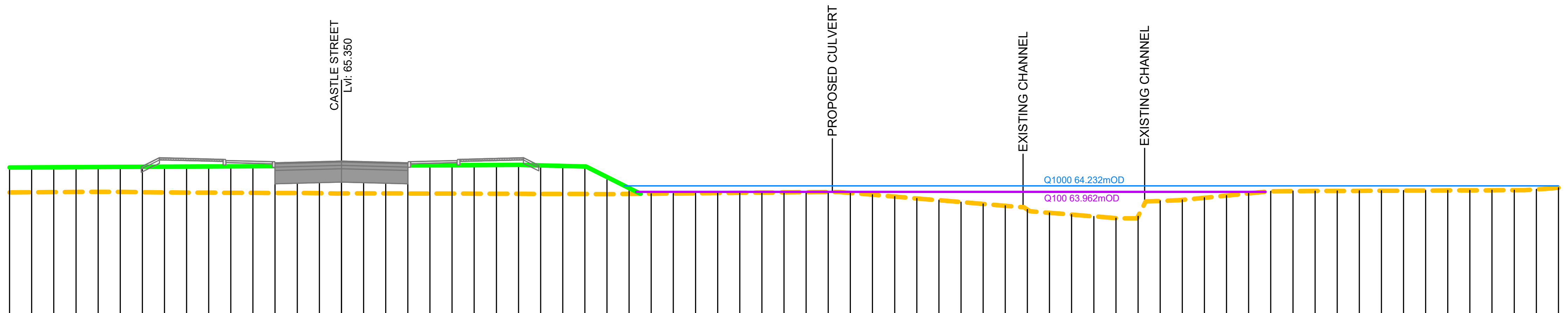
54.00		64.05
55.00		64.061

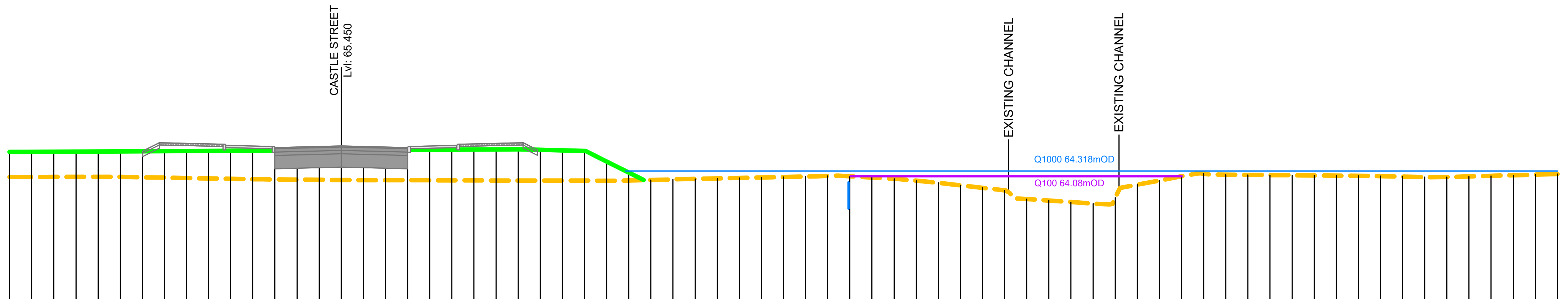
Section 400.000



Datum :57.50

Offset	Proposed Levels	Existing Levels
-15.00	65.057	63.934
-14.00	65.062	63.94
-13.00	65.067	63.95
-12.00	65.073	63.96
-11.00	65.078	63.96
-10.00	65.083	63.955
-9.00	65.088	63.95
-8.00	65.093	63.94
-7.00	65.099	63.93
-6.00	65.104	63.92
-5.00	65.109	63.919
-4.00	65.114	63.91
-3.00	65.119	63.91
-2.00	65.125	63.91
-1.00	65.130	63.90
0.00	65.135	63.888
1.00	65.140	63.89
2.00	65.145	63.89
3.00	65.151	63.89
4.00	65.156	63.88
5.00	65.161	63.881
6.00	65.166	63.88
7.00	65.171	63.88
8.00	65.176	63.87
9.00	65.153	63.87
10.00	65.128	63.866
11.00	65.103	63.86
12.00	64.627	63.86
13.00	64.127	63.87
14.00		63.88
15.00		63.886
16.00		63.90
17.00		63.91
18.00		63.92
19.00		63.92
20.00		63.933
21.00		63.94
22.00		63.95
23.00		63.91
24.00		63.83
25.00		63.746
26.00		63.66
27.00		63.58
28.00		63.50
29.00		63.42
30.00		63.333
31.00		63.16
32.00		63.01
33.00		62.93
34.00		62.85
35.00		62.774
36.00		62.86
37.00		63.55
38.00		63.60
39.00		63.70
40.00		63.791
41.00		63.89
42.00		63.98
43.00		63.99
44.00		64.00
45.00		64.003
46.00		64.01
47.00		64.01
48.00		64.02
49.00		64.02
50.00		64.024
51.00		64.03
52.00		64.03
53.00		64.04
54.00		64.07
55.00		64.147

Section 450.000



Datum :57.50

Offset	Proposed Levels	Existing Levels
-12.67	65.182	64.048
-12.67	65.187	64.05
-12.67	65.192	64.05
-12.00	65.197	64.05
-11.00	65.202	64.06
-10.00	65.207	64.055
-9.00	65.212	64.04
-8.00	65.217	64.02
-7.00	65.222	64.00
-6.00	65.227	63.99
-5.00	65.232	63.968
-4.00	65.237	63.95
-3.00	65.242	63.94
-2.00	65.247	63.93
-1.00	65.252	63.92
0.00	65.257	63.913
1.00	65.262	63.91
2.00	65.267	63.91
3.00	65.272	63.90
4.00	65.277	63.90
5.00	65.282	63.898
6.00	65.287	63.90
7.00	65.292	63.89
8.00	65.297	63.89
9.00	65.274	63.88
10.00	65.249	63.884
11.00	65.224	63.88
12.00	64.749	63.88
13.00	64.249	63.89
14.00		63.92
15.00		63.939
16.00		63.96
17.00		63.98
18.00		64.00
19.00		64.03
20.00		64.049
21.00		64.07
22.00		64.10
23.00		64.08
24.00		64.02
25.00		63.968
26.00		63.88
27.00		63.78
28.00		63.67
29.00		63.56
30.00		63.447
31.00		63.05
32.00		62.99
33.00		62.92
34.00		62.85
35.00		63.121
36.00		63.70
37.00		63.89
38.00		64.08
39.00		64.20
40.00		64.152
41.00		64.14
42.00		64.14
43.00		64.13
44.00		64.12
45.00		64.111
46.00		64.10
47.00		64.09
48.00		64.07
49.00		64.04
50.00		64.048
51.00		64.08
52.00		64.10
53.00		64.13
54.00		64.15
55.00		64.181

Section 470.000

COLOUR DRAWING ☒

Date Drawn: 2019-01-22
Drawn By: T. Hanley
Date Issued: 2021-03-01
Issued By: IBS

Rev	Amendment	By	Date
PL0	PLANNING ISSUE	IBS	2022/03/28

Client:

1 CARRICKMINES LAND LTD.

Job: PRIORSLAND CHERRYWOOD SHD - PERMANENT PROPOSAL
Title: CHANNEL UPGRADE WORKS SHEET 3

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Stage: PLANNING
Scale @ A1: 1:200
Technician Check:
Engineer Check:
Approved:
Drawing No: 182-186-037
Rev: PL0