Project

White Pines East Residential Development, Stocking Avenue, Dublin 16.

Report Title

Site Specific Flood Risk Assessment

Client

Ardstone Homes Limited

INFRASTRUCTURE

DBFL CONSULTING ENGINEERS

March 2021

Document Control

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A	Feb 2021	ABP submission	SB	BK	
B	Mar 2021	ABP submission	SB	BK	

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1.0 INTRODUCTION

1.1 Background

DBFL Consulting Engineers have been instructed to prepare a Site Specific Flood Risk Assessment (SSFRA) to support a planning application for a proposed residential development at lands north of Stocking Avenue, Dublin 16.

The proposed development ("the site") comprises of 241 No. residential units, residential tenant amenity space (reception area, games space, residents lounge and gym) and dedicated community space on a 2.98 Ha site.

The proposed site layout is shown on John Fleming Architects Drawing WPE-JFA-SP-00-DR-A-P1002.

This SSFRA should be read in conjunction with DBFL's Infrastructure Design Report (190230-rep-001).

1.2 Objectives

The objectives of this report are to inform the planning authority in relation to flood risk associated with the site.

The report will assess the site in accordance the requirements of "The Planning System and Flood Risk Management, Guidelines for Planning Authorities" and its Technical Appendices (Office of Public Works, November 2009).

This flood risk assessment will outline the following;

- Information to allow an informed decision by the planning authority in relation to flood risk
- The site's flood zone category
- Appropriate flood risk mitigation and management measures for any residual flood risk

1.3 Flood Risk Assessment Scope

This SSFRA relates only to the proposed development lands at Stocking Avenue, Dublin 16 and its immediate surroundings.

This SSFRA uses information obtained from various sources in order to carry out an assessment of flood risk for the existing land and proposed development.

1.4 Approach

Section 2.0 of this SSFRA considers "The Planning System and Flood Risk Management, Guidelines for Planning Authorities" and its Technical Appendices as they relate to the site.

Flood risk identification is presented in Section 3.0, an initial flood risk assessment is carried out in Section 4.0, while a more detailed flood risk assessment is presented in Section 5.0.

Conclusions and recommendations are outlined in Section 6.0.

1.5 Existing Site

The site, which is currently undeveloped, is located immediately to the east of the White Pine North development (recently completed by Ardstone Homes Limited, see Figure 1.1 below). The M50 motorway is located to the north of the site and Stocking Avenue runs along the site's southern boundary. An existing dwelling ("Green Acres House") and associated lands are located to the east of the site.

The site falls from its southern boundary (adjacent to Stocking Avenue) towards its northern boundary (adjacent to the M50 motorway). Surface gradient immediately adjacent to Stocking Avenue are relatively steep (typically 1v:10h). Elsewhere, over the majority of the site and on approach to the northern boundary, surface gradients moderate somewhat (typically 1v:30h).

Existing topographic survey information is shown in the background of the Proposed Roads Layout Plan (refer to DBFL Drawing No. 190230-DBFL-RD-SP-DR-C-1001).

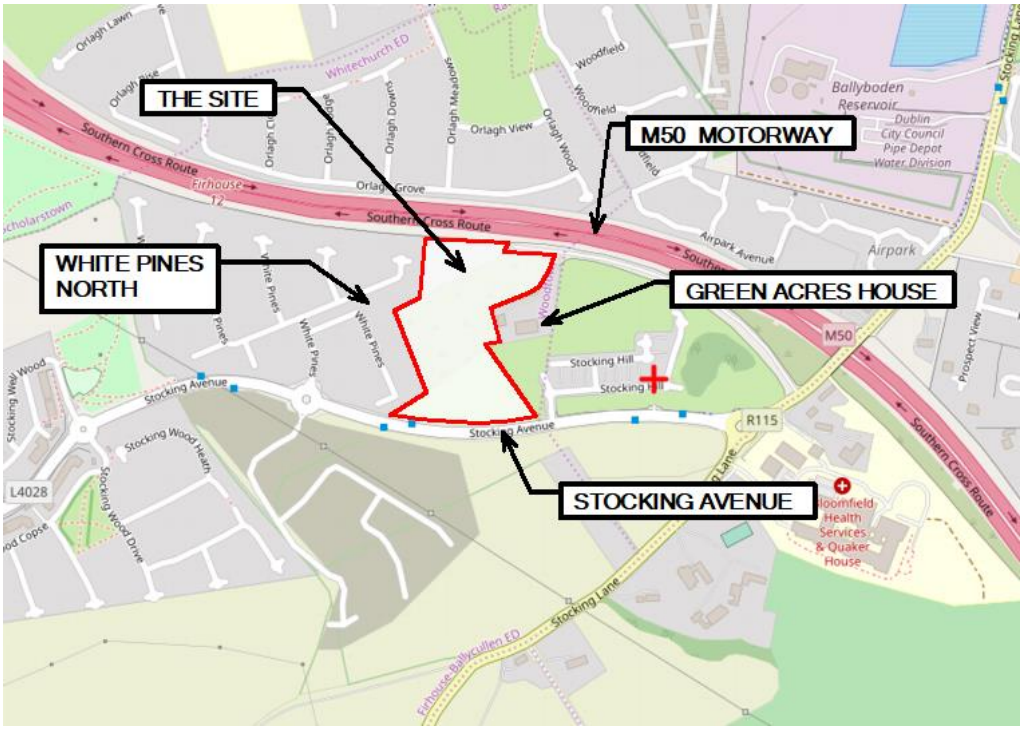

Figure 1.1 Site Location – Extract from EPA Map viewer (Site Boundary Indicative Only).

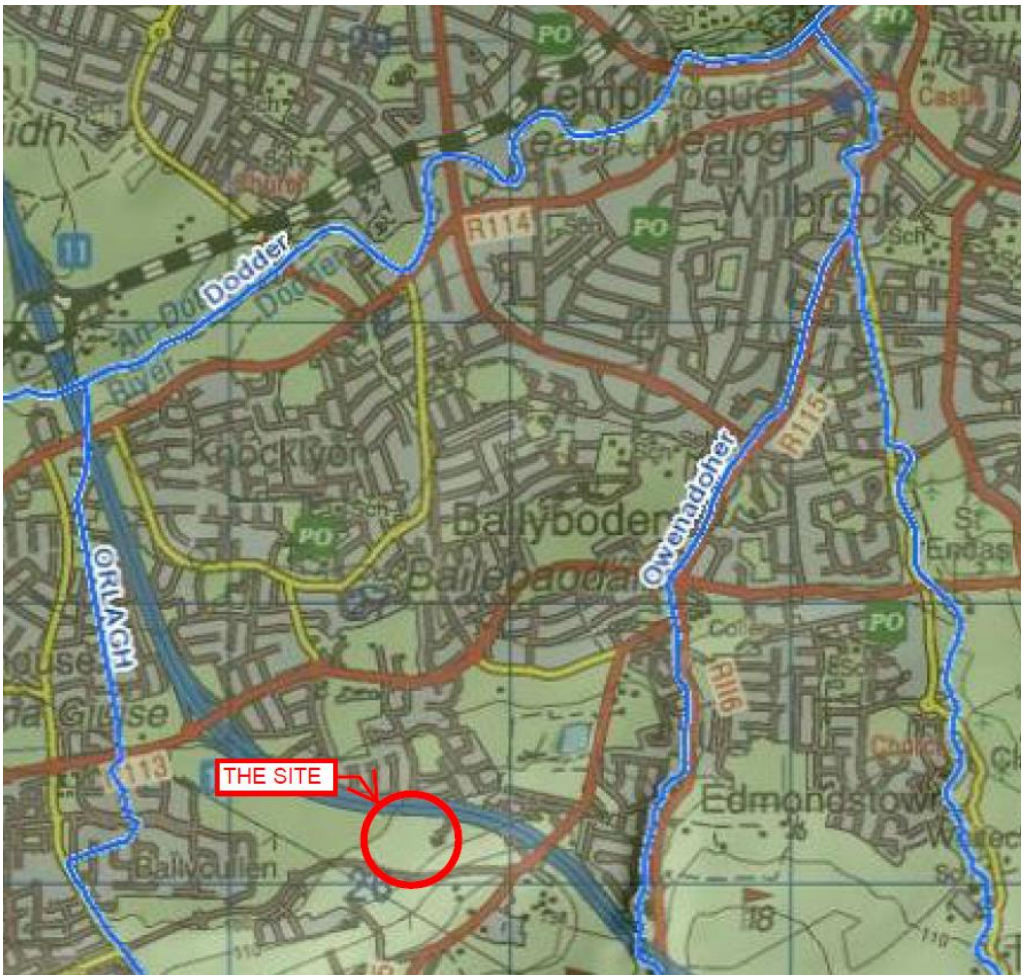

Figure 1.2 Existing Watercourses – Extract from EPA Online Mapping Service

1.6 Proposed Development

The proposed development ("the site") comprises of 241 No. residential units, residential tenant amenity space (reception area, games space, residents lounge and gym) and dedicated community space on a 2.98 Ha site (refer to John Fleming Architects Schedule of Accommodation and Site Layout Plans for further detail).

The proposed development will also include the following associated engineering infrastructure:

- Provision of internal site roads including associated footpaths and access for vehicles and pedestrians from Stocking Avenue (primary access) and White Pines North (secondary access).

  Refer to DBFL Drawings 190230-DBFL-RD-SP-DR-C-1001.

- Provision of surface water drainage, foul drainage and water supply infrastructure.

  Refer to DBFL Drawings 190230-DBFL-CS-SP-DR-C-1001 and 190230-DBFL-WM-SP-DR-C-1001.

2.0 PLANNING SYSTEM FLOOD RISK MANAGEMENT GUIDELINES

2.1 General

The Planning System and Flood Risk Management, Guidelines for Planning Authorities" and its Technical Appendices outline the requirements for a Site Specific Flood Risk Assessment.

Table 3.1 of the guidelines classify "dwelling houses" as "highly vulnerable development".

Table 3.2 of the guidelines indicates that "highly vulnerable development" are classified as "appropriate" once located in Flood Zone C i.e. where probability of flooding from rivers is low (less than 0.1% AEP or 1 in 1,000 year).

If a "highly vulnerable development" is to be located in Flood Zone A or Flood Zone B a Justification Test is required.

2.2 Sequential Approach

This SSFRA will initially use existing flood risk information to determine the flood zone category of the site i.e. to determine whether the development is considered appropriate or whether a justification test is required (see Figure 2.1 below).

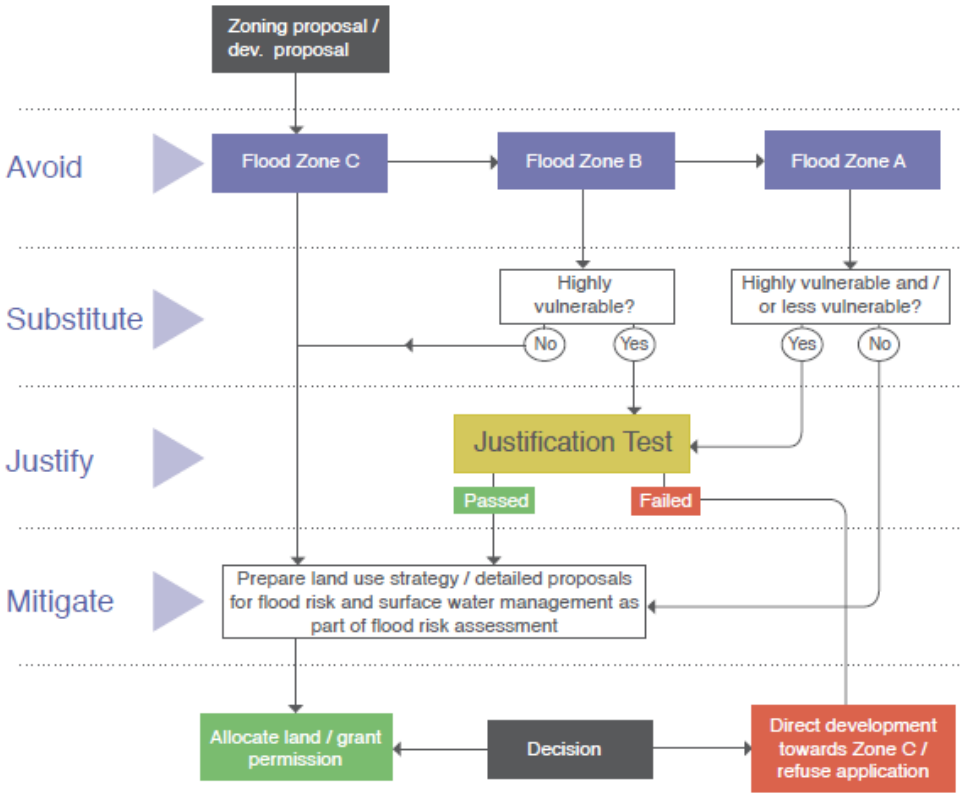

Figure 2.1 – Extract from The Planning System and Flood Risk Management Guidelines (*Fig. 3.2: Sequential Approach Mechanism in the Planning Process*)

2.3 Flood Risk Assessment Stages

The stages of a Flood Risk Assessment as defined by "The Planning System and Flood Risk Management, Guidelines for Planning Authorities" and its Technical Appendices are as follows:

- Stage 1 – Flood Risk Identification
- Stage 2 – Initial Flood Risk Assessment
- Stage 3 – Detailed Flood Risk Assessment

The following sections of this SSFRA follows this approach.

3.0 STAGE 1 – FLOOD RISK ASSESSMENT

3.1 General

The flood risk identification stage uses existing information to identify whether there may be any flooding or surface water management issues related to the site that may require further investigation.

3.2 Information Sources

Information sources consulted for the identification exercise are outlined in Table 3.1 below.

Information Source	Comments
Predictive and historic flood maps, and Benefiting Lands Maps, such as those at www.floods.ie and www.floodinfo.ie;	Information obtained (and reviewed) from www.floods.ie & www.floodinfo.ie (OPW websites)
Predictive flood maps produced under CFRAM Studies;	Information obtained (and reviewed) from *www.cfram.ie* (Dodder CFRAMS), fluvial flood depth, fluvial flood extents etc.
Previous Strategic Flood Risk Assessments;	Eastern CFRAM Study consulted.
Topographical maps, in particular digital elevation models produced by aerial survey or ground survey techniques;	Site topographic survey undertaken
Information on flood defence condition and performance;	No flood defences identified in the Eastern CFRAM Study in the vicinity of the site.
Alluvial deposit maps of the Geological Survey of Ireland (which would allow the potential for the implementation of source control and infiltration techniques and for groundwater and overland flood risk to be assessed).	GSI maps consulted.
Walkover survey to assess potential sources of flooding, likely routes for flood waters and the site's key features, including flood defences, and their condition;	Walkover survey carried out.
'Liable to flood' markings on the old '6 Inch' maps;	Historic OSI maps consulted.
Trial Pit Logs from Site Investigations	GII carried out site investigation in March 2020

Table 3.1 - Information Sources Consulted

3.2.1 OPW National Flood Hazard Mapping and Benefitting Lands Mapping

OPW's Summary Local Area Report is included in Appendix A (Flood Hazard Information). This report is sourced from the OPW website (www.floodmaps.ie) and summarises all flood events within 2.5 km of the site.

No flood events are noted in the immediate vicinity of the site. Also, no benefitting lands are identified in the vicinity of the site.

Note: Benefiting lands are lands that might benefit from implementation of a major drainage scheme or lands subject to flooding or poor drainage.

3.2.2 Dodder Catchment Flood Risk Assessment and Management Study

Extracts from the Dodder Catchment Flood Risk Assessment and Management Study are included in Appendix A (Flood Hazard Information) which indicates the extent of fluvial flooding in the vicinity of the site.

No Fluvial flooding in indicated in the vicinity of the site.

3.2.3 Other Sources

Other information sources were consulted to determine if there was any additional flood risk to the site including:

- Topographical surveys of the area – the site is significantly elevated above the predicated 0.1% APE fluvial flood event as shown in the Dodder Catchment Flood Risk Assessment and Management Study Maps (refer to Appendix A).
- Soils data from the GSI – no alluvium deposits within the site boundary.
- Groundwater information from GSI – no groundwater wells or springs are identified within the site.
- 6 inch OSI Map – no evidence of flooding or marsh areas shown within the site.
- Ground Investigation Ireland carried excavated 10 No. trial pits and at the site in March 2020 (depths ranging from 2.0m to 3.0m). Seepage was observed at six of the ten trial pit locations at depths of 0.9m and 2.8m below existing ground level.

- Walkover survey – An existing open drain is located along a portion of the site's eastern boundary. (refer to Figure 3.1). This appears to be a dry ditch as there's no piped inlet at the head of the drain and it terminates approx. halfway along the eastern boundary at an existing wall. A number of large trees are located along this boundary which are being retained as part of the proposed development, therefore, this existing dry ditch will remain in place and be unaffected by the proposed development.

Review of the 'other sources' of information noted above do not indicate evidence of flood risk to the site.

Figure 3.1 Existing Ditch Along Eastern Boundary– Extract from EPA Online Mapping

3.3 Source Pathway Receptor Model

A Source-Pathway-Receptor model has been produced to summarise the possible sources of floodwater, the pathways by which flood water could reach receptors and the receptors that could be affected by potential flooding, see Table 3.2 below.

It outlines effects of various potential sources, the performance and response of pathways and the consequences to the receptors in the context of the proposed development.

These sources, pathways and receptors will be assessed further by the initial flood risk assessment stage.

Source	Pathway	Receptor	Likelihood	Consequence	Risk
Fluvial	Overbank from the Owendoher River 950m east of the site (refer to Figure 1.2)	People and Property (the proposed development).	Remote	Medium	Low
Surface Water (Pluvial)	Blockage and / or surcharging of the proposed surface water drainage network	People and Property (the proposed development).	Possible	Medium	Medium
Human / Mechanical Error (Pluvial)	Failure of proposed SuDS measures (e.g. Hydrobrake failure)	People and Property (the proposed development).	Possible	Medium	Medium
Groundwater	Rising groundwater levels within the site	People and Property (the proposed development).	Remote	Low	Low

Table 3.2 - Source-Pathway-Receptor Analysis

4.0 STAGE 2 – INITIAL FLOOD RISK ASSESSMENT

Flood risks identified during Stage 1 – Flood Risk Identification, are outlined in Table 3.2 (Source Pathway Receptor Analysis) and noted below. These risks are assessed further in this section of the SSFRA.

- Low risk of fluvial flooding
- Medium risk of pluvial flooding (surface water and human / mechanical error)
- Low risk of groundwater flooding

The information sources identified in Section 3.2 are considered adequate for the purpose of an Initial Flood Risk Assessment for the site and no further technical studies are proposed.

4.1 Initial Fluvial Flood Risk Assessment

The Dodder CFRAM flood extents maps identify the location of the predicated 0.1% AEP, 1.0% AEP and 10% AEP fluvial flood extents associated with watercourses in the Knocklyon / Ballyboden / Rathfarnham areas (refer to Appendix A).

No fluvial flooding is indicated in the vicinity of the site.

The closest modelled node to the site is located on the Owenadoher River (Node OS_430), approximately 900m east of the site (inside the M50 orbital route).

The location of the Owenadoher River in relation to the site is shown in Figures 1.2 and 4.1.

The location of this node is shown on CFRAM Drawing OSWS/EXT/UA/CURS/103 (Appendix A).

Node OS_430, 10% AEP fluvial flood level	+96.23m
Node OS_430, 1% AEP fluvial flood level	+96.52m
Node OS_430, 0.1% AEP fluvial flood level	+96.95m
Lowest Proposed FFL	+101.85m

The lowest proposed FFL (+101.85) is 4.90m above the predicted 0.1% AEP fluvial flood event associated with Node OS_430 (+96.95m).

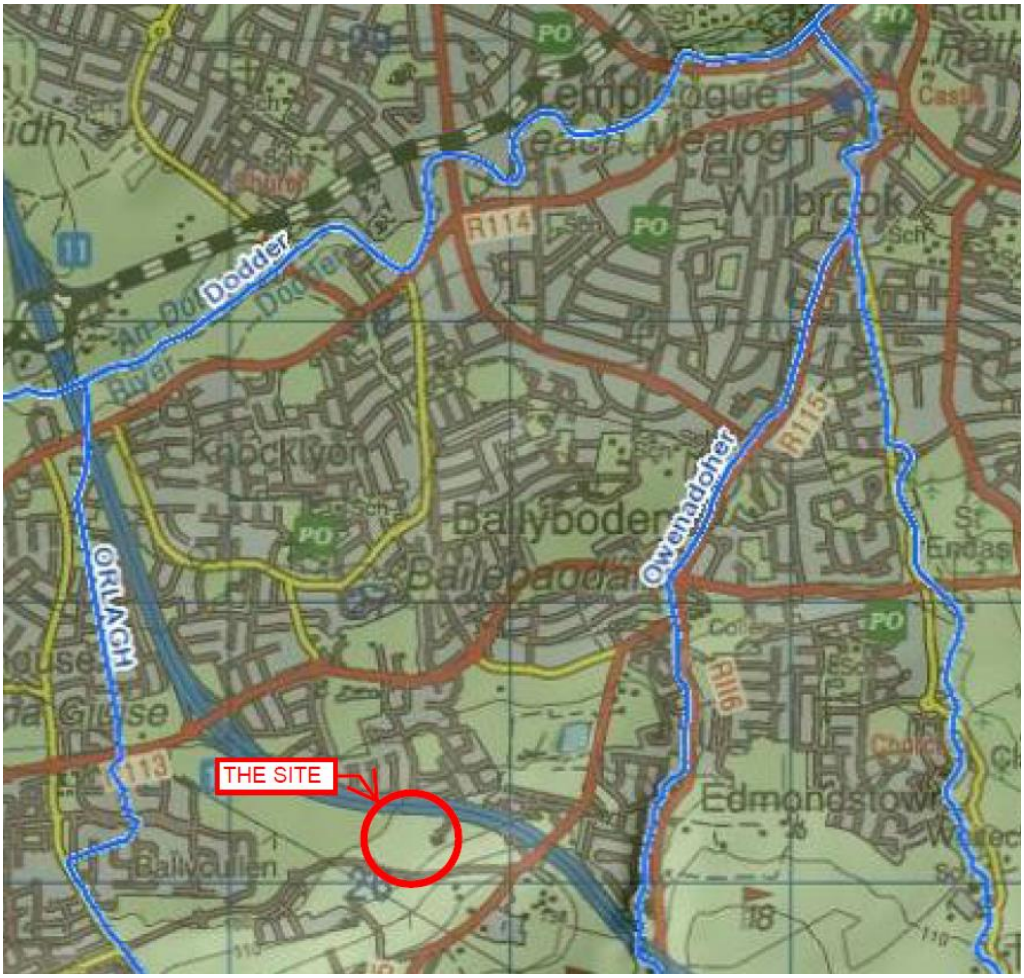

Figure 4.1 Existing Watercourses – Extract from EPA Online Mapping Service

4.2 Initial Pluvial Flood Risk Assessment

The Source-Pathway-Receptor model identified a medium risk of pluvial flooding relating to the proposed surface water drainage network and human / mechanical error. This risk can be mitigated by designing the surface water network in accordance with the Greater Dublin Strategic Drainage Study (GDSDS) including attenuation of the 1:100 year storm event and implementation of SuDS methodologies.

Proper operation and maintenance of the drainage system should also be implemented to reduce the risk of human or mechanical error causing pluvial flood risk from blockages, fuel / oil interceptor operation problems, Hydrobrake failure etc.

4.3 Initial Groundwater Flood Risk Assessment

During the site walkover survey, no marshy ground was observed. No groundwater wells or marsh areas are located within the site (based on review of information available on the GSI and OSI websites). This is consistent with Ground Investigation Irelands observations during trial pit excavations (see Section 3.2.3 Other Sources).

Therefore, the risk of groundwater flooding occurring at the site is considered negligible.

4.4 Flood Zone Category

On completion of Stage 2 – Initial Flood Risk Assessment, the site is considered to be located in Flood Zone C as defined by the requirements of "The Planning System and Flood Risk Management, Guidelines for Planning Authorities" and its Technical Appendices.

The proposed development ("dwellings") is therefore considered appropriate as it is located in a Flood Zone C area.

5.0 STAGE 3 – DETAILED FLOOD RISK ASSESSMENT

5.1 General

As the Initial Flood Risk Assessment considers the site to be located in Flood Zone C and the proposed development is considered appropriate, the Detailed Flood Risk Assessment Stage will only consider pluvial flood risk in relation to the following;

- Proposed Surface Water Management Measures and SuDS
- Flood Exceedance.
- Impact on Adjacent Areas.
- Climate Change.
- Access and Egress for Emergency Services during Flood Events.
- Residual Risks.
- Effectiveness of Flood Mitigation Measures.

5.2 Surface Water Management Measures and SuDS

An existing 375 diameter surface water drain runs along the site's southern boundary / along the M50 (falling east to west before crossing the M50 downstream of the site) and will provide suitable surface water discharge point for the proposed development.

Surface water discharge rates from the proposed surface water drainage network will be controlled by a vortex flow control device (Hydrobrake or equivalent) and associated underground attenuation tanks (Stormtech Chambers).

Surface water discharge will also pass via a full retention fuel / oil separator (sized in accordance with permitted discharge from the site). Refer to DBFL Drawing 190230-DBFL-CS-SP-DR-C-1001 and DBFL's Infrastructure Design Report for further detail in relation to the proposed SUDS Strategy.

The proposed surface water drainage network will collect surface water runoff from the site via a piped network prior to discharging off site via the attenuation tank, flow control device and separator arrangement as noted above.

Surface water runoff from the site's road network will be directed to tree pits via conventional road gullies (with high level overflow to the piped surface water network).

Surface water runoff from apartment roofs will be captured by green roofs (sedum blanket) prior to being routed to the piped surface water drainage network.

Surface water runoff from the roofs of duplex's located along the site's western boundary will be routed to the proposed surface water pipe network via the porous aggregates beneath permeable paved driveways (providing an additional element of attenuation).

5.8.1 SuDS Methodoligies

The following methodologies are being implemented as part of a SuDS treatment train approach:

- Permeable paving in parking spaces / in curtilage areas.
- Typically, road gullies discharge to tree pits (with high level overflow to the piped surface water network).
- Surface water runoff from Duplex's roofs will be routed to the proposed surface water pipe network via the stone reservoir beneath permeable paved parking. Note, this detail does not rely on infiltration, the stone reservoir is intended to provide an additional element of attenuation storage.
- Surface water runoff from apartment roofs will be captured by green roofs (sedum blanket) prior to being routed to the piped surface water drainage network.
- Attenuation of the 1 in 30 year return period storms in underground attenuation chambers (Stormtech) with the difference between the 1 in 100 year event and the 1 in 30 year event is being attenuated above ground in shallow basins. (refer to DBFL Drawing 190230-DBFL-CS-SP-DR-C-5013).

  Note: Our calculation has not allowed for any infiltration when calculating the attenuation volume
- Installation of a vortex flow control device (Hydrobrake or equivalent), limiting surface water discharge from the site to 3.9 l/sec/ha.
- Surface water discharge will also pass via a Class 1 full retention fuel / oil separator (sized in accordance with permitted discharge from the site).

5.8.2 Surface Water Attenuation and Storage

Attenuation volumes have been calculated based on an allowable outflow / greenfield runoff rate of 3.9 l/sec/ha (refer to DBFL Infrastructure Design Report 190230-rep-001).

5.3 Flood Risk Exceedance

During storms greater than the 1% AEP pluvial event, the development's drainage network design may be exceeded and areas with low ground levels will begin to flood.

Proposed road levels fall towards site's north-western corner. Overland flow is therefore directed towards open space located adjacent to the M50 Motorway (refer to Figure 5.1).

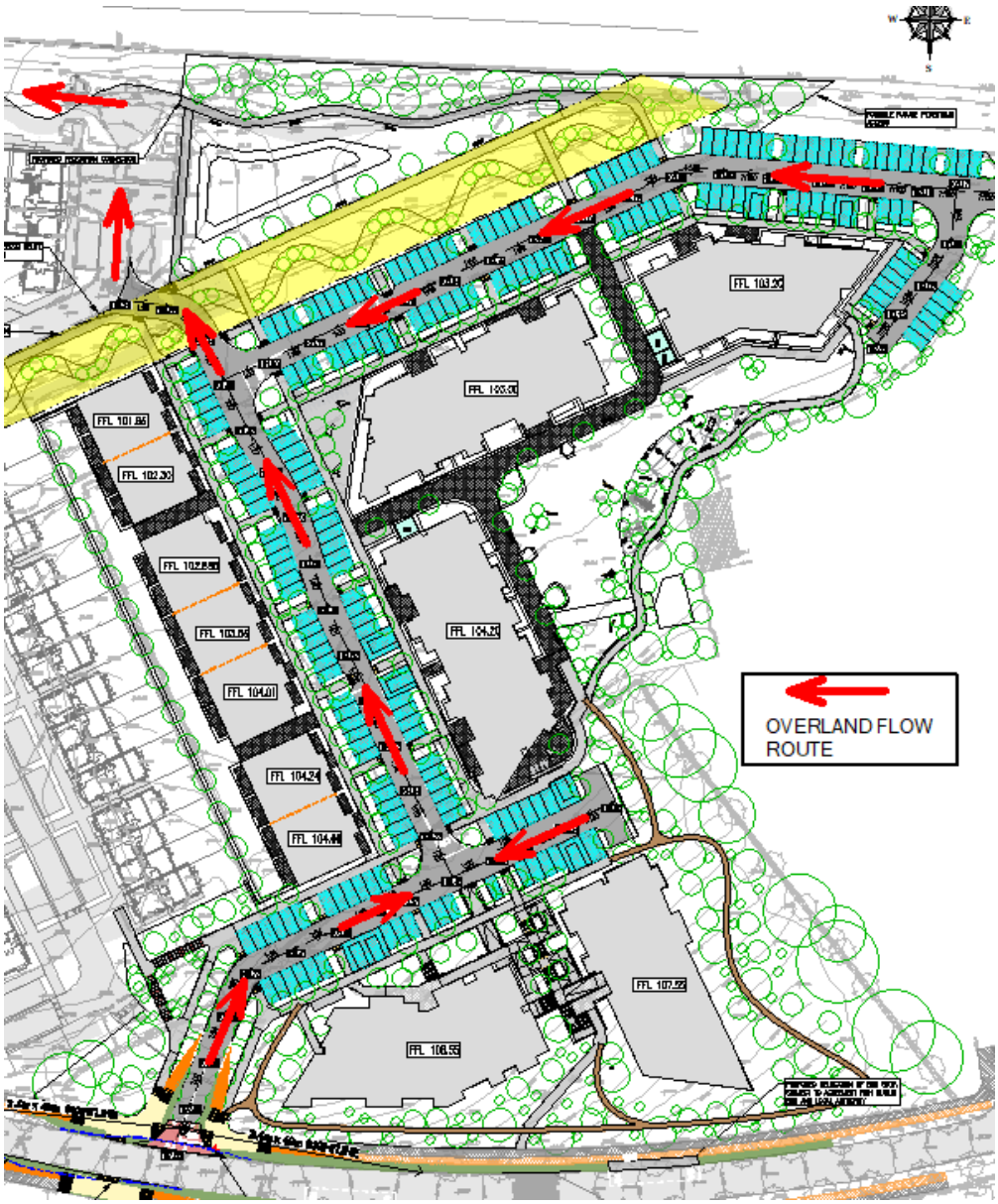

Figure 5.1 – Flood Exceedance (>1%AEP) Overland Flow Routes

5.4 Impact on Adjacent Areas

Adjacent areas will not be impacted by the development up to the 1% AEP flood event.

Storms greater that the 1% AEP (exceeding the design capacity of the site's drainage system) may result in overland flow being directed towards open space located adjacent to M50.

5.5 Climate Change

The potential impact of climate change has been allowed for as follows;

- Pluvial flood risk - attenuation storage design allows for a 20% increase in rainfall intensities, as recommended by the GDSDS.
- Pluvial flood risk - drainage system design allows for a 20% increase in flows, as recommended by the GDSDS.

5.6 Access and Egress for Emergency Services During Flood Events

The primary access point for motorised vehicles is located along the site's southern boundary (Scholarstown Road).

A secondary access point is located adjacent to the north-west corner of the site (providing a link to the recently constructed White Pines North development).

Both of these access points are located in Flood Zone C; therefore, it is expected that the site can be safely accessed during storms up to the 1% AEP event.

5.7 Residual Risks

Remaining residual flood risks, following the detailed assessment include the following;

1. Pluvial flooding from the private drainage system related to pipe blockage, flood exceedance or mechanical failure.
2. Pluvial flooding from the development's drainage system for storms in excess of the 1% AEP storm event.

5.8 Mitigation Measures

Proposed mitigation measures to address residual flood risks are summarised below;

M1. Proposed drainage system to be maintained on a regular basis to reduce the risk of a blockage.

M2. In the event of storms exceeding the 1% AEP design capacity of the attenuation system, possible overland flow routing towards open space areas should not to be blocked (refer to Section 5.3).

5.8.1 Effectiveness of Mitigation Measures

It is considered that the flood risk mitigation measures if implemented are sufficient to provide a suitable level of protection to the proposed development. A regularly maintained drainage system will ensure that it remains effective and in good working order should a large pluvial storm occur.

Should extreme pluvial flooding occur that is in excess of the development's attenuation capacity (i.e. greater than 1% AEP), then overland flow routes directed towards open space areas are provided in order to protect the proposed development.

6.0 CONCLUSIONS

The Site Specific Flood Risk Assessment for proposed development at Stocking Avenue was undertaken in accordance with the requirements of "The Planning System and Flood Risk Management, Guidelines for Planning Authorities" and its Technical Appendices.

Following the Flood Risk Assessment, it has been determined that it is located in Flood Zone C as defined by the Guidelines.

It is concluded that the;

- Proposed mixed use development is appropriate for the site's flood zone category.
- The sequential approach outlined in Planning System and Flood Risk Management Guidelines has been adhered to and that the 'Avoid' principal has been achieved.

In conclusion, the proposed development is considered to have the required level of flood protection up to and including the 100 year return event.

Overland flow paths have been identified for pluvial flooding exceeding the capacity of the surface water drainage network.

APPENDIX A – FLOOD HAZARD INFORMATION

OPW National Flood Hazard Mapping

Summary Local Area Report

This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Dublin

NGR: O 123 257

Map Scale 1:20,842

Map Legend	
	Flood Points
	Multiple / Recurring Flood Points
	Areas Flooded
	Hydrometric Stations
	Rivers
	Lakes
	River Catchment Areas
	Land Commission *
	Drainage Districts *
	Benefiting Lands *

* Important: These maps do not indicate flood hazard or flood extent. Thier purpose and scope is explained in the Glossary.

13 Results

1. Dodder Avonmore Park Nov 2000
County: Dublin
Start Date: 05/Nov/2000
Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

2. Dodder Mount Carmel Park recurring
County: Dublin
Start Date:
Flood Quality Code:4
Additional Information: Reports (1) Press Archive (1) More Mapped Information

3. Flooding at Homeville, Knocklyon, Dublin 16.on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

4. Flooding at Castlefield, Glenvara and Glenlyon, Knocklyon, Dublin 16.on 24th Oct 2011
County: Dublin
Start Date: 24/Oct/2011
Flood Quality Code:2
Additional Information: Reports (1) More Mapped Information

5. Grange River Tibradden Lane June 2003
County: Dublin
Start Date: 30/Jun/2003
Flood Quality Code:4

Additional Information: Reports (2) More Mapped Information

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6. Mount Carmel Park Firhouse Nov 2000 — Start Date: 05/Nov/2000
County: Dublin — Flood Quality Code:3

Additional Information: Reports (1) Press Archive (1) More Mapped Information

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7. Owenadoher Edmondstown Road. Nov 2000 — Start Date: 05/Nov/2000
County: Dublin — Flood Quality Code:3

Additional Information: Reports (2) More Mapped Information

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8. Knocklyon Ave Nov 2000 — Start Date: 05/Nov/2000
County: Dublin — Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

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9. Old City water Course Spawell House Feb 1994 — Start Date: 03/Feb/1994
County: Dublin — Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

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10. Whitechurch Court Feb 1994 — Start Date: 03/Feb/1994
County: Dublin — Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

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11. Boden Villas Feb 1994 — Start Date: 03/Feb/1994
County: Dublin — Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

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12. Ballyboden Road Whitecliff Recurring — Start Date:
County: Dublin — Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

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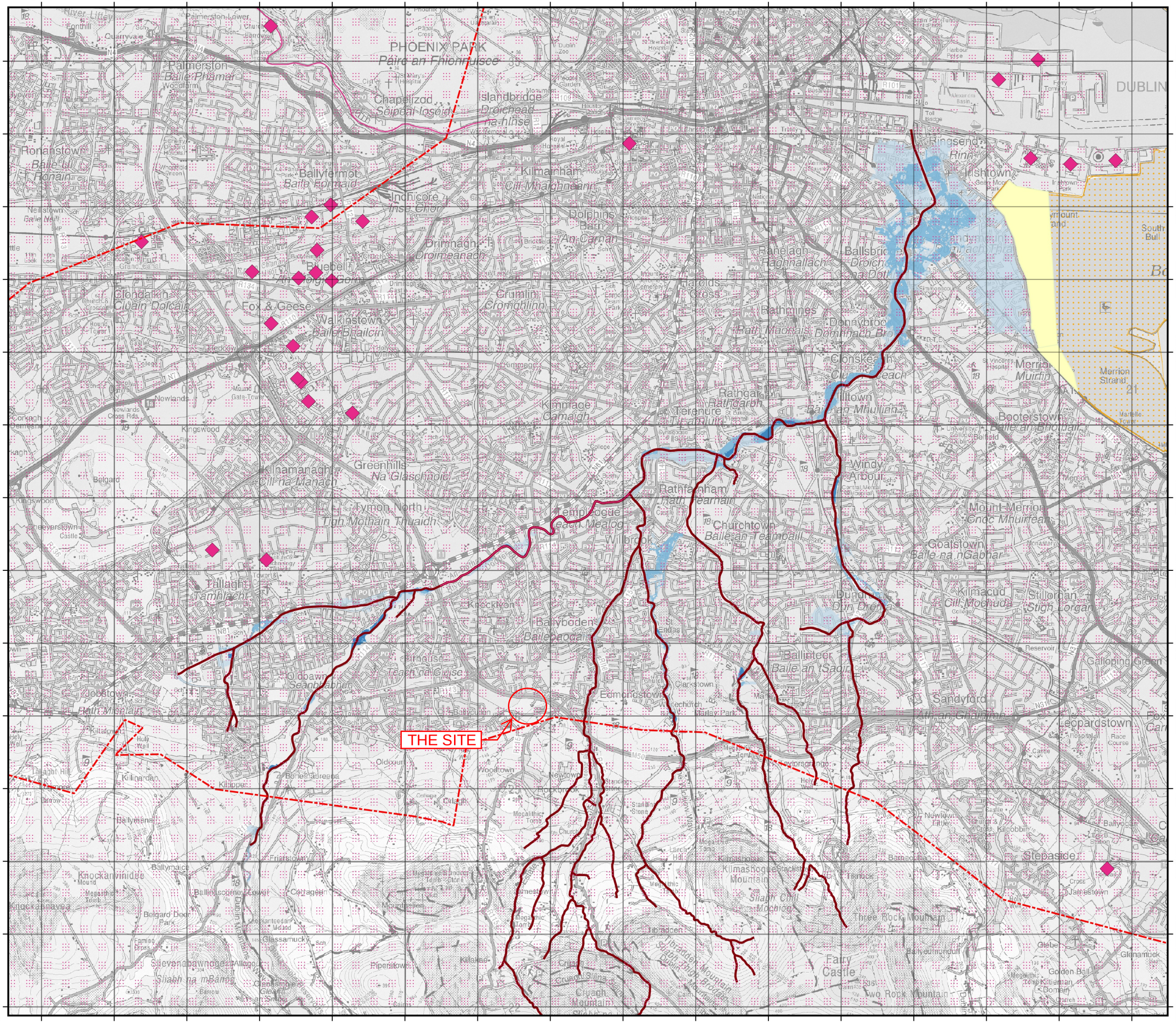
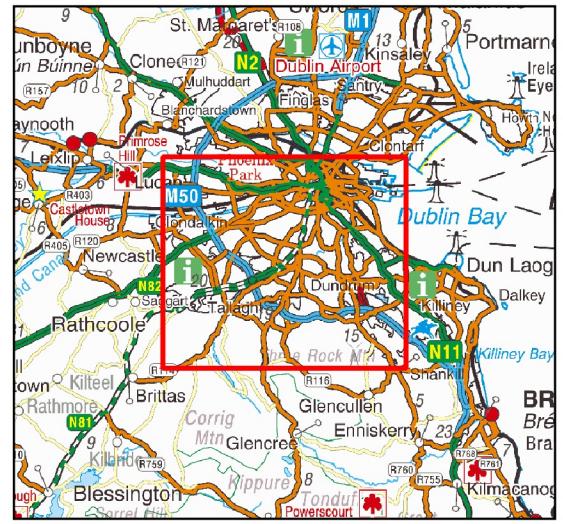
13. Grange Stream Tibradden Lane Mutton Lane Recurring — Start Date:
County: Dublin — Flood Quality Code:4

Additional Information: Reports (2) More Mapped Information



Location Plan:



LEGEND

- AFA Boundary
- IED Sites
- Designated for Drinking Water Abstraction
- Designated for Drinking Water Abstraction
- Recreational Waters
- SAC Water Dependent
- SAC Water Dependent
- SAC Water Dependent
- SPA Water Dependent
- Modelled River Centreline
- 10% AEP Fluvial
- 1% AEP Fluvial
- 0.1% AEP Fluvial

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

OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath

Project:

DODDER STUDY

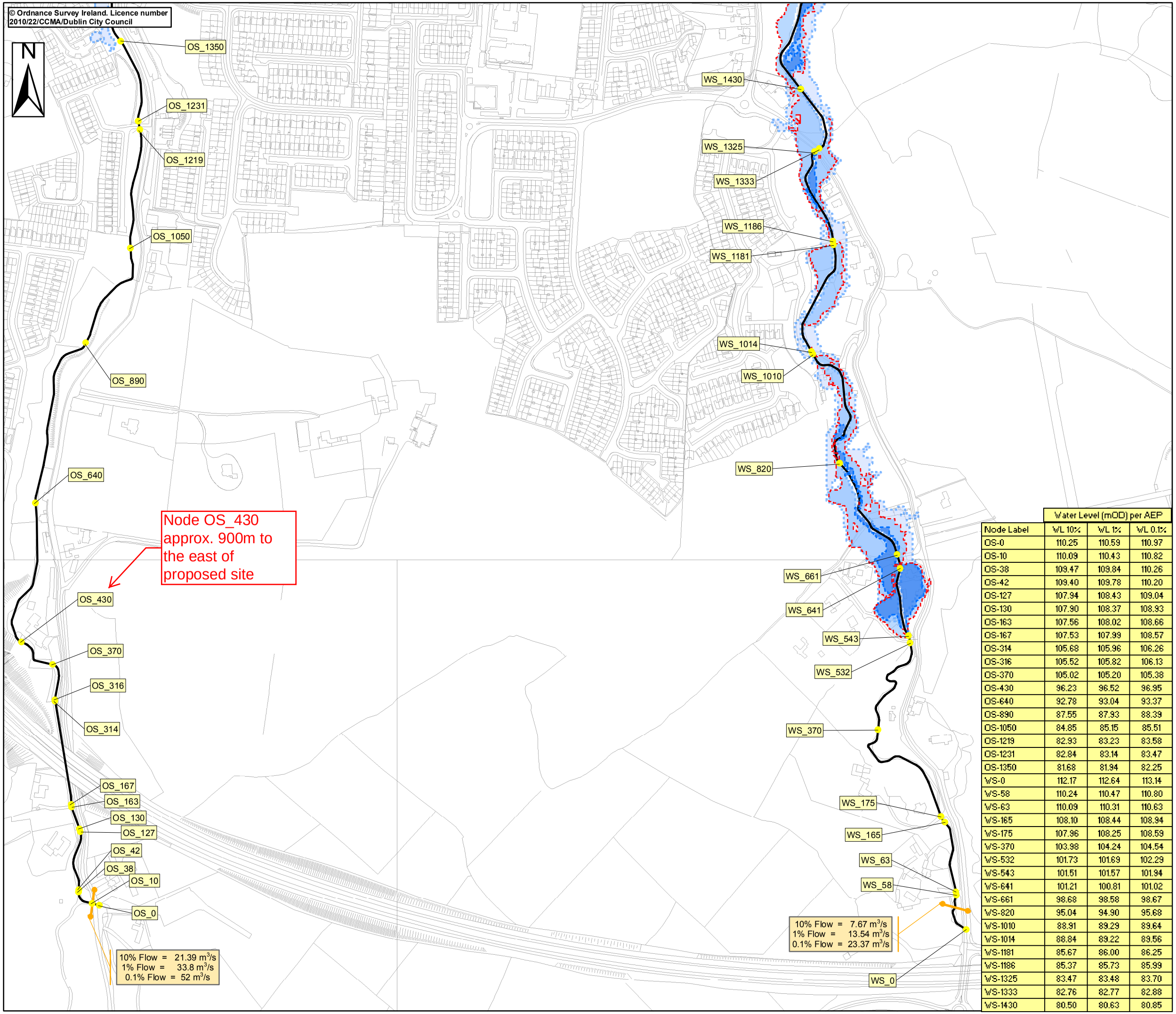
Map: **DUBLIN CITY FLUVIAL GENERAL RISK - ENVIRONMENT**

Map Type:	GENERAL RISK ENVIRONMENT		
Source:	FLUVIAL		
Map Area:	HPW		
Scenario:	CURRENT		
Drawn by:	IH	Date:	Sep - 2016
Checked by:	MC	Date:	Sep - 2016
Approved by:	JM	Date:	Sep - 2016

Map No.: E09DCD_RVFCD_F0_01

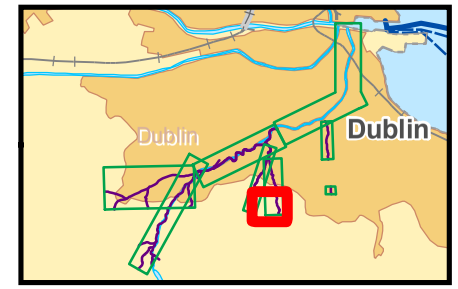
Revision: F0

Map Scale: 1:50,000 Plot Scale: 1:1 @ A3



Node Label	Water Level (mOD) per AEP		
	WL 10%	WL 1%	WL 0.1%
OS-0	110.25	110.59	110.97
OS-10	110.09	110.43	110.82
OS-38	109.47	109.84	110.26
OS-42	109.40	109.78	110.20
OS-127	107.94	108.43	109.04
OS-130	107.90	108.37	108.93
OS-163	107.56	108.02	108.66
OS-167	107.53	107.99	108.57
OS-314	105.68	105.96	106.26
OS-316	105.52	105.82	106.13
OS-370	105.02	105.20	105.38
OS-430	96.23	96.52	96.95
OS-640	92.78	93.04	93.37
OS-890	87.55	87.93	88.39
OS-1050	84.85	85.15	85.51
OS-1219	82.93	83.23	83.58
OS-1231	82.84	83.14	83.47
OS-1350	81.68	81.94	82.25
WS-0	112.17	112.64	113.14
WS-58	110.24	110.47	110.80
WS-63	110.09	110.31	110.63
WS-165	108.10	108.44	108.94
WS-175	107.96	108.25	108.59
WS-370	103.98	104.24	104.54
WS-532	101.73	101.69	102.29
WS-543	101.51	101.57	101.94
WS-641	101.21	100.81	101.02
WS-661	98.68	98.58	98.67
WS-820	95.04	94.90	95.68
WS-1010	88.91	89.29	89.64
WS-1014	88.84	89.22	89.56
WS-1181	85.67	86.00	86.25
WS-1186	85.37	85.73	85.99
WS-1325	83.47	83.48	83.70
WS-1333	82.76	82.77	82.88
WS-1430	80.50	80.63	80.85

Location Plan:



Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended Area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (>40m) (10% and 0.1% AEP)
- High Confidence (<20m) (1% AEP)
- Medium Confidence (<40m) (1% AEP)
- Low Confidence (>40m) (1% AEP)
- River Centreline
- Node Point
- OS_2975 Node Label (refer to table)
- Flow reporting location
- 10% Flow = 1.20 1% Flow = 1.56 0.1% Flow = 2.17 Peak flow during design flood extent

USER NOTE:

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

Client:

Dublin City Baile Átha Cliath · South Dublin County Council · Dún Laoghaire-Rathdown County Council Comhairle Contae Dhún Laoghaire-Ráth an Dúin · OPW

Project:

DODDER CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map:

PRESENT DAY OWENDOHER & WHITECHURCH

Map Type:	FLOOD EXTENT
Source:	FLUVIAL FLOODING
Map Area:	URBAN AREA
Scenario:	CURRENT
Drawn By :	A.A.B — Date : 26 November 2010
Checked By :	A.J. — Date : 26 November 2010
Approved By :	A.G.B — Date : 26 November 2010

Figure No. :

OSWS/EXT/UA/CURS/103

Map Series : Page 1 of 3

Drawing Scale : 1: 5,000 — Plot Scale : 1:1 @ A3

0 0.1 0.2 Kilometers

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APPENDIX B – GII SITE INVESTIGATION REPORT (EXTRACTS)

APPENDIX 2 – Trial Pit Records

Ground Investigations Ireland Ltd
www.gii.ie

Site White Pines East			**Trial Pit Number** TP01
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 3.40m X 0.40m X 2.60m	**Ground Level (mOD)** 103.06	**Client**	**Job Number** 9411-02-20
	Location 712656.3 E 726232.8 N	**Dates** 04/03/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	Brown slightly sandy slightly gravelly TOPSOIL		
				102.86	0.20			
					(0.40)	Soft brown slighlty sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles		
				102.46	0.60			
0.75	ES		medium ingress(1) at 0.90m.		(0.50)	Firm brown slighlty sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles		▽1
1.00	B			101.96	1.10			
					(0.70)	Firm brown mottled grey slightly sandy gravelly CLAY with some subangular to subrounded cobbles		
1.75	ES			101.26	1.80			
2.00	B				(0.40)	Firm brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
				100.86	2.20			
					(0.20)	Stiff brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
				100.66	2.40			
					(0.20)	Very stiff dark grey slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
				100.46	2.60	Complete at 2.60m		

Plan

Remarks

Groundwater encountered at 0.90m BGL; medium ingress
Trial pit unstable; side walls collapsed
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9411-02-20.TP01

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Site White Pines East			**Trial Pit Number** TP02
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 3.10m X 0.40m X 3.00m	**Ground Level (mOD)** 102.73	**Client**	**Job Number** 9411-02-20
	Location 712599.3 E 726230.1 N	**Dates** 04/03/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	MADE GROUND: Brown slightly sandy slightly gravelly Clay with grass rootlets and scrap metal		
				102.53	0.20	Soft brown slighlty sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles		
					(0.50)			
				102.03	0.70			
0.75	ES					Firm brown mottled grey slightly sandy slightly gravelly CLAY with some subangular to subrounded cobbles		
1.00	B				(0.60)			
				101.43	1.30			
					(0.30)	Firm brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
				101.13	1.60			
1.75	ES					Stiff brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
2.00	B				(0.90)			
				100.23	2.50			
					(0.50)	Very stiff dark grey slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
3.00	B			99.73	3.00	Complete at 3.00m		

Plan

Remarks

No groundwater encountered
Trial pit unstable; side walls collapsed
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9411-02-20.TP02

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Site White Pines East			**Trial Pit Number** TP03
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 3.40m X 0.40m X 2.50m	**Ground Level (mOD)** 104.13	**Client**	**Job Number** 9411-02-20
	Location 712625.4 E 726183.6 N	**Dates** 04/03/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				104.03	(0.10) 0.10	MADE GROUND: Tarmacadam		
						MADE GROUND: Dark brown/brown slightly sandy gravelly Clay with some cobbles and glass, plastic, PVC, tarmacadam, and concrete pieces		
					(1.00)			
0.75	ES							
1.00	B			103.03	1.10	Possible MADE GROUND: Soft brown slightly sandy slightly gravelly Clay with some subangular to subrounded cobbles, orgranic pockets and flat granite boulders		
			medium ingress(1) at 1.50m.		(0.90)			▽1
1.75	ES							
2.00	B		fast ingress(2) at 2.00m.	102.13	2.00	Firm brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		▽2
					(0.50)			
				101.63	2.50	Complete at 2.50m		

Plan

Remarks

Groundwater encountered at 1.50m BGL; medium ingress
Second groundwater strike at 2.00m BGL; fast ingress
Trial pit unstable; side walls collapsed
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9411-02-20.TP03

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Site White Pines East			**Trial Pit Number** TP04
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 2.90m X 0.40m X 3.00m	**Ground Level (mOD)** 110.80	**Client**	**Job Number** 9411-02-20
	Location 712645.9 E 726104 N	**Dates** 05/03/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Brown slightly sandy slightly gravelly TOPSOIL with roots		
				110.40	0.40			
					(0.30)	Soft brown slighlty sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles		
				110.10	0.70			
0.75	ES				(0.40)	Firm to stiff brown slighlty sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles		
1.00	B			109.70	1.10			
					(0.30)	Stiff brown slightly sandy very gravelly CLAY with occasional angular cobbles. Gravel is angular fine to coarse of schist		
				109.40	1.40			
					(0.30)	Medium dense brown/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of schist. (presumed residual Schist)		
			fast ingress(1) at 1.70m.	109.10	1.70			▽1
1.75	ES				(0.30)	Dense brown/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of schist. (presumed residual Schist)		
2.00	B			108.80	2.00			
					(1.00)	Dense brown/grey silty sandy angular fine to coarse GRAVEL with some angular cobbles of schist. (presumed residual Schist)		
3.00	B			107.80	3.00	Complete at 3.00m		

Plan

Remarks

Groundwater encountered at 1.70m BGL; fast ingress
Trial pit unstable; side walls spalling
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9411-02-20.TP04

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Site White Pines East			**Trial Pit Number** TP05
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 2.90m X 0.40m X 3.00m	**Ground Level (mOD)** 114.30	**Client**	**Job Number** 9411-02-20
	Location 712656.1 E 726070.8 N	**Dates** 05/03/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Brown slightly sandy slightly gravelly TOPSOIL with roots		
				113.90	0.40			
					(0.35)	Soft to firm brown slighlty sandy slightly gravelly CLAY		
0.75	ES			113.55	0.75			
1.00	B				(0.45)	Soft brown slightly sandy very gravelly CLAY with occasional angular cobbles. Gravel is angular fine to coarse of schist		
				113.10	1.20			
					(0.30)	Medium dense brown/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of schist. (presumed residual Schist)		
				112.80	1.50			
1.75	ES					Dense brown/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of schist. (presumed residual Schist)		
2.00	B				(1.10)			
				111.70	2.60			
					(0.40)	Dense brown/grey silty sandy angular fine to coarse GRAVEL with some angular cobbles of schist. (presumed residual Schist)		
3.00	B			111.30	3.00			
						Complete at 3.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9411-02-20.TP05

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Site White Pines East			**Trial Pit Number** TP06
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 2.90m X 0.40m X 3.00m	**Ground Level (mOD)** 111.15	**Client**	**Job Number** 9411-02-20
	Location 712606.9 E 726065.4 N	**Dates** 05/03/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	MADE GROUND: Brown slightly sandy gravelly Clay with some cobbles and fragments of plastic		
				110.75	0.40			
					(0.50)	Firm brown slightly sandy gravelly CLAY with some angular cobbles of schist. Gravel is angular fine to coarse of schist		
0.75	ES			110.25	0.90			
1.00	B				(0.20)	Stiff brown slightly sandy gravelly CLAY with some angular cobbles of schist. Gravel is angular fine to coarse of schist		
				110.05	1.10			
					(1.10)	Medium dense brown/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of schist. (presumed residual Schist)		
1.75	ES							
2.00	B							
				108.95	2.20			
					(0.80)	Dense brown/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of schist. (presumed residual Schist)		
			seepage(1) at 2.80m.					▽1
3.00	B			108.15	3.00			
						Complete at 3.00m		

Plan

Remarks

Groundwater seepage at 2.80m BGL
Trial pit unstable; side walls slightly spalling
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9411-02-20.TP06

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Site White Pines East			**Trial Pit Number** TP07
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 3.40m X 0.40m X 2.70m	**Ground Level (mOD)** 107.42	**Client**	**Job Number** 9411-02-20
	Location 712578.1 E 726079.9 N	**Dates** 05/03/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Brown slightly sandy slightly gravelly TOPSOIL		
				107.12	0.30			
					(0.30)	Soft brown slighlty sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles		
				106.82	0.60			
0.75	ES					Firm brown slightly sandy very gravelly CLAY with occasional angular cobbles. Gravel is angular fine to coarse of schist		
1.00	B				(0.70)			
				106.12	1.30			
					(0.60)	Medium dense brown/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of schist. (presumed residual Schist)		
1.75	ES							
				105.52	1.90			
2.00	B				(0.40)	Dense brown/grey silty sandy angular fine to coarse GRAVEL with occasional angular cobbles of schist. (presumed residual Schist)		
						Obstruction: presumed bedrock		
				105.12	2.30	Complete at 2.70m		
2.50	B							

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9411-02-20.TP07

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Site White Pines East			**Trial Pit Number** TP08
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 2.90m X 0.40m X 2.30m	**Ground Level (mOD)** 106.59	**Client**	**Job Number** 9411-02-20
	Location 712594.1 E 726108.4 N	**Dates** 05/03/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Brown slightly sandy slightly gravelly TOPSOIL with roots		
				106.29	0.30			
					(0.45)	Soft to firm brown slighlty sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles		
0.75	ES			105.84	0.75			
1.00	B				(0.45)	Firm brown/grey slightly sandy very gravelly CLAY with occasional angular cobbles. Gravel is angular fine to coarse of schist		
				105.39	1.20			
					(1.10)	Brown/grey silty sandy angular fine to coarse GRAVEL with some angular cobbles of schist. (presumed residual Schist)		
1.75	ES		seepage(1) at 1.80m.					▽1
2.00	B					Obstruction: presumed bedrock		
				104.29	2.30	Complete at 2.30m		

Plan

Remarks

Groundwater seepage at 1.80m BGL
Trial pit stable
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9411-02-20.TP08

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Site White Pines East			**Trial Pit Number** TP09
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 2.70m X 0.40m X 3.00m	**Ground Level (mOD)** 102.08	**Client**	**Job Number** 9411-02-20
	Location 712542.8 E 726176.5 N	**Dates** 04/03/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	MADE GROUND: Brown slightly sandy very gravelly Clay with grass rootlets		
				101.88	0.20	MADE GROUND: Brown slightly sandy gravelly Clay with some cobbles and brick, PVC and concrete		
					(0.90)			
0.75	ES							
1.00	B			100.98	1.10	Soft brown mottled grey slightly sandy slightly gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
					(0.20)			
				100.78	1.30	Soft to firm brown mottled grey slightly sandy slightly gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		▽1
			seepage(1) at 1.40m.					
					(0.90)			
1.75	ES							
2.00	B							
				99.88	2.20	Firm to stiff dark grey slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
					(0.70)			
				99.18	2.90			
				99.08	(0.10) 3.00	Stiff dark grey slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
3.00	B					Complete at 3.00m		

Plan

Remarks

Groundwater seepage at 1.40m BGL
Trial pit stable
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9411-02-20.TP09

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Site White Pines East			**Trial Pit Number** TP10
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 2.70m X 0.40m X 3.00m	**Ground Level (mOD)** 101.08	**Client**	**Job Number** 9411-02-20
	Location 712541.1 E 726207 N	**Dates** 04/03/2020	**Engineer** DBFL	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.60)	MADE GROUND: Brown mottled grey slightly sandy gravelly Clay with some cobbles and plastic		
				100.48	0.60			
0.75	ES				(0.50)	Soft to firm brown mottled grey slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles		
1.00	B			99.98	1.10			
					(1.00)	Firm brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles		
1.75	ES							
2.00	B			98.98	2.10			
					(0.90)	Stiff dark grey slightly sandy gravelly CLAY with some subangular to subrounded cobbles and occasional boulders		
3.00	B			98.08	3.00			
						Complete at 3.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled on completion

Scale (approx)	Logged By	Figure No.
1:25	JC	9411-02-20.TP10