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PUBLIC REALM IMPROVEMENT AND LIBRARY REFURBISHMENT AND EXTENSION, DUBLIN

Flood Risk Assessment

February 2023

ROD
ROUGHAN & O'DONOVAN

Public Realm Improvement and Library Refurbishment and Extension

Flood Risk Assessment Report – For Planning

Document No: ..... PRDWLS-ROD-EWE-SW_AE-RP-EN-300001

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Revision	Description	Made	Checked	Approved	Date
P01	Draft	RW	CMG	EOC	21/02/2023
P02	For Planning Issue	RW	CMG	EOC	21/03/2023

Public Realm Improvement and Library Refurbishment and Extension

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1. INTRODUCTION

As part of the preliminary design process, Roughan & O'Donovan Consulting Engineers has carried out a Flood Risk Assessment for Public Realm Development Works at Library Square, Ringsend, Dublin. This report has been prepared to assess the flood risk to the site and adjacent lands as a result of the proposed development.

2. PROJECT SCOPE

The proposed public realm development includes highway improvements, public access and pedestrian walkway areas at Bridge Street R802, Irishtown Road and Fitzwilliam Street, Ringsend, Dublin. The *OPW Planning and Flood Risk Management Guidelines for Planning Authorities* determines that developments such as this are classified as less vulnerable to flooding.

The development area is focused at Library Square, Bridge Street, Irishtown Road and Fitzwilliam Street Ringsend, Dublin. The site area is currently an existing public space which includes Ringsend Library and local amenities adjacent to Fitzwilliam Street. The proposals are focused on enhancements to the public realm including the introduction of a raised table to control traffic flow speeds with controlled pedestrian crossing, cycle lane, shared surface plaza, defensive planting, communal seating and feature lighting. The site boundary is shown in Figure 2.1.

Figure 3.1 Site Boundary

Bridge Street and Irishtown Road areas appear to be positively drained via a number of gullies located within the highway. The public space areas to the north of Bridge Street contains precast concrete channels to convey captured surface water to the

surrounding gullies located at Parkview Place and Saint Patricks Villas. Captured surface water from the hardstanding areas surrounding Ringsend Library appears to be guided to the highways gullies at Bridge Street and Fitzwilliam Street and surface water captured at Fitzwilliam Street is drained to highway gullies.

3. METHODOLOGY

3.1 Introduction

This report has been prepared in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' herein referred to as 'The Guidelines' as published by the Office of Public Works (OPW) and Department of Environment, Heritage and Local Government (DoHLG) in 2009.

3.2 Definition of Flood Risk

Flood risk is a combination of the likelihood of a flood event occurring and the potential consequences arising from that flood event and is then normally expressed in terms of the following relationship:

Flood risk = Likelihood of flooding x Consequences of flooding.

To fully assess flood risk an understanding of where the water comes from (i.e. the source), how and where it flows (i.e. the pathways) and the people and assets affected by it (i.e. the receptors) is required. Figure 3.1 below shows a source-pathway-receptor model reproduced from 'The Guidelines'.

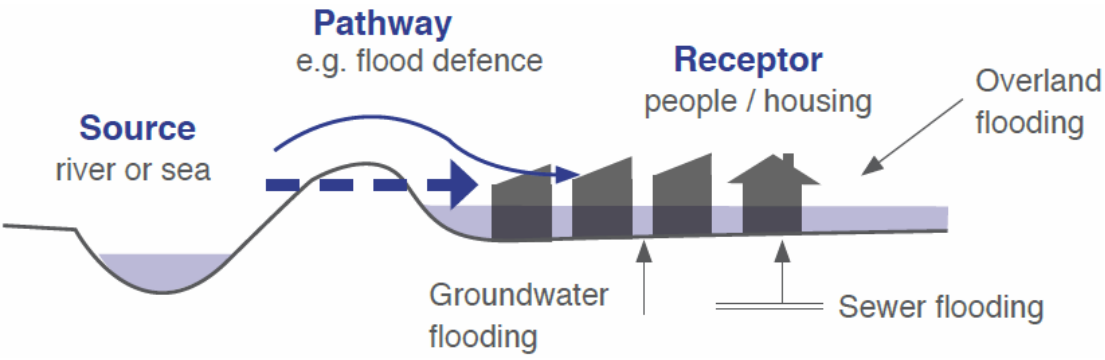


Figure 3.1 Source-Pathway-Receptor Model

The principal sources of flooding are rainfall or higher than normal sea levels. The principal pathways are rivers, drains, sewers, overland flow and river and coastal floodplains. The receptors can include people, their property and the environment. All three elements as well as the vulnerability and exposure of receptors must be examined to determine the potential consequences.

The guidelines set out a staged approach to the assessment of flood risk with each stage carried out only as needed. The stages are listed below:

- Stage I Flood Risk Identification – to identify whether there may be any flooding or surface water management issues.
- Stage II Initial Flood Risk Assessment – to confirm sources of flooding that may affect an area or proposed development, to appraise the adequacy of existing information and to scope the extent of the risk of flooding which may involve preparing indicative flood zone maps.

- Stage III Detailed Flood Risk Assessment – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development or land to be zoned, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures.

3.3 Likelihood of Flooding

The Guidelines define the likelihood of flooding as the percentage probability of a flood of a given magnitude or severity occurring or being exceeded in any given year. It is generally expressed as a return period or annual exceedance probability (AEP). A 1% AEP flood indicates a flood event that will be equalled or exceeded on average once every hundred years and has a return period of 1 in 100 years. Annual Exceedance Probability is the inverse of return period as shown in Table 3.1 below.

Table 3.1 Correlation between return period and AEP

Return Period (years)	Annual Exceedance Probability (%)
1	100
10	10
50	2
100	1
200	0.5
1000	0.1

3.4 Definition of Flood Zones

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and are split into three categories in The Guidelines:

Flood Zone A

Flood Zone A where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);

Flood Zone B

Flood Zone B where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 or 0.5% or 1 in 200 for coastal flooding);

Flood Zone C

Flood Zone C where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding. Flood Zone C covers all plan areas which are not in zones A or B.

It is important to note that when determining flood zones the presence of flood protection structures should be ignored. This is because areas protected by flood defences still carry a residual risk from overtopping or breach of defences and the fact that there is no guarantee that the defences will be maintained in perpetuity.

3.5 Objectives and Principles of the Planning Guidelines

The principle actions when considering flood risk are set out in the planning guidelines and are summarised below:

- *"Flood hazard and potential risk should be determined at the earliest stage of the planning process..."*
- *"Development should preferentially be located in areas with little or no flood hazard thereby avoiding or minimising the risk...."*
- *"Development should only be permitted in areas at risk of flooding when there are no alternative, reasonable sites available..."*
- *"Where development is necessary in areas at risk of flooding an appropriate land use should be selected"*
- *A precautionary approach should be applied, where necessary, to reflect uncertainties in flooding datasets and risk assessment techniques..."*
- *"Land required for current and future flood management... should be pro-actively identified..."*
- *"Flood risk to, and arising from, new development should be managed through location, layout and design incorporating Sustainable Drainage Systems (SuDS) and compensation for any loss of floodplain..."*
- *Strategic environmental assessment (SEA) of regional planning guidelines, development plans and local area plans should include flood risk as one of the key environmental criteria..."*

3.6 The Sequential Approach and Justification Test

The Guidelines outline the sequential approach that is to be applied to all levels of the planning process. This approach should also be used in the design and layout of a development and the broad philosophy is shown in Figure 3.2 below. In general, development in areas with a high risk of flooding should be avoided as per the sequential approach. However, this is not always possible as many town and city centres are within flood zones and are targeted for development.

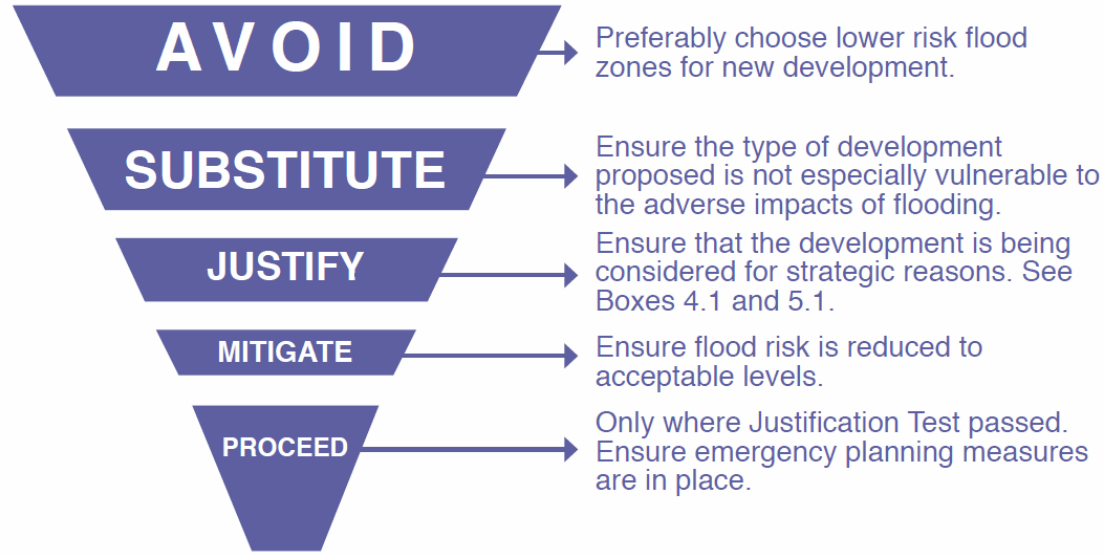


Figure 3.2 Sequential Approach (Source: The Planning System and Flood Risk Management)

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of developments that are being considered in areas of moderate or high flood risk. The test comprises the following two processes.

- The first is the Plan-making Justification Test and is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
- The second is the Development Management Justification Test and is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

Table 3.2 below illustrates the types of development that would be required to meet the Justification Test.

Table 3.2 Matrix of Vulnerability Versus Flood Zone to Illustrate Appropriate Development and that Required to Meet the Justification Test (Source: The Planning System and Flood Risk Management)

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

3.7 Climate Change

Climate change adaption and resilience is a fundamental consideration for this project. The likely result of climate change in the East of Ireland includes:

- Sea level rise,
- Increase in the duration of summer with more frequent droughts,
- More intense storms and rainfall events,
- Increased likelihood and magnitude of river and coastal flooding, and
- Adverse impacts on water quality,
- Changes in distribution of plant and animal species.

As such, an appraisal of the potential impacts of climate change was carried out as part of this Flood Risk Assessment with regard to the OPW climate change parameters stated in the Flood Risk Management Climate Change Sectoral Adaptation Plan (2019). OPW climate change allowances are stated in Table 3.3 below.

Table 3.1 Allowances in Flood Parameters for Mid Range and High End Future Scenarios

Parameter	MRFS	HEFS
Extreme Rainfall Depths	+ 20%	+ 30%
Peak Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 500 mm	+ 1000 mm
Land Movement	- 0.5 mm / year[1]	- 0.5 mm / year[1]
Urbanisation	*No General Allowance – Review on Case-by-Case Basis*	*No General Allowance – Review on Case-by-Case Basis*
Forestation	- 1/6 Tp^2	- 1/3 Tp^2 + 10% SPR[3]

Note 1: Applicable to the southern part of the country only (Dublin – Galway and south of this)

Note 2: Reduction in the time to peak (Tp) to allow for potential accelerated runoff that may arise as a result of drainage of afforested land

Note 3: Add 10% to the Standard Percentage Runoff (SPR) rate: This allows for temporary increased runoff rates that may arise following felling of forestry.

There is an increasing likelihood that Irelands climate will be similar to that depicted in the Mid-Range Future climate change scenario by the year 2100. Therefore, it is prudent to consider the MRFS parameters for developments such as the proposed. This approach will also assist in achieving obligations under the Water Framework Directive (WFD).

4. STAGE 1 - FLOOD RISK IDENTIFICATION

4.1 General

This Stage 1 Flood Risk Identification includes a review of the existing information and the identification of any flooding or surface water management issues in the vicinity of the proposed site that may warrant further investigation.

4.2 Vulnerability of the Proposed Site

As per the OPW Guidelines, the proposed development is classified as a "Less Vulnerable" development as it comprises local transport infrastructure (refer to Figure 4.1 below).

Vulnerability class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).
*Uses not listed here should be considered on their own merits	

Figure 4.1 Classification of vulnerability of different types of development (The Planning System and Flood Risk Management, Guidelines for Planning Authorities, November 2009)

4.3 Information Sources Consulted

The following information sources were consulted as part of the Stage I Flood Risk Identification:

Table 4.1 Information Sources Consulted

Source	Comments
Catchment Flood Risk Assessment and Management Study (CFRAM)	Fluvial, Pluvial, Coastal and Groundwater flooding examined; www.floodinfo.ie
National Indicative Fluvial Maps	www.floodinfo.ie
Dublin City Development Plan 2022 - 2028	Strategic Flood Risk Assessment
Irish Coastal Protection Strategy Study	OPW Costal flood Maps
OPW flood records	www.floodmaps.ie
OPW drainage districts	http://maps.opw.ie/drainage/map/
Geological Survey of Ireland (GSI) Maps	GSI Teagasc subsoils map consulted to identify if alluvium is present at development site that may indicate the presence of a watercourse and floodplain
Ground Investigation Report Fitzwilliam Quay, Ringsend 2006	Report of GI for commercial/residential development at Fitzwilliam Quay, Dublin
Historical Maps	OSI Geo Hive 25" and 6'' Historic Mapping
Historical Flooding Events	www.irishtimes.com

4.3.1 Previous Flood Risk Assessments and Predictive Flood Maps

(i) Catchment Flood Risk Assessment and Management Study

The Project area is covered within the Dodder catchment CFRAM study area. The CFRAM programme led by the OPW, provides a detailed assessment of flooding in areas. Catchment wide Flood Risk Management Plans were also developed as part of the programme.

The Dodder CFRAM mapping identities that a portion of the site is defended against the 1% AEP (1 in 100 year) flood event as a result of the Dodder Flood Defences. The 0.1% AEP (1 in 1000 year) flood extents encroach at the south of the study area at Irishtown Road and Fitzwilliam Street.

Coastal flooding maps identify the development area to be at risk of coastal flooding from the 0.1% AEP (1 in 1000 year) flood extent with the area to the east of Ringsend Library and Irishtown Road within an area defended by the River Dodder tidal flood defences.

The CFRAM fluvial and coastal flood zone maps are shown in Appendix B.

(ii) National Indicative Fluvial Maps

The indicative fluvial flood maps were finalised in December 2020. The mapping presents flood extents for river reaches that were not previously modelled as part of the CFRAMS and have catchments larger than 5km². As per the OPW the use of these maps is to '*provide an indication of areas that maybe prone to flooding. These are not necessarily locally accurate and should not be used as the sole basis for defining the Flood Zones nor for making decisions on planning applications.* No indication of flooding was found in the National Indicative Fluvial Mapping.

(iii) Dublin City Development Plan 2022-2028

The purpose of this SFRA is to provide sufficient information to allow proper planning decisions to be made on sites at risk of flooding over the lifetime of the Dublin City Development Plan 2022-2028.

Flood zone maps supporting the SFRA identify the southern end of the site as being located within Flood Zone B defended area. The defences associated with the River Dodder defence scheme incorporate the estimated 200-year tide levels, plus 650mm for climate change, plus 300mm freeboard, plus allowance for fluvial surcharge at high tide and have been constructed from Ringsend Bridge (adjacent to the site) to Ballsbridge.

The SFRA flood zone map is shown in Appendix C.

(i) Irish Coastal Protection Strategy Study

The Irish Coastal Protection Strategy Study (ICPSS) Phase 3, undertaken by the OPW, covers coastal flooding throughout Ireland. The aim of the ICPSS was to establish extreme coastal flood extents, produce coastal flood extent and flood depth maps and assess and quantify the hazard and potential risk associated with coastal erosion.

The ICPSS flood maps indicate that the development area is within the 0.5% AEP coastal flood extent. The ICPSS mapping does not consider flood defence infrastructure.

The *published ICPSS flood maps are reproduced in Appendix D.*

(iv) OPW Flood Records

The OPW National Flood Hazard Mapping Web Site, www.floodmaps.ie, was examined to identify any recorded flood events within the vicinity of the proposed development site. There is one historic event identified approximately 400m to the west of the development area, on the west side of the River Dodder. This recorded flooding event was from June 1963. The rainfall in Dublin was recorded well above normal due mainly to heavy thunderstorms on June 11th. Over 24 hours, 3.85 inches (97.8mm) of rain was recorded at Ballsbridge with most of the rain falling between 2pm – 5pm.

The flood records are shown in Appendix E.

(v) OPW Drainage Districts

Drainage Districts are areas where drainage schemes to improve land for agricultural purposes were constructed. Under the Arterial Drainage Act, 1945 the OPW undertook a number of arterial drainage schemes to improve land for agricultural production. The OPW has a statutory duty to maintain these schemes, which is delivered through their arterial drainage maintenance programme. The OPW does not have powers to undertake river or channel maintenance other than where these rivers form part of an arterial drainage scheme or flood relief schemes.

The River Dodder is not identified as being part of an OPW Arterial Drainage Scheme. No section of the subject site falls within benefited land.

(vi) GSI Maps

GSI Teagasc subsoil map was sourced from the GSI Groundwater Data Viewer. The mapping shows the subsoil characteristics of the site of interest.

The proposed development site is indicated to be underlain by "Made Ground".

Refer to Appendix F for GSI maps.

(vii) Ground Investigation Report – Fitzwilliam Quay, Ringsend

In 2006 a report on Ground Investigation was undertaken for a development at Fitzwilliam Quay in Dublin for the construction of a multi storey residential/commercial units. The programme of investigation included a review of sub-soil conditions for the construction of five exploratory boreholes to establish stratification, the excavation of 6 trial pits, the installation of groundwater monitoring standpipes, geotechnical soil testing and environmental soil testing.

Refer to Appendix G for GI extracts.

(viii) Historical Maps

Historical maps were consulted to indicate areas of flooding documented previously to records being kept by the current responsible authorities. The enclosed historical maps have been prepared using GeoHive, web-based access to authoritative Irish spatial data from multiple providers, including Ordnance Survey Ireland (OSi). No areas of flooding were indicated on the 6" Inch or 25" maps.

Refer to Appendix H for Historical Maps.

(ix) Historic Flood Events

In 2002, a flood event was recorded in the Ringsend area. It was reported that this flood event occurred when the River Liffey was at its highest level since 1924. The worse affected areas reported in Dublin were Irishtown, Ringsend, Clontarf Road, Merrion Gates, Strand Road and the north and south quays. The flooding mostly affected areas around the mouth of the Liffey. The River Dodder burst its banks at Ballsbridge with most of the flood water subsiding by low tide.

Refer to Appendix J for historic news article and report.

4.4 Stage 1 Conclusions

A number of sources of information indicate that the site and adjacent lands are at risk of fluvial/coastal flooding. Therefore, a Stage 2 – Initial Flood Risk Assessment is required for the proposed development.

5. STAGE 2 – INTIAL FLOOD RISK ASSESSMENT

5.1 General

The Stage 2 Initial Flood Risk Assessment will confirm the sources of flooding that may affect the proposed development site and appraise the accuracy of the existing information. This is summarised in Table 5.1 (taken from Appendix A of the Guidelines).

Table 5.1 Possible Sources of Flooding Associated with the Ringsend Site

Source	Pathway	Receptor	Likelihood	Consequence	Risk
Tidal	Overland flow, out of bank	Development area	Moderate (Area is defended to 1 in 200-year tidal event)	Moderate (the development is considered less vulnerable infrastructure; tidal-fluvial interaction has to be considered)	Moderate (due to proximity to tidal estuary)
Fluvial	Overland flow, out of bank	Development area	Moderate Possibility (Area is defended to 1 in 100-year fluvial event)	Low (majority of site elevations are above modelled CFRAM flood levels for 100 year event however area is defended)	Moderate (due to tidal interaction and proximity to tidal estuary)
Surface Water	Overland flow	Development area	Low Possibility	Low (no reported surface water flooding on site)	Low (if appropriate drainage system is incorporated in development and maintained appropriately)
Ground Water	Rising levels	Development area	Low Possibility	Low (Groundwater not encountered during GI works associated with Fitzwilliam Quay, Ringsend)	Low (based on ground conditions and no indication of previous groundwater flooding at site)

The consulted sources indicate that the most prevalent flood risk to the site is from extreme tidal inundation for 0.1% AEP (1 in 1000) year event. Sources consulted as part of this assessment indicate the majority of the site is located within fluvial Flood Zone C, however a small proportion of Irishtown Road is indicated to fall within Flood Zone B. Though no fluvial flooding has been reported in the OPW CFRAM Study, fluvial – tidal interaction must be considered.

The fluvial and coastal CFRAM flood maps indicate the River Dodder tidal defence project offers protection to a proportion of the development area, defended to the estimated 200-year tide levels plus 650mm for climate change, plus 300mm freeboard.

It is considered the proposed development will have a negligible effect on tidal/fluvial flooding due to:

- The area of hardstanding will remain the same.
- No walls, structures or significant change in ground level are to be constructed that would affect flow path or displace flood waters.

The nature of the development will not increase or decrease flood risk derived from fluvial or coastal flooding. The public realm development is classed as less vulnerable and it is therefore considered an appropriate development within Flood Zone C and Flood Zone B.

6. FLOOD RISK ASSESSMENT CONCLUSIONS

The Library Square Public Realm Project has been assessed for existing and future sources of flood risk. The sources examined indicate that the site is at risk of flooding in the 1 in 1000 Year fluvial and 1 in 1000 Year coastal events. As per the OPW Guidelines, the development area falls within Flood Zone B and Flood Zone C and is therefore deemed suitable for the associated flood risk in line with the sequential approach.

APPENDIX A
GLOSSARY OF TERMS

GLOSSARY OF TERMS

Catchment: The area that is drained by a river or artificial drainage system.

Catchment Flood Risk Assessment and Management Studies (CFRAMS): A catchment-based study involving an assessment of the risk of flooding in a catchment and the development of a strategy for managing that risk in order to reduce adverse effects on people, property and the environment. CFRAMS precede the preparation of Flood Risk Management Plans (see entry for FRMP).

Climate change: Long-term variations in global temperature and weather patterns, which occur both naturally and as a result of human activity, primarily through greenhouse gas emissions.

Core of an urban settlement: The core area of a city, town or village which acts as a centre for a broad range of employment, retail, community, residential and transport functions.

Detailed flood risk assessment: A methodology to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of flood hazard and potential risk to an existing or proposed development, of its potential impact on flood elsewhere and of the effectiveness of any proposed measures.

Estuarial (or tidal) flooding: Flooding from an estuary, where water level may be influenced by both river flows and tidal conditions, with the latter usually being dominant.

Flooding (or inundation): Flooding is the overflowing of water onto land that is normally dry. It may be caused by overtopping or breach of banks or defences, inadequate or slow drainage of rainfall, underlying groundwater levels or blocked drains and sewers. It presents a risk only when people, human assets and ecosystems are present in the areas that flood.

Flood Relief Schemes (FRS): A scheme designed to reduce the risk of flooding at a specific location.

Flood Defence: A man-made structure (e.g., embankment, bund, sluice gate, reservoir or barrier) designed to prevent flooding of areas adjacent to the defence.

Flood Risk Assessment (FRA): FRA can be undertaken at any scale from the national down to the individual site and comprises 3 stages: Flood risk identification, initial flood risk assessment and detailed flood risk assessment.

Flood Risk Identification: A desk- based study to identify whether there may be any flooding or surface water management issues related to a plan area or proposed development site that may warrant further investigation.

Flood Hazard: The features of flooding which have harmful impacts on people, property or the environment (such as the depth of water, speed of flow, rate of onset, duration, water quality, etc.).

Floodplain: A flood plain is any low-lying area of land next to a river or stream, which is susceptible to partial or complete inundation by water during a flood event.

Flood Risk: An expression of the combination of the flood probability, or likelihood and the magnitude of the potential consequences of the flood event.

Flood Storage: The temporary storage of excess run-off, or river flow in ponds, basins, reservoirs or on the flood plain.

Flood Zones: A geographic area for which the probability of flooding from rivers, estuaries or the sea is within a particular range.

Fluvial flooding: Flooding from a river or other watercourse.

Groundwater flooding: Flooding caused by groundwater escaping from the ground when the water table rises to or above ground level.

Initial flood risk assessment: A qualitative or semi-quantitative study to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information, to provide a qualitative appraisal of the risk of flooding to development, including the scope of possible mitigation measures, and the potential impact of development on flooding elsewhere, and to determine the need for further detailed assessment.

Freeboard: Factor of safety applied for water surfaces. Defines the distance between normal water level and the top of a structure, such as a dam, that impounds or restrains water.

Justification Test: An assessment of whether a development proposal within an area at risk of flooding meets specific criteria for proper planning and sustainable development and demonstrates that it will not be subject to unacceptable risk nor increase flood risk elsewhere. The justification test should be applied only where development is within flood risk areas that would be defined as inappropriate under the screening test of the sequential risk-based approach adopted by this guidance.

Likelihood (probability) of flooding: A general concept relating to the chance of an event occurring. Likelihood is generally expressed as a probability or a frequency of a flood of a given magnitude or severity occurring or being exceeded in any given year. It is based on the average frequency estimated, measured or extrapolated from records over a large number of years and is usually expressed as the chance of a particular flood level being exceeded in any one year. For example, a 1-in-100 or 1% flood is that which would, on average, be expected to occur once in 100 years, though it could happen at any time.

Ordnance Datum (or OD) Malin: is a vertical datum used by an ordnance survey as the basis for deriving altitudes on maps. A spot height may be expressed as AOD for "above ordnance datum". Usually mean sea level (MSL) is used for the datum. In the Republic of Ireland, OD for the Ordnance Survey of Ireland is Malin Ordnance Datum: the MSL at Portmoor Pier, Malin Head, County Donegal, between 1960 and 1969. Prior to 1970, Poolbeg Ordnance Datum was used: the low water of spring tide at Poolbeg lighthouse, Dublin, on 8 April 1837. Poolbeg OD was about 2.7 metres lower than Malin OD.

Management Train/Treatment Train: the sequence of drainage components that collect, convey, store and treat runoff as it drains through the site.

Mitigation: The term is used to describe an action that helps to lessen the impacts of a process or development on the receiving environment. It is used most often in association with measures that would seek to reduce negative impacts of a process or development.

Pathways: These provide the connection between a particular source (e.g., high river or tide level) and the receptor that may be harmed (e.g., property). In flood risk management, pathways are often 'blocked' by barriers, such as flood defence structures, or otherwise modified to reduce the incidence of flooding.

Pluvial flooding: Usually associated with convective summer thunderstorms or high intensity rainfall cells within longer duration events, pluvial flooding is a result of rainfall-generated overland flows which arise before run-off enters any watercourse or sewer. The intensity of rainfall can be such that the run-off totally overwhelms surface water and underground drainage systems.

Regional Planning Guidelines (RPG): These provide the regional context and priorities for applying national planning strategy to each NUTS III region and encourage greater co-ordination of planning policies at the city/county level. RPGs are an important part of the flood policy hierarchy as they can assist in co-ordinating flood risk management policies at the regional level.

Resilience: Sometimes known as "wet-proofing", resilience relates to how a building is constructed in such a way that, although flood water may enter the building, its impact is minimised, structural integrity is maintained, and repair, drying and cleaning and subsequent reoccupation are facilitated.

Receptors: Things that may be harmed by flooding (e.g., people, houses, buildings or the environment).

Residual risk: The risk which remains after all risk avoidance, substitution and mitigation measures have been implemented, on the basis that such measures can only reduce risk, not eliminate it.

Sequential Approach: The sequential approach is a risk-based method to guide development away from areas that have been identified through a flood risk assessment as being at risk from flooding. Sequential approaches are already established and working effectively in the plan-making and development management processes.

Sustainable Drainage System (SuDS): Drainage systems that are considered to be environmentally beneficial, causing minimal or no long-term detrimental impact.

Site-specific Flood Risk Assessment: An examination of the risks from all sources of flooding of the risks to and potentially arising from development on a specific site, including an examination of the effectiveness and impacts of any control or mitigation measures to be incorporated in that development.

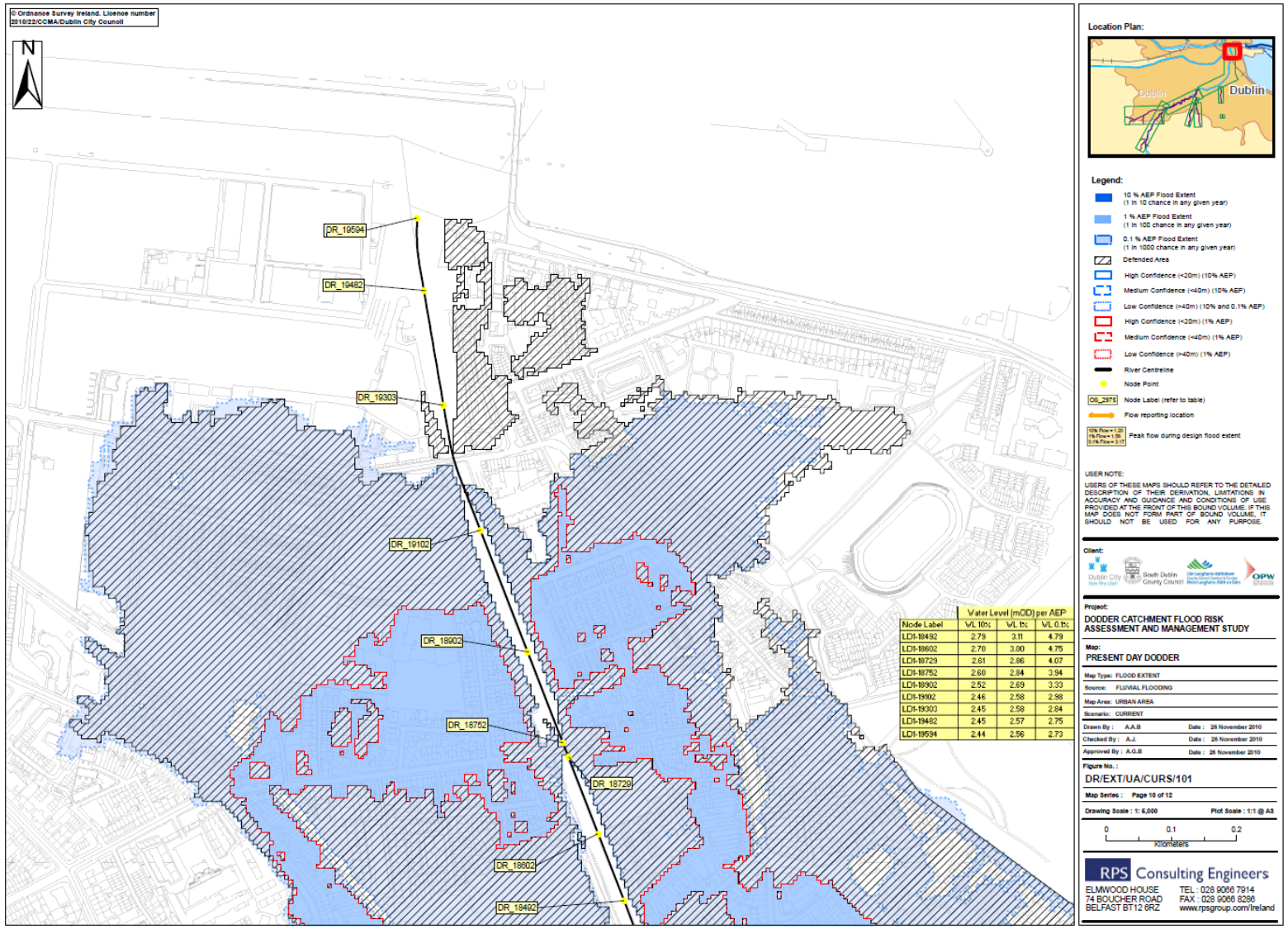
Source: Refers to a source of hazard (e.g., the sea, heavy rainfall).

Strategic Flood Risk Assessment: The assessment of flood risk on a wide geographical area against which to assess development proposed in an area (Region, County, Town).

Vulnerability: The resilience of a particular group of people or types of property or habitats, ecosystems or species to flood risk, and their ability to respond to a hazardous condition and the damage or degree of impact they are likely to suffer in the event of a flood. For example, elderly people may be more likely to suffer injury, and be less able to evacuate, in the event of a rapid flood than younger people.

Source: *The definitions above are sourced from the DoEHLG Guidelines for Planning Authorities on 'The Planning System and Flood Risk Management, 2009' and Ciria 753 "the SuDS Manual".*

APPENDIX B
CFRAM MAPS



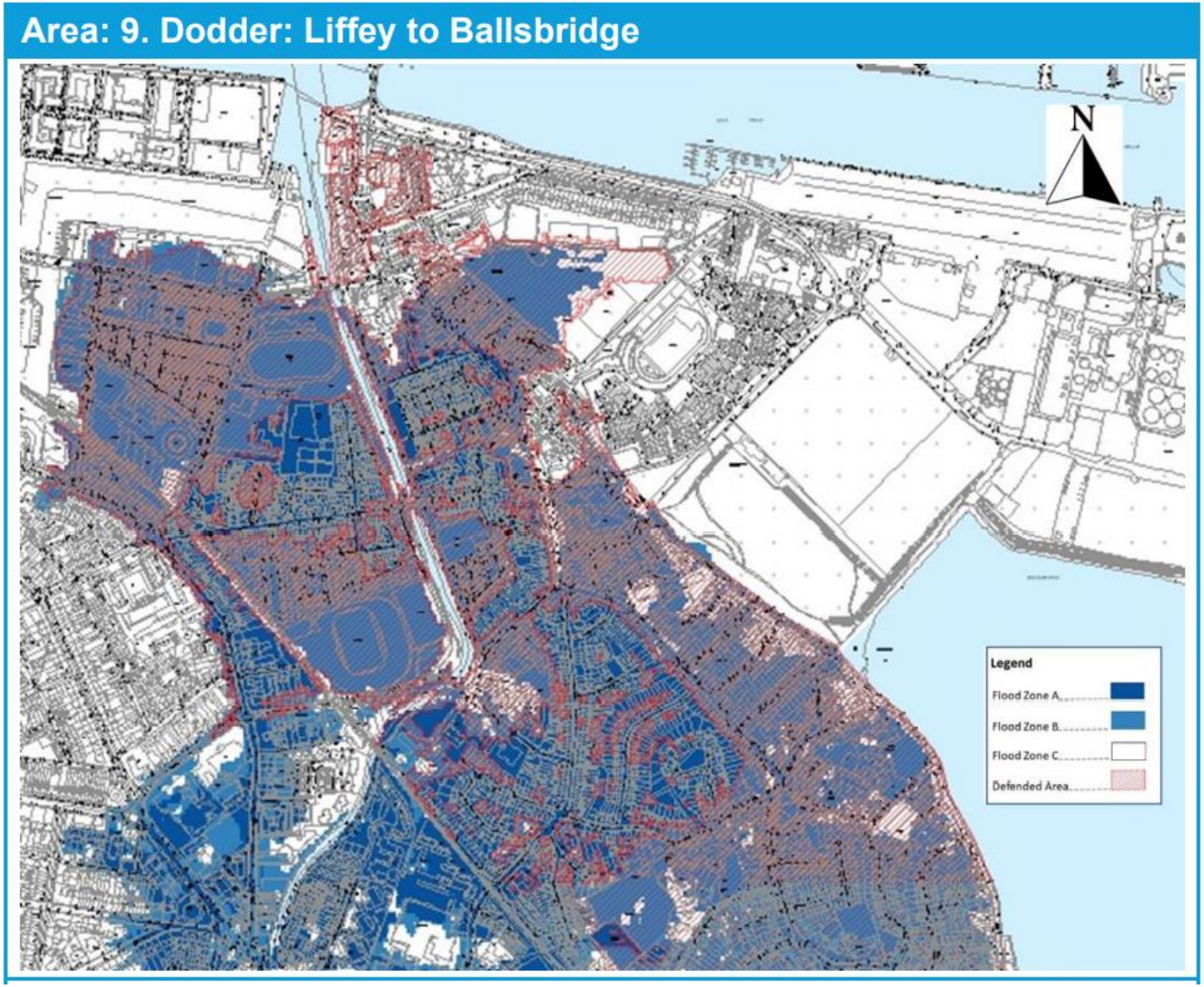
	Water Level (mOD) per AEP		
Node Label	WL 10%	WL 1%	WL 0.1%
LDI-19492	2.79	3.11	4.79
LDI-18602	2.70	3.00	4.75
LDI-18729	2.61	2.86	4.07
LDI-18752	2.60	2.84	3.94
LDI-18902	2.52	2.69	3.33
LDI-19102	2.46	2.58	2.98
LDI-19303	2.45	2.58	2.84
LDI-19482	2.45	2.57	2.75
LDI-19594	2.44	2.56	2.73

CFRAM Fluvial Flood Map

	Water Level (mOD) per AEP		
NodeLabel	WL 10%	WL 1%	WL 0.1%
DR-18492	2.77	3.18	3.37
DR-18602	2.74	3.08	3.36
DR-18692	2.73	3.06	3.35
DR-18802	2.71	3.01	3.30
DR-18802	2.70	3.00	3.30
DR-18992	2.67	2.97	3.28
DR-19102	2.67	2.97	3.28
DR-19303	2.67	2.96	3.27
DR-19482	2.67	2.97	3.28
DR-19589	2.67	2.97	3.28
DR-19594	2.67	2.97	3.28

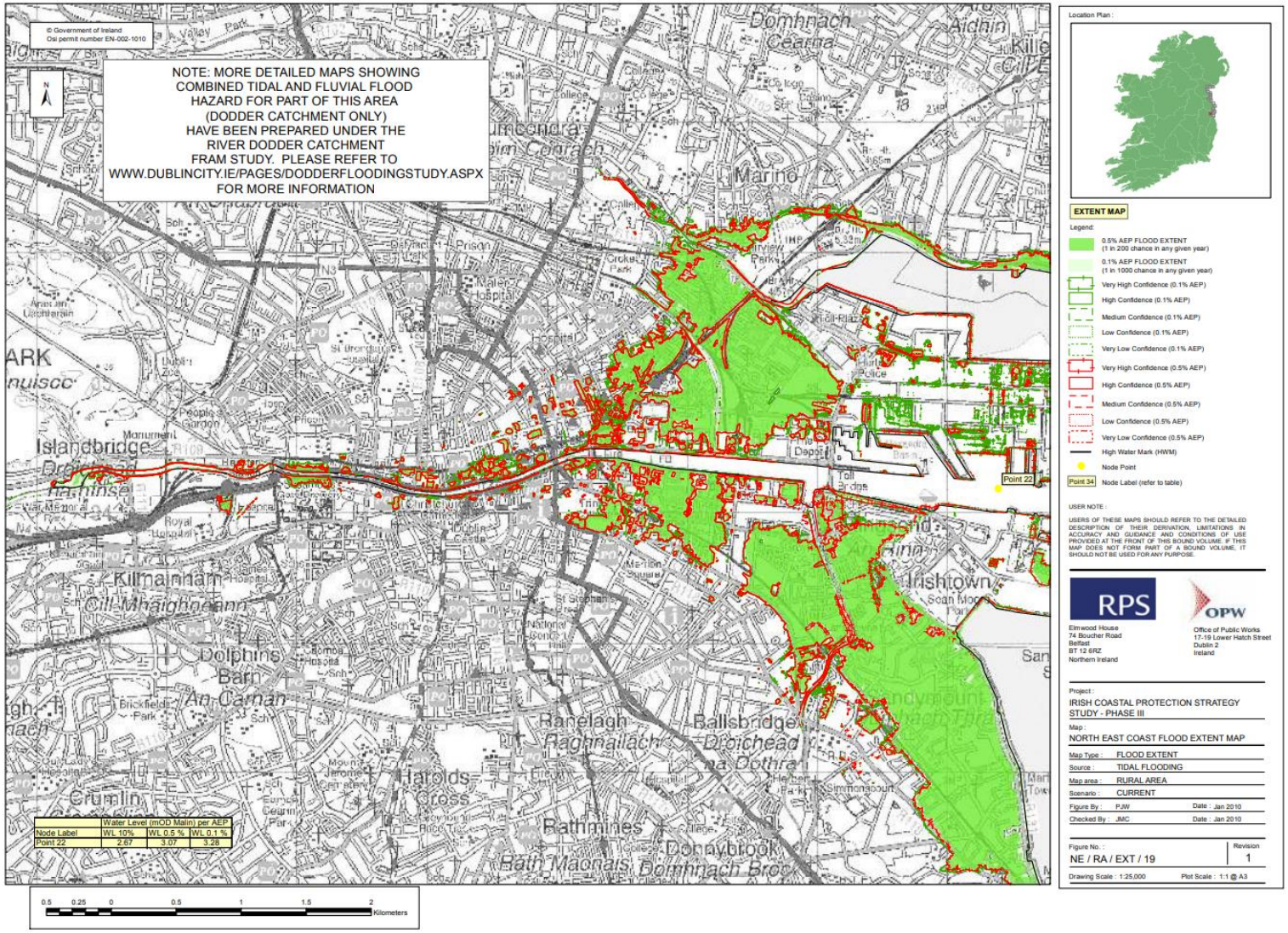
CFRAM Tidal Flood Map

APPENDIX C
DUBLIN CITY DEVELOPMENT PLAN 2022-2028



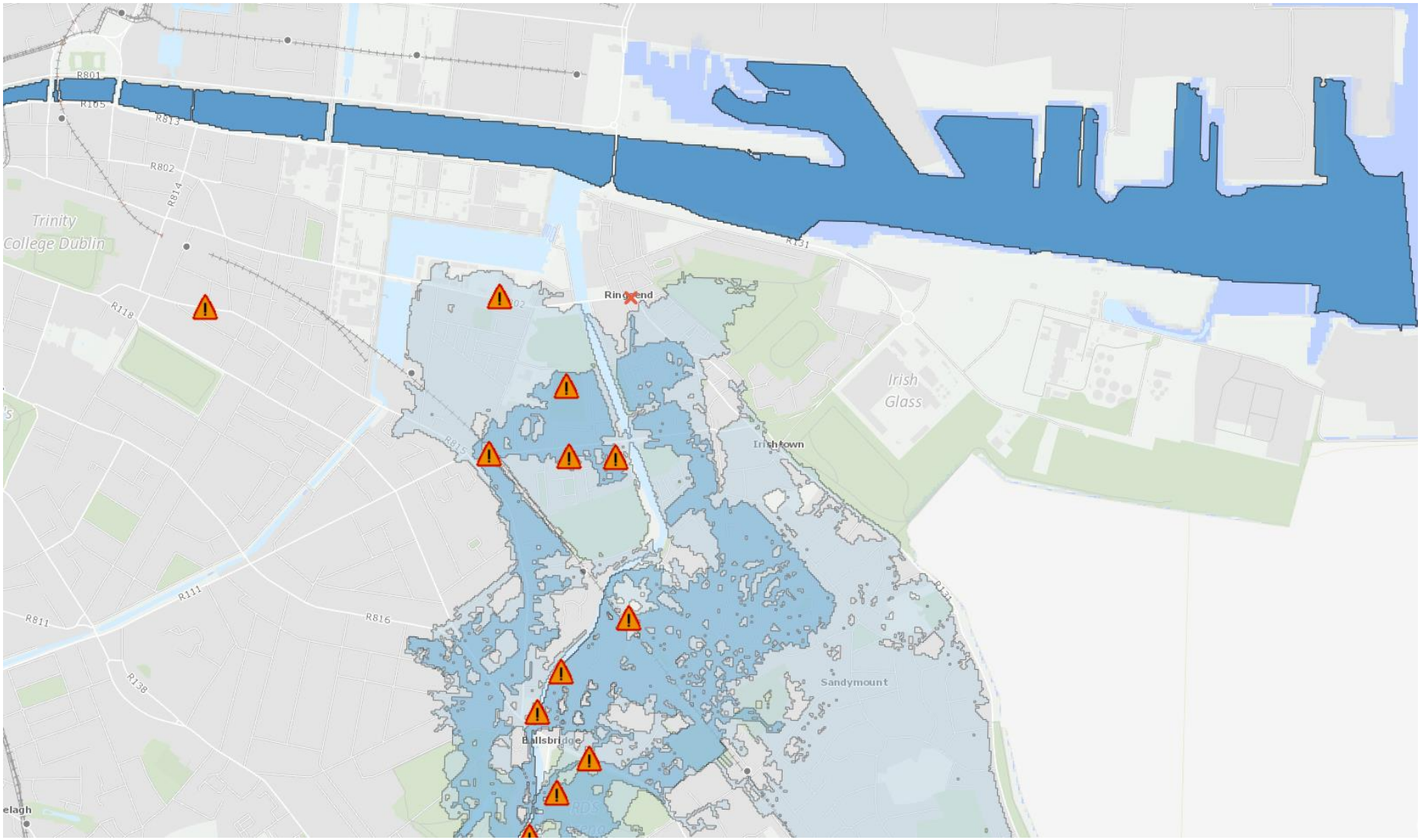
Dublin City Development Plan 2022-2028

APPENDIX D
ICPSS FLOOD EXTENTS MAP



ICPSS Coastal Flood Extent Map

APPENDIX E
OPW FLOOD RECORDS


Trinity
College Dublin
Irish
Glass
Irishtown
Sandymount
Ballsbridge
R801
R105
R813
R802
R814
R118
R111
R811
R816
R138
R131

2nd July 1963

Dublin thunderstorms

RECORD RAINFALL RECORDED

THE Meteorological Service of the Department of Transport and Power in a weather summary for June, says that rainfall was above normal in the east and parts of the midlands but was below normal in almost all other areas. In the Dublin area it was well above normal due mainly to heavy thunderstorms on June 11. On this day torrential rain fell in the south side of the city.

Over 24 hours 3.85 inches (97.8 millimetres) of rain was recorded at an official gauge at Ballsbridge and 7.25 inches (184.1 millimetres) was recorded by a private observer in Mount Merrion.

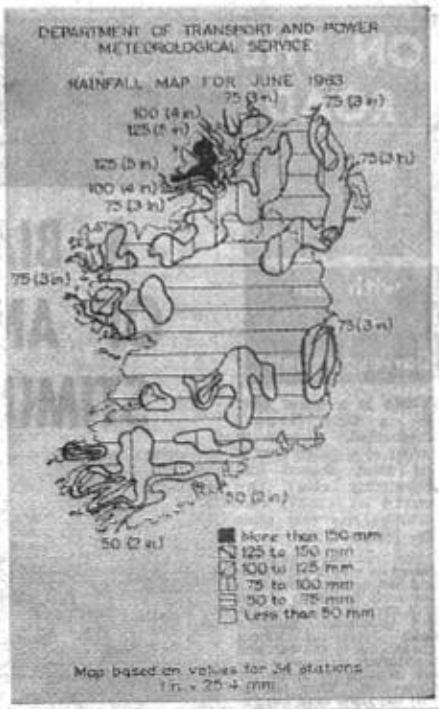
Most of this rain fell in the period 2 p.m.-4 p.m. The amount of 7.25 inches is greater than any previously recorded daily amount.

SUNSHINE VARIED

Average daily duration of bright sunshine over the country varied between 6.3 hours (at Valentia Observatory) and 3.7 hours (at Rosslare). It was below normal in the extreme south and south-west but was above normal at most other places. The periods June 1 to 4 and 7 to 10 were particularly sunny in most areas. During the period, June 2 to 4 more than 12 hours of bright sunshine were recorded almost everywhere. 15.8 hours was recorded at Belmullet on June 3.

Mean temperature over the country varied between 13.6°C (56.4°F) at Malin Head and [illegible] at Dublin Upper O'Connell St. In the Dublin area mean temperature was near normal but was above normal at most other places. Over the period June 1-11 most inland places had several days with temperatures in excess of 21.1°C (70.0°F).

However, the highest temperature, 26.6°C (79.9°F), was recorded at Belmullet on June 10. This was the highest June maximum recorded there since 1957. Over the period June 15 to end of the month there was a noticeable lack of high temperatures, few places having more than two days with temperatures higher than 18.0°C (64.4°F). Lowest temperatures occurred at most places on June 13 and 23 when values below 8.0°C (46.4°F) were generally recorded. The lowest temperature, 4.7°C (40.5°F), was recorded at Claremorris on June 13.



Figures for June twice normal

The School of Cosmic Physics in the Dublin Institute for Advanced Studies reports that, in Dublin City, rainfall for June (4.07 ins.) was more than twice the normal amount, but 1.92 inches or 47 p.c. of the total fell on June 11, and was accompanied by a severe thunderstorm. Temperature was 0.5 degrees F. above and sunshine 10 per cent above average.

Monthly mean temperature was 57.9 degrees F., and the deviation of the monthly mean from the average (1900-1936) was +0.4 degrees F. Highest maximum was [illegible] degrees F. on June 11, and lowest minimum was 47 degrees F. on June 23.

Only rainfall total was 4.07 [illegible] and the monthly total as [illegible] of the average (1881-[illegible] June 222 per cent. Greatest [illegible] day was 1.92 inches on [illegible] and the number of days [illegible] inch or more rain was [illegible]. Mean [illegible] hours of sunshine was 14.7 hours, maximum being [illegible] June 3.

Interchange of students urged

A PLEA for the promotion of the international service aspect of Rotary, such as the interchange of students and looking after the needs of foreign students in Dublin especially those from the new nations of Africa and India, was made by **Dr. Brendan J. Senior**, newly-elected president of the Dublin Rotary Club in the Royal Hibernian Hotel, Dublin, yesterday.

The time was opportune for a further expansion of Rotary activity in Ireland, especially in Dublin, where there were only 130 members, he added.

President Kennedy had paid us a compliment last week when he said that although Ireland was neither rich nor powerful, it had made both a rich and powerful contribution to world affairs.

CHAIN OF OFFICE

Dr. Senior was presented with his chain of office by the outgoing president, Mr. Owen Bruny. Mr. Bruny, in turn, was presented with the past president's badge by Dr. Senior, and a vote of thanks to him was proposed by Mr. Leo Calnow and seconded by Mr. John Jennings, both past presidents.

Dr. Senior is a Dublin businessman and he also farms in Leixlip, where he resides. He was previously a lecturer in Agriculture in U.C.D. He is married and has three children.

EXHIBITION DEPICTS CANADA

BRIDGE by B. Jay Becker

Test your play

1. You are declarer with the West hand at Three Notrump. North leads the six of spades, which you win in dummy with the queen. How would you now play the hand?

♠ A85 ♥ 652 ♦ AJ63 ♣ 974	N W E S	♠ Q4 ♥ AKJ83 ♦ K752 ♣ A6

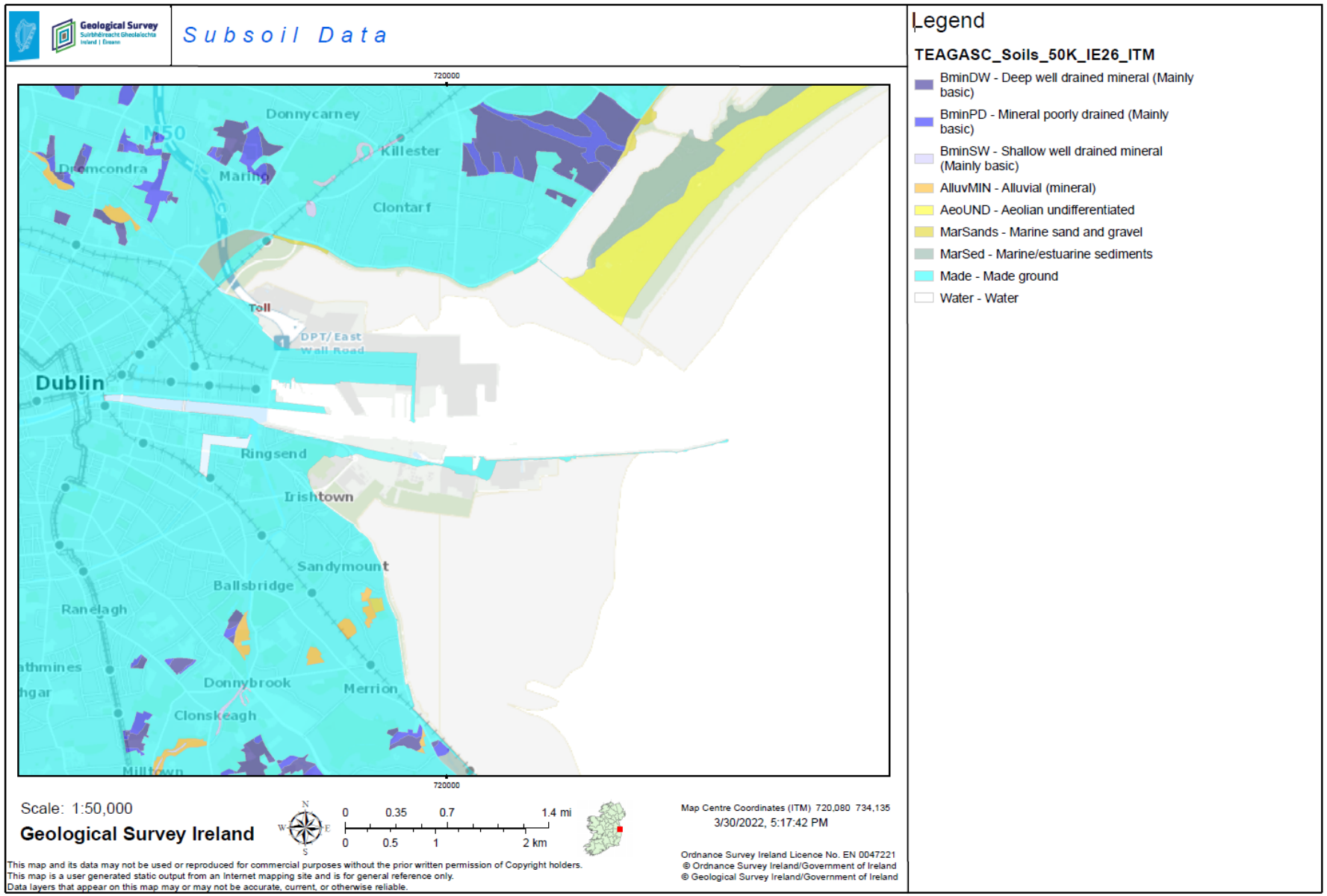
2. You are declarer with the West hand at Four Spades. North cashes the K-Q of diamonds and plays a low diamond to the ace, which you ruff. You draw two rounds of trumps, both opponents following suit. How would you now play the hand?

♠ KQJ94 ♥ KJ ♦ 85 ♣ Q832	N W E S	♠ A1083 ♥ A7 ♦ 1062 ♣ AJ54

1. The first thing to do is find out whether the hearts are divided 3-2. If they are, you are sure of making the contract. You therefore cash the A-K of hearts immediately. Assuming that both defenders play low, you continue with a heart and thus assure nine tricks.

If it turns out that South was dealt Q-10-x-x of hearts, which you learn after the second heart lead, you shift your attention to diamonds by playing the king first and then [illegible]

APPENDIX F
GSI MAP


Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann
Subsoil Data
720000
Donnycarney
Killester
Drumcondra
Marino
Clontarf
Toll
DPT/East
Wall Road
Dublin
Ringsend
Irishtown
Sandymount
Ballsbridge
Ranelagh
Donnybrook
Merrion
Clonskeagh
Milltown
720000
Legend
TEAGASC_Soils_50K_IE26_ITM
BminDW - Deep well drained mineral (Mainly basic)
BminPD - Mineral poorly drained (Mainly basic)
BminSW - Shallow well drained mineral (Mainly basic)
AlluvMIN - Alluvial (mineral)
AeoUND - Aeolian undifferentiated
MarSands - Marine sand and gravel
MarSed - Marine/estuarine sediments
Made - Made ground
Water - Water
Scale: 1:50,000
Geological Survey Ireland
0 0.35 0.7 1.4 mi
0 0.5 1 2 km
Map Centre Coordinates (ITM) 720,080 734,135
3/30/2022, 5:17:42 PM
This map and its data may not be used or reproduced for commercial purposes without the prior written permission of Copyright holders.
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Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.
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© Ordnance Survey Ireland/Government of Ireland
© Geological Survey Ireland/Government of Ireland

APPENDIX G
GI REPORT FITZWILLIAM QUAY

IGSL Limited
Ground Investigation
Fitzwilliam Quay Ringsend
Project No. 12028
On Behalf Of
P.J.Walls & Co. Limited

Appendices

Appendix I	- Cable Tool Borehole Records
Appendix II	- Trial Pit Records
Appendix III	- Geotechnical Test Records
Appendix IV	- Environmental Test Records
Appendix V	- Site Plan

FOREWORD

The following Conditions and Notes on Site Investigation Procedures should be read in conjunction with this report.

General.

Recommendations made, and opinions expressed in the report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. No responsibility can be held for conditions which have not been revealed by exploratory work, or which occur between exploratory hole locations. Whilst the report may suggest the likely configuration of strata, both between exploratory hole locations, or below the maximum depth of the investigation, this is only indicative, and liability cannot be accepted for its accuracy.

Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction below or close to the site.

Boring Procedures.

Unless otherwise stated, the 'Shell and Auger' technique of soft ground boring has been employed. All boring operations sampling and/or logging of soils and in-situ testing complies with the recommendations of the British Standard Code of Practice BS 5930 (1981), 'Site Investigation' and BS 1377:1990, 'Methods of test for soils for civil engineering purposes'.

Whilst the technique allows the maximum data to be obtained in soft ground, some disturbance and variation of soft and layered soils is unavoidable. Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

Where peat has been encountered during siteworks, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 & Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986).

Routine Sampling.

Undisturbed samples of soils, predominantly cohesive in nature are obtained unless otherwise stated by a 104mm diameter open-drive tube sampler. In granular soils, and where undisturbed sampling is inappropriate, disturbed samples are collected. Smaller disturbed samples are also recovered at intervals to allow a visual examination of the full strata section.

In-Situ Testing.

Standard penetration tests, utilising either the standard split spoon sampler or solid cone and automatic trip-hammer are conducted unless otherwise where required by instruction. Subsequent to a seating drive of 150mm, a summation for the number of blows for 300mm penetration is recorded on the boring records together with the blow count for each 75mm penetration. In cases where incomplete penetration is obtained, the number of blows for the recorded value of penetration are noted. In coarse granular soils, a cone end is fitted to the sampler and a similar procedure adopted.

Groundwater.

The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water
level.

Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage condition, tidal variation or other causes.

Retention of Samples.

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material is discarded unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

REPORT ON A GROUND INVESTIGATION
FOR
PROPOSED RESIDENTIAL / COMMERCIAL DEVELOPMENT
AT
FITZWILLIAM QUAY, DUBLIN
ON BEHALF OF
P.J.WALLS & COMPANY LIMITED

REPORT NO. 12028 **SEPTEMBER 2006**

I.INTRODUCTION

The proposed development site is located at Fitzwilliam Quay in Dublin and it is proposed to construct new multi storey residential / commercial units on this site. An investigation of sub-soil conditions was ordered by the projects consulting engineers, Muir Associates, and commissioned by the projects developers P.J.Walls & Company Limited.

The programme of ground investigation completed included,

- ✓ The construction of five exploratory boreholes to establish stratification. During the course of boring in-situ tests were performed at regular intervals and representative soil samples were recovered for visual examination and laboratory analysis (Appendix I).

- ✓ The excavation of six trial pits using a CAT tracked excavator. All of the trial pits were logged and sampled by an IGSL geotechnical engineer (Appendix II), the excavation plant was supplied by the developer.

- ✓ The installation of groundwater monitoring standpipes at selected borehole locations and the provision of an electric dipmeter for use by the P.J.Walls project engineers.

- ✓ The carrying out of laboratory geotechnical soils testing (Appendix III).

- ✓ The carrying out of environmental soils testing in accordance with the Murphy Suite (Appendix IV).

This report contains the information pertaining to the works as completed at locations marked on site by a representative of P.J.Walls & Co. Limited, no geotechnical interpretation has been carried out.

Appendix I – Cable Tool Borehole Records

GEOTECHNICAL BORING RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay	BOREHOLE NO.	BH1
		SHEET	Sheet 1 of 2
CO-ORDINATES(_)		GROUND LEVEL (m)	
		BOREHOLE DIAMETER (mm)	200
		DATE STARTED	23/08/2006
		DATE COMPLETED	24/08/2006
CLIENT	P.J.Walls Ltd.	BORED BY	J.McDonell
ENGINEER	Muir Associates	PROCESSED BY	C.Killaly
		BOREHOLE DEPTH (m)	12.60
		CASING DEPTH (m)	12.60

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Field Test Results	Standpipe Details
0	MADE GROUND comprised of concrete								
	MADE GROUND comprised of cobbles, steel and red brick fill			0.20					
1	MADE GROUND comprised of concrete			1.00	3335	B	0.90-0.90		
	MADE GROUND comprised of medium dense grey fine to coarse sandy gravel with red brick fill			1.20					
2					3336	B	2.00-2.00	N = 20 (3, 3, 4, 4, 6, 6)	
3					3337	B	3.10-3.10	N = 20 (3, 3, 4, 5, 5, 6)	
4	Medium dense grey sandy fine to coarse GRAVEL with sea shells and pockets of grey silt			4.00	3338	B	4.10-4.10	N = 6 (3, 4, 5, 4, 4, 3)	
5					3339	B	5.00-5.00	N = 4 (2, 3, 3, 4, 4, 3)	
6	Dense grey medium to coarse sandy GRAVEL with some cobbles and occasional boulders.			6.00	3340	B	6.10-6.10	N = 57 (7, 9, 11, 11, 16, 19)	
7					3341	B	7.00-7.00	N = 38 (5, 7, 8, 9, 10, 11)	
8	Hard brown sandy gravelly CLAY with occasional cobbles and boulders			7.80	3342	B	8.00-8.00	N = 62 (7, 10, 12, 16, 16, 18)	
	Hard black sandy gravelly CLAY with occasional cobbles and boulders			8.40					
9					3343	B	9.00-9.00	N = 74 (10, 12, 17, 18, 19, 20)	

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0.6	0.9	1	
8.4	8.7	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (hh:mm)	Comments
3.00	3.00				Seepage
4.00	4.00		2.90		

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS JCB broke through concrete to 0.20m and 1.0m 1.2m

IGSL BH LOG 12028.GPJ IGSL.GDT 1/9/06

GEOTECHNICAL BORING RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay	**BOREHOLE NO.**	**BH1**
		SHEET	Sheet 2 of 2
CO-ORDINATES(_)		**GROUND LEVEL (m)**	
		BOREHOLE DIAMETER (mm)	200
		DATE STARTED	23/08/2006
		DATE COMPLETED	24/08/2006
CLIENT	P.J.Walls Ltd.	**BORED BY**	J.McDonell
ENGINEER	Muir Associates	**BOREHOLE DEPTH (m)**	12.60
		CASING DEPTH (m)	12.60
		PROCESSED BY	C.Killaly

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Field Test Results	Standpipe Details
10	Hard black sandy gravelly CLAY with occasional cobbles and boulders *(continued)*				3344	B	10.00 - 10.00	N = 25/75 mm (12, 25, 25)	
11					3345	B	11.00 - 11.00	N = 57/225 mm (9, 11, 15, 17, 25)	
12					3346	B	12.00 - 12.00	N = 4 / 50 mm (10, 12, 16, 25)	
	Obstruction			12.60					
13									
14									
15									
16									
17									
18									
19									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
10.2	10.5	1	
12.5	12.6	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (hh:mm)	Comments
					Seepage

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
24-08-06	12.60	0.00		End of Borehole

REMARKS JCB broke through concrete to 0.20m and 1.0m 1.2m

IGSL BH LOG 12028.GPJ IGSL.GDT 1/9/06

GEOTECHNICAL BORING RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay
CO-ORDINATES(_)	
CLIENT	P.J.Walls Ltd.
ENGINEER	Muir Associates
GROUND LEVEL (m)	
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	12.50
CASING DEPTH (m)	12.50
BOREHOLE NO.	BH2
SHEET	Sheet 1 of 2
DATE STARTED	25/08/2006
DATE COMPLETED	26/08/2006
BORED BY	J.McDonell
PROCESSED BY	C.Killaly

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Field Test Results	Standpipe Details
0	MADE GROUND comprised of concrete			/					
	MADE GROUND comprised of cobbles, steel and red brick fill			0.20					
1	MADE GROUND comprised of concrete			1.00	3347	B	0.90-0.90		
	MADE GROUND comprised of cobbles, steel, wire and red brick fill			1.20					
2					3348	B	2.00-2.00	N = 36 (3, 4, 12, 8, 8, 8)	
3	Loose grey silty SAND			3.00	3349	B	3.10-3.10	N = 7 (1, 1, 1, 2, 2, 2)	
4	Medium dense grey fine to coarse sandy GRAVEL with occasional cobbles and sea shells			4.00	3350	B	4.10-4.10	N = 4 (3, 3, 4, 4, 3, 3)	
5					3351	B	5.00-5.00	N = 5 (2, 2, 3, 4, 4, 4)	
	Very soft grey SILT			5.50					
6					3352	B	6.00-6.00	N = 3 (0, 0, 0, 1, 1, 1)	
	Very dense grey fine to coarse sandy GRAVEL with occasional cobbles and boulders			6.40					
7					3353	B	7.00-7.00	N = 29/75 mm (9, 12, 29)	
8	Hard brown sandy gravelly CLAY with occasional cobbles and boulders			8.00	3354	B	8.10-8.10	N = 64 (7, 8, 12, 16, 18, 18)	
9	Hard black sandy gravelly CLAY with occasional cobbles and boulders			9.00	3355	B	9.00-9.00	N = 70 (8, 10, 14, 16, 20, 20)	

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.5	1.9	1.5	
7.3	7.5	1	
9.4	9.7	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (hh:mm)	Comments
3.00	3.00		2.00		Moderate

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
26/08/2006	12.50	1.00	12.50	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS JCB broke through concrete to 0.20m and 1.0m 1.2m

IGSL BH LOG 12028.GPJ IGSL.GDT 1/9/06

GEOTECHNICAL BORING RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay
CO-ORDINATES(_)	
CLIENT	P.J.Walls Ltd.
ENGINEER	Muir Associates
GROUND LEVEL (m)	
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	12.50
CASING DEPTH (m)	12.50
BOREHOLE NO.	BH2
SHEET	Sheet 2 of 2
DATE STARTED	25/08/2006
DATE COMPLETED	26/08/2006
BORED BY	J.McDonell
PROCESSED BY	C.Killaly

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Field Test Results	Standpipe Details
10	Hard black sandy gravelly CLAY with occasional cobbles and boulders *(continued)*				3356	B	10.00 - 10.00	N = 44/ 50 mm (9, 10, 17, 27)	
11					3357	B	11.00 - 11.00	N = 56/225 mm (9, 13, 16, 18, 22)	
12					3358	B	12.00 - 12.00	N = 25/75 mm (10, 16, 25)	
	Obstruction			12.30					
				12.50					
13									
14									
15									
16									
17									
18									
19									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
10.4	10.8	1	
12.3	12.5	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (hh:mm)	Comments
					Moderate

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
26-08-06	12.50	0.00	2.50	End of Borehole

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
26/08/2006	12.50	1.00	12.50	50mm SP

REMARKS JCB broke through concrete to 0.20m and 1.0m 1.2m

IGSL BH LOG 12028.GPJ IGSL.GDT 1/9/06

GEOTECHNICAL BORING RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay
CO-ORDINATES(_)	
CLIENT	P.J.Walls Ltd.
ENGINEER	Muir Associates
GROUND LEVEL (m)	
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	12.50
CASING DEPTH (m)	12.50
BOREHOLE NO.	BH3
SHEET	Sheet 1 of 2
DATE STARTED	21/08/2006
DATE COMPLETED	22/08/2006
BORED BY	J.McDonell
PROCESSED BY	F.Clancy

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Field Test Results	Standpipe Details
0	Concrete								
	MADE GROUND comprising of red brick, ash and boulders.			0.20					
1					3323	B	1.00-1.00	N = 4 (2, 2, 3, 3, 4, 4)	
2	Loose fine to medium SAND with some gravels			2.00	3324	B	2.10-2.10	N = 8 (1, 1, 2, 2, 2, 2)	
3					3325	B	3.00-3.00	N = 0 (1, 1, 2, 3, 3, 2)	
4	Medium dense fine to medium sandy GRAVEL			3.50	3326	B	4.00-4.00	N = 6 (2, 3, 3, 5, 4, 4)	
	Dense fine to coarse GRAVEL with cobbles and boulders			4.50					
5					3327	B	5.00-5.00	N = 64/225 mm (7, 10, 15, 24, 25)	
6					3328	B	6.00-6.00	N = 81 (8, 11, 14, 19, 23, 25)	
7					3329	B	7.00-7.00	N = 69 (9, 10, 15, 20, 18, 16)	
	Very hard black sandy gravelly CLAY with cobbles and boulders			7.50					
8					3330	B	8.00-8.00	N = 62 (6, 9, 10, 16, 18, 18)	
9					3331	B	9.00-9.00	N = 84 (8, 10, 15, 18, 26, 25)	

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
4.7	4.9	1	
5.3	5.6	1	
8.4	8.6	1.25	
9.5	9.8	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (hh:mm)	Comments
3.00	3.00	No	2.00		Moderate

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
22/08/2006	12.50	1.00	12.50	50mm SP

REMARKS JCB broke through concrete to 0.20m

IGSL BH LOG 12028.GPJ IGSL.GDT 1/9/06

GEOTECHNICAL BORING RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay	**BOREHOLE NO.**	**BH3**
		SHEET	Sheet 2 of 2
CO-ORDINATES(_)		**GROUND LEVEL (m)**	
		BOREHOLE DIAMETER (mm)	200
		DATE STARTED	21/08/2006
		DATE COMPLETED	22/08/2006
CLIENT	P.J.Walls Ltd.	**BOREHOLE DEPTH (m)**	12.50
		BORED BY	J.McDonell
ENGINEER	Muir Associates	**CASING DEPTH (m)**	12.50
		PROCESSED BY	F.Clancy

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Field Test Results	Standpipe Details
10	Very hard black sandy gravelly CLAY with cobbles and boulders *(continued)*				3332	B	10.00 - 10.00	N = 81 (8, 12, 16, 20, 20, 25)	
11					3333	B	11.00 - 11.00	N = 55/ 50 mm (10, 12, 30, 25)	
12					3334	B	12.00 - 12.00	N = 83 (9, 15, 18, 19, 21, 25)	
	Obstruction - Presumed rock or boulders			12.30					
				12.50					
13									
14									
15									
16									
17									
18									
19									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
12.3	12.5	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (hh:mm)	Comments
					Moderate

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
22/08/2006	12.50	1.00	12.50	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS JCB broke through concrete to 0.20m

IGSL BH LOG 12028.GPJ IGSL.GDT 1/9/06

GEOTECHNICAL BORING RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay	**BOREHOLE NO.**	**BH4**
		SHEET	Sheet 1 of 2
CO-ORDINATES(_)		**GROUND LEVEL (m)**	
		BOREHOLE DIAMETER (mm)	200
		DATE STARTED	19/08/2006
		DATE COMPLETED	20/08/2006
CLIENT	P.J.Walls Ltd.	**BORED BY**	J.McDonell
ENGINEER	Muir Associates	**BOREHOLE DEPTH (m)**	12.10
		CASING DEPTH (m)	12.10
		PROCESSED BY	F.Clancy

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Field Test Results	Standpipe Details
0	Concrete								
	MADE GROUND comprising of red brick, ash and boulders.			0.20					
1					3312	B	1.00-1.00	N = 9 (3, 3, 8, 4, 4, 3)	
2					3313	B	2.00-2.00	N = 5 (2, 3, 3, 4, 4, 4)	
	Loosde grey silty SAND with seashells			2.50					
3	Medium dense very sandy fine GRAVEL			3.10	3314	B	3.00-3.00	N = 2 (1, 1, 2, 2, 4, 4)	
4					3315	B	4.00-4.00	N = 7 (2, 3, 5, 5, 4, 3)	
	Dense fine to coarse GRAVEL with many cobbles and boulders			4.50					
5					3316	B	5.00-5.00	N = 46 (6, 9, 10, 12, 13, 11)	
6					3317	B	6.00-6.00	N = 62/225 mm (7, 9, 15, 22, 25)	
7					3318	B	7.00-7.00	N = 56 (6, 10, 15, 16, 14, 11)	
8	Very hard black sandy gravelly CLAY with boulder			8.00	3319	B	8.10-8.10	N = 66 (7, 10, 14, 16, 18, 18)	
9					3320	B	9.00-9.00	N = 85 (8, 11, 15, 20, 25, 25)	

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0.7	0.9	1	
5.7	6	1.5	
8.6	8.7	0.75	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (hh:mm)	Comments
2.50	2.50	No	No		Seepage
4.50	4.50	No	3.00		

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS JCB broke through concrete to 0.20m

IGSL BH LOG 12028.GPJ IGSL.GDT 1/9/06

GEOTECHNICAL BORING RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay
CO-ORDINATES(_)	
CLIENT	P.J.Walls Ltd.
ENGINEER	Muir Associates
GROUND LEVEL (m)	
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	12.10
CASING DEPTH (m)	12.10
BOREHOLE NO.	BH4
SHEET	Sheet 2 of 2
DATE STARTED	19/08/2006
DATE COMPLETED	20/08/2006
BORED BY	J.McDonell
PROCESSED BY	F.Clancy

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Field Test Results	Standpipe Details
10	Very hard black sandy gravelly CLAY with boulder *(continued)*				3321	B	10.00 - 10.00	N = 77 (99, 12, 16, 16, 20, 25)	
11					3322	B	11.00 - 11.00	N = 70/225 mm (10, 14, 16, 29, 25)	
12	Obstruction - Possible rock or boulders			11.90				N = 55/ 50 mm (30, 25)	
				12.10					
13									
14									
15									
16									
17									
18									
19									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
10.5	10.9	1	
11.9	12.1	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (hh:mm)	Comments
					Seepage

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
20-08-06	12.10	0.00	1.70	End of boring

REMARKS JCB broke through concrete to 0.20m

IGSL BH LOG 12028.GPJ IGSL.GDT 1/9/06

GEOTECHNICAL BORING RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay	**BOREHOLE NO.**	**BH5**
		SHEET	Sheet 1 of 2
CO-ORDINATES(_)		**GROUND LEVEL (m)**	
		BOREHOLE DIAMETER (mm)	200
		DATE STARTED	17/08/2006
		DATE COMPLETED	18/08/2006
CLIENT	P.J.Walls Ltd.	**BORHOLE DEPTH (m)**	12.00
		BORED BY	J.McDonell
ENGINEER	Muir Associates	**CASING DEPTH (m)**	12.00
		PROCESSED BY	F.Clancy

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Field Test Results	Standpipe Details
0	Concrete			0.10					
	MADE GROUND comprising of red brick,ash,cobbles and boulders				3301	B	1.00-1.00	N = 6 (3, 3, 4, 4, 4, 4)	
1									
2					3302	B	2.00-2.00	N = (2, 2, 2, 3, 3, 3)	
	Loose fine grey silty SAND			2.50					
3	Loose to medium dense very sandy fine to medium GRAVEL			3.00	3303	B	3.10-3.10	N = 5 (2, 3, 3, 5, 4, 3)	
4	Dense sandy fine to coarse GRAVEL with many cobbles and boulders			4.00	3304	B	4.00-4.00	N = 37 (5, 6, 7, 9, 10, 11)	
5					3305	B	5.00-5.00	N = 61 (7, 9, 11, 16, 18, 16)	
6					3306	B	6.00-6.00	N = 76 (8, 10, 12, 20, 19, 25)	
7					3307	B	7.00-7.00	N = 54/ 50 mm (9, 15, 29, 25)	
8	Very hard black sandy gravelly CLAY with cobbles and boulders			8.00	3308	B	8.10-8.10	N = 84 (8, 12, 16, 18, 25, 25)	
9					3309	B	9.00-9.00	N = 91 (9, 12, 17, 22, 27, 25)	

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0.5	0.8	1	
4.6	4.8	0.75	
6.5	6.8	1	
8.4	8.8	1.25	
9.6	9.9	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (hh:mm)	Comments
3.00	3.00	No	2.50		Slow

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS JCB broke through concrete to 0.20m

IGSL BH LOG 12028.GPJ IGSL.GDT 1/9/06

GEOTECHNICAL BORING RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay	**BOREHOLE NO.**	**BH5**
		SHEET	Sheet 2 of 2
CO-ORDINATES(_)		**GROUND LEVEL (m)**	
		BOREHOLE DIAMETER (mm)	200
		DATE STARTED	17/08/2006
		DATE COMPLETED	18/08/2006
CLIENT	P.J.Walls Ltd.	**BOREHOLE DEPTH (m)**	12.00
ENGINEER	Muir Associates	**CASING DEPTH (m)**	12.00
		BORED BY	J.McDonell
		PROCESSED BY	F.Clancy

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Field Test Results	Standpipe Details
10	Very hard black sandy gravelly CLAY with cobbles and boulders *(continued)*				3310	B	10.00 - 10.00	N = 25/75 mm (11, 30, 25)	
11					3311	B	11.00 - 11.00	N = 69/225 mm (10, 16, 19, 25, 25)	
	Obstruction - Possible rock or boulders			11.80					
12				12.00				N = 25/75 mm (25)	
13									
14									
15									
16									
17									
18									
19									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
10.2	10.4	1	
11.8	12	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (hh:mm)	Comments
					Slow

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
18-08-06	12.00	0.00	1.20	End of boring

REMARKS JCB broke through concrete to 0.20m

IGSL BH LOG 12028.GPJ IGSL.GDT 1/9/06

Appendix II – Trial Pit Records

TRIAL PIT RECORD

REPORT NUMBER 12028

CONTRACT Fitzwilliam Quay Ringsend Dublin

TRIAL PIT NO. TH1
SHEET Sheet 1 of 1

CO-ORDINATES(_)

GROUND LEVEL (m)

DATE STARTED 14/08/2006
DATE COMPLETED 14/08/2006

CLIENT

ENGINEER PJ Walls

EXCAVATION METHOD

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	MADE GROUND (consisting of concrete)		0.10							
	MADE GROUND (consisting of grey/brown clayey gravelly sand with pieces of red brick)					W 2875	D	0.50-0.50		
	MADE GROUND (consisting of soft sandy gravelly clay)		0.90			W 2876	D	1.00-1.00		
1.0						W 2877	B	1.00-1.00		
						W 2878	D	1.50-1.50		
	MADE GROUND (consisting of light brown sand with occasional cobble)		1.90			W 2879	D	2.00-2.00		
2.0						W 2880	B	2.00-2.00		
	Loose dark grey clayey silty SAND(wet)		2.25		1					
	Loose grey/brown slightly sandy fine to medium GRAVEL with sea shell		2.50			W 2881	D	2.50-2.50		
3.0	End of Trial Pit at 3.00m		3.00			W 2882	D	3.00-3.00		
						W 2883	B	3.00-3.00		
4.0										
5.0										

Groundwater Conditions

Stability
Stable

General Remarks

IGSL TP LOG 12028.GPJ IGSL.GDT 17/8/06

TRIAL PIT RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay Ringsend Dublin
TRIAL PIT NO.	TH2
SHEET	Sheet 1 of 1
CO-ORDINATES(_)	
GROUND LEVEL (m)	
DATE STARTED	15/08/2006
DATE COMPLETED	15/08/2006
CLIENT	
ENGINEER	PJ Walls
EXCAVATION METHOD	

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (consisting of concrete)									
MADE GROUND (consisting of different loose thin layers of clayey sand with pieces of red brick)		0.15			W 2884	D	0.50-0.50		
1.0					W 2885	D	1.00-1.00		
					W 2886	B	1.00-1.00		
					W 2887	D	1.50-1.50		
MADE GROUND (consisting of medium dense orage brown SAND with pieces of red brick)		1.90							
2.0					W 2888	D	2.00-2.00		
					W 2889	B	2.00-2.00		
					W 2890	D	2.50-2.50		
Loose dark grey SAND		2.90		1					
3.0 End of Trial Pit at 3.00m		3.00			W 2891	D	3.00-3.00		
					W 2892	B	3.00-3.00		
4.0									
5.0									

Groundwater Conditions

Stability
Stable

General Remarks

IGSL TP LOG 12028.GPJ IGSL.GDT 17/8/06

TRIAL PIT RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay Ringsend Dublin
TRIAL PIT NO.	TH3
SHEET	Sheet 1 of 1
CO-ORDINATES(_)	
GROUND LEVEL (m)	
DATE STARTED	15/08/2006
DATE COMPLETED	15/08/2006
CLIENT	
ENGINEER	PJ Walls
EXCAVATION METHOD	

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (consisting of concrete)		0.10							
MADE GROUND (consisting of loose clayey sand with sea shell and red bricks)		0.50			W 2893	D	0.50-0.50		
MADE GROUND (consisting of loose grey fine to medium GRAVEL with sea shell)					W 2894	D	1.00-1.00		
1.0					W 2895	B	1.00-1.00		
MADE GROUND (consisting of medium dense sand with sea shell)		1.30			W 2896	D	1.50-1.50		
2.0 Medium dense light brown SAND		2.10		1	W 2897	D	2.00-2.00		
					W 2898	B	2.00-2.00		
					W 2899	D	2.50-2.50		
3.0 End of Trial Pit at 3.00m		3.00			W 2900	D	3.00-3.00		
					W 7641	B	3.00-3.00		
4.0									
5.0									

Groundwater Conditions

Stability
Unstable from 0 to 1.60m

General Remarks

TRIAL PIT RECORD

REPORT NUMBER 12028

CONTRACT Fitzwilliam Quay Ringsend Dublin

TRIAL PIT NO. TH4

SHEET Sheet 1 of 1

CO-ORDINATES(_)

GROUND LEVEL (m)

DATE STARTED 15/08/2006

DATE COMPLETED 15/08/2006

CLIENT

ENGINEER PJ Walls

EXCAVATION METHOD

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (consisting of concrete)		0.10							
MADE GROUND (consisting of different loose thin layers of clayey sand with pieces of red brick)					W 7642	D	0.50-0.50		
1.0					W 7643	D	1.00-1.00		
					W 7648	B	1.00-1.00		
					W 7644	D	1.50-1.50		
2.0					W 7645	D	2.00-2.00		
					W 7649	B	2.00-2.00		
Loose dark grey silty SAND		2.40			W 7646	D	2.50-2.50		
Loose grey/brown sandy fine to coarse GRAVEL		2.90		1					
3.0 End of Trial Pit at 3.00m		3.00			W 7647	D	3.00-3.00		
					W 7650	B	3.00-3.00		
4.0									
5.0									

Groundwater Conditions

Stability
Stable

General Remarks

IGSL TP LOG 12028.GPJ IGSL.GDT 17/8/06

TRIAL PIT RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay Ringsend Dublin
TRIAL PIT NO.	TH5
SHEET	Sheet 1 of 1
CO-ORDINATES(_)	GROUND LEVEL (m)
DATE STARTED	16/08/2006
DATE COMPLETED	16/08/2006
CLIENT	
ENGINEER	PJ Walls
EXCAVATION METHOD	

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (consisting of concrete)		0.10							
MADE GROUND (consisting of 804)		0.45			W 7651	D	0.50-0.50		
MADE GROUND (consisting of white/grey sand with concrete blocks, red bricks, lights, steel, plastics, cables, car body, plastic pipes)		0.85							
1.0 MADE GROUND (consisting of concrete block)		1.15							
MADE GROUND (consisting of dark brown clayey gravelly sand with red bricks)					W 7653	D	1.50-1.50		
					W 7657	B	1.50-1.50		
2.0					W 7654	D	2.00-2.00		
					W 7658	B	2.00-2.00		
Medium dense orange brown SAND with some cobble		2.60			W 7655	D	2.50-2.50		
Loose brown fine to coarse grvelly SAND with some cobble		2.82							
3.0 Loose grey/brown SAND with sea shell		3.10		1					
End of Trial Pit at 3.30m		3.30			W 7656	D	3.30-3.30		
					W 7659	B	3.30-3.30		
4.0									
5.0									

Groundwater Conditions

Stability
Stable

General Remarks

IGSL TP LOG 12028.GPJ IGSL.GDT 17/8/06

TRIAL PIT RECORD

REPORT NUMBER 12028

CONTRACT	Fitzwilliam Quay Ringsend Dublin
TRIAL PIT NO.	TH6
SHEET	Sheet 1 of 1
CO-ORDINATES(_)	
GROUND LEVEL (m)	
DATE STARTED	16/08/2006
DATE COMPLETED	16/08/2006
CLIENT	
ENGINEER	PJ Walls
EXCAVATION METHOD	

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (consisting of concrete)									
MADE GROUND (consisting of white/grey sand with concrete blocks, red bricks, lights, steel, plastics, cables, car body, plastic pipes, wood,)		0.15			W 7660	D	0.50-0.50		
MADE GROUND (consisting of concrete block)		0.90							
1.0 MADE GROUND (consisting of ash, brown clayey sand with some stones)		1.10			W 7661	D	1.00-1.00		
2.0					W 7663	D	2.00-2.00		
					W 7667	B	2.00-2.00		
					W 7664	D	2.50-2.50		
					W 7666	B	2.50-2.50		
Obstruction- Possible boulder End of Trial Pit at 2.70m		2.70			W 7668	B	2.70-2.70		
3.0									
4.0									
5.0									

Groundwater Conditions

Stability
Stable

General Remarks

IGSL TP LOG 12028.GPJ IGSL.GDT 17/8/06

Appendix III – Geotechnical Laboratory Records

Contract: Fitzwilliam Quay (PJ Walls)
Contract No: 12028

Copies | | Folder: | Client:

LABORATORY TESTING SCHEDULE

I.G.S.L.

Location	Sample No.	Depth (m)	Type	Visual	Water Con.	att lims.	P.S.D. Sieve W/D	P.S.D. hydro	Organic matter	SG	pH & Sulphate	MCV		Compaction 2.5kg	Murphy Suite	Other Tests and Remarks
Geotechnical - Foundation																
Bh1	3339	5.00	D	1			1									
Bh1	3343	9.00	D	1	1	1	1	1								
Bh2	3348	2.00	D	1							1					
Bh2	3353	7.00	D	1			1									
Bh2	3357	11.00	D	1	1	1										
Bh3	3327	5.00	D	1			1									
Bh3	330	8.00	D	1	1	1	1	1								
Bh4	3312	1.00	D	1							1					
Bh4	3320	9.00	D	1	1	1										
Bh5	3306	6.00	D	1			1									
Bh5	3310	10.00	D	1	1	1	1	1			1					
PAGE TOTAL				11	5	5	7	3			3	0	0	0	0	

Issued by: John Clancy
Issue Date 30.08.06
Requirements 12.09.06
Client's Signature:

Comments

Comments: Urgent

CREW ENG: Jimmy Mac Donald

IGSL LAB REF.

Main Soils	X	
Materials		
Kinnegad		
Environ.		

SHEET NO. 1 of 1

Summary of Classification Tests

BS1377:Part 2:1990, clauses 3.2, 4.3, 5.3 & 5.4

BH/TP No.	Sample No.	Depth (m)	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	<425μm %	Preparation	Description	Classification
BH 1	3343	9.00	D	10.9	27	14	13	51.0	WS	Black slightly sandy gravelly CLAY	C L
BH 2	3357	11.00	D	11.4	29	15	14	58.8	WS	Grey slightly sandy gravelly CLAY	C L
BH 3	3330	8.00	D	10.4	29	15	14	55.0	WS	Black brown slightly sandy slightly gravelly CLAY	C L
BH 4	3320	9.00	D	12.7	27	14	13	57.0	WS	Grey black slightly sandy gravelly CLAY	C L
BH 5	3310	10.00	D	11.8	34	17	17	42.0	WS	Grey black slightly sandy gravelly CLAY	C L

Notes: NAT - tested as received WS - Wet sieved (425μm) NP - Non Plastic

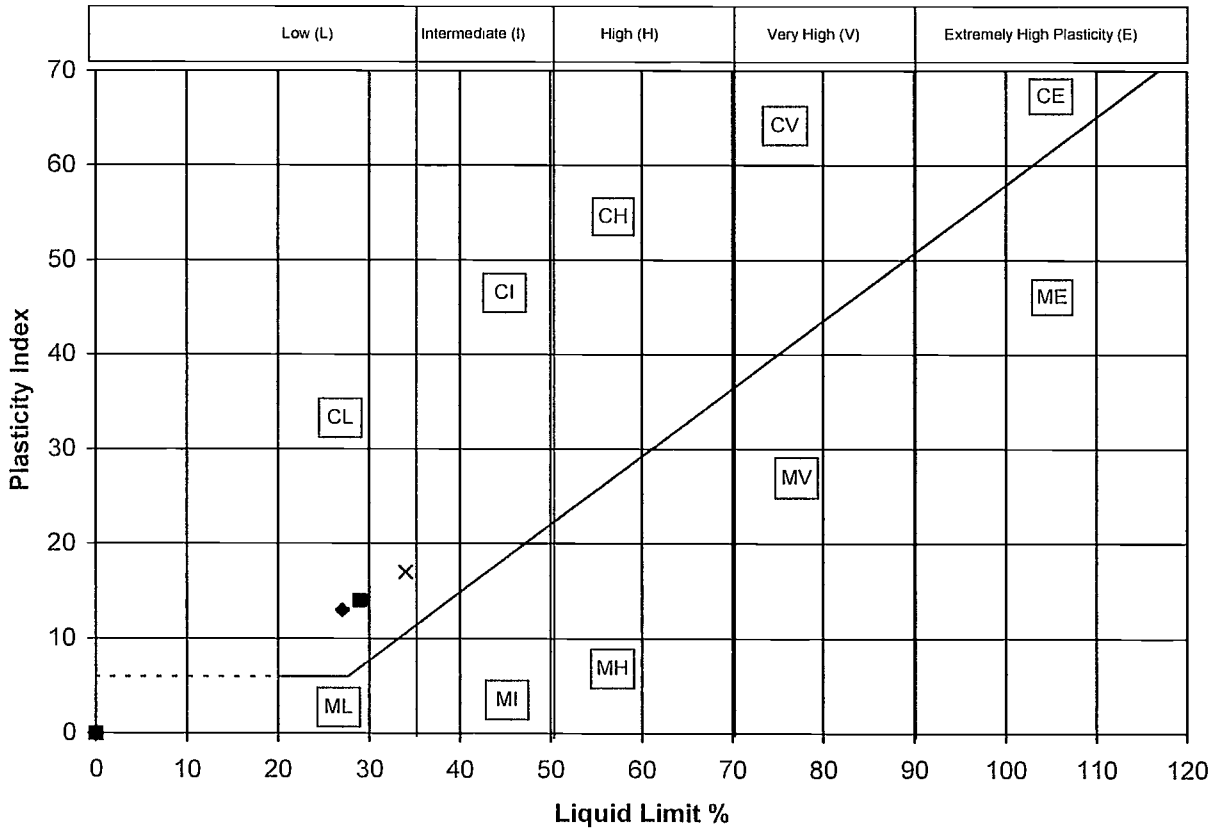
IGSL	Contract	FITZWILLIAM QUAY			Contract No. 12028
	Issued By	Date		Date	Page
		18/09/2006			of

Plasticity Chart - Summary of Liquid & Plastic Limit Tests

BS1377:Part 2:1990, clauses 3.2, 4 & 5

Chart in accordance with BS5930:1999, fig.18

Contract No. 12028 Contract: FITZWILLIAM QUAY



Code	BH/TP	Sample	Depth (m)	MC%	LL%	PL%	PI%	%<425µm	Description
-	BH 1	3343	9.00	10.9	27	14	13	51.0	Black slightly sandy gravelly CLAY
■	BH 2	3357	11.00	11.4	29	15	14	58.8	Grey slightly sandy gravelly CLAY
●	BH 3	3330	8.00	10.4	29	15	14	55.0	Black brown slightly sandy slightly gravelly CLAY
◆	BH 4	3320	9.00	12.7	27	14	13	57.0	Grey black slightly sandy gravelly CLAY
❹	BH 5	3310	10.00	11.8	34	17	17	42.0	Grey black slightly sandy gravelly CLAY
🗍									
⑥									
□									
-									
■									
●									
◆									
❹									
🗍									
⑥									
□									

NP denotes specimen is non-plastic.

	Issued by	Date		Date	Page
IGSL		########			

REPORT NO. **SULPHATE ANALYSIS** **IGSL**

CONTRACT: **FITZWILLIAM QUAY** CONTRACT NO 12028

BH/TP NO.	DEPTH (M)	SAMPLE NO.	SAMPLE TYPE	TEST CODE	% Passing 2mm	SULPHUR TRIOXIDE		(so3 X 1.2)	pH
						2:1WATER EXTRACT S03 g/L	TOTAL SOIL so3 %	TOTAL SOIL so 4 %	VALUE
BH 2	2.00	3348	D	S	51	1.2	0.74	0.89	8.6
BH 4	1.00	3312	D	S	49	1.72	0.58	0.70	8.4
BH 5	10.00	3310	D	S	71	0.44	0.17	0.21	8.4

TEST CODE W = WATER S = SOIL A = AQUEOUS SOIL EXTRACT(2:1)

Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	
50	100	
37.5	100	
28	100	
20	98	GRAVEL
14	96	
10	90	
6.3	84	
5	80	
3.35	70	
2	59	
1.18	49	
0.6	38	SAND
0.425	31	
0.3	24	
0.15	14	
0.063	10	
0.042	#N/A	
0.030	#N/A	
0.019	#N/A	SILT/CLAY
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 12028

Contract: FITZWILLIAM QUAY

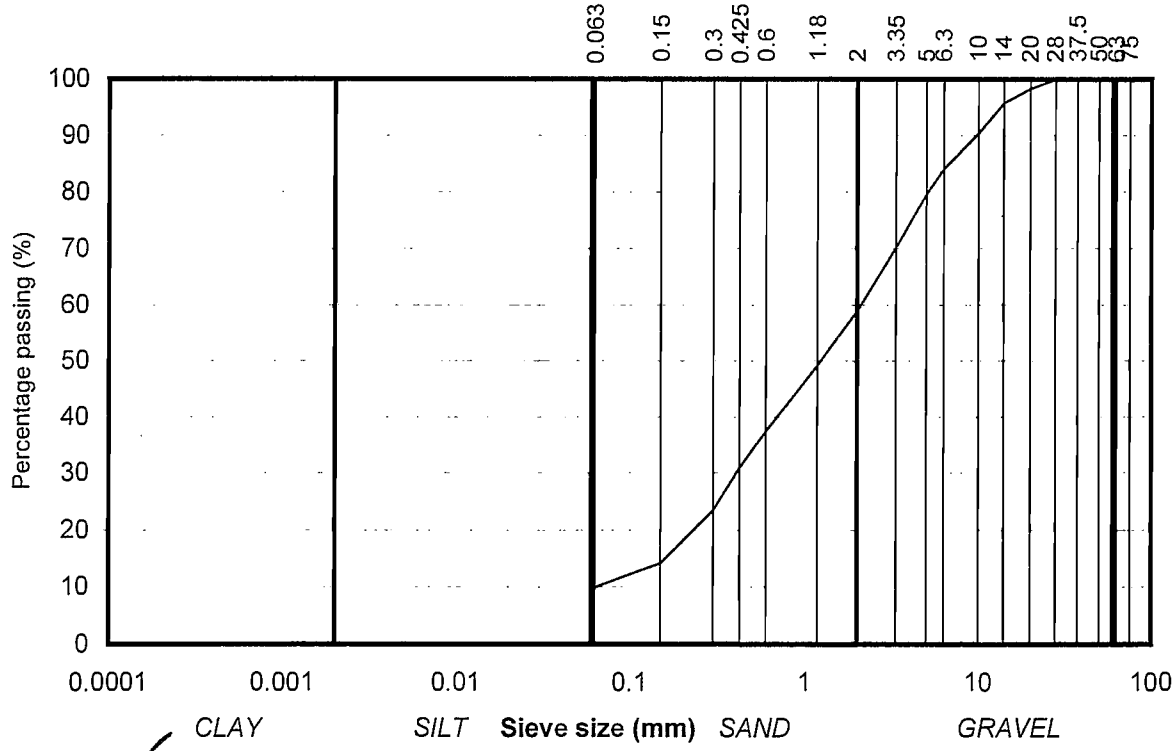
BH/TP No: BH1

SAMPLE No.: 3339

DEPTH (m): 5.00

TEST METHOD: Wet sieve

DESCRIPTION: Grey clayey/silty, very gravelly, SAND with shell fragments



IGSL	Issued By	Date:			Page no:
		18/09/2006			

IGSL LIMITED, UNIT F, M7 BUSINESS PARK, NAAS, CO.KILDARE. PSD V3.1 12.01

Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	
50	100	
37.5	97	
28	97	
20	93	GRAVEL
14	86	
10	81	
6.3	76	
5	73	
3.35	68	
2	63	
1.18	58	
0.6	53	SAND
0.425	51	
0.3	48	
0.15	44	
0.063	37	
0.038	30	
0.027	27	
0.017	23	SILT/CLAY
0.010	18	
0.007	16	
0.004	13	
0.002	9	

Contract No: 12028

Contract: FITZWILLIAM QUAY

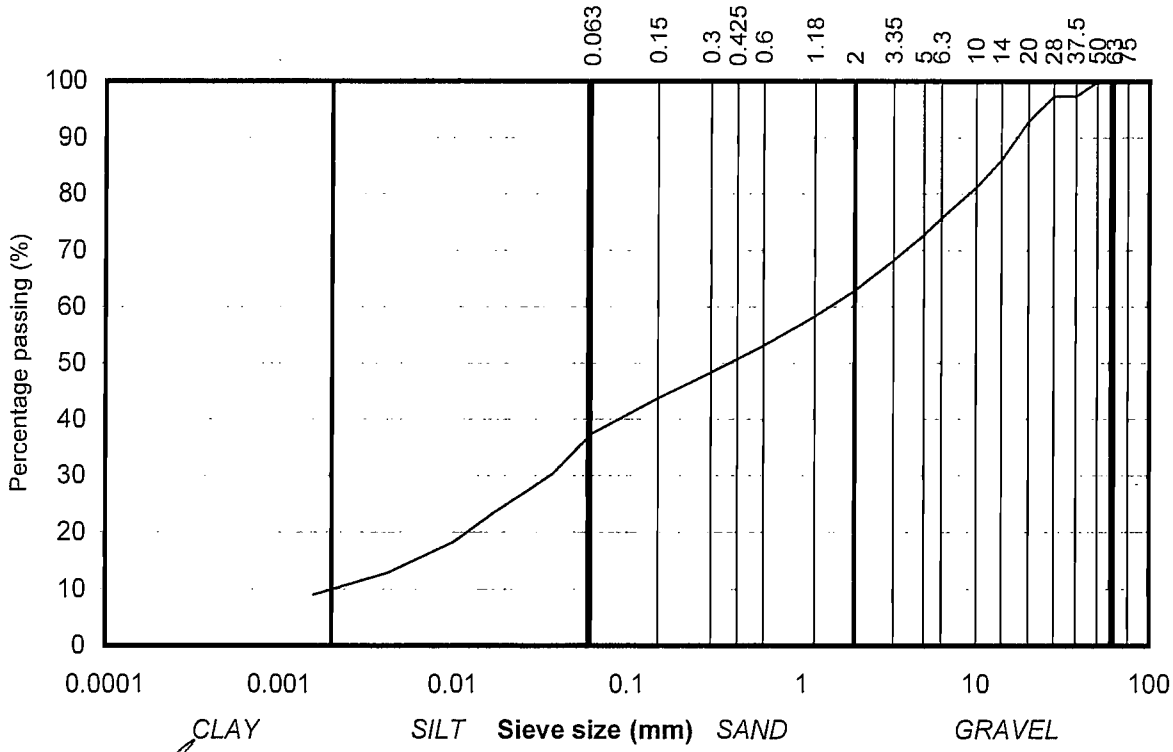
BH/TP No: BH1

SAMPLE No.: 3343

DEPTH (m): 9.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Black slightly sandy, gravelly, CLAY



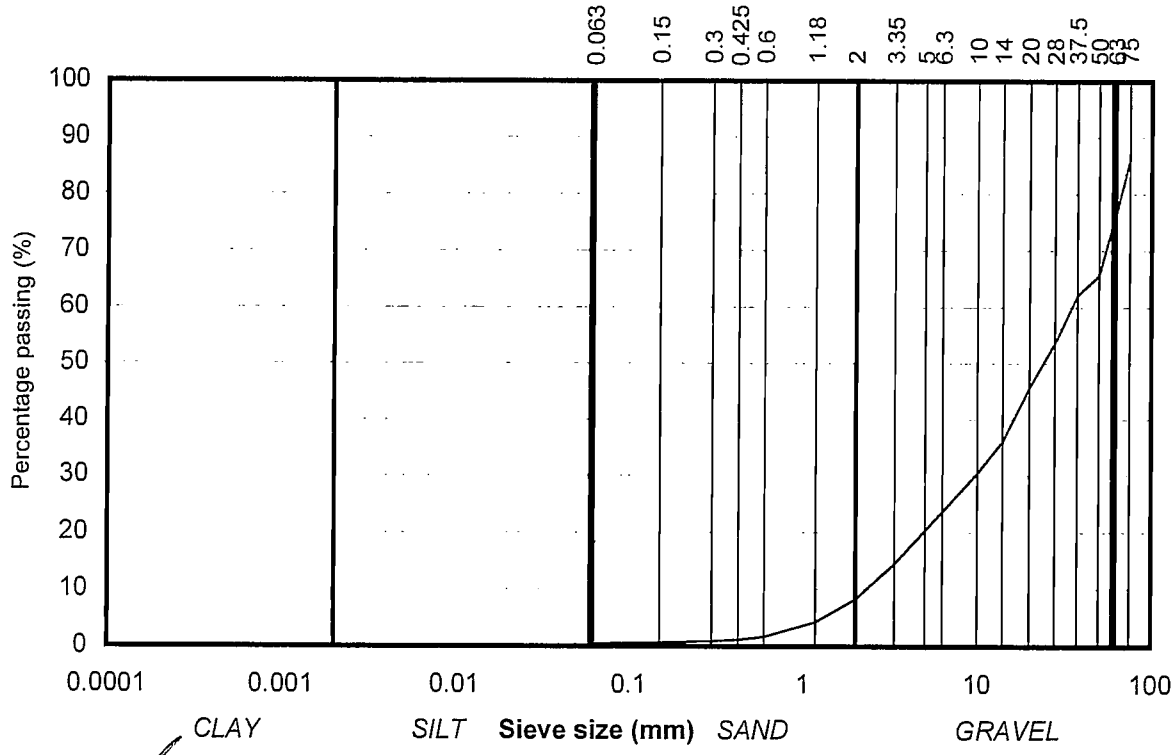
IGSL	Issued By	Date:			Page no:
		18/09/2006			

Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	86	COBBLES
63	77	
50	66	
37.5	62	
28	54	
20	46	GRAVEL
14	36	
10	30	
6.3	24	
5	20	
3.35	14	
2	8	
1.18	4	
0.6	2	SAND
0.425	1	
0.3	1	
0.15	1	
0.063	0	
0.042	#N/A	
0.030	#N/A	
0.019	#N/A	SILT/CLAY
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 12028
Contract: FITZWILLIAM QUAY
BH/TP No: BH2
SAMPLE No.: 3353
DEPTH (m): 7.00
TEST METHOD: Wet sieve
DESCRIPTION: Grey sandy, GRAVEL with many cobbles



IGSL	Issued By:	Date:			Page no:
		18/09/2006			

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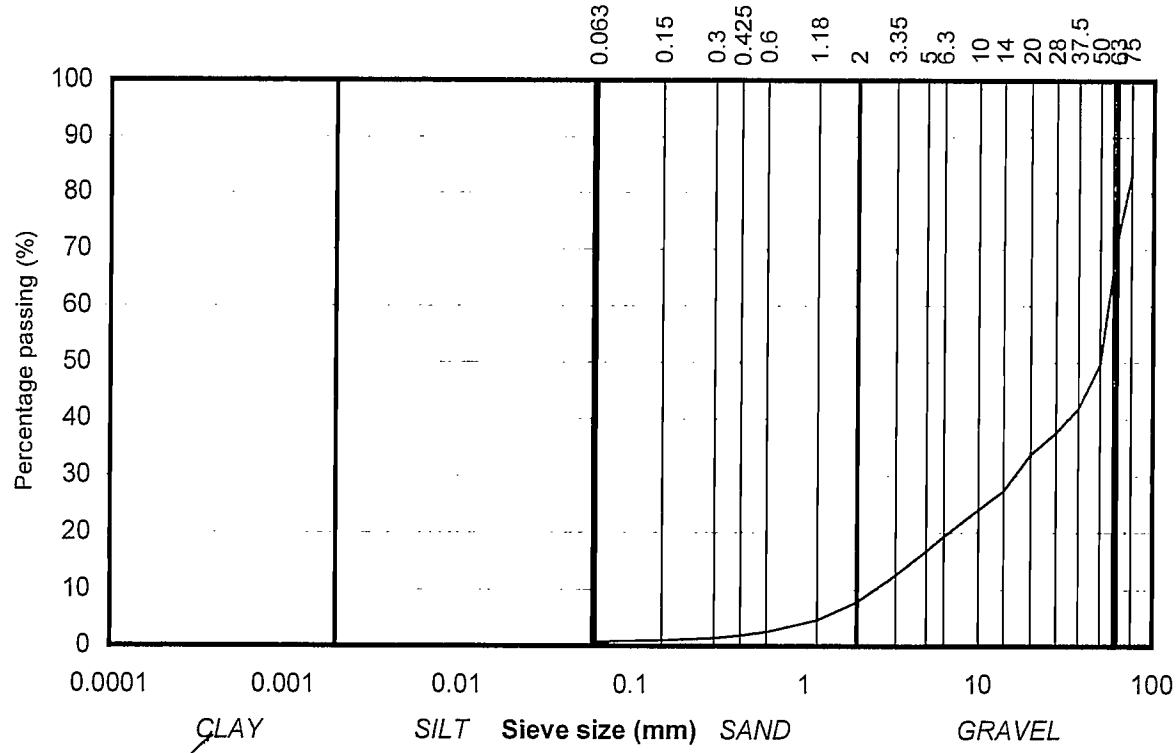
Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	83	COBBLES
63	72	
50	50	
37.5	42	
28	38	
20	34	GRAVEL
14	27	
10	24	
6.3	19	
5	17	
3.35	13	
2	8	
1.18	5	
0.6	3	SAND
0.425	2	
0.3	1	
0.15	1	
0.063	1	
0.042	#N/A	
0.030	#N/A	
0.019	#N/A	SILT/CLAY
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 12028
Contract: FITZWILLIAM QUAY
BH/TP No: BH3
SAMPLE No.: 3327
DEPTH (m): 5.00
TEST METHOD: Wet sieve
DESCRIPTION: Grey slightly clayey/silty, sandy, GRAVEL with many cobbles



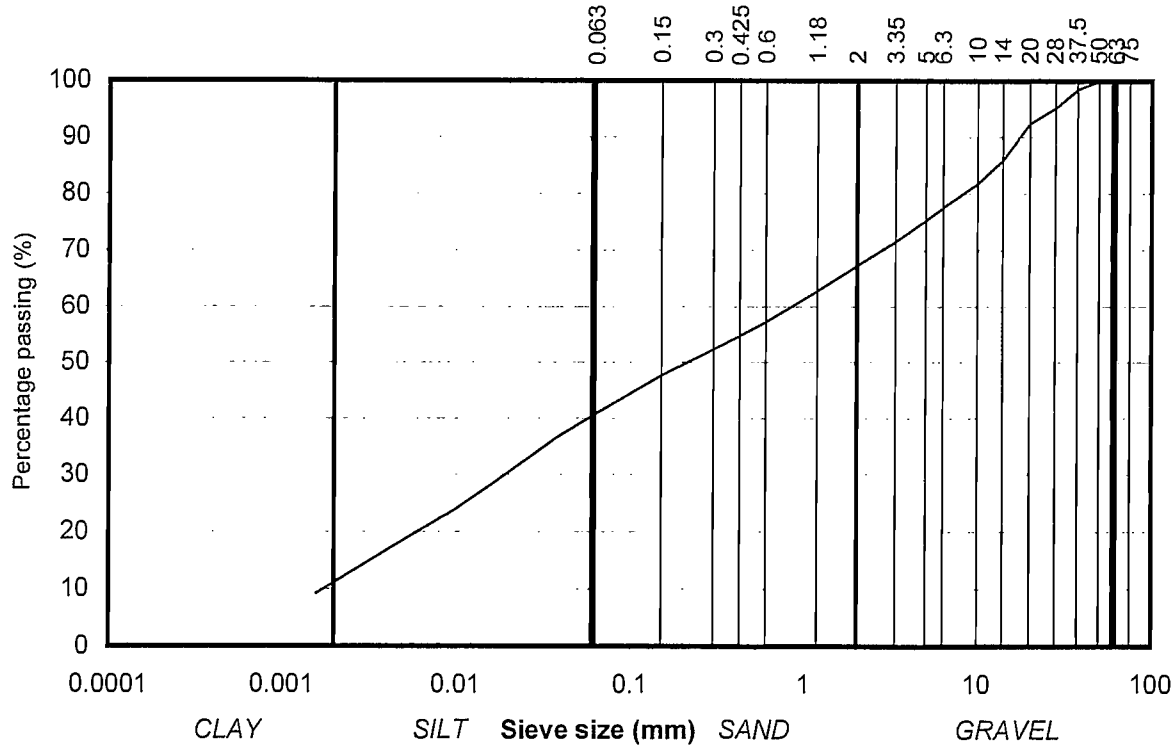
IGSL	Issued By	Date:			Page no:
		18/09/2006			

Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	
50	100	
37.5	99	
28	95	
20	92	GRAVEL
14	86	
10	82	
6.3	78	
5	75	
3.35	72	
2	67	
1.18	63	
0.6	57	SAND
0.425	55	
0.3	52	
0.15	48	
0.063	41	
0.037	36	
0.027	33	
0.017	29	SILT/CLAY
0.010	24	
0.007	21	
0.004	17	
0.002	9	

Contract No: 12028
Contract: FITZWILLIAM QUAY
BH/TP No: BH3
SAMPLE No.: 3330
DEPTH (m): 8.00
TEST METHOD: Wet sieve and hydrometer
DESCRIPTION: Black brown slightly sandy, slightly gravelly, CLAY



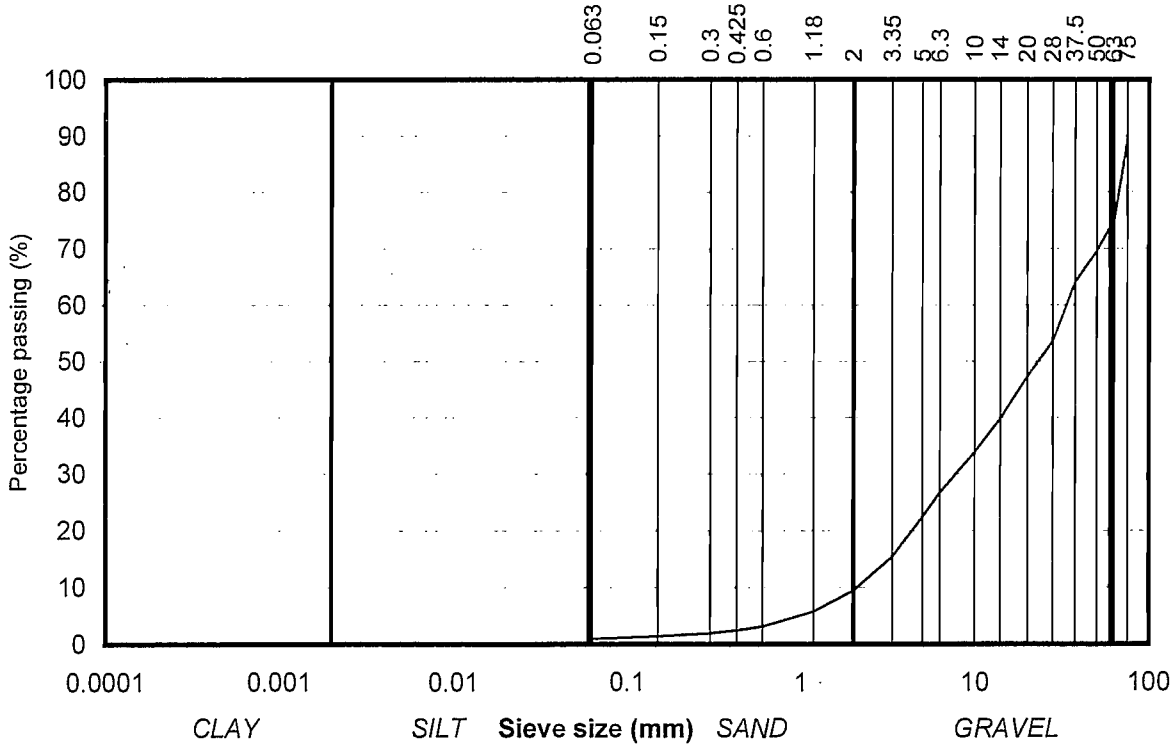
IGSL	Issued By	Date:			Page no:
		18/09/2006			

Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	90	COBBLES
63	75	
50	70	
37.5	64	
28	54	
20	47	GRAVEL
14	40	
10	34	
6.3	27	
5	22	
3.35	15	
2	9	
1.18	6	
0.6	3	SAND
0.425	2	
0.3	2	
0.15	1	
0.063	1	
0.042	#N/A	
0.030	#N/A	
0.019	#N/A	SILT/CLAY
0.011	#N/A	
0.008	#N/A	
0.004	#N/A	
0.002	#N/A	

Contract No: 12028
Contract: FITZWILLIAM QUAY
BH/TP No: BH5
SAMPLE No.: 3306
DEPTH (m): 6.00
TEST METHOD: Wet sieve
DESCRIPTION: Grey slightly clayey/silty, sandy, GRAVEL with many cobbles



IGSL	Issued By	Date:			Page no:
		18/09/2006			

Determination of Particle Size Distribution

BS1377:Part2:1990 , clauses 9.2

particle size	% passing	
75	100	COBBLES
63	100	
50	79	
37.5	79	
28	79	
20	75	GRAVEL
14	72	
10	70	
6.3	65	
5	63	
3.35	58	
2	54	
1.18	49	
0.6	44	SAND
0.425	42	
0.3	40	
0.15	36	
0.063	31	
0.038	26	
0.027	24	
0.017	20	SILT/CLAY
0.010	16	
0.007	14	
0.004	11	
0.002	8	

Contract No: 12028

Contract: FITZWILLIAM QUAY

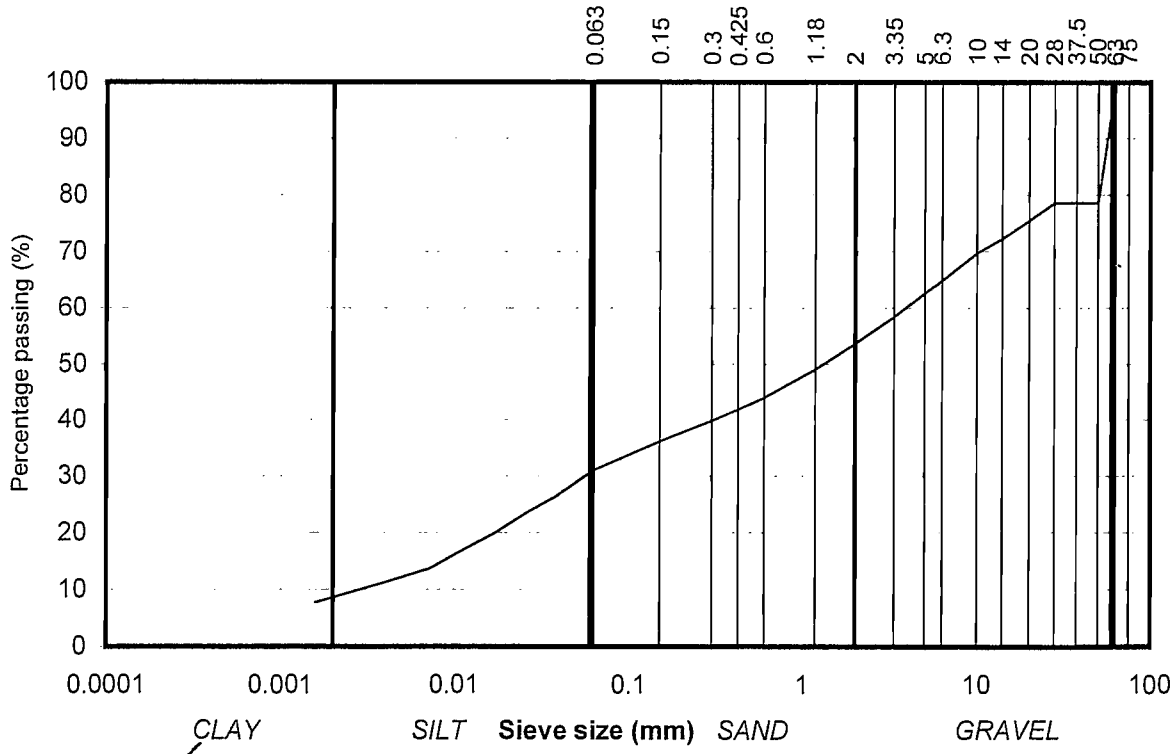
BH/TP No: BH5

SAMPLE No.: 3310

DEPTH (m): 10.00

TEST METHOD: Wet sieve and hydrometer

DESCRIPTION: Grey black slightly sandy, gravelly, CLAY



IGSL	Issued By	Date:			Page no:
		18/09/2006			

IGSL LIMITED, UNIT F, M7 BUSINESS PARK, NAAS, CO.KILDARE. PSD V3.1 12.01

Appendix IV – Environmental Laboratory Records

Contract: Fitzwilliam Quay Dublin (PJ Walls) - Environmental
Contract No: 12028

Copies | | Folder: | Client:

LABORATORY TESTING SCHEDULE

I.G.S.L.

Location	Sample No.	Depth (m)	Type	Visual	Water Con.	att lims.	P.S.D. Sieve W/D	P.S.D. hydro	Organic matter	SG	pH & Sulphate	MCV	Compaction 2.5kg	Murphy Suite	Other Tests and Remark:
Geotechnical															
Tp1	2876/77	1.00	D	1										1	*Murphy Suite*
Tp4	7645/49	2.00	D	1										1	*Murphy Suite*
Tp6	7663 /67	2.00	D	1										1	*Murphy Suite*
PAGE TOTAL				3	0	0	0	0			0	0	0	3	

Issued by: John Clancy
Issue Date 18.8.06
Requirements 04.09.06
Client's Signature:

Comments

Comments

CREW ENG: Muhammed Athar

IGSL LAB REF.

Main Soils	X	
Materials		
Kinnegad		
Environ.		

SHEET NO. 1 of 1

ALcontrol Laboratories (Dublin)

18a Rosemount Business Park,
Ballycoolin,
Dublin 11
Ireland
Tel: +353 (0) 1 8829893
Fax: +353 (0) 1 8829895

CERTIFICATE OF ANALYSIS

Client: IGSL Ltd

Unit F
M7 Business Park
Naas
Co Kildare
Ireland

Attention: John Clancy

Date: 6 September, 2006

Our Reference: 06-B05296/01

Your Reference: 12028

Location: Fitzwilliam Quay Dublin

A total of 3 samples was received for analysis on Monday, 21 August 2006. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Signed

Ken Scally

Lorraine Mc Namara

Ken Scally
General Manager, Ireland

Lorraine McNamara
Laboratory Technical Manager

Compiled By

Dylan Halpin

Dylan Halpin

UKAS TESTING
1291
GROUP

Printed at 10:24 on 11/09/2006

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 06-B05296/01
Client: IGSL Ltd
Date of Receipt: 21/08/2006

Sample Type: SOIL
Location: Fitzwilliam Quay Dublin
Client Contact: John Clancy
Client Ref: 12028

Detection Method				CEN 10:1 Leach	CV AA	GC	GC FID/CALC	GCMS	GCMS	GRAVIMETRIC	GRAVIMETRIC	HPLC	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS
UKAS Accredited [Testing Laboratory] No. 1291						✓	✓	✓			✓	✓	✓	✓	✓	✓	✓
ALcontrol Reference	Sample Identity	Other ID	P / V	CEN 10:1 Leachate Test	Dissolved Mercury Low Level in CEN 10:1 Leachate	PRO & BTEX	Mineral Oil by GC	PAH Total (6) GCMS <1.6mg/kg (Solid)	PCB 7 Congeners	Natural Moisture Content	Total Dissolved Solids Gravimetric CEN 10:1	Total Phenols by HPLC in CEN 10:1 Leachate	Dissolved Antimony Low CEN 10:1 Leach	Dissolved Arsenic Low CEN 10:1 Leach	Dissolved Barium Low CEN 10:1 Leach	Dissolved Cadmium Low CEN 10:1 Leach	Dissolved Chromium Low CEN 10:1 Leach
06-B05296-S0006-A01	TP1 2876	1M	Plastic tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
06-B05296-S0007-A01	TP4 7645	2M	Plastic tub	X	X	X	X	X	X	X	X	X	X	X	X	X	X
06-B05296-S0008-A01	TP6 7667	2M	Plastic Bag	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 06-B05296/01

Client: IGSL Ltd

Date of Receipt: 21/08/2006

Sample Type: SOIL

Location: Fitzwilliam Quay Dublin

Client Contact: John Clancy

Client Ref: 12028

Detection Method				ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	IR	KONE	KONE	KONE	LECO			
UKAS Accredited [Testing Laboratory] No. 1291				✓	✓	✓	✓	✓	✓		✓		✓	✓			
ALcontrol Reference	Sample Identity	Other ID	P / V	Dissolved Copper Low CEN 10:1 Leach	Dissolved Lead Low CEN 10:1 Leach	Dissolved Molybdenum Low CEN 10:1 Leach	Dissolved Nickel Low CEN 10:1 Leach	Dissolved Selenium Low CEN 10:1 Leach	Dissolved Zinc Low CEN 10:1 Leach	Dissolved Organic Carbon in CEN 10:1 Leachate	Chloride in CEN 10:1 Leachate	Fluoride in CEN 10:1 Leachate	Sulphate in CEN 10:1 Leachate	Total Organic Carbon**			
06-B05296-S0006-A01	TP1 2876	1M	Plastic tub	X	X	X	X	X	X	X	X	X	X	X			
06-B05296-S0007-A01	TP4 7645	2M	Plastic tub	X	X	X	X	X	X	X	X	X	X	X			
06-B05296-S0008-A01	TP6 7667	2M	Plastic Bag	X	X	X	X	X	X	X	X	X	X	X			

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule Summary

Ref Number: 06-B05296/01
Client: IGSL Ltd
Date of Receipt: 21/08/2006

Sample Type: SOIL
Location: Fitzwilliam Quay Dublin
Client Contact: John Clancy
Client Ref: 12028

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

SCHEDULE	METHOD	TEST NAME	TOTAL
X	CEN 10:1 Leach	CEN 10:1 Leachate Test	3
X	CV AA	Dissolved Mercury Low Level in CEN 10:1 Leachate	3
X	GC	PRO & BTEX	3
X	GC FID/CALC	Mineral Oil by GC	3
X	GCMS	PAH Total (6) GCMS <1.6mg/kg (Solid)	3
X	GCMS	PCB 7 Congeners	3
X	GRAVIMETRIC	Natural Moisture Content	3
X	GRAVIMETRIC	Total Dissolved Solids Gravimetric CEN 10:1	3
X	HPLC	Total Phenols by HPLC in CEN 10:1 Leachate	3
X	ICP MS	Dissolved Antimony Low CEN 10:1 Leach	3
X	ICP MS	Dissolved Arsenic Low CEN 10:1 Leach	3
X	ICP MS	Dissolved Barium Low CEN 10:1 Leach	3
X	ICP MS	Dissolved Cadmium Low CEN 10:1 Leach	3
X	ICP MS	Dissolved Chromium Low CEN 10:1 Leach	3
X	ICP MS	Dissolved Copper Low CEN 10:1 Leach	3
X	ICP MS	Dissolved Lead Low CEN 10:1 Leach	3
X	ICP MS	Dissolved Molybdenum Low CEN 10:1 Leach	3
X	ICP MS	Dissolved Nickel Low CEN 10:1 Leach	3
X	ICP MS	Dissolved Selenium Low CEN 10:1 Leach	3
X	ICP MS	Dissolved Zinc Low CEN 10:1 Leach	3
X	IR	Dissolved Organic Carbon in CEN 10:1 Leachate	3
X	KONE	Chloride in CEN 10:1 Leachate	3
X	KONE	Fluoride in CEN 10:1 Leachate	3
X	KONE	Sulphate in CEN 10:1 Leachate	3
X	LECO	Total Organic Carbon**	3

☐ Interim

☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 06-B05296/01

Client: IGSL Ltd

Date of Receipt: 21/08/2006

(of first sample)

Sample Type: SOIL

Location: Fitzwilliam Quay Dublin

Client Contact: John Clancy

Client Ref: 12028

	Detection Method	CV AA	GC	GC	GC	GC	GC	GC	GC FID/CALC	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS	GCMS
	Method Detection Limit	<0.0005mg/kg	<10ug/kg	<10ug/kg	<10ug/kg	<10ug/kg	<10ug/kg	<10ug/kg	<1mg/kg	<1.6mg/kg	<1 ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg	<1ug/kg
UKAS Accredited [Testing Laboratory] No. 1291			✓	✓	✓	✓	✓	✓	✓	✓						
ALcontrol Reference	Sample Identity	Other ID	Dissolved Mercury Low CEN 10:1 Leachate	Petrol Range Organics C5-C9	Petrol Range Organics C10-12	Benzene	Toluene	Ethylbenzene	Total Xylene	Mineral Oil by GC	Total 6 PAHs	PCB Congener 28	PCB Congener 52	PCB Congener 101	PCB Congener 118	PCB Congener 153	PCB Congener 138
			mg/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/kg	mg/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
06-B05296-S0006	TP1 2876	1M	<0.0005	<10	<10	<10	<10	<10	<10	<1	<1.6	<1	<1	<1	<1	<1	<1
06-B05296-S0007	TP4 7645	2M	<0.0005	<10	<10	<10	<10	<10	<10	<1	4.6	<1	<1	<1	<1	<1	<1
06-B05296-S0008	TP6 7667	2M	<0.0005	<10	<10	<10	<10	<10	<10	<1	<1.6	91	27	5	6	4	4

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Dylan Halpin

Printed at 10:24 on 11/09/2006

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

☐ Interim
☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 06-B05296/01
Client: IGSL Ltd
Date of Receipt: 21/08/2006
(of first sample)

Sample Type: SOIL
Location: Fitzwilliam Quay Dublin
Client Contact: John Clancy
Client Ref: 12028

	Detection Method	GCMS	GCMS	GRAVIMETRIC	GRAVIMETRIC	HPLC	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS	ICP MS
	Method Detection Limit	<1ug/kg	<1ug/kg	<0.1%	<350mg/kg	<0.1mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg	<0.01mg/kg
UKAS Accredited [Testing Laboratory] No. 1291					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ALcontrol Reference	Sample Identity	Other ID	PCB Congener 180	PCB Total of 7 Congeners	Natural Moisture Content	Total Dissolved Solids in CEN 10:1 Leachate	Total Phenols in CEN 10:1 Leachate	Dissolved Antimony Low CEN 10:1 Leach	Dissolved Arsenic Low CEN 10:1 Leach	Dissolved Barium Low CEN 10:1 Leach	Dissolved Cadmium Low CEN 10:1 Leach	Dissolved Chromium Low CEN 10:1 Leach	Dissolved Copper Low CEN 10:1 Leach	Dissolved Lead Low CEN 10:1 Leach	Dissolved Molybdenum Low CEN 10:1 Leach	Dissolved Nickel Low CEN 10:1 Leach	Dissolved Selenium Low CEN 10:1 Leach
			ug/kg	ug/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
06-B05296-S0006	TP1 2876	1M	<1	<1	21.1	1413	<0.1	0.02	0.13	1.91	<0.01	0.02	0.06	0.01	0.10	0.01	<0.01
06-B05296-S0007	TP4 7645	2M	<1	<1	26.9	682	<0.1	<0.01	0.03	1.69	<0.01	0.01	0.04	0.02	0.08	0.01	<0.01
06-B05296-S0008	TP6 7667	2M	<1	137	14.3	5441	<0.1	0.20	0.02	1.78	<0.01	<0.01	0.03	<0.01	0.01	0.02	<0.01

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL. **NDP** = NO DETERMINATION POSSIBLE

Checked By : Dylan Halpin

Printed at 10:24 on 11/09/2006

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

☐ Interim
☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 06-B05296/01
Client: IGSL Ltd
Date of Receipt: 21/08/2006
(of first sample)

Sample Type: SOIL
Location: Fitzwilliam Quay Dublin
Client Contact: John Clancy
Client Ref: 12028

	Detection Method	ICP MS	IR	KONE	KONE	KONE	LECO
	Method Detection Limit	<0.01mg/kg	<20mg/kg	<10mg/kg	<1mg/kg	<30mg/kg	<0.01%
UKAS Accredited [Testing Laboratory] No. 1291		✓		✓		✓	✓
ALcontrol Reference	Sample Identity	Other ID	Dissolved Zinc Low CEN 10:1 Leach	Dissolved Organic Carbon in CEN 10:1 Leachate	Chloride in CEN 10:1 Leachate	Fluoride in CEN 10:1 Leachate	Sulphate in CEN 10:1 Leachate	Total Organic Carbon**
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%
06-B05296-S0006	TP1 2876	1M	0.25	34	87	3	255	3.92
06-B05296-S0007	TP4 7645	2M	0.25	32	39	3	87	2.61
06-B05296-S0008	TP6 7667	2M	0.55	53	32	1	3881	8.81

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL. **NDP** = NO DETERMINATION POSSIBLE

Checked By : Dylan Halpin

Printed at 10:24 on 11/09/2006

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

Geochem Analytical Services

Diesel Range Organics/Mineral Oil
by
G.C.

Client Name IGSL Ltd
Client Ref 12028
Sample Matrix Soil

Job Number B05296
Date Extracted/Prepared 31/08/2006
Date Analysed 05/09/2006

Separatory Funnel Ext No
Soxtec Extraction No
Column Extraction Yes

Sample number	Sample Identity	Depth	Diesel Range Hydrocarbons (mg/kg)	Mineral Oil (mg/kg)	Interpretation
006	TO1 2876	1m	< 1	< 1	No Identification Possible
007	TP4 7645	2m	< 1	< 1	No Identification Possible
008	TP6 7667	2m	< 1	< 1	No Identification Possible

Checked by Belen Zalama

ALCONTROL GEOCHEM (IRELAND)

Gasoline Range Organics
by
GC-FID

Job Number = B05296
Client = IGSL Ltd
Client Ref = 12028
Contact = -

Sample Type = Soil
Location = -
Date Extracted = 30/08/06
Date Analysed = 05/09/06

Sample number	C5 - C9 µg/kg	C10- C12 µg/kg	Total GRO µg/kg
S0006	<10	<10	<10
S0007	<10	<10	<10
S0008	<10	<10	<10

Checked by Brendan Carrion.....

Geochem Analytical Services

BTEX Analysis
By
G.C.

Job No: B05296
Client: IGSL Ltd
Client Ref: 12028
Date Extracted 30/08/06
Date Analysed 05/09/06
Matrix: Soil
Units: µg/kg

Sample No	Sample Ref	Depth m/ft	Benzene	Toluene	Ethyl Benzene	Total Xylene
S0006	TP1 2876	1M	<10	<10	<10	<10
S0007	TP4 7645	2M	<10	<10	<10	<10
S0008	TP 6 7667	2M	<10	<10	<10	<10

Checked by Brendan Carrion.....

APPENDIX

APPENDIX

1. Results are expressed as mg/kg dry weight (dried at 30°C) on all soil analyses except for the following: NRA Leach tests, flash point, and ammoniacal N_2 by the BRE method, VOC, PRO, Cyanide, Acid Soluble Sulphide, SVOC, DRO, PAH, PCB, TPH CWG ,TPH by IR, OFGs and SEM.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. A sub sample of all samples received will be retained free of charge for one month for soils and one month for waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, an asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD – no fibres detected. If fibres are detected, then identification and quantification is carried out by ALcontrol Technichem or Alcontrol Shutlers in the UK . If a sample is suspected of containing asbestos, then drying and crushing will be suspended on that sample until the asbestos results are known. If asbestos is present, then no analysis requiring dry sample are undertaken.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace is present in the volatile sample.

8. NDP – No Determination Possible due to insufficient/unsuitable sample.

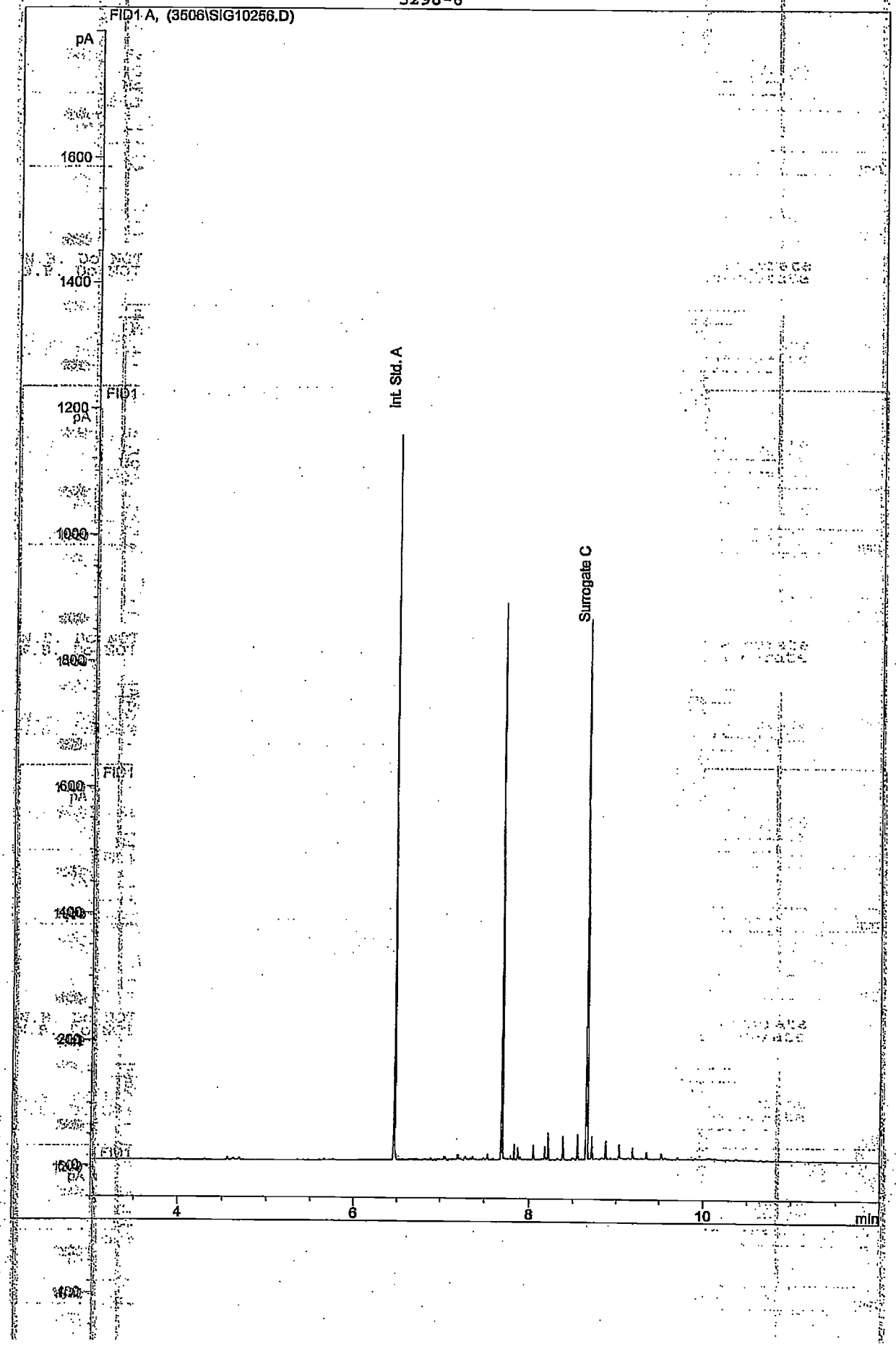
9. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.

10. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.

Last updated February 2005

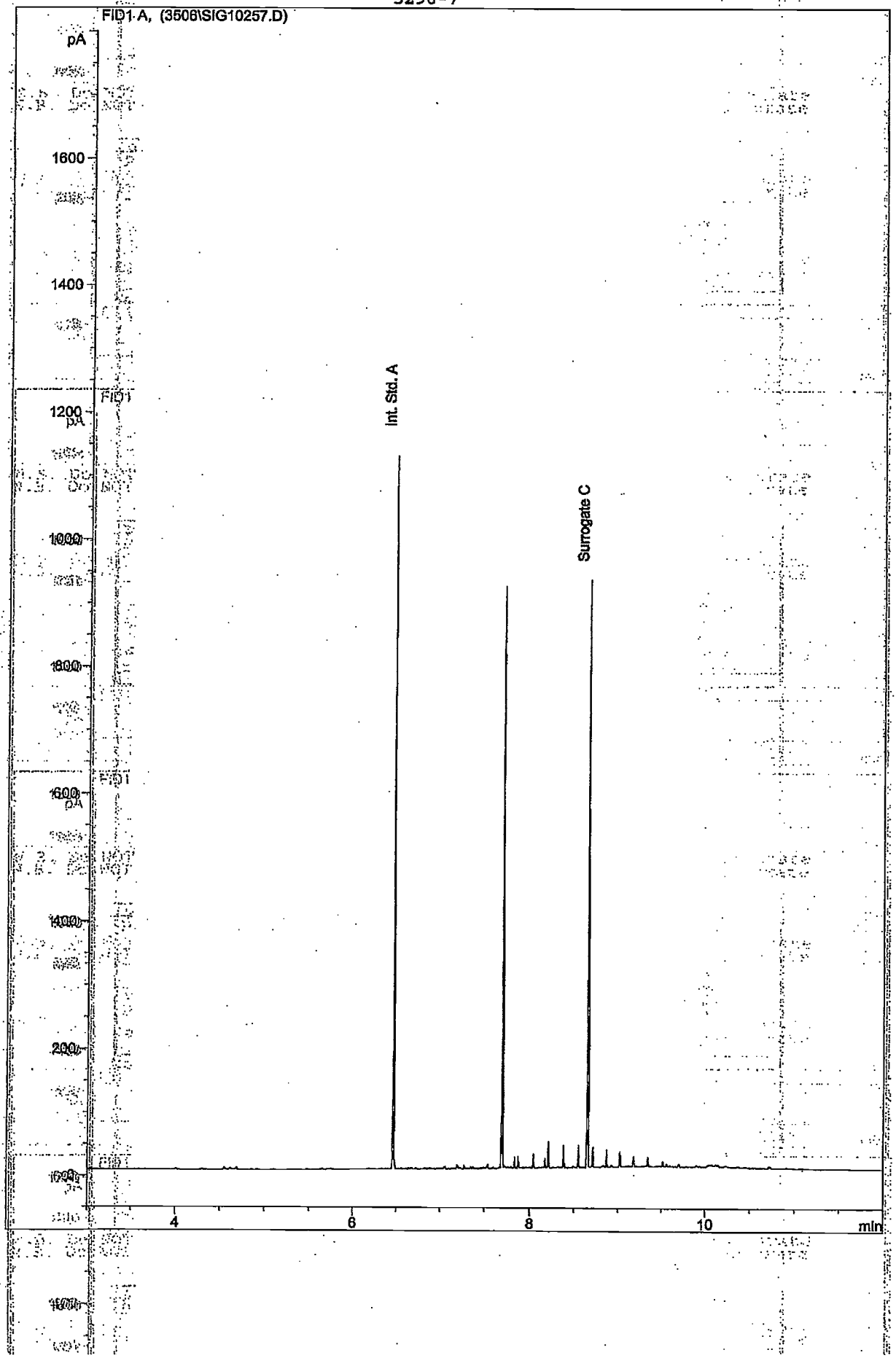
Alcontrol Laboratories Ireland
Diesel Range Organics Analysis
By G.C.

5296-6



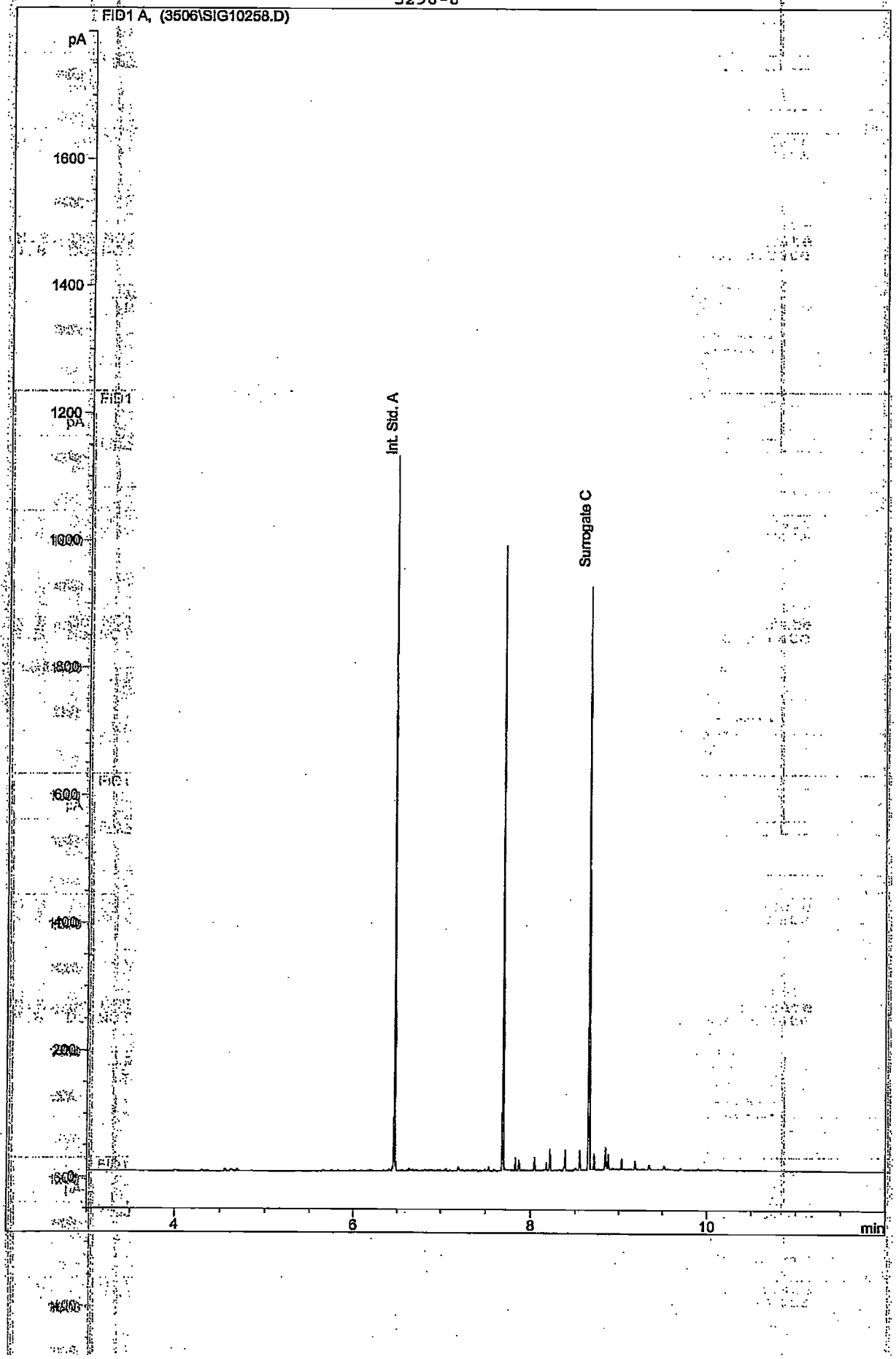
Alcontrol Laboratories Ireland
Diesel Range Organics Analysis
By G.C.

5296-7



Alcontrol Laboratories Ireland
Diesel Range Organics Analysis
By G.C.

5296-8



Chain of Custody No: 34230 **GEOTRACE - ANALYSIS REQUEST FORM AND SAMPLE CUSTODY SHEET**

ALcontrol Laboratories
Unit 18a, Rosemount Business Park,
Ballycoolin, Dublin 11
e-mail: Ireland.schedulers@alcontrol.ie
Tel: 01 8829893 Fax: 01 8829895

Client: I.G.S.L. Limited
Address: UNIT F, M7 BUSINESS PARK, NAAS, CO. KILDARE.
Contact name: JOHN CLANCY
Tel: 045-846176 Fax: 045-846187
Project/Site Name: FITZWILLIAM QUAY DUBLIN
Project Code: 12028
Quote Reference:

Date of Despatched:
Sampler:
Email schedule to:
Email results to: johnclancy@igsl.ie
Job Continuation - yes / no

Sheet ..... of .....

Date of Sampling:	Sample Ref. ID	Depth in metres	Sample Preservation Y/N	(S)oil or (W)ater (specify if other	Sample Concentration Low, Medium or High (L, M, H)	Suite Name/Analysis Required: MURPHY SUITE
21/8/06	TP1 2876	1.00		(S)		✓
	TP4 7645	2.00		(S)		✓
	TP6 7667	2.00		(S)		✓

Turnarcund - please tick
10 day t/a ✓
5 day t/a
3 day t/a
1 day t/a

date results required by: A.S.A.P.

Comments

Report format
Standard

Sampler Signature

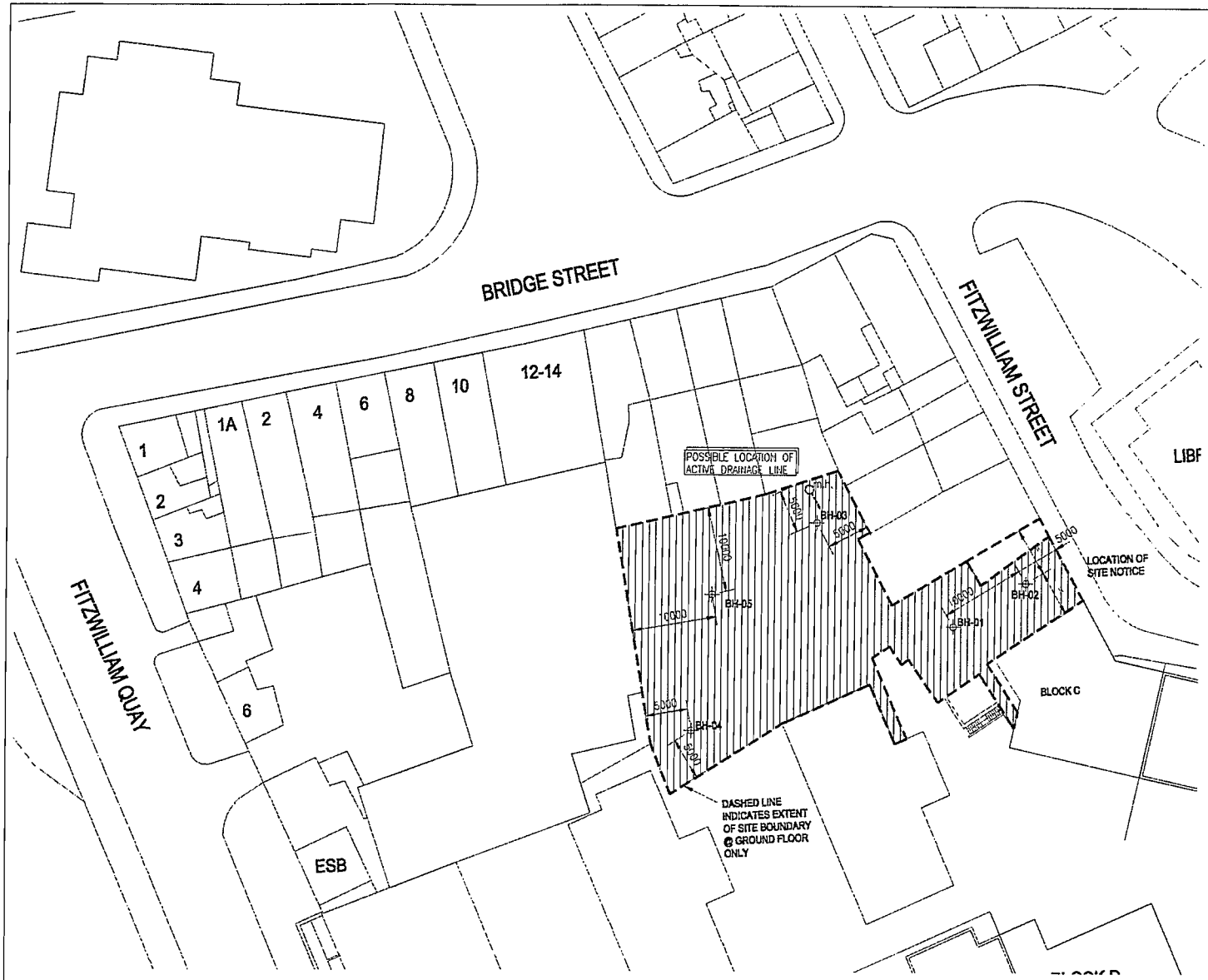
Special Instructions/Known Hazards:
(Please inform the lab of any known hazards in the sample, ie Asbestos)

P.O. Number

Invoice address if different from above:

Date Received: *Time:* 17.00 *Temp* 21° *Signature:*

Appendix V – Site Plan



LEGEND

BORE HOLE LOCATION ⌖

ACTIVE DRAINAGE IN GROUND m.h.
(the location of these needs to be confirmed, by contractor)

SITE LOCATION PLAN

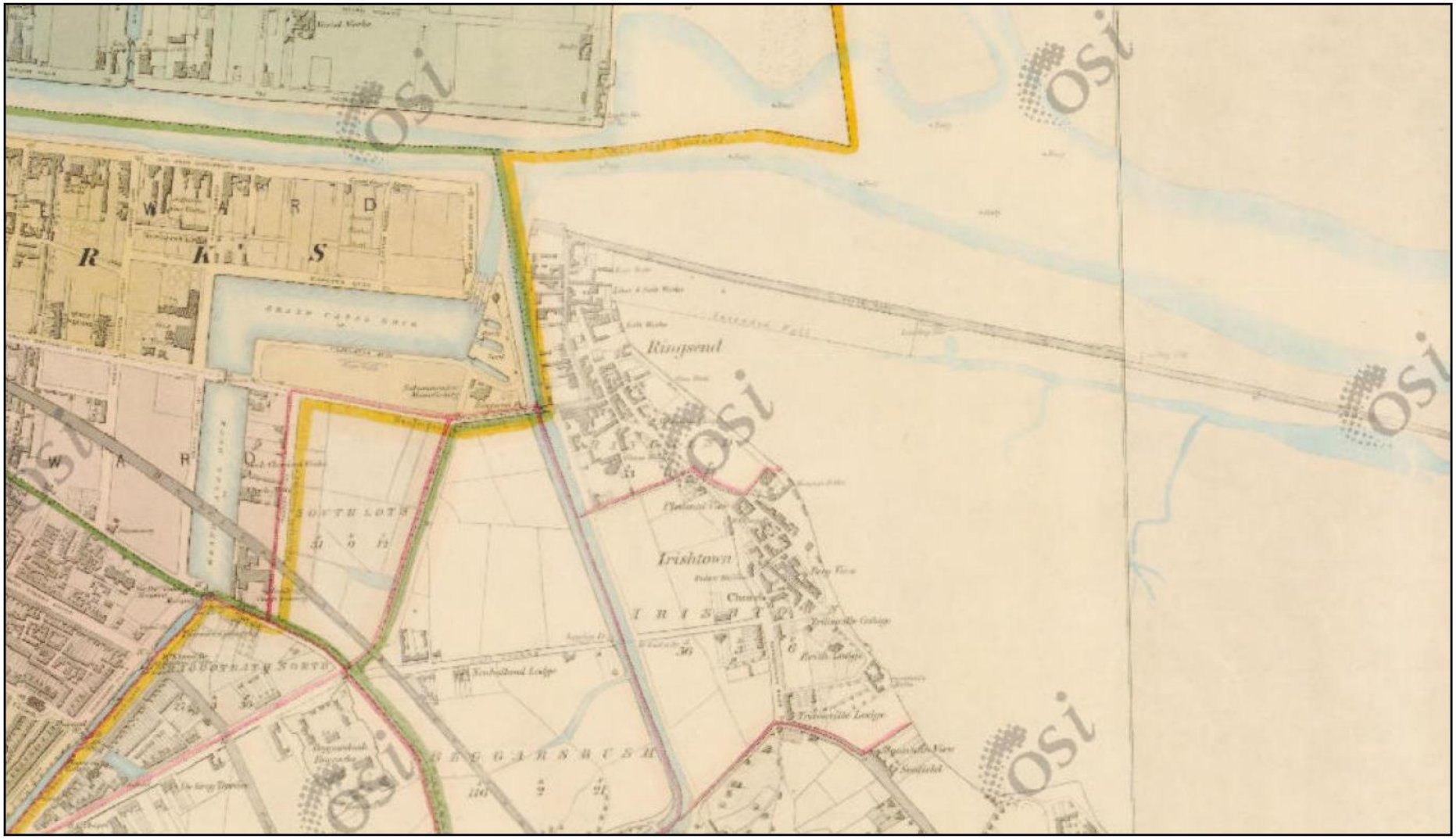
NOTES:

REVISION	DATE	DESCRIPTION	REV BY	CHK BY
/	28/03/08	ISSUED FOR INFORMATION		AAK

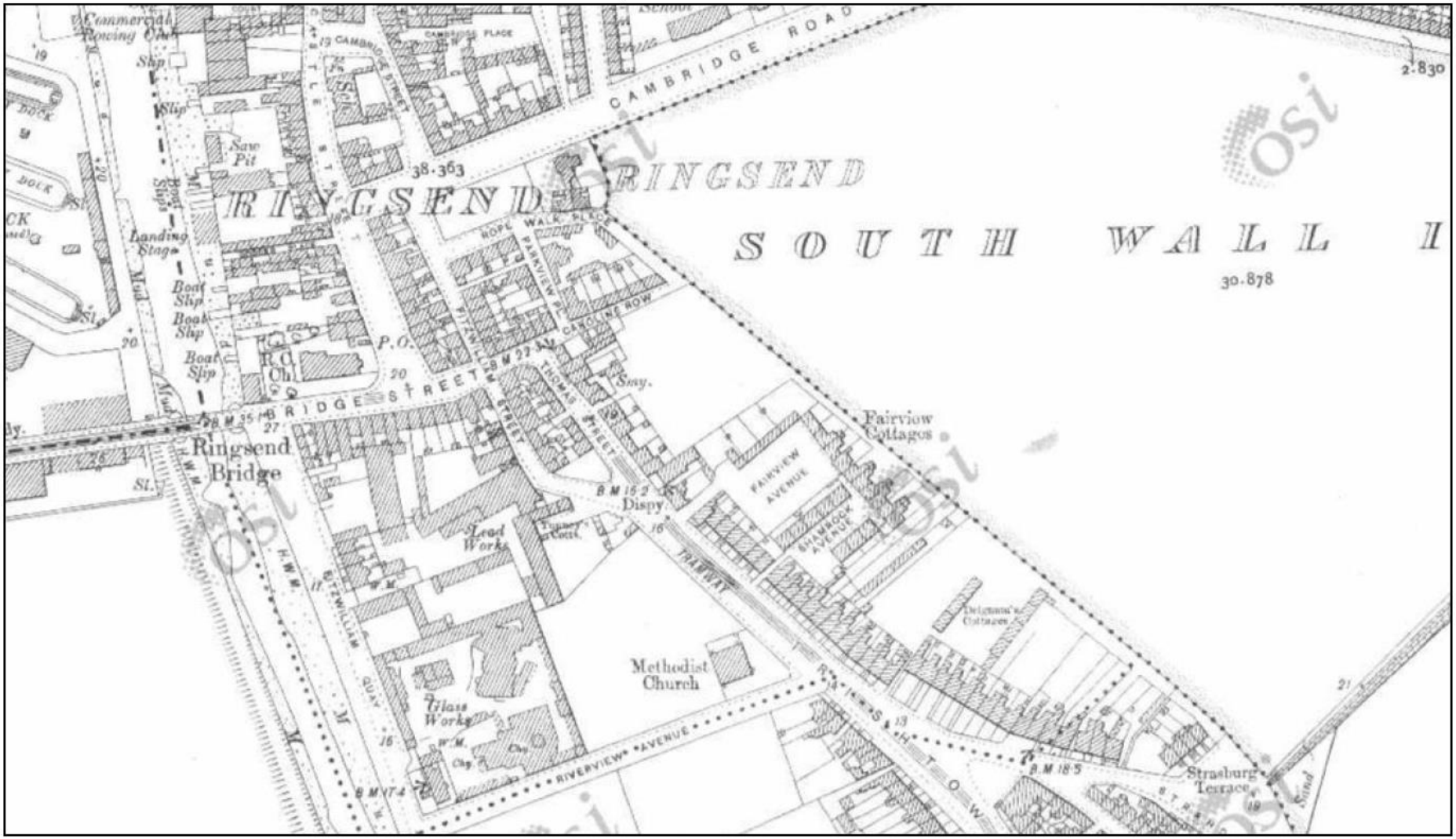
MUIR ASSOCIATES
Consulting Engineers
17, Fitzwilliam Place,
Dublin 2, Ireland
Telephone +353-1-6787788
Facsimile +353-1-6624566
E-mail muir@indigo.ie

PROJECT	RESIDENTIAL DEVELOPMENT, FITZWILLIAM QUAY
TITLE	SITE LOCATION PLAN
ISSUE	ISSUED FOR INFORMATION
Partner P.P	Proj Eng A.A.Y.
Drawn by A.A.K	ORG ID D1377(B)-EN-100
REV /	
Scale 1:500	Checked A.A.Y.
Date 29/03/08	

APPENDIX H
HISTORIC MAPS



6 Inch Historic Map



25 Inch Historic Map

APPENDIX J
HISTORIC NEWS ARTICLES

100 evacuated from homes in Dublin area

Sat, Feb 2, 2002, 00:00

Declan Fahy

Three people were hospitalised and more than 100 were evacuated yesterday from the Ringsend and Irishtown areas of Dublin, which were severely affected by the city's worst flooding in decades.

A major emergency plan was put in place by Dublin City Council, which mobilised the resources of the council, the Garda, Civil Defence, Army and Fire Brigade.

The Liffey was at its highest level since 1924, said Mr Michael Phillips, city engineer with Dublin City Council.

He said most of those evacuated by the Irish Coast Guard, many of them by boat, were last night staying with friends and relatives. Others were being housed in the Glanna Gael GAA club in Ringsend, said a spokesman for the Department of the Marine.

Those hospitalised are believed to be suffering from small injuries and hypothermia.

AA Roadwatch reported enormous delays and disruptions in the city centre as well as in several other areas along the coast.

The Dublin Coastguard helicopter and coastal unit as well as an RNLI lifeboat carried out a search of the coast at South End, Dalkey, following reports of a canoeist in difficulty. It was stood down early yesterday evening.

Worst-affected areas in Dublin were Irishtown, Ringsend, Clontarf Road, Merrion Gates, Strand Road, and the north and south quays. The flooding mostly affected areas around the mouth of the Liffey, said Mr Phillips.

The boardwalk along the Liffey's north bank was closed for safety reasons yesterday afternoon.

Mr Phillips said the River Dodder burst its banks at Ballsbridge, but further flooding in this area was prevented by adding sandbags. Most of the flooding had subsided by low tide at around 8 p.m, but flood water still remained lodged around East Wall Road, Ringsend and Irishtown. Emergency services were last night pumping out flood water from these areas.

About 500 homes may still be without electricity in Dublin this morning after the Liffey burst its banks and flooded sub-stations at Clontarf, Ringsend and East Wall, which distribute power to the local areas, said an ESB spokesman. The ESB, in consultation with the Fire Brigade, was last night considering cutting power in 700 homes in the city centre for safety reasons.

Traffic diversions were in place in the city centre. The East Link Bridge was also closed yesterday afternoon for about an hour due to flooding. The city council advised motorists to avoid the city centre and other affected areas. Bus lanes were opened up to traffic. Bus Éireann and Dublin Bus reported delays of up to two hours on their services yesterday.

The DART between Lans-downe Road and Dún Laoghaire was suspended for two hours, and the Inter City rail line between Greystones and Wicklow was closed for four hours.

Traffic was gridlocked in the city during rush hour yesterday evening, with delays on all routes out of the city. Motorists travelling from the north to the south of the city were advised to use the M50 which did not experience flooding.

The emergency plan was being controlled at Dublin City Council civic offices on the quays, with meetings continuing throughout last night.