Verde Environmental Consultants

Preliminary Site Assessment Report for Junction of Howth Road and Clontarf Road, Dublin 3

ESB Site Ref: 11
Clontarf – East Wall Road 38 kV

September 2019

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LIMITATION

This report represents the results of a site inspection and desk study research conducted at the above referenced site. Best practice was followed at all times and within the limitations stated. This report is the property of Verde Environmental Consultants Limited (Verde) and cannot be used, copied or given to any third party without the explicit prior approval or agreement of Verde.

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This preliminary environmental site assessment consists of a review of the potential environmental impact associated with a suspected hydrocarbon leak from a power cable at the Junction of Howth Road and Clontarf Road, Dublin 3. (ESB Ref: 11).

There was an approximate volume of 1,056 litres of cable fluid consisting of linear alkyl benzene (LAB) mixed with mineral oil (MO) lost to ground at the road junction at an approximate rate of 42L/month for 25 months. The leak began in July 2013 and was repaired in August 2015.

The known leak point is located within the centre of the road junction of Howth Road and Clontarf Road next to Fariview Park, which is a residential area along Howth Road and commercial and open parkland along Clontarf Road. There is evidence of abundant site services near the ESB cable route.

This area of Dublin is seen to have a similar land use in the 6-inch Cassini historical maps (1830's – 1940's) to today with residential, greenfield parks and railway line. The land in the area is largely zoned for residential use and public open space.

The site is underlain by locally important (meaning capable of suppling moderate groundwater yields) dark calp limestones of the Lucan Formation. The vulnerability is Moderate indicating thick (5-10metres) low permeability boulder clay subsoils, which provide a good level of natural protection to the underlying bedrock aquifer.

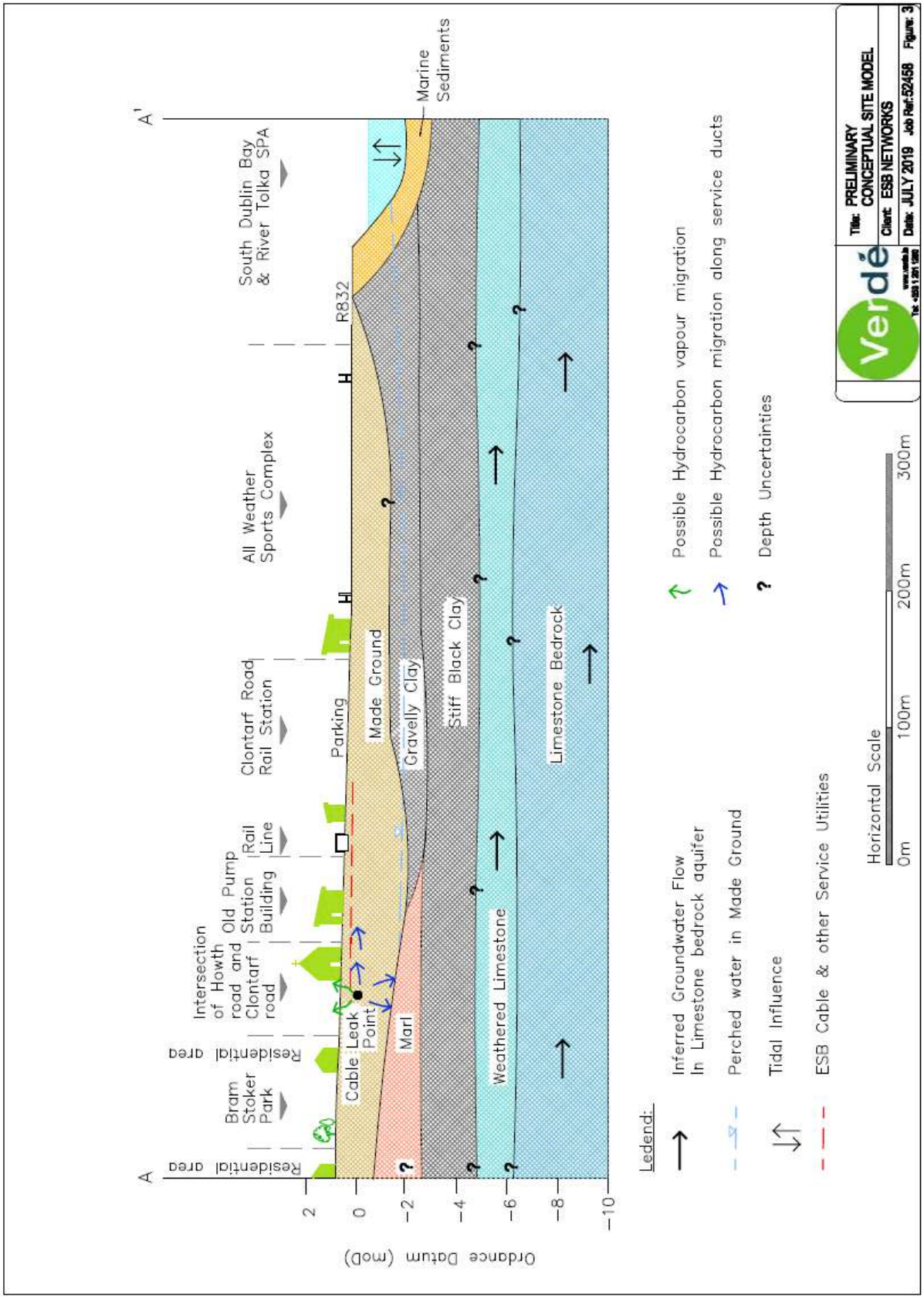
The nearest surface watercourses are Dublin Bay approximately 460m to the south-east of the site and the Tolka River located approximately 800m to the south. There are no groundwater wells within a 1km radius of the site. Dublin Bay SPA and pNHA is located approximately 460m to the south and south east of the leak point. Groundwater in the bedrock aquifer is likely to be semi-confined by the thick subsoils with groundwater flow direction in a southerly direction following site topography.

Based on the known cable leak point, contaminant of potential concern (COPC) fate and transport and hydrogeological desk study information the CSM has the following initial key findings for human health and environmental risks;

There is a Low risk posed by LAB and MO from contact with suspected contamination in the soil and groundwater through;

- direct dermal/inhalation and ingestion contact to residents or other building users;
- dermal/inhalation and ingestion pathways to construction workers which can be managed by appropriate use of PPE and H&S procedures;
- ingestion of contaminated water by water users in the area following its permeation through plastic water pipes.
- leaching to shallow groundwater given the contaminant properties of low mobility and high sorption to soil, with shallow groundwater unlikely to be a viable groundwater resource in the residential urban setting.
- migration of shallow contaminated groundwater to Dublin Bay SPA & pNHA given the contaminant properties of low mobility and high sorption with a distance of 460m from the leak point and not a significant oil loss volume.
- hydrocarbon vapours in preferential pathways such as services ducts to residents or other building users.

Figure 3 – Conceptual Site Model



	EPA Contaminated Land & Groundwater Risk Assessment Methodology	Report Reference	Report Date	Status
	STAGE 1: SITE CHARACTERISATION & ASSESSMENT			
1.1	**PRELIMINARY SITE ASSESSMENT**	Preliminary Report, Verde, Ref: 52458	14th November 2019	Final
1.2	**DETAILED SITE ASSESSMENT**			
1.3	**QUANTITATIVE RISK ASSESSMENT**			
	STAGE 2: CORRECTIVE ACTION FEASIBILITY & DESIGN			
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3.2	**CORRECTIVE ACTION IMPLEMENTATION & VERIFICATION**			
3.3	**AFTERCARE**			

1. INTRODUCTION

1.1. PROJECT CONTRACTUAL BASIS AND PERSONNEL INVOLVED

Verde Environmental Consultants, (Verde) was commissioned by ESB Engineering & Major Projects to undertake Preliminary Risk Assessments at six locations where there were suspected leaks of cable fluids. This report focuses on a hydrocarbon leak from a 38 kV power cable located at the Junction of Howth Road and Clontarf Road, Dublin 3. (ESB Ref: 11 Clontarf – East Wall Road 38 kV).

A site visit was undertaken by a Verde Hydrogeologist on 4th July 2019 to examine the area of the known cable leak point in relation to any observed evidence of contamination and surrounding land uses and sensitive human health and environmental receptors.

A site location map for the leak point is presented in Figure 1 with a detailed map on the cable route and leak location presented in an ESB map in Appendix A.

1.2. BACKGROUND INFORMATION

The ESB cable fluid acts as an electrical insulator and aids the conduction of heat away from the conductor allowing the cable to be run more efficiently. Fluid filled cables are largely located in urban/suburban areas and so are particularly vulnerable to third party interference or damage. Over time a cable can develop a leak due to corrosion / fracture/ defects in the cable sheath and in joints and terminations. When such a leak occurs, there is potential for pollution to occur to surface water, groundwater, soils and ecology.

This preliminary environmental site assessment consists of a review of the potential environmental impact associated with a suspected hydrocarbon leak from a power cable at the Junction of Howth Road and Clontarf Road, Dublin 3, next to Fairview Park. (ESB Ref: 11).

The suspected leak is reported to have begun in July 2013 with an approximate volume of 1,056 litres (l) of linear alkyl benzene mixed with mineral oil leaking from a 38kV cable at a rate of 42l/month. The leak was repaired in August 2015.

Details on the physical and chemical aspects of the hydrocarbon products used as Insulating Fluids in the cable are discussed in Section 2.3 below.

1.3. PROJECT OBJECTIVES

The project objective was to determine the potential risks to human health and the environment at the leak locations and potential areas of impact. As requested by ESB, a risk-based approach has been applied to this assessment. This risk based approach is also recommended in the best practice documents produced by the EPA on Management of Contaminated Land & Groundwater at EPA Licenced Sites published in 2013. Although the scope of this guidance specifically applies to licensed sites, the approach presented is consistent with UK and mainland European best-practice guidance in the assessment and management of potentially contaminated land. It is therefore considered to be a robust basis for the assessment of the subject site.

This report has been prepared in accordance with the EPA guideline reporting template for Preliminary Site Assessments under the EPA Contaminated Land & Groundwater Risk Assessment Methodology.

1.4. SCOPE OF WORKS

In order to complete the assessment and meet the objective of the brief the following scope of works was completed:

- A desk study review of available historical, geological and hydrogeological and environmental sensitivity information for the site. The desk study includes an assessment of historical land uses. Information on site utility services from various providers was examined together with detailed information on the cable route with a known leak point on the ESB cable, such as cable ends or joints.
- Site walkover to undertake a detailed site inspection to establish as much information as possible regarding site operations, activities, observed evidence of contamination and land use to include detailed site notes and photographs.
- Prepare a report in accordance with best practice guidance, in that the information gathered will be used to develop a preliminary conceptual model for the site.

2. SOURCE AUDIT FINDINGS – PRODUCTION & OPERATIONAL HISTORY

2.1. CURRENT SITE OPERATIONS

The known leak point (ESB Ref: 11) is located at the Junction of Howth Road and Clontarf Road, Dublin 3, which is combination of residential and commercial properties together with open greenfield parklands, as presented in the map in Appendix A.

The ESB cable runs along the southern side of Howth Road, as presented in Photograph 1 in Appendix C. There are several buried services under the concrete footpath between Howth Road and residential properties, as presented in Photograph 2. There is an Apple Green service station located approximately 100m further east from the 200m eastern marker on Howth Road and therefore 300m upgradient from the leak point.

The location of the cable leak point is located in the middle of the road junction as presented in Photograph 4 & 5 in Appendix C. There is no physical evidence of hydrocarbon contamination on the surface in terms of oil odours/staining or impact to vegetation with healthy looking trees and hedges. Immediately to the south of the leak point on Clontarf road is a grassed area, cycle lane and footpath.

Clontarf DART railway station is located along the southern side of the ESB cable route along Clontarf Road. A pumping station which is part of the North Dublin drainage system (stormwater) is also located on this roadway together with a depot with gas network utilities.

The known presence of permeable made ground around the power cable together with the presence of other underground services along the roadway indicates there is a high potential for preferential lateral migration from the leak point along the underground services routes.

2.2. PREVIOUS SITE OPERATIONS

This area of Dublin is seen to have a similar land use in the 6-inch Cassini historical maps (1830's – 1940's) to today with residential, greenfield parks and railway line as shown in the historical desk study maps in Appendix B. The existing location of the Westwood Club gym to the south of the cable leak point was constructed between 1995 and 2000 as seen in the aerial images. The ESB power cable was installed in the area in 1964. Further details on the site history are presented in section 3.2.

2.3. CHEMICALS OF POTENTIAL CONCERN (COPC)

The fluid in the power cable is a mixture of two components Mineral Oil and Linear Alkyl Benzenes (T3788). MSDS for the fluids are included in Appendix D and further detail on their physical, fate and transport and toxicological properties provided below.

2.3.1 Linear Alkyl Benzenes

Linear Alkyl Benzene is a benzene compound with a side alkyl chain of 10-13 carbon atoms in length. The following presents relevant information on its Fate and Transport in the environment.

- low solubility, which means it doesn't mix with water easily;
- low to moderate volatility with the MSDS providing that the compound should not present an inhalation hazard under ambient conditions and that exposure to vapour or oil mists may

irritate the mucous membranes and cause dizziness, headaches and nausea;

- Strongly absorbs to soil and combined with its low solubility means it generally has low mobility in the water environment;
- Its preference in soil will be to remain as free product or sorb to soil with a smaller proportion in the vapour phase;
- It will form a Light Non-Aqueous Phase Liquid (LNAPL) on water;
- It is readily biodegradable in both water and soil, with a half life in soils of 15.3 days and less than 28 days in water. Half-life is the time required for a quantity to reduce to half of its initial value (REACH database);
- Does not bio accumulate;
- The Predicted No Effect Concentration (PNEC) is the concentration of a chemical which marks the limit at below which no adverse effects of exposure in an ecosystem are measured. LAB is toxic to the water environment with a PNEC aqua (freshwater) of 0.001mg/l: PNEC soil terrestrial organisms of 0.329mg/kg and PNEC sediment of 1.65mg/kg for freshwater sediment and 0.165mg/kg for marine sediments (REACH database).

2.3.2 Mineral Oil

In scientific terminology, the term mineral oil tends to be nonspecific in that it can refer to a substance which contains varying substances depending on its manufacture process.

Mineral oils are manufactured from petroleum with about 10-25% comprising of additives which can include antioxidants, metal deactivators, detergents, dispersants, corrosion inhibitor etc. Their composition will also have changed over time and in the context of cable fluid will vary according to when a cable was installed. In summary, the following characteristics have been identified:

- Physical properties can vary widely being defined by the crude oil source, carbon number distribution, boiling range and viscosity.
- Mineral oils are refined from petroleum crude oils, and are complex mixtures of straight- and branched chain paraffinic, naphthenic, and aromatic hydrocarbons with 15 or more carbons and boiling points in the range of 300°C to 600°C.
- Are insoluble in water and alcohol, but soluble in benzene, chloroform, ether, carbon disulfide and petroleum ether. They have ranging viscosities.
- Mineral oils from paraffinic crude oils are characterized by high wax content, high natural viscosity index, and relatively low aromatic hydrocarbon content. Naphthenic crude oils are generally low in wax content and relatively high in cyclo-paraffins and aromatic hydrocarbons. All crude oils contain some polycyclic aromatic hydrocarbons, and the proportions and types of these compounds in the finished mineral oils are determined primarily by the refining process.
- In the past, many mineral oils were only mildly refined and contained significant levels of polycyclic aromatic hydrocarbons (PAHs). Acid treatment was initially used to remove PAHs and other impurities and to improve the technical properties of the finished oils. In recent

decades, acid treatment has largely been replaced by extensive refining with solvent extraction and/or hydro-treatment, which has further reduced the level of PAHs and other contaminants.

- In conclusion to the above, due to mineral oils likely varying composition, its physical, fate and transport and toxicological properties are best determined through consideration of the TPH CWG framework which characterises petroleum hydrocarbons according to the number of carbons. For a mineral oil, carbon fractions of C_{15} and above are relevant and PAHs. Additives may also be wide ranging and so their characteristics can be determined by the presence of analysed volatile and semi-volatile organic compounds.
- Mineral oil as represented by TPH hydrocarbon fractions of C_{15} and greater have a very low mobility and low degradation half lives. They therefore have the potential to persist in the environment.
- The longer carbon chain lengths also mean that mineral oil will have a relatively low volatility, with carbon fractions of greater than C_{16} not being considered to be volatile.
- The MSDS for Masse 106 (Mineral oil that leaked from cable) has identified that the product if it enters soil will be absorbed to soil particles and so will not be mobile. It has the potential to bio-accumulate. The MSDS also identifies that the product is expected to be non-toxic to aquatic organisms and that toxicologically it is not toxic and not carcinogenic. However more recently studies such as that for TPH CWG have published health criteria values for carbon range C_{16-35} and along with potential additives potential impacts to human health and the environment will need to be considered.

3. SITE ENVIRONMENTAL SETTING

3.1. GENERAL INTRODUCTION

The area of interest is an approximate 400m stretch of the road extending 200m north east along Howth Road from the Junction with Clontarf Road and 200m east along Clontarf Road. The main land use in this area is primarily residential with private gardens along the Howth Road cable route section. The Westwood Club Gym is located to the immediate south of the leak point together with Clontarf Road DART station. The raised rail line extends in a north-east to south-west direction to the east of the leak point. There is a flyover over the Clontarf Road by the railway line, as presented in Photograph 6 in Appendix C. A church is located within 65m east of the leak point with residential properties 110m away on the Howth Road.

The land in the area is zoned for various uses. To the north of the leak site the land is zoned for residential use primarily with areas of public open space, as presented in the Dublin City Council Development Plan Map Appendix B. The areas to the south of the leak site are zoned as open space/amenity.

The River Tolka is located approximately 800m to the southwest of the site flowing in an easterly direction eventually draining to Dublin Bay. Under the Water Framework Directive, the River Tolka has been assigned a "Bad" status and has also been categorised as being at risk of deteriorating in the future, as presented in the Water Framework Directive River Body report in Appendix E.

3.2. SITE HISTORY

Primary sources used to research the history of the site included available extracts from historical Ordnance Survey Ireland (OSI) maps, aerial photographs and planning information from Myplan.ie.

The maps consulted include the OSI 6-inch historic maps from 1837 to 1842, the OSI 25-inch historical maps surveyed between 1888 and 1913 and the OSI 6-inch Cassini map surveyed in early 20th century. Table 3.2 below gives further details of the site history and the land use of the surrounding area.

Table 3.1 – Site History

History	**National Monuments Service:** There is a potential burial monument present on the Greenland located to the northwest of the junction of Howth road and Clontarf road.
	Historic Mapping: OSI 6 inch map (Black and White) (1837-1842): The road layout resembles that of present times and the railway line is in place in its current position. Marino Crescent is in place to the north of the intersection. The area to the south of the junction which now houses the Westwood club and Clontarf Road DART Station appears to be undeveloped at this time. The area to the east and west of Marino Crescent are also undeveloped. OSI 25 inch map (Black and White) (1888-1913): The road layout resembles that of present times and the railway line remains in place in its current position. Marino Crescent is in place to the north of the intersection. Further north there are more residential properties present when compared to the earlier map. The area to

	the south of the junction which now houses the Westwood club and Clontarf Road DART Station appears to be undeveloped at this time. The area to the east of Marino Crescent now hosts a Presbyterian church and a school and the area to the west remains undeveloped however there is an "electricity sub-station" present to the immediate west of the green area to the front of Marino Crescent. Cassini 6 inch (1830-1930): The road layout resembles that of present times and the layout of residential properties appears similar to present times also. Marino Crescent is in place to the north of the intersection. The area to the south of the junction which now houses the Westwood club and Clontarf Road DART Station appears to be undeveloped at this time with the exception of the presence of a "Pumping Station" associated with the North Dublin drainage system along the roadside. The ESB power cable is reported to have been laid in the area in 1964.
Aerial Photos	Aerial Photo 1995: The road lay out and position of residential properties remains largely the same as present times. The DART station is now in its current position to the south od Clontarf road. The area now occupied by West Wood Club cleared but there doesn't appear to be any buildings present in this area. Aerial Photo 2000: The site and its surroundings remain largely similar to the previous image. The notable changes occur to the south of the site, the West Wood Club is now in place as is the sports complex to the south east of the rail line. There is now a car park serving the rail station to the south west of the line also. Aerial Photo 2005: There are no notable changes since the previous image in the immediate surroundings of the site. However, to the south west it is apparent that the Dublin Port Tunnel is under construction. Aerial Photo 2012: The site and its immediate surroundings remain largely unchanged.

3.3. REGIONAL GEOLOGY AND HYDROGEOLOGY

The site is underlain by dark calp limestones of the Lucan Formation (GSI) which is overlain of subsoils comprising of Urban deposits with small pockets of marine sands and dunes and Made Ground (Teagasc). The closest surface watercourse is Dublin Bay approximately 460m to the south east of the site. The Tolka River is located approximately 800m to the south of the site flowing in an easterly direction eventually draining to Dublin Bay. The River Tolka catchment area is a subcatchment of the River Liffey and Dublin Bay Catchment as defined by the River Basin Management Plan which covers a total area of 1,624km^2.

The River Tolka has been classed as having a "Bad" status and is at risk of deteriorating in the future. The River Tolka Estuary has been classed as being of a "Moderate" status as are the coastal waters of Dublin Bay in the area, as presented in the Water Framework Directive River Body report in Appendix E.

The following information sources were consulted as part of this desk-based research and the relevant information has been compiled in Table 3.2 below.

- Dublin City Council (Planning and Environment Sections)
- Ordnance Survey of Ireland (historic map series)
- National Monuments Service (protected structures)
- Dept. of the Environment, Community and Local Government
- Geological Survey of Ireland
- Environmental Protection Agency data bases
- National Parks and Wildlife Services
- Office of Public Works (flood maps)

Table 3.2 – Site Physical Setting

Feature	Details & Comments
Topography	The site itself is relatively flat. The regional topography of the area slopes gently to the south east toward Dublin Bay.
Geology	**Overburden:** The GSI and EPA databases describe the soils at the site as Made Ground with the subsoils in the area consisting of Urban deposits with small areas of wind blown sands and dunes. There are small deposits of marine estuarine silts and clays to the south.
	Solid Geology: The site is underlain by calp limestones of the Lucan Formation. The Lucan Formation comprises dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey.
Hydrogeology	**Regional Classification:** According to the GSI the Lucan Formation below the area of interest is classified as a Locally Important aquifer, bedrock which is moderately productive only in local zones. This type of bedrock aquifer unit it typically capable of supplying locally important abstractions (e.g. smaller public water supplies, group schemes), or 'good' yields (100-400m³/d). Groundwater flow occurs predominantly through fractures, fissures and joints (secondary permeability) in a southerly flow direction towards the Tolka River and Dublin Bay. This type of aquifer typically has a limited and relatively poorly connected network of fractures, fissures and joints, giving a low fissure permeability which tends to decrease further with depth. A shallow zone of higher permeability may exist within the top few metres of more fractured/weathered rock, and higher permeability may also occur along fault zones. These zones may be able to provide larger 'locally important' supplies of water. In general, the lack of connection between the limited fissures results in relatively poor aquifer storage and flow paths that may only extend a few hundred metres. The typical recharge rate of this type of aquifer is 200mm/year.
	Vulnerability: The vulnerability rating for the aquifer beneath the site is classified as moderate indicating the depth to bedrock can be up to 10 metres below ground level (mBGL). This was confirmed from geotechnical drilling works in the area where it can be seen that the bedrock is within

	5.5 to 6.5mBGL. The drilling reports show Made Ground/Fill to an average depth of 4.1mBGL underlain by a stiff to hard clay with boulder clay identified in a number of boreholes.
	Groundwater Body: Under the Water Framework Directive (WFD) the groundwater body beneath the site is Dublin Urban (code: IE_EA_G_005) and is classed as having Good status.
	Well Search: There are no abstraction wells noted within 1km of the project site. There is a spring located approximately 1.31km to the east of the site called Brian Boroimhes Well. There is no further information on this spring but is not located directly downgradient of the leak point source.
Hydrology	**Surface Water Courses/Abstractions:** There are no surface watercourses in the immediate vicinity of the site. Dublin Bay is located approximately 460m to the south-east of the site. The River Tolka flows in an easterly direction approximately 800m to the south of the site.
Geotechnical	One borehole was drilled at the Clontarf pumping station with the available log dated 21st May 2002, as presented in Appendix F. The Clontarf pumping station is 71m south-east of the leak site, on the other side of the Clontarf Road. The log shows approximately black boulder clay to approximately 6.5mBGL overlying bedrock. The logs show a thickness of marl from 3 to 3.3mBGL.
	The leak point at Clontarf is within 200m of several boreholes drilled and trial pits dug as part of an investigation carried out into sub-soil conditions by IGSL on behalf of Dublin Corporation in May and June 1993, as presented in Appendix F. Further information is provided in Section 3.4.
Protected Areas	**South Dublin Bay and River Tolka Special Protection Area (SPA)** The boundary of this area (*site code: 004024*) is located approximately 450m to the south east of the project area. This SPA occupies a substantial part of Dublin Bay and comprises extensive intertidal flats which support wintering waterfowl which are part of the overall Dublin Bay population.
	North Dublin Bay (SAC) The boundary of the North Dublin Bay Special Area of Conservation (SAC) (*site code: 000206*) is located approximately 3km to the east of the site.
	Proposed Natural Heritage Area (pNHA) The boundary of the North Dublin Bay pNHA (*site code: 000206*) is located approximately 450m to the south east of the project area.
Flooding	According to OPW flood mapping the site does not appear to be at risk of any coastal, fluvial or pluvial flooding.

3.4. SITE GEOLOGY AND HYDROGEOLOGY

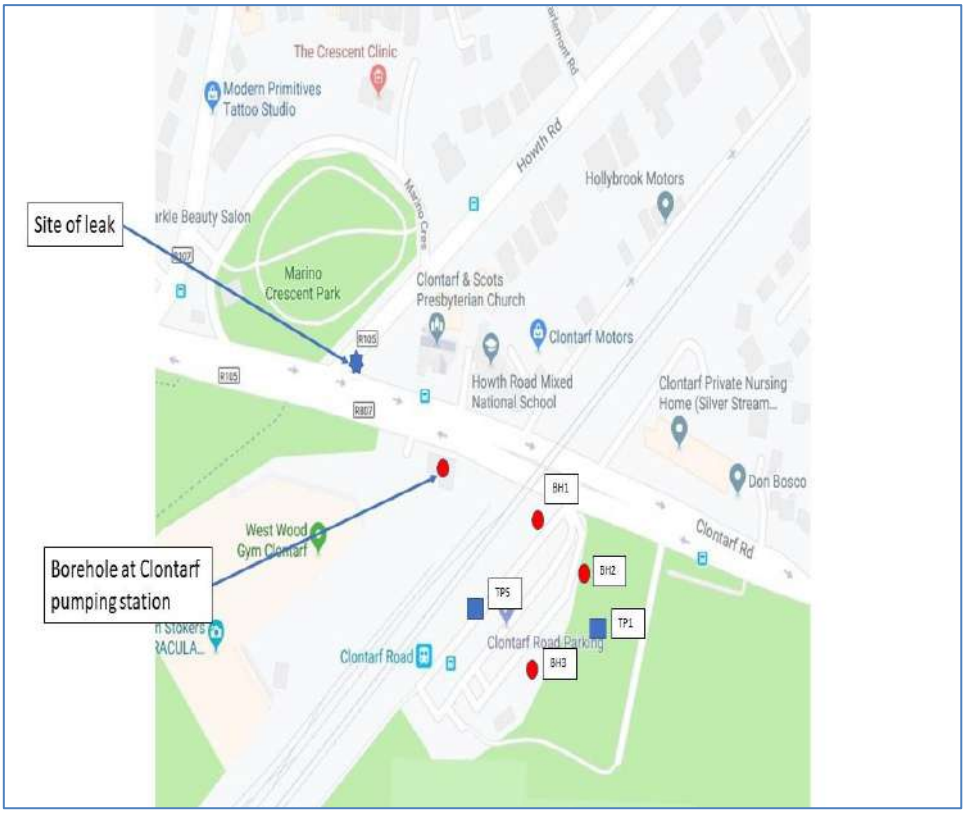
The details of the typical cable and trench dimensions for a fluid filled cable includes the following;

- Depth to the base of trench 1200mm
- Depth to top of cable 900mm-1000mm
- Thickness of sand surrounding a cable 350mm
- Width of trench 1100mm
- Backfill can be either arisings or Clause 804.

According to the GSI Database the site is located within the calp limestones of the Lucan Formation overlain by Urban deposits and Made Ground up to approximately 10mBGL indicated by the moderate groundwater vulnerability rating. This was confirmed from geotechnical drilling works in the area where it can be seen that the bedrock is within 5.5 to 6.5mBGL. The drilling reports show Made Ground/Fill to an average depth of 4.1mBGL underlain by a stiff to hard clay with boulder clay identified in a number of boreholes.

The leak point location on the Clontarf Road is located within 200m of several boreholes drilled and trial pits dug as part of an investigation carried out into sub-soil conditions by IGSL on behalf of Dublin Corporation in May and June 1993. The site investigation boreholes are located immediately east of Clontarf Railway station approximately 50m south-east from the leak point, as presented in Figure 3.1 below. Below are the details of boreholes BH1, BH2 and BH3 and trial pits TP1 and TP5 along with the dates of drilling and excavation.

Figure 3.1 Geotechnical Borehole locations (from GSI database and 1993 Site Investigation Report))



A borehole was drilled at the Clontarf pumping station with the available log dated 21st May 2002, as presented in Appendix F. The Clontarf pumping station is approximately 80m south-east of the leak point on the Clontarf Road.

The permeable made ground is seen to contain shallow groundwater at 3mBGL, which will be restricted from vertical migration by low permeability marl and boulder clay. These low permeability subsoils are seen locally to be up to 3.7m thick beneath the made ground which is restricting migration to the underlying limestone bedrock aquifer, as presented in the conceptual site model in Figures 3 and 4. The groundwater in the underlying limestone bedrock aquifer is likely to be confined or semi-confined by the boulder clay.

The topography of the area as obtained from the GSI database show the cable leak point is located at less than 10metres ordnance datum (mOD) with a slight gradient towards Dublin Bay. The topographic contours are orientated approximately east-west which infers that the groundwater flow direction is likely to be in a southerly to south easterly flow direction, as presented in Figure 2 and within the CSM in Figures 3 and 4.

3.5. SUMMARY OF PREVIOUS SITE SAMPLING AND MONITORING DATA

The made ground within the cable trench is reported to be up to 1.2m deep and contained sand and backfill material. The underlying boulder clay is reported to be of low permeability with a thickness up to 6.5mBGL.

There is no available soil/vapour or groundwater quality information from the area in the vicinity of the cable leak point. There are no groundwater abstractions or monitoring wells in the vicinity of the leak point. A summary of the Environmental and Human Health Pollutant Linkages for the COPCs (TPH fractions, BTEX compounds, Speciated PAHs, SVOCs, VOCs) in relation to the known leak point details and available desk study information is presented in Section 4.0 and summarised below.

For the COPC the following can be determined;

- **Linear Alkyl Benzenes (LAB)** is of low mobility and strongly absorbs to soil. It has low to moderate volatility and will remain largely as free product or sorb to soil/fill material. It is readily biodegradable in aerobic conditions and does not bio-accumulate.
- **Mineral Oils** are refined from petroleum crude oils and are complex mixtures of straight- and branched hydrocarbons and are insoluble in water. Mineral oil with hydrocarbon fractions of C_{15} and greater have a very low mobility and low degradation half lives. They therefore have the potential to persist in the environment. The longer carbon chain lengths also mean that mineral oil will have a relatively low volatility.

4. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

4.1. PRELIMINARY QUALITATIVE RISK ASSESSMENT (PQRA)

4.1.1 Risk Assessment Methodology

Currently there is no specific legislation addressing contaminated land in Ireland and therefore this report has been prepared considering the most relevant guidance published by the Irish Environmental Protection Agency (EPA) and the UK Environment Agency (EA) guidance, specifically as follows:

1. Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites, EPA 2013;
2. Model Procedures for the Management of Land Contamination – Contaminated Land Report (CLR 11), UK EA 2004.

Both approaches advocate a risk-based assessment when dealing with contaminated land and groundwater issues and this is considered as best practice.

Current surface water and groundwater pollution legislation is taken into account for these assessments as required under the Water Framework Directive, Directive 2000/60/EC, that was adopted in 2000 as a single piece of legislation covering rivers, lakes, groundwater and transitional (estuarine) and coastal waters and includes heavily modified and artificial waterbodies. Its objectives are to prevent further deterioration of and to protect, enhance and restore the status of all bodies of water with the aim of achieving at least good status.

It was given effect in Ireland under the European Communities (Water Policy) Regulations 2003 as amended, the European Communities Objectives (Surface Waters) Regulations 2009, as amended and the European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended. These Water Policy Regulations govern the shape of the WFD characterisation, monitoring and status assessment programmes.

A critical element of the risk assessment process is the establishment of a Conceptual Site Model (CSM) for the land and groundwater environment. A CSM describes the potential sources of contamination at a site, the migration pathways it may follow and the receptors it could impact. If complete source-pathway-receptor scenarios exist, then there is a potential pollutant linkage that needs to be characterised and assessed (via formal risk assessment). The CSM is updated as more information is gathered from subsequent desk studies and site investigations with a preliminary CSM presented in Figures 3 and 4.

4.2. OUTLINE SITE CONCEPTUAL MODEL

On the basis of the desk study and site walkover, a number of possible pollutant linkages have been identified for this site. Based on available information the outline site conceptual model is presented in Tables 4.1 and 4.2 below which considers possible pollutant linkages for the site.

Table 4.1 – Outline Site Conceptual Model (Environmental and Human Health)

Source	Pathway	Receptor	Potential Pollutant Linkage (Y/N)	Discussion
Human Health				
Historical leak of cable fluid from underground electricity cable comprising of an approximate volume of 1,056 litres of linear alkyl benzene (LAB) mixed with mineral oil (MO) (Site 11) July 2013 to August 2015. PCOCs include: TPH fractions, BTEX compounds, Speciated PAHs Mineral Oil SVOCs VOCs	LAB and MO volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration into houses & other properties to indoor air and then inhalation	Residents & other commercial or retail building users	Y	There are residential properties within 110m of the leak point along Howth Road. A church is located within 65m east and West Wood Gym 60m south. Vapour phase migration will be preferential potentially along utility service runs and through more permeable made ground soils and or sand/gravel fractions of soils if present.
	LAB and MO partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts / ingestion of home grown produce	Residents &other commercial or retail building users	Y	There are residential properties within 110m of the leak point along Howth Road. A church is located within 65m east and West Wood Gym 60m south. The cable source of leak is at a depth of 0.9m and so direct contact and ingestion pathways are unlikely to be viable unless groundwater levels are near ground surface bringing contamination upwards into shallow soils where direct contact is possible.
	LAB and MO partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then permeation through plastic potable water supply pipes and ingestion	Nearby residents	Y	The water supply pipes could potentially run through contaminated zones. LAB and MO have the potential to permeate through the wall of plastic supply pipes and through joins and gaskets. An internet search has not identified proven instances where this has occurred elsewhere. Any permeating compounds would be diluted depending on water flows in the pipe. A WHO drinking water standard for hydrocarbons >C10 is 0.09mg/l which exceeds the LAB theoretical solubility limit of 0.041mg/l. So, unless NAPL is present within the pipe then this WHO drinking water

				standard would not be exceeded.
	LAB and MO volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration to outdoor air and then inhalation	Workers undertaking any subsurface works	Y	Unlikely to be significant as workers exposed in outdoor air where vapours cannot accumulate to high concentrations. Also, risks are localised areas of contamination which can be managed with the correct PPE and H&S procedures.
	LAB and MO partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts	Workers undertaking any subsurface works	Y	Unlikely to be significant as contamination is likely to be localised and can be managed with the correct PPE and H&S procedures.
Environmental – Water Receptors				
Historical leak of cable fluid from underground electricity cable comprising of an approximate volume of 1,056 litres of linear alkyl benzene (LAB) mixed with mineral oil (MO) (Site 11) July 2013 to August 2015. PCOCs include: TPH fractions, BTEX compounds, Speciated PAHs Mineral Oil SVOCs VOCs	LAB and MO partitioning to soil (sorbed phase) and as NAPL in soil pore spaces, that then can leach downwards to groundwater in shallow made ground and boulder clay subsoils	Shallow groundwater	Y	LAB and MO present in soils as sorbed and NAPL phases can leach downwards with infiltrating rainwater and soil water movements to groundwater. In groundwater will form LNAPL due to low solubility. There may also be limited dissolved concentrations.
	LAB and MO direct downward migration as NAPL until reaches shallow groundwater where forms LNAPL and with a limited dissolved plume based on low solubilities, then lateral migrations towards surface waters	River Tolka	N	The Tolka River approximately 800m to the south and low permeability boulder clay dominates the geological substrate between the leak site and the river. Given the presence of low permeability boulder clay underlying the leak site and its capacity to limit the lateral migration of groundwater; the evidence that groundwater is perched at the base of made ground as observed during site investigations; and the distance between the leak site and the River Tolka there is no potential for a hydrogeological pathway to connect the project area to the River Tolka to the south.

	LAB and MO migration downwards through glacial till to Limestone bedrock aquifer and then lateral migration	Limestone bedrock aquifer / Groundwater Users	N	There are no known recorded domestic groundwater abstraction wells located within a 1km radius of the suspected leak. The surrounding properties are serviced by mains water. Additionally, downward contaminant migration into the limestone will be prohibited by depths of boulder clay up to 6.5mBGL.

4.3. POLLUTANT LINKAGE ASSESSMENT

As outlined in Tables 4.1 above a number of possible pollutant linkages were identified, which have been further risk assessed with reference to BS10175:2011 and CIRIA Document C552: Contaminated Land Risk assessment 'A Guide to Good Practice'. The risk assessment has been carried out by assessing the severity of the potential consequences, taking into account both the potential severity of the hazard and the sensitivity of the target, based on categories given in Table 4.2 below.

Table 4.2 - Potential Hazard Severity Definition

CATEGORY	DEFINITIONS
Severe	Acute risks to human health, catastrophic damage to buildings, major risk to an environmental receptor such as a river
Medium	Chronic risk to human health, pollution of sensitive environmental receptor, significant damage to buildings and structures.
Mild	Pollution of non-sensitive waters, minor damage to buildings or structures
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non-sensitive ecosystems or species

The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given in Table 4.3 below.

Table 4.3 - Probability of Risk Definition

CATEGORY	DEFINITIONS
High likelihood	Pollutant linkages may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur are improbable

The potential severity of the risk and probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard, as presented in Table 4.4 below.

Table 4.4 - Level of Risk for Potential Hazard Definition

PROBABILITY OF RISK	POTENTIAL SEVERITY			
	Severe	Medium	Mild	Minor
High likelihood	Very high	High	Moderate	Low/Moderate
Likely	High	Moderate	Low/Moderate	Low
Low likelihood	Moderate	Low/Moderate	Low	Very low
Unlikely	Low/Moderate	Low	Very Low	Very low

The assessment is discussed below in terms of plausible pollutant linkages.

The pollutant linkages of Linear Alkyl Benzene and Mineral Oil in the shallow soils/groundwater and nearby receptors are summarised in Tables 4.5 below.

Table 4.5 - Pollutant Linkage Assessment for Linear Alkyl Benzene and Mineral Oil

Source	Pathway	Receptor	Severity	Likelihood	Risk Level	Comments
Human Health						
Historical leak of cable fluid from underground electricity cable comprising of an approximate volume of 1,056 litres of linear alkyl benzene (LAB) mixed with mineral oil (MO) (Site 11) July 2013 to August 2015. PCOCs include: TPH fractions, BTEX compounds Speciated PAHs Mineral Oil	LAB and MO volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration into houses & other properties to indoor air and then inhalation	Residents & other commercial or retail building users	Medium	Unlikely	Low	Has the potential to migrate along preferential pathways such as service trenches. Outside of preferential pathways, contamination will strongly sorb to soil, has low mobility, readily biodegrades under aerobic conditions in both soil and water and does not exist readily in the vapour-phase, consequently the risk to nearby residents is low.
	LAB and MO partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts / ingestion of home grown produce	Residents & other commercial or retail building users	Medium	Unlikely	Low	The cable source of leak is at a depth of 0.9m and so direct contact and ingestion pathways are unlikely to be viable unless groundwater levels are near ground surface or capillary action brings contamination upwards into shallow soils where direct contact is possible.

SVOCs VOCs	LAB and MO partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then permeation through plastic potable water supply pipes and ingestion	Nearby residents and other users of the water mains.	Medium	Unlikely	Low	Water supply pipes could potentially be present next to a power cable with the leaked cable fluid that has the potential to permeate plastic water supply pipes. With the exception of NAPL presence, the risk is unlikely to cause actual harm to health because any permeating contaminants would be diluted by water flows in the water supply pipe and the dissolved concentrations will be less than WHO drinking water threshold guidelines due to low solubility limits.
	LAB and MO volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration to outdoor air and then inhalation	Workers undertaking any subsurface works	Medium	Unlikely	Low	Risk to workers from localised areas of contamination and vapours is unlikely due to low volatility and exposure in outdoor air, if it does occur it will be short term and can be managed with the correct PPE and H&S procedures.
	LAB and MO partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts	Workers undertaking any subsurface works	Medium	Unlikely	Low	Risk to workers from localised areas of contamination will be short term and can be managed with the correct PPE and H&S procedures.

Environmental – Water Receptors						
Historical leak of cable fluid from underground electricity cable comprising of an approximate volume of 1,056 litres of linear alkyl benzene (LAB) mixed with mineral oil (MO) (Site 11) July 2013 to August 2015.	LAB and MO partitioning to soil (sorbed phase) and as NAPL in soil pore spaces, that then can leach downwards to groundwater in shallow made ground and glacial till soils	Shallow groundwater	Mild	Low Likelihood	Low	Low risk due to alkyl benzene contamination strongly absorbs to soil, has low mobility, readily biodegrades under aerobic conditions in both soil and water. Mineral oil is less biodegradable therefore has a greater tendency to accumulate and may present a greater risk. Shallow groundwater in made ground and boulder clay subsoils is unlikely to be used as an actual resource due low water volumes and location in a residential urban area. Overall risk is low.
PCOCs include: TPH fractions, BTEX compounds, Speciated PAHs Mineral Oil SVOCs, VOCs,	LAB and MO partitioning to soil (sorbed phase) and as NAPL in soil pore spaces, that then can leach downwards to groundwater in shallow made ground and glacial till soils	South Dublin Bay and River Tolka Estuary SPA South Dublin Bay SAC/pNHA	Mild	Low Likelihood	Low	Has the potential to migrate in shallow groundwater in made ground. The contamination will strongly sorb to soil, has low mobility, readily biodegrades in both soil and water. Given the distance of 460m to Dublin Bay and River Tolka Estuary SPA & South Dublin Bay SAC/pNHA and not a significant reported oil loss (1,056l) the risk is low.

4.4. SUMMARY OF PQRA

A desktop study and site walkover were conducted at the Clontarf-East Wall Road Site in Clontarf after there was a suspected volume of 1,056 litres of linear alkyl benzene mixed with mineral oil lost from the cable at an approximate rate of 42L/month for 25 months. The leak began in July 2013 and were repaired in August 2015. Results of the PQRA are summarised below:

4.4.1 Human Health:

- There is a potential Low risk posed by LAB and MO vapours in suspected contamination in the soil and groundwater through preferential pathways such as services ducts to residents or other building users;
- There is a potential Low risk posed by LAB and MO from contact with suspected contamination in the soil and groundwater through direct dermal/inhalation and ingestion contact to residents or other building users;
- There is a potential Low risk posed by LAB and MO contact from ingestion contact with suspected contamination in the soil and groundwater through permeation of contamination through plastic water pipes;
- There is a potential Low risk to construction workers from dermal/inhalation and ingestion pathways which can be managed by appropriate use of PPE and H&S procedures.

4.4.2 Environmental:

- There is a potential Low risk posed by LAB and MO to shallow groundwater from suspected contamination in the shallow made ground and boulder clay subsoils given the contaminant properties of low mobility and high sorption to soil, with shallow groundwater unlikely to be a viable groundwater resource in the residential urban setting.
- Any potential contamination arising from the leakages will be restricted to shallow groundwater underlying the leak site. As noted in the above bullet point the risk to this shallow groundwater body will be low. Due to the presence of the shallow groundwater body, which, based on the results of site investigations, is considered to be perched at the base of made ground and due to the presence of boulder clay underlying the project area and its capacity to limit the lateral migration of groundwater no pathway is considered to occur between the project area and the River Tolka to the southwest and Dublin Bay to the east.

4.5. SUMMARY AND CONCLUSIONS

This preliminary environmental site assessment consists of a review of the potential environmental impacts associated with a hydrocarbon leak from a power cable at the Junction of Howth Road and Clontarf Road, Dublin 3. (ESB Ref: 11).

There was an approximate volume of 1,056 litres of cable fluid consisting of linear alkyl benzene mixed with mineral oil lost to ground at the road junction at an approximate rate of 42L/month for 25 months. The leak began in July 2013 and were repaired in August 2015.

The known leak point is located within the centre of the road junction of Howth Road and Clontarf Road next to Fariview Park, which is an area with residential mainly along Howth Road and commercial and open parkland along Clontarf Road. There is evidence of abundant site services in the roadway, the grass verge and concrete footpaths with manhole covers. There is no physical evidence of hydrocarbon contamination on the surface in terms of oil odours/staining or impact to vegetation along the cable route, 200m either side of the leak point.

The site is underlain by the locally important dark calp limestones of the Lucan Formation. The vulnerability is Moderate indicating low permeability boulder clay subsoils, which provide a good level of natural protection to the underlying bedrock aquifer.

The nearest surface watercourse is the Tolka River, located approximately 800m to the south. There are no groundwater wells within 1km of the site. South Dublin Bay and River Tolka Estuary SPA and pNHA are located 450m to the east, south-east of the leak point. Groundwater in the bedrock aquifer is likely to be semi-confined by the thick subsoils with groundwater flow direction in a south to south-easterly flow direction following site topography.

There are no hydrogeological pathways connecting the project area to the River Tolka or to protected areas occurring at and in the vicinity of the River Tolka Estuary at Dublin Bay.

Based on the known cable leak point, COPC fate and transport and hydrogeological desk study information the CSM has the following initial key findings for human health and environmental risks:

There is no risk posed by LAB and MO to:

- surface waters in the wider surrounding area. The River Tolka is the nearest watercourse to the leak site and there is no hydrogeological pathway connecting the leak site to this watercourse. Hence there is no link to the SPA;

There is a potential Low risk posed by LAB and MO from contact with suspected contamination in the soil and groundwater through;

- direct dermal/inhalation and ingestion contact to residents or other building users;
- dermal/inhalation and ingestion pathways to construction workers which can be managed by appropriate use of PPE and H&S procedures;
- leaching to shallow groundwater given the contaminant properties of low mobility and high sorption to soil, with shallow groundwater unlikely to be a viable groundwater resource in the residential urban setting.
- migration of shallow contaminated groundwater to Dublin Bay SPA & pNHA given the contaminant properties of low mobility and high sorption with a distance of 460m from the leak point and not a significant oil loss volume.
- hydrocarbon vapours in preferential pathways such as service ducts to residents or other building users.

In order to further develop the conceptual site model and investigate the identified potential risks to sensitive receptors further investigation has been recommended in the form of site investigation.

5. REFERENCES

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oo0oo

Respectfully submitted

On behalf of Verde Environmental Consultants

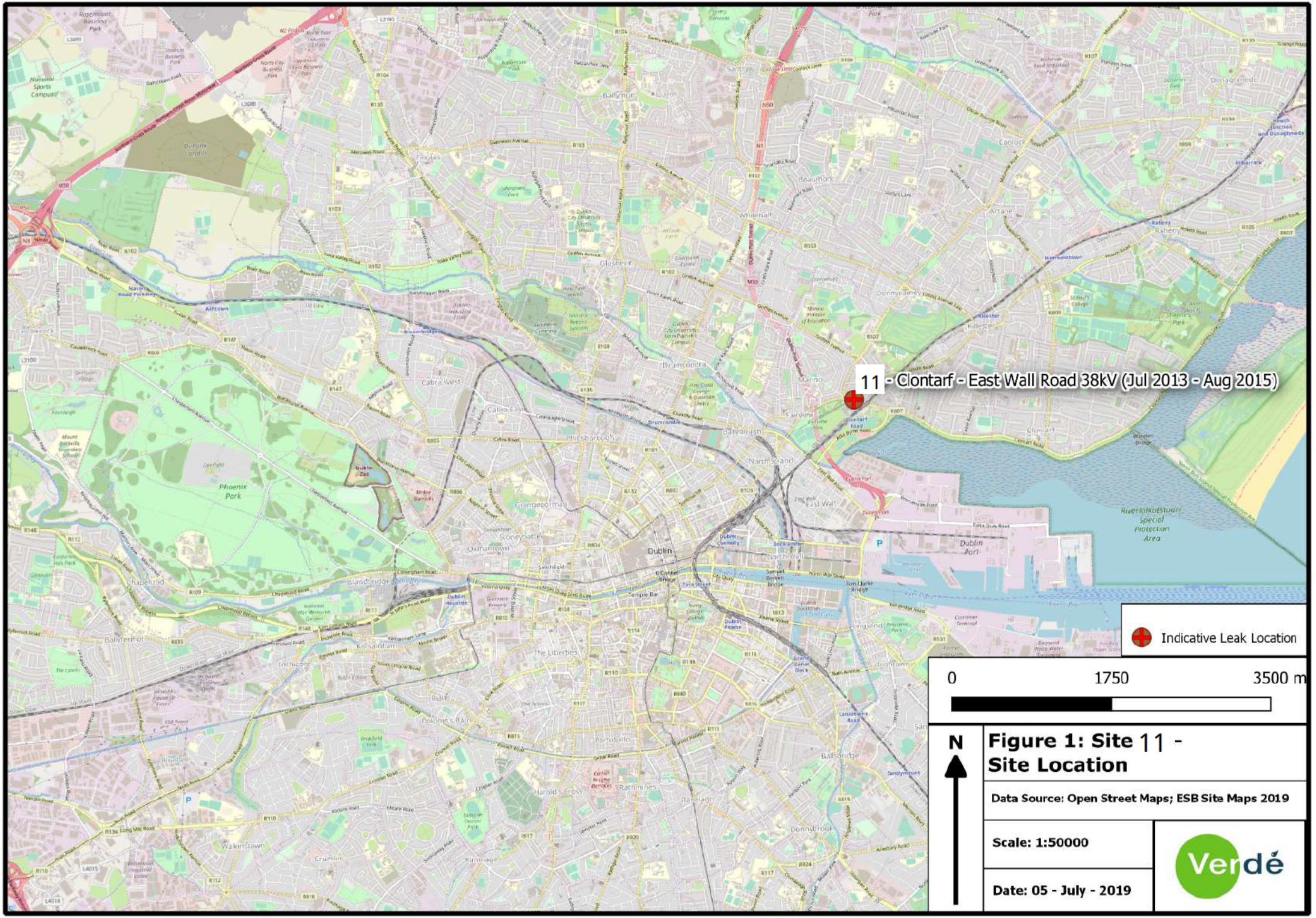
[redacted]

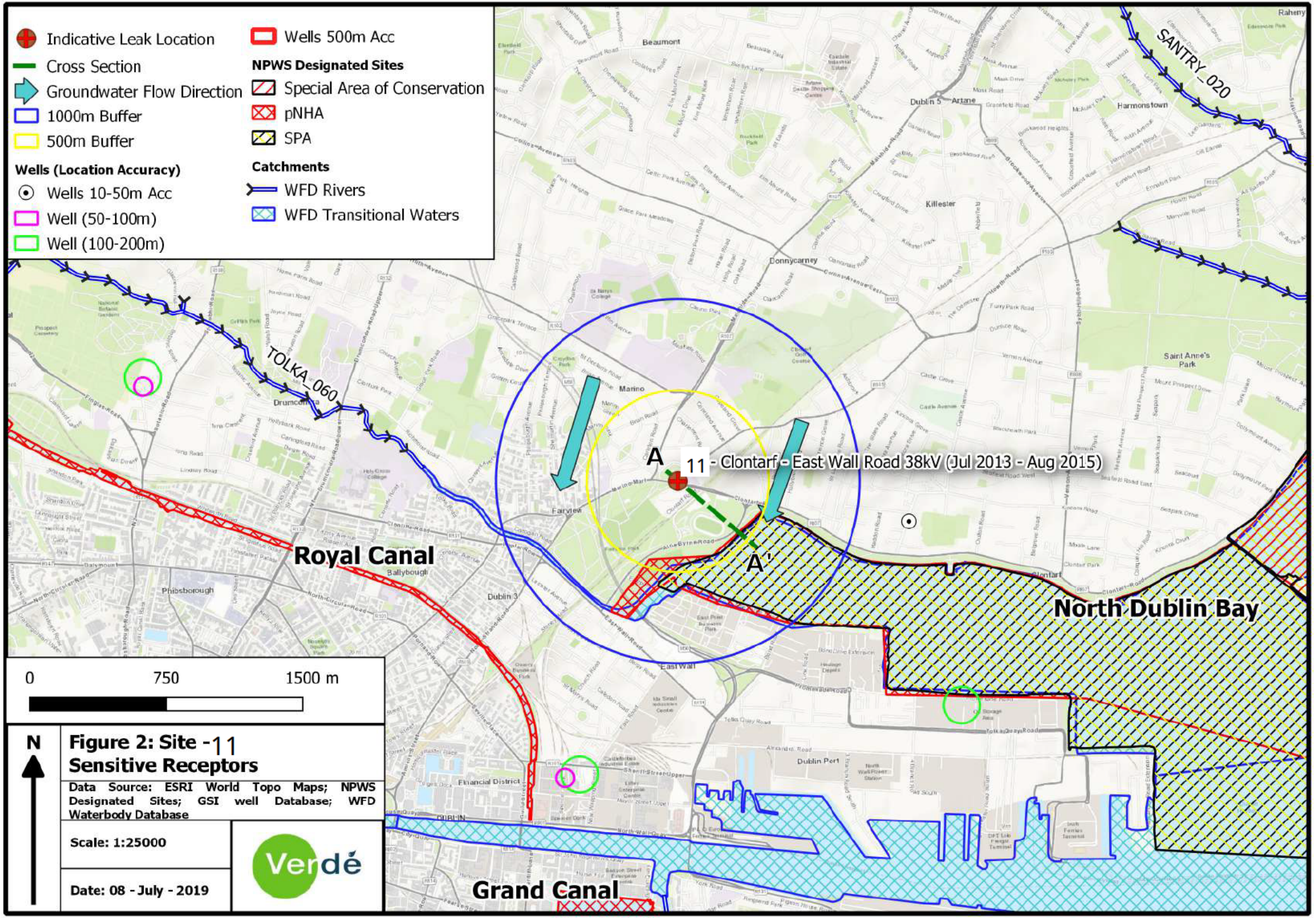
SENIOR HYDROGEOLOGIST

[redacted]

PROJECT DIRECTOR

FIGURES


11 - Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
Indicative Leak Location
0
1750
3500 m
N
Figure 1: Site 11 - Site Location
Data Source: Open Street Maps; ESB Site Maps 2019
Scale: 1:50000
Date: 05 - July - 2019
Verdé


Indicative Leak Location
Cross Section
Groundwater Flow Direction
1000m Buffer
500m Buffer
Wells (Location Accuracy)
Wells 10-50m Acc
Well (50-100m)
Well (100-200m)
Wells 500m Acc
NPWS Designated Sites
Special Area of Conservation
pNHA
SPA
Catchments
WFD Rivers
WFD Transitional Waters
A
11 - Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
A'
TOLKA_060
SANTRY_020
Royal Canal
Grand Canal
North Dublin Bay
Beaumont
Dublin 5
Artane
Harmonstown
Killester
Donnycarney
Marino
Fairview
Clontarf
Saint Anne's Park
Ballybough
Phibsborough
Dublin 3
East Wall
Financial District
Dublin Port
Raheny
0
750
1500 m
N
Figure 2: Site -11
Sensitive Receptors
Data Source: ESRI World Topo Maps; NPWS Designated Sites; GSI well Database; WFD Waterbody Database
Scale: 1:25000
Date: 08 - July - 2019
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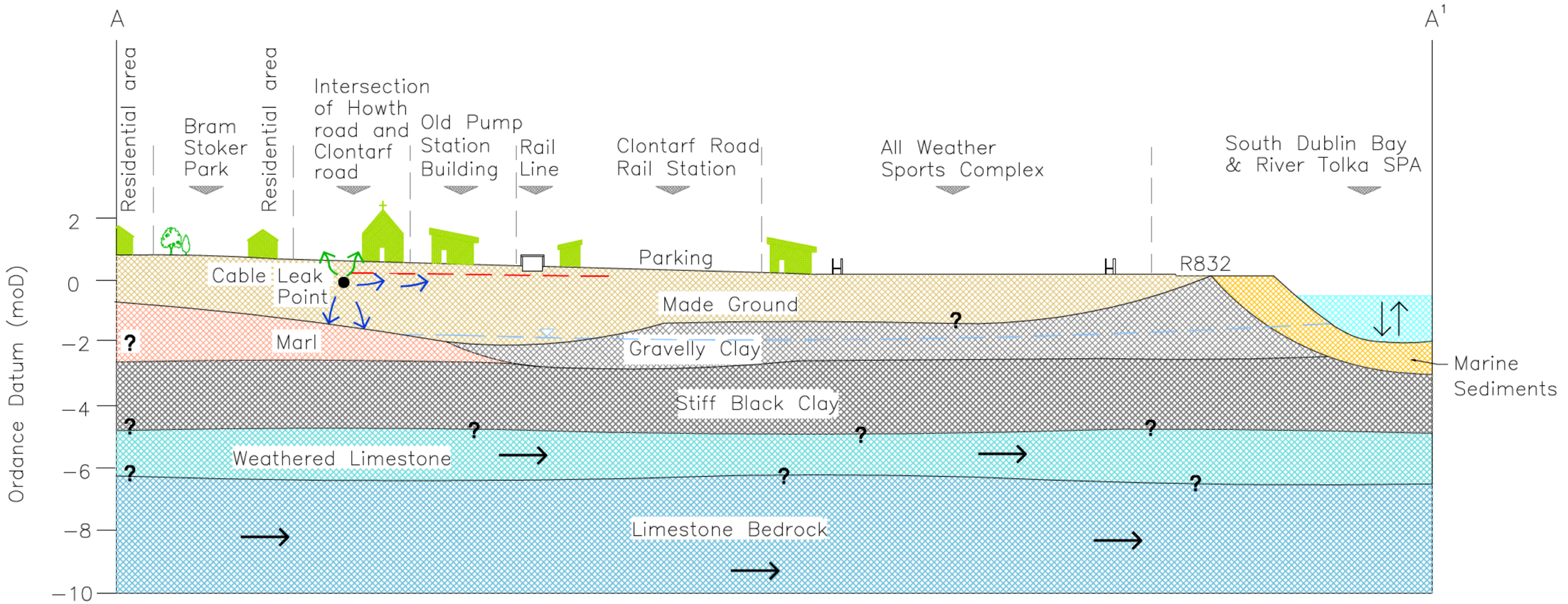

Ledend:

- Inferred Groundwater Flow In Limestone bedrock aquifer
- Perched water in Made Ground
- Tidal Influence
- ESB Cable & other Service Utilities
- Possible Hydrocarbon vapour migration
- Possible Hydrocarbon migration along service ducts
- ? Depth Uncertainties

Horizontal Scale

0m 100m 200m 300m

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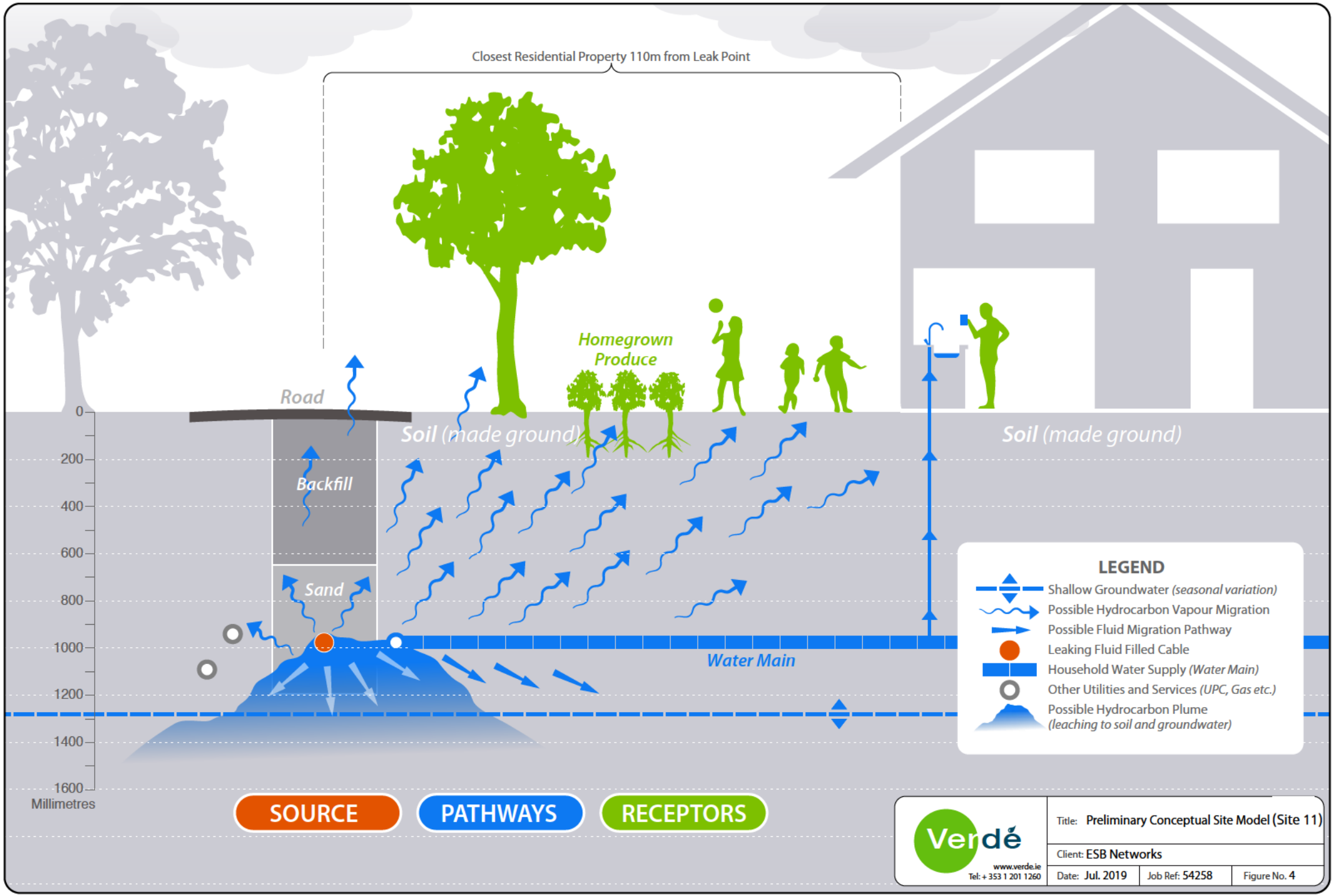
Title: PRELIMINARY CONCEPTUAL SITE MODEL
Client: ESB NETWORKS
Date: JULY 2019 Job Ref: 52458 Figure: 3



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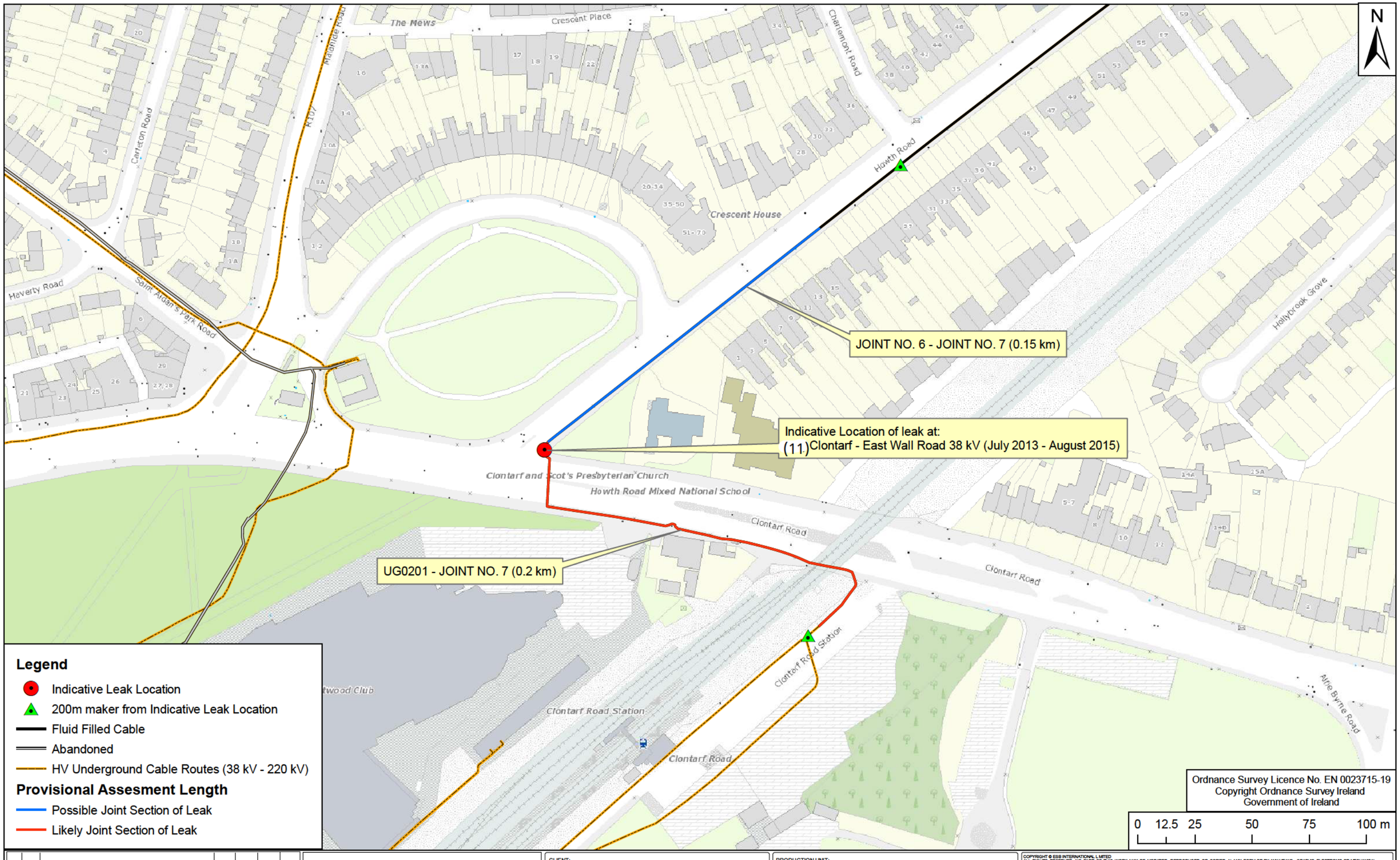
Title: Preliminary Conceptual Site Model (Site 11)
Client: ESB Networks
Date: Jul. 2019 | Job Ref: 54258 | Figure No. 4

APPENDIX A

ESB SITE LAYOUT PLAN WITH INDICATIVE CABLE FLUID LEAKAGE LOCATION



REV	DATE	REVISION DESCRIPTION	DRN	PROD	VER	APP
1	26/06/19	ADDITIONAL SPATIAL INFORMATION ADDED	T.O'R	T.O'R	J.F	A.M.C
0	26/06/19	REQUEST FOR PROPOSAL	T.O'R	T.O'R	J.F	A.M.C

CLIENT APPROVAL ☐ PLANNING ☐ TENDER ☐ CONSTRUCTION ☐ AS-BUILT ☐

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CLIENT: ESB Networks

PROJECT: P.R.A.

CONTRACT

PRODUCTION UNIT: Civil & Environmental Engineering

DRAWING TITLE: Indicative Cable Fluid Leakage Locations & Cable Sections (11) Clontarf - East Wall Road 38 kV (July 2013 - August 2015)

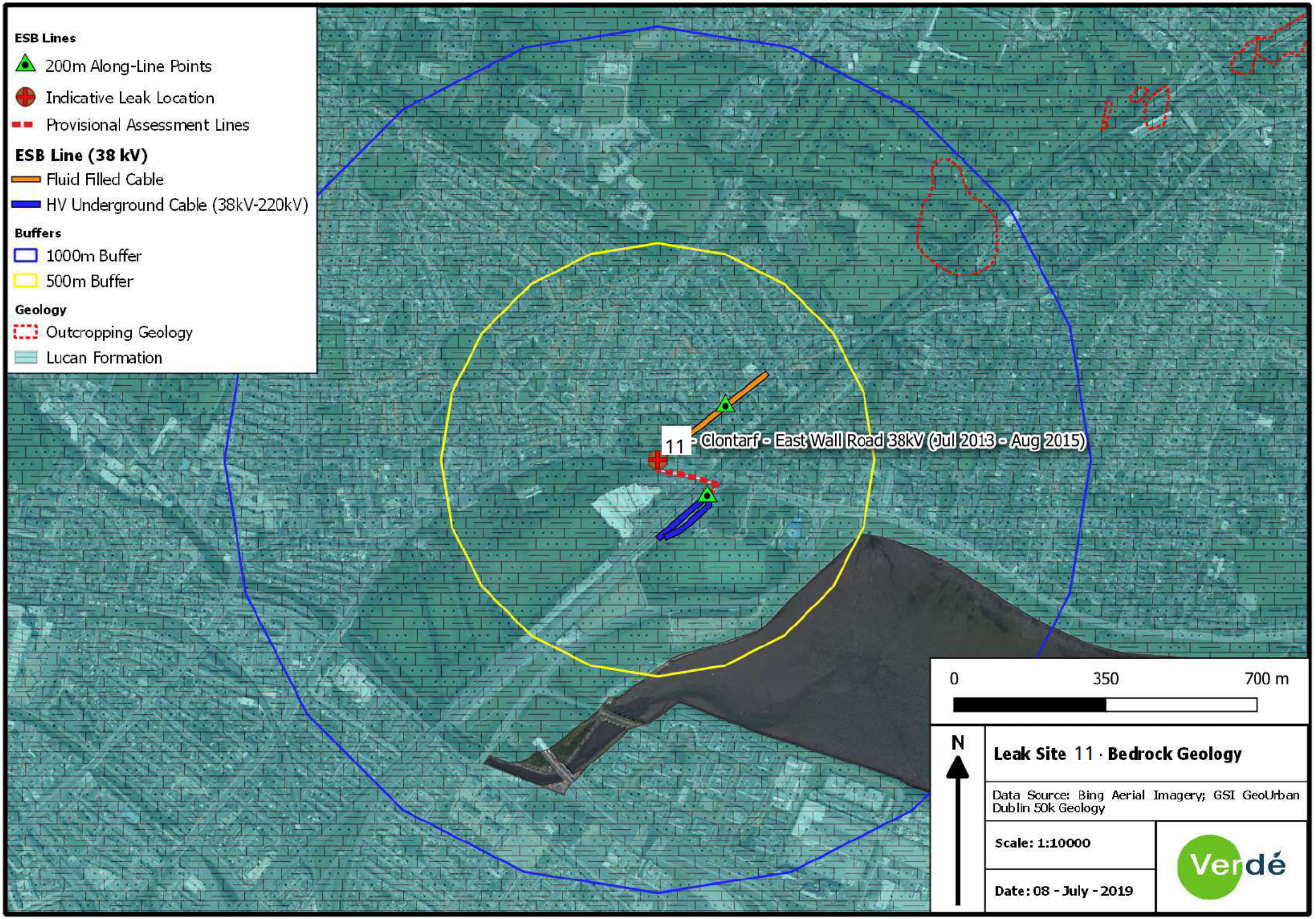
DRAWN	PRODUCED	VERIFIED	APPROVED	APPROVAL DATE
T.O'Rourke	T.O'Rourke	J. Fitzpatrick	A.M. Casey	26/06/2019

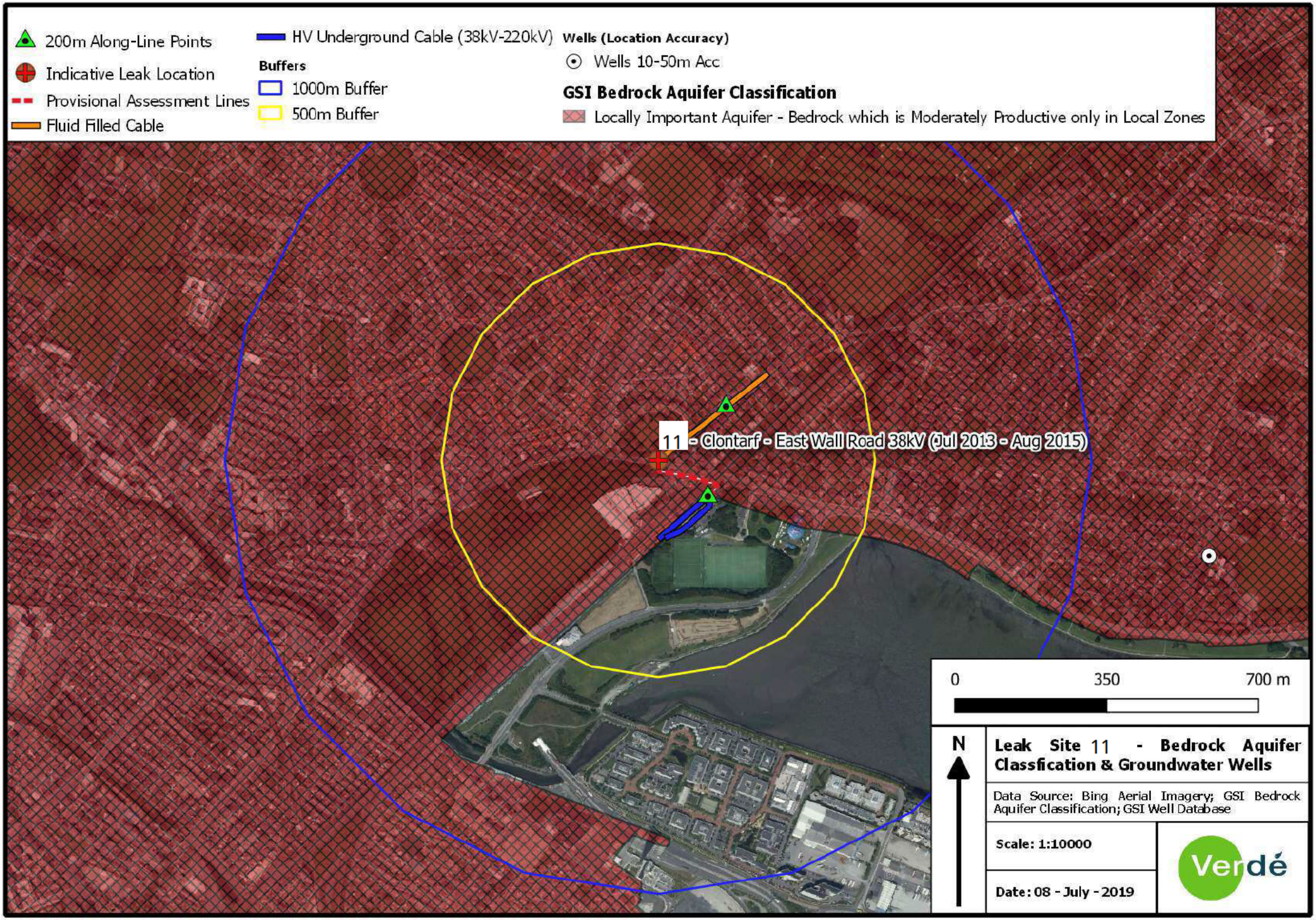
CLIENT REF.	Revision	NO. OF SHEETS	SIZE	SCALE
00-00	1	1 of 1	A3	1:1,500

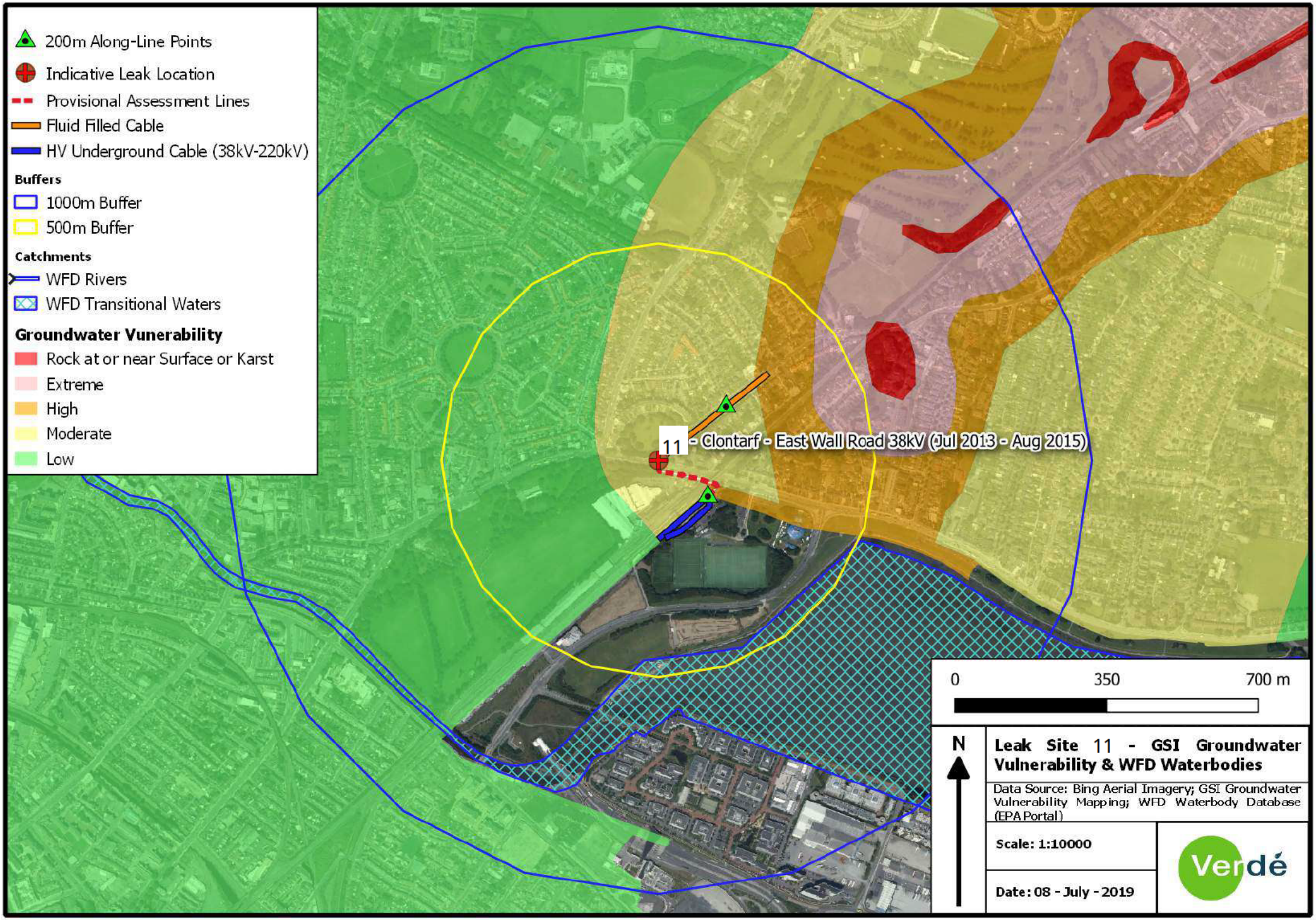
DRAWING NUMBER: QD-354120-01-D460-001-015-001

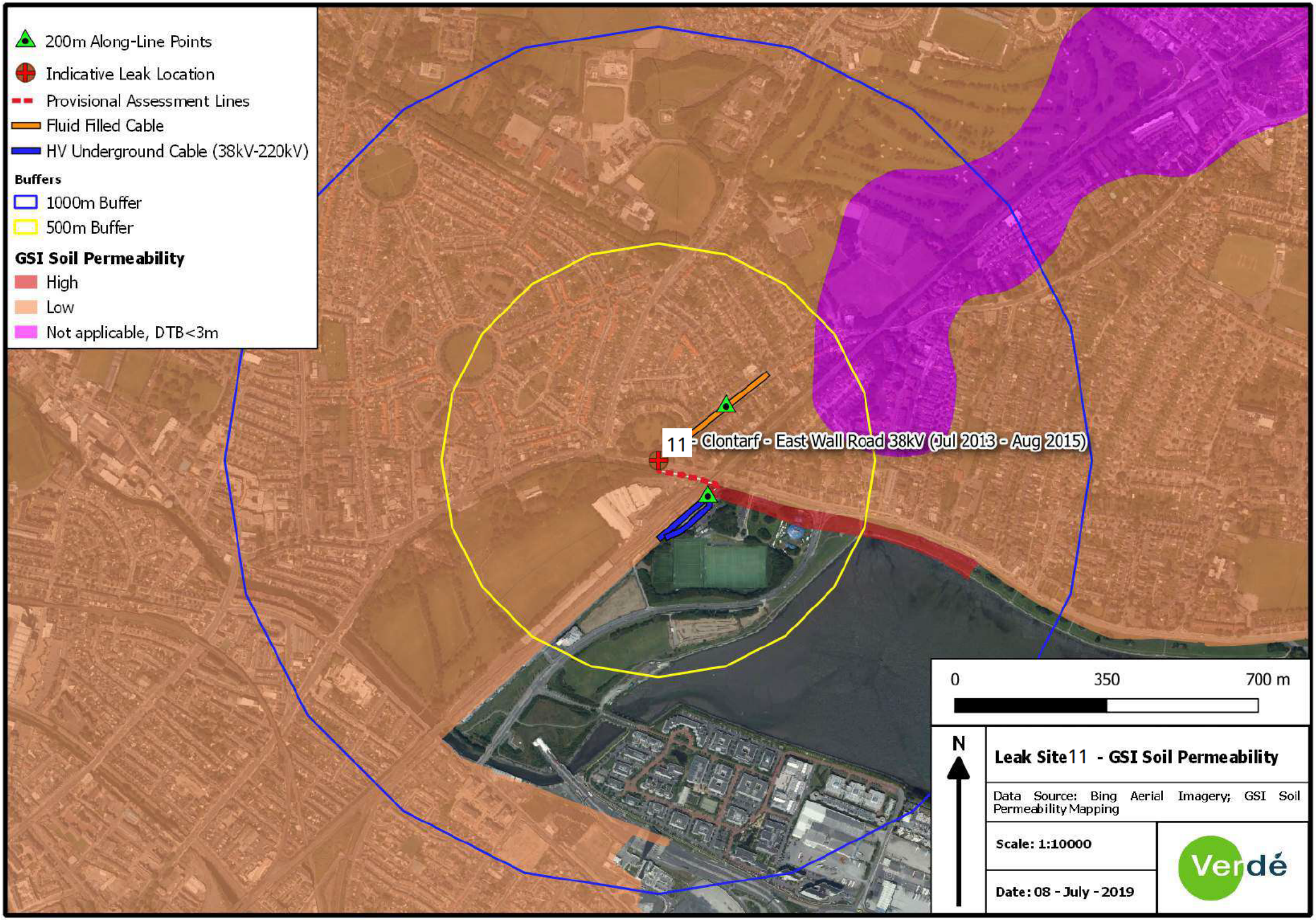
APPENDIX B

DESK STUDY MAPS

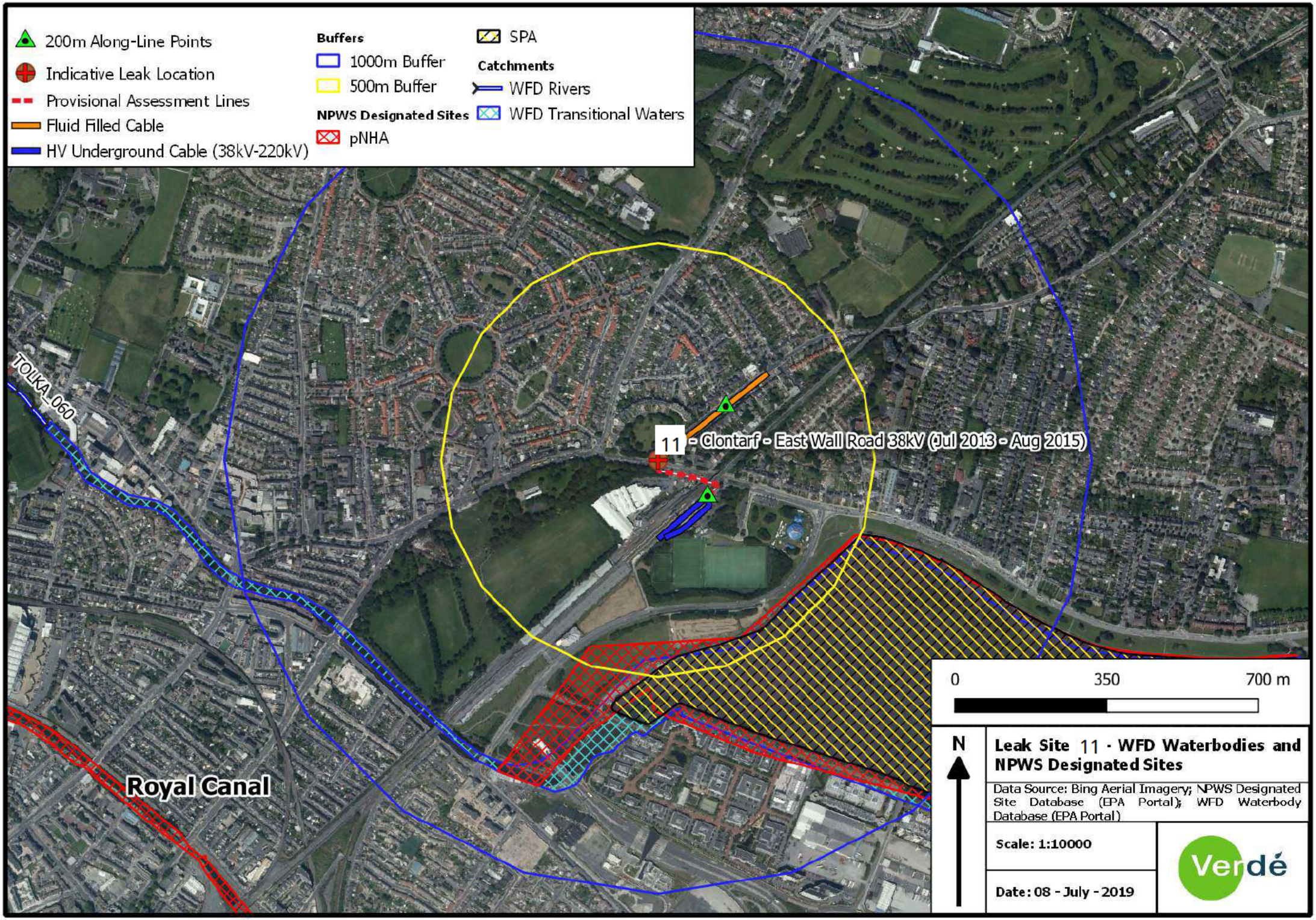

ESB Lines
200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
ESB Line (38 kV)
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
Buffers
1000m Buffer
500m Buffer
Geology
Outcropping Geology
Lucan Formation
11
- Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
0
350
700 m
N
Leak Site 11 · Bedrock Geology
Data Source: Bing Aerial Imagery; GSI GeoUrban Dublin 50k Geology
Scale: 1:10000
Date: 08 - July - 2019
Verdé

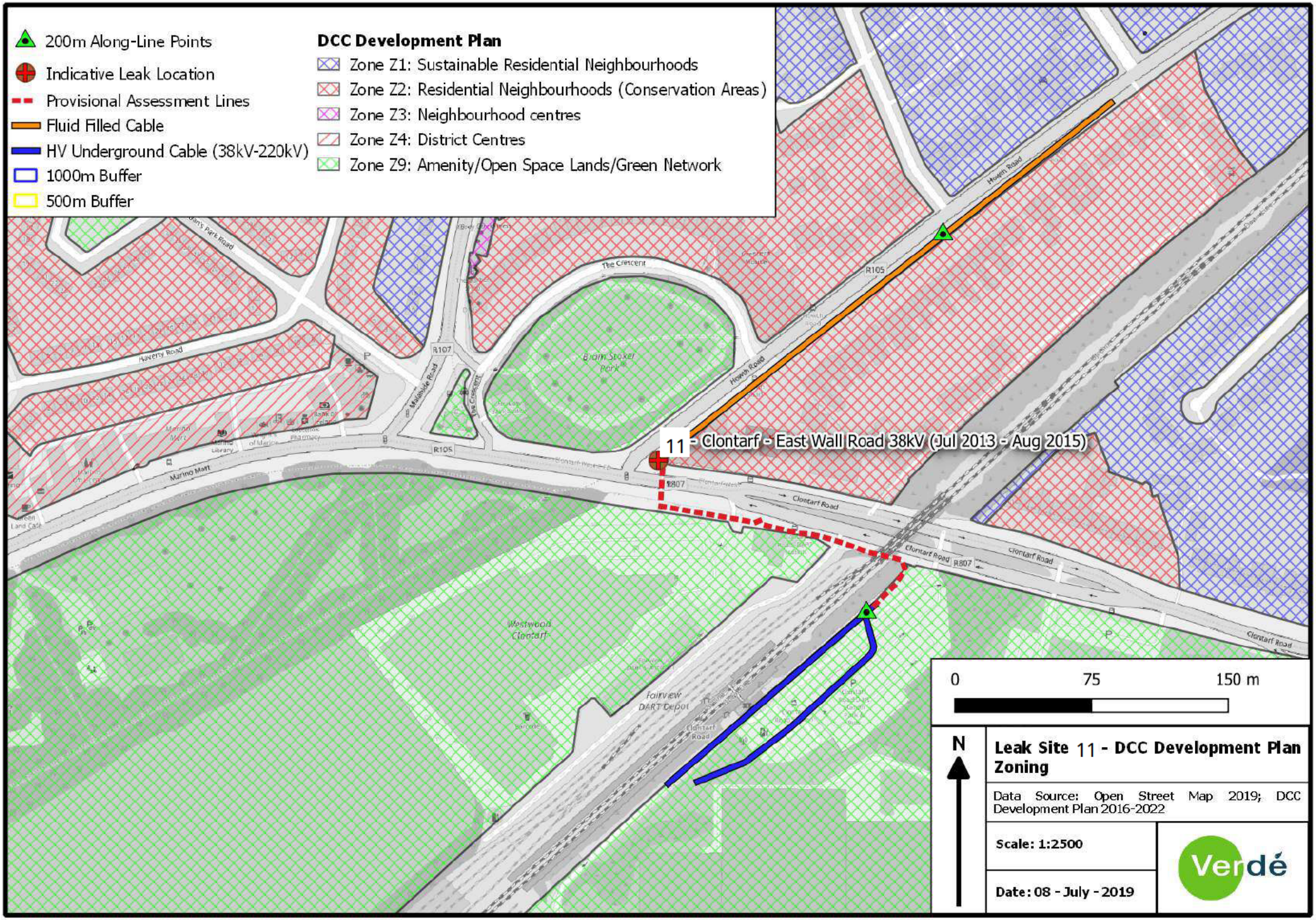

200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
Buffers
1000m Buffer
500m Buffer
Wells (Location Accuracy)
Wells 10-50m Acc
GSI Bedrock Aquifer Classification
Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
11 - Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
0
350
700 m
N
Leak Site 11 - Bedrock Aquifer Classfication & Groundwater Wells
Data Source: Bing Aerial Imagery; GSI Bedrock Aquifer Classification; GSI Well Database
Scale: 1:10000
Date: 08 - July - 2019
Verdé

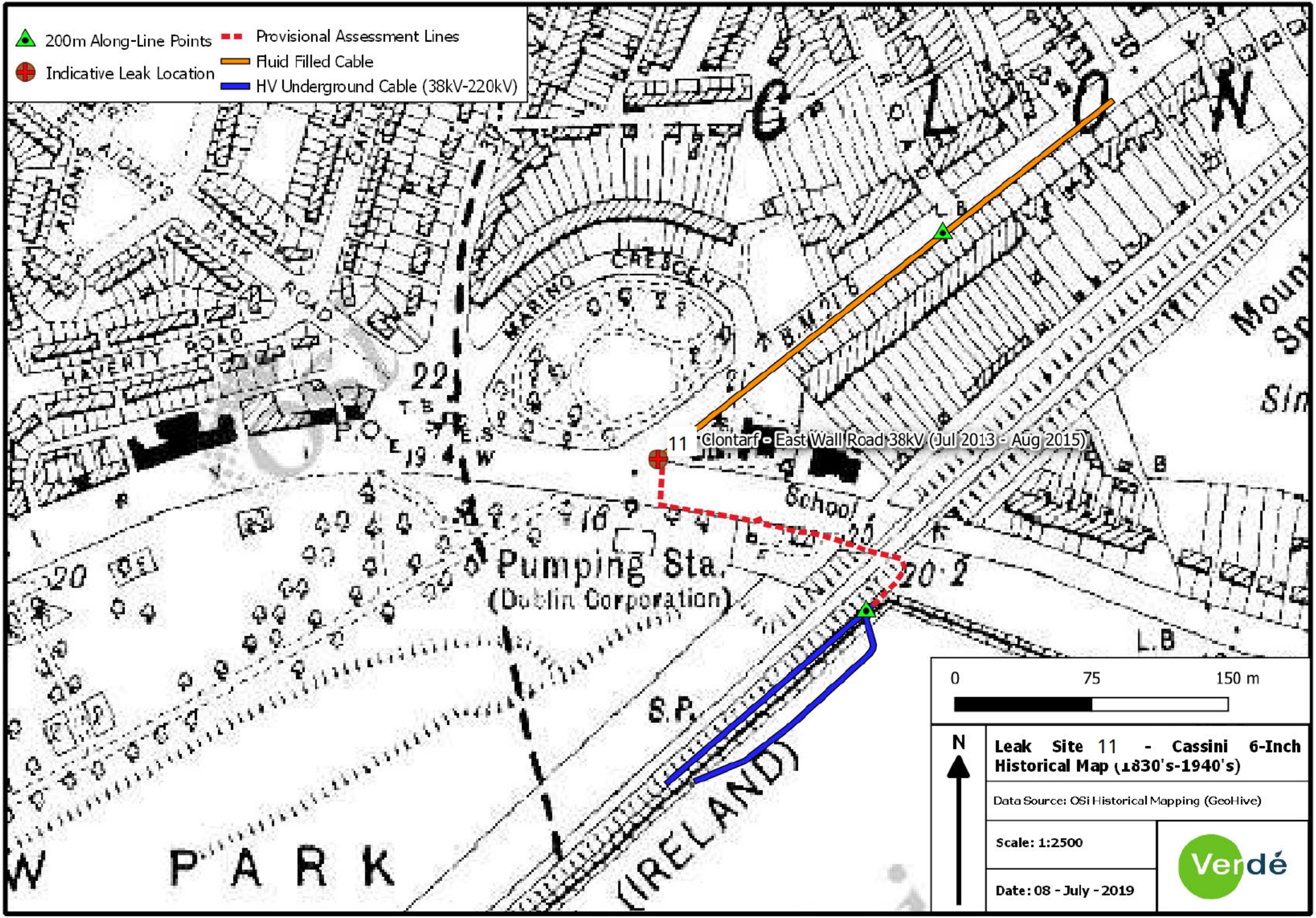

200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
Buffers
1000m Buffer
500m Buffer
Catchments
WFD Rivers
WFD Transitional Waters
Groundwater Vunerability
Rock at or near Surface or Karst
Extreme
High
Moderate
Low
11 - Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
0
350
700 m
N
Leak Site 11 - GSI Groundwater Vulnerability & WFD Waterbodies
Data Source: Bing Aerial Imagery; GSI Groundwater Vulnerability Mapping; WFD Waterbody Database (EPA Portal)
Scale: 1:10000
Date: 08 - July - 2019
Verdé

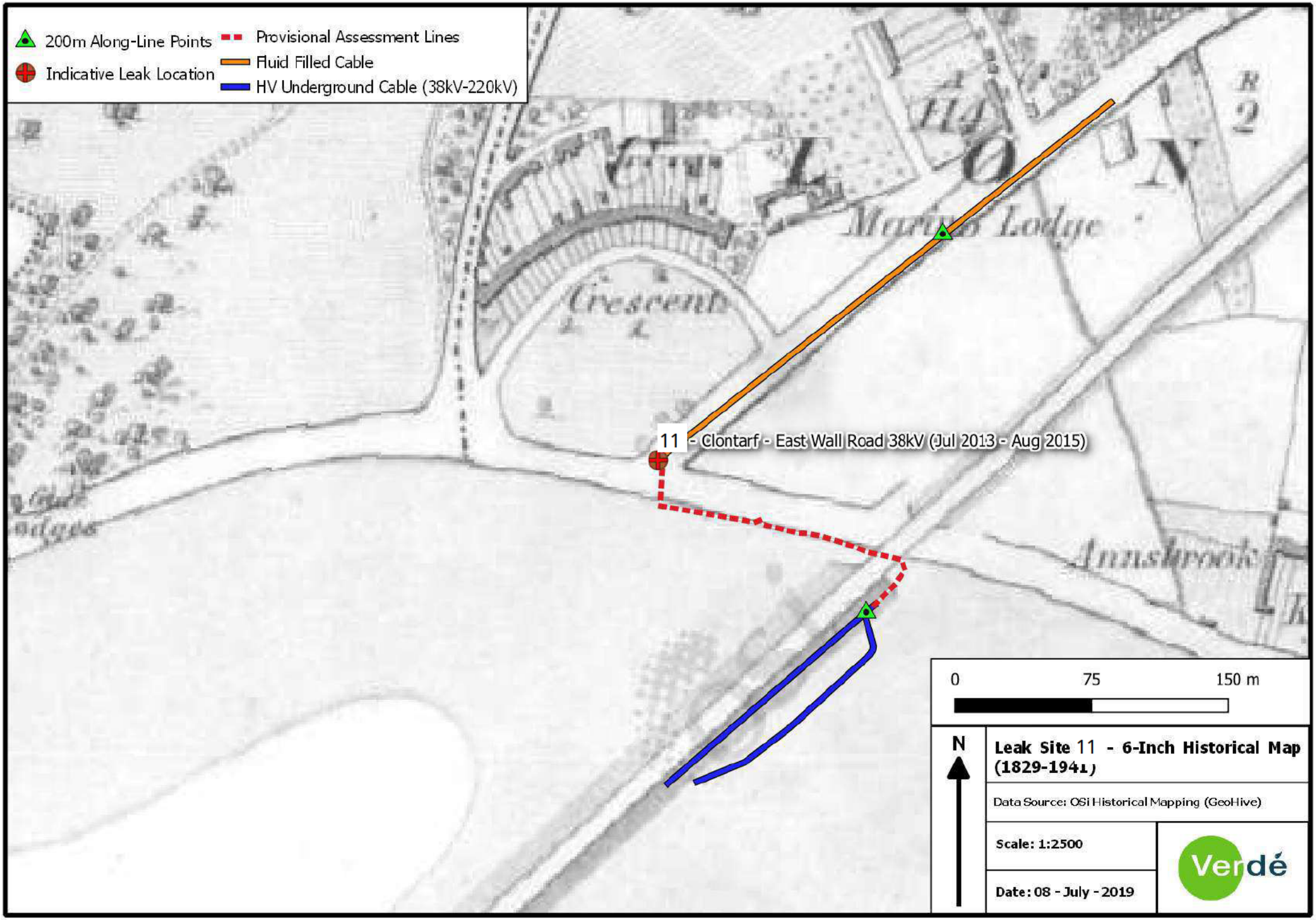

200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
Buffers
1000m Buffer
500m Buffer
GSI Soil Permeability
High
Low
Not applicable, DTB<3m
11 - Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
0
350
700 m
N
Leak Site11 - GSI Soil Permeability
Data Source: Bing Aerial Imagery; GSI Soil Permeability Mapping
Scale: 1:10000
Date: 08 - July - 2019
Verdé

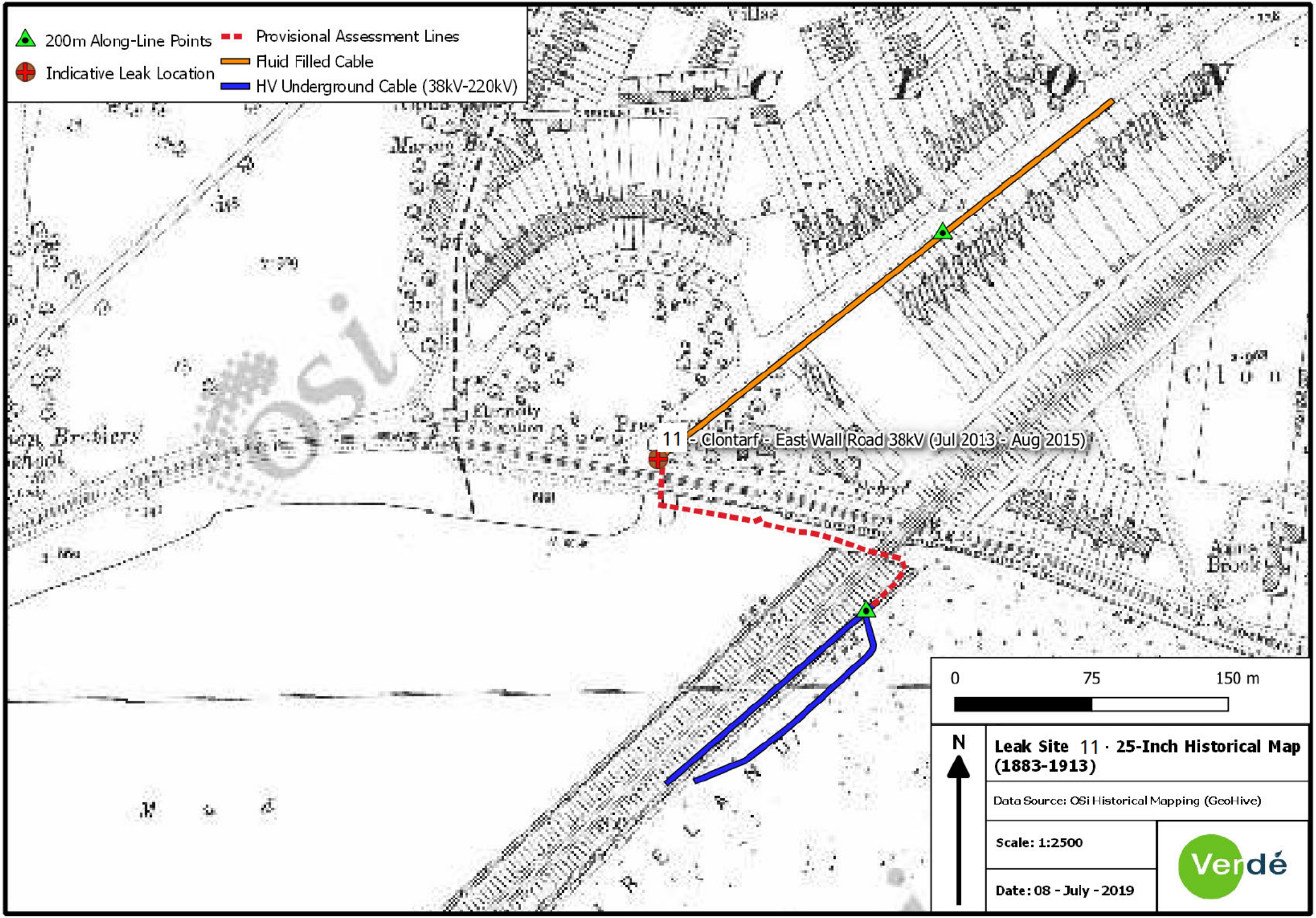

200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
National Soils (Teagasc)
Mineral alluvium
Deep well drained mineral soil derived from mainly basic parent materials
Poorly drained mineral soils derived from mainly basic parent materials
Shallow well drained mineral soil derived from mainly basic parent materials
Made Ground
Marine Sands
Marine Sediments
11
- Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
0
350
700 m
N
Leak Site 11 · Soil Map
Data Source: Bing Aerial Imagery; National Soil Database (Teagasc)
Scale: 1:10000
Date: 08 - July - 2019
Verdé

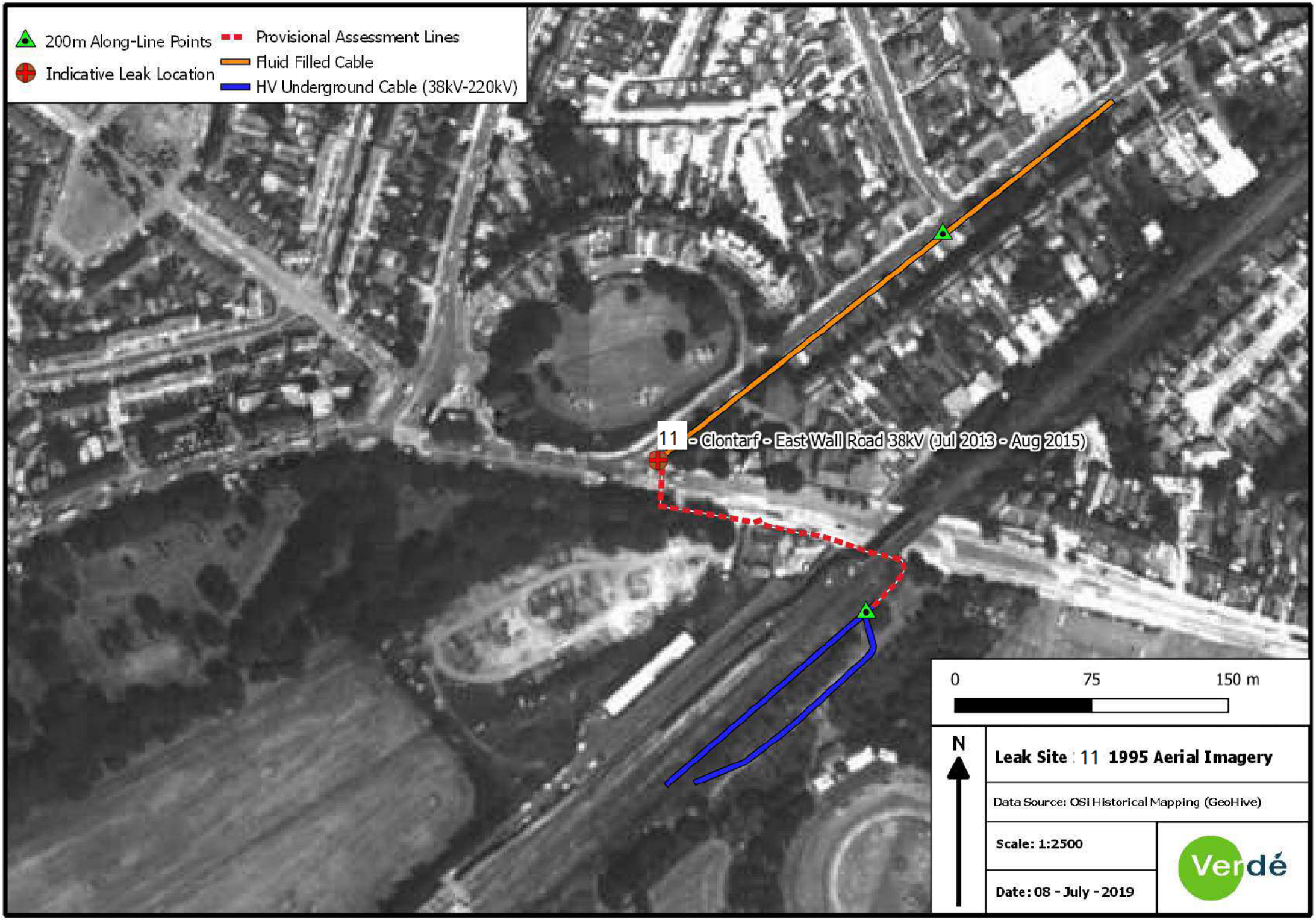

200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
Buffers
1000m Buffer
500m Buffer
NPWS Designated Sites
pNHA
SPA
Catchments
WFD Rivers
WFD Transitional Waters
TOLKA_060
11 - Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
Royal Canal
0
350
700 m
N
Leak Site 11 - WFD Waterbodies and NPWS Designated Sites
Data Source: Bing Aerial Imagery; NPWS Designated Site Database (EPA Portal); WFD Waterbody Database (EPA Portal)
Scale: 1:10000
Date: 08 - July - 2019
Verdé

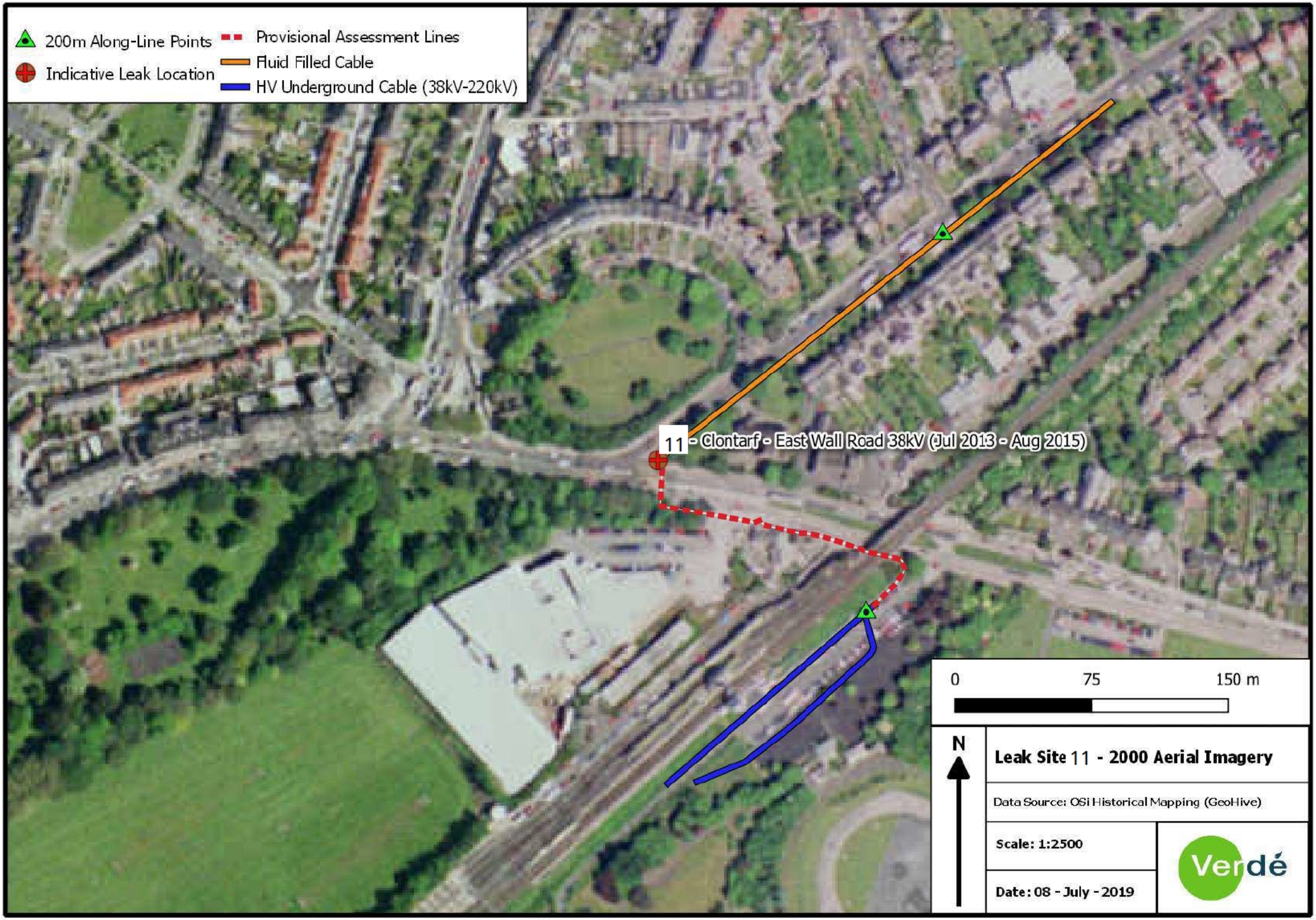

200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
1000m Buffer
500m Buffer
DCC Development Plan
Zone Z1: Sustainable Residential Neighbourhoods
Zone Z2: Residential Neighbourhoods (Conservation Areas)
Zone Z3: Neighbourhood centres
Zone Z4: District Centres
Zone Z9: Amenity/Open Space Lands/Green Network
11 - Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
Howth Road
R105
Clontarf Road
R807
Malahide Road
R107
The Crescent
Bram Stoker Park
Havery Road
Marino Mart
Westwood Clontarf
Fairview DART Depot
0
75
150 m
N
Leak Site 11 - DCC Development Plan Zoning
Data Source: Open Street Map 2019; DCC Development Plan 2016-2022
Scale: 1:2500
Date: 08 - July - 2019
Verdé

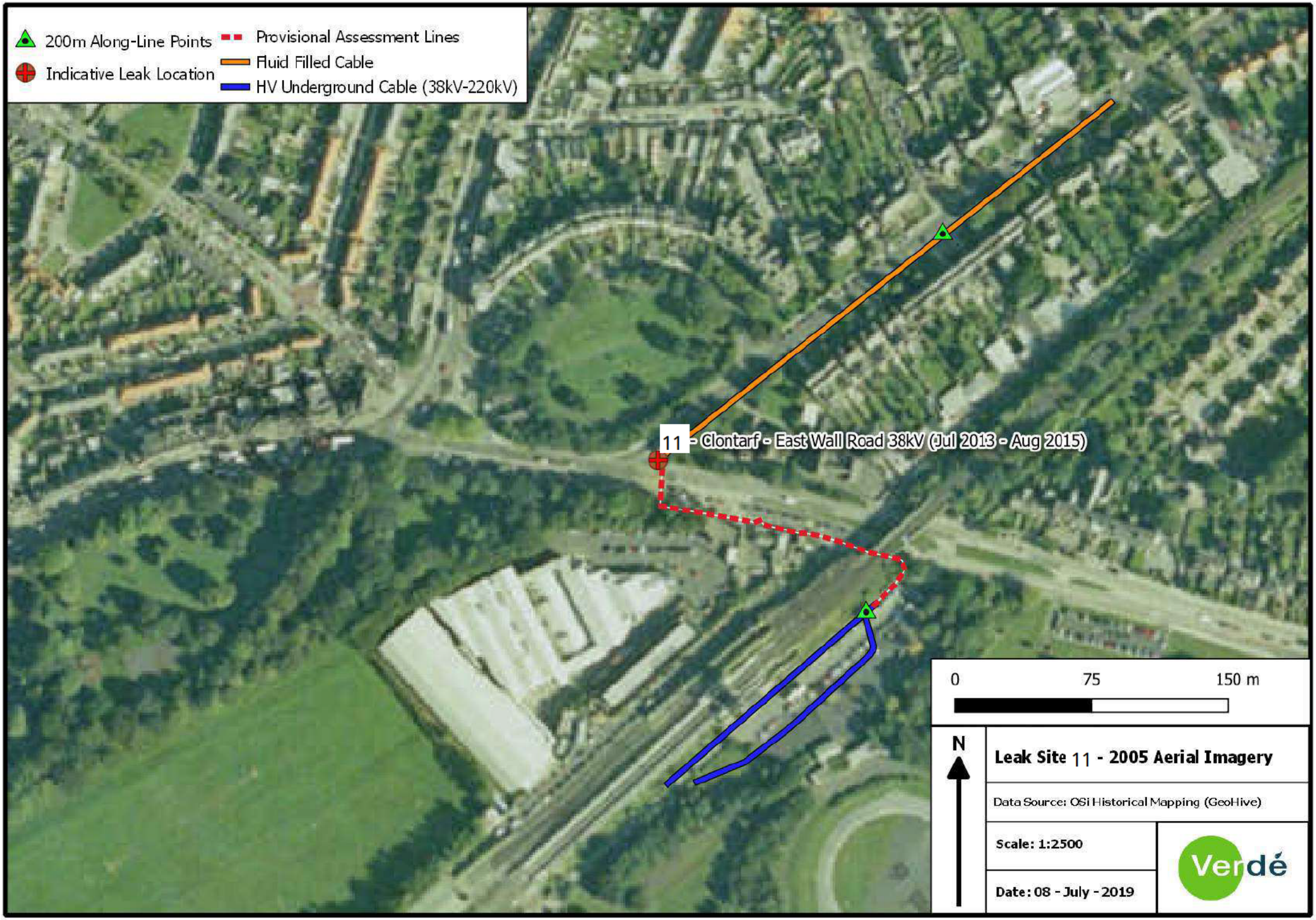

200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
11
Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
Pumping Sta.
(Dublin Corporation)
School
HAVERTY ROAD
MARINO CRESCENT
P A R K
(IRELAND)
0
75
150 m
N
Leak Site 11 - Cassini 6-Inch Historical Map (1830's-1940's)
Data Source: OSi Historical Mapping (GeoHive)
Scale: 1:2500
Date: 08 - July - 2019
Verdé


200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
11 - Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
Marino Lodge
Crescent
Annsbrook
0
75
150 m
N
Leak Site 11 - 6-Inch Historical Map (1829-1941)
Data Source: OSi Historical Mapping (GeoHive)
Scale: 1:2500
Date: 08 - July - 2019
Verdé


200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
11 - Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
0
75
150 m
N
Leak Site 11 · 25-Inch Historical Map (1883-1913)
Data Source: OSi Historical Mapping (GeoHive)
Scale: 1:2500
Date: 08 - July - 2019
Verdé


200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
11 - Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
0
75
150 m
N
Leak Site : 11 1995 Aerial Imagery
Data Source: OSi Historical Mapping (GeoHive)
Scale: 1:2500
Date: 08 - July - 2019
Verdé


200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
11 - Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
0
75
150 m
N
Leak Site 11 - 2000 Aerial Imagery
Data Source: OSi Historical Mapping (GeoHive)
Scale: 1:2500
Date: 08 - July - 2019
Verdé


200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
11 - Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
0
75
150 m
N
Leak Site 11 - 2005 Aerial Imagery
Data Source: OSi Historical Mapping (GeoHive)
Scale: 1:2500
Date: 08 - July - 2019
Verdé


200m Along-Line Points
Indicative Leak Location
Provisional Assessment Lines
Fluid Filled Cable
HV Underground Cable (38kV-220kV)
11 - Clontarf - East Wall Road 38kV (Jul 2013 - Aug 2015)
0
75
150 m
N
Leak Site 11 - Aerial Premium Imagery (OSi)
Data Source: OSi Historical Mapping (GeoHive)
Scale: 1:2500
Date: 08 - July - 2019
Verdé

APPENDIX C

SITE PHOTOGRAPHS

Photo 1: At 200m north-east of Leak Point - View to north-east along Howth Road.
Applegreen service station in background.

Photo 2: Abundant services on concrete footpath adjacent to cable route on Howth Road.
View to south west along Howth Road

Photo 3: Leak point location in roadway in area of newer tarmac

Photo 4: Grassed areas located immediately to the south of the leak point on Clontarf Road

Photo 5: Yard near Clontarf Pumping Station with Gas Network Utilities

Photo 6: Abundant services on concrete footpath adjacent to Clontarf Road – Approx. 140m east of leak point

APPENDIX D

MSDS FOR COPC

1. LINEAR ALKYL BENZENES

2. MINERAL OIL

MATERIAL SAFETY DATA SHEET

1: IDENTIFICATION OF THE SUBSTANCE / PREPARATION AND OF THE COMPANY / UNDERTAKING

Product Name: T 3788

Application: Hollow-core Energy Cable Saturant

Company: H&R ESP Ltd.

Address: Matrix House
North 4th Street
Milton Keynes, MK9 1NJ
United Kingdom

Telephone: +44 (0)1908 351 111 Fax: +44 (0)1908 351122

2: COMPOSITION / INFORMATION ON INGREDIENTS

Composition: Low viscosity compound based on a blend of linear alkyl benzenes that have side alkyl chains of 10 – 13 carbon atoms in length.

Synonyms: Linear Alkyl Benzenes
Alkyl C10-C13, benzenes
Benzene, C10-13-alkyl-deriv.
Detergent Alkylate

Composition	EINECS number	CAS number	Symbol letters	Risk numbers	Concentration range
C10 – C13 Linear Alkyl Benzenes	267-051-0	67774-74-7	Not regulated		100%

All constituents of this product are listed in EINECS (European Inventory of Existing Commercial Chemical Substances) or ELINCS (European List of Notified Chemical Substances) or are exempt.

3: HAZARDS IDENTIFICATION

Classification of preparation: This product is not classified as a dangerous substance / preparation in accordance with The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (CHIP3).

Physical and Chemical Properties: Not classified as flammable, but will burn. Avoid contact with strong oxidisers.

Health Effects

Skin:	Contact with the skin may cause irritation. Prolonged or repeated skin contact may cause drying of the skin, progressing to dermatitis. Symptoms may include itching, discolouration, swelling and blistering.
Eyes:	Contact with the eyes may cause irritation. Symptoms may include reddening, swelling and impaired vision.
Ingestion:	Ingestion of small amounts may cause nausea and vomiting.
Inhalation:	Due to low volatility, this product should not present an inhalation hazard under ambient conditions. Exposure to vapour or mineral oil mists may irritate the mucous membranes and cause dizziness, headaches and nausea.

Environmental Effects

No specific hazards under normal use conditions.

4: FIRST AID MEASURES

Inhalation:	Remove from further exposure. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance and call a doctor. If breathing has stopped, administer artificial respiration.
Skin contact:	Remove contaminated clothing and wash affected skin with soap and water. If persistent irritation occurs, obtain medical attention. If high pressure injection injuries occur, obtain medical attention immediately.
Eye contact:	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion:	Wash out mouth with water and obtain medical attention. DO NOT INDUCE VOMITING.

5: FIRE FIGHTING MEASURES

Suitable extinguishing media:	Carbon dioxide (CO_2), dry chemical, foam or water spray.
Unsuitable extinguishing media:	Do not use water jets.
Special exposure hazards:	Combustion is likely to give rise to a complex mixture of airborne solid and liquid particulates and gases, including carbon monoxide, and unidentified organic and inorganic compounds.
Special protective equipment:	Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.

6: ACCIDENTAL RELEASE MEASURES

Personal Precautions:	Spilt product presents a significant slip hazard. Remove any sources of heat.
Environmental Precautions:	Prevent from spreading or entering into drains, sewers and watercourses by using inert absorbent material or other appropriate barriers. Inform local authorities if this cannot be prevented.
Methods for cleaning up:	Absorb liquid with inert absorbent material. Sweep up and remove to a suitable, clearly marked container for disposal in accordance with local and national regulations

7: HANDLING AND STORAGE

Handling:	Do not eat, drink or smoke whilst using this product. To avoid the possibility of skin disorders repeated or prolonged contact with products of this type must be avoided. It is essential to maintain a high standard of personal hygiene.
Storage:	Store in a cool place away from sources of heat and out of direct sunlight to avoid pressure build up. Do not store near oxidisers.

Handling and Storage Materials and Coatings

Suitable:	Carbon steel, baked epoxy or Phenolic coatings, aluminium.
Unsuitable:	Natural rubber, Butyl rubber

8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Limits:	Not established.
Engineering control measures:	Use of local exhaust ventilation is recommended whenever this product is used in a confined space, is heated above ambient temperatures, or is agitated.
Hygiene measures:	Wash hands before eating, drinking, smoking and using the toilet. Gloves should be washed before being removed.
Respiratory Protection:	Normally not required if adequate ventilation is in place. Where concentrations in air may exceed the limits given in this section, it is recommended to use a half mask respirator to protect from over exposure by inhalation. Suitable filter material depends on the amount and type of chemicals being handled, but filter material suitable for organic vapours may be considered for use.
Hand Protection:	When handling this product it is recommended to wear chemical resistant gloves. Suggested materials for protective gloves include: PVC, Neoprene or similar.
Eye Protection:	Wear eye protection such as safety glasses, chemical goggles, or face shield if engineering controls or work practices are not adequate to prevent eye contact. Have suitable eye wash water available.

Skin Protection:	Wear impervious protective clothing to prevent skin contact. Selection of protective clothing may include gloves, apron, boots, and complete facial protection depending on operations conducted.

9: PHYSICAL AND CHEMICAL PROPERTIES

General Information

Appearance:	Clear, colourless liquid
Odour:	Mild petroleum odour

Health, safety and environmental information

pH:	Not determined
Boiling point/range:	280°C
Flash point:	>135°C
Flammability:	Non flammable
Explosive properties:	Not explosive
Oxidising properties:	Not applicable
Vapour pressure at 20°C:	<0.02 kPa
Density:	0.86 g/cm^{-3} at 20°C typical
Solubility in water:	Insoluble
Kinematic Viscosity at 20°C:	4.0 – 4.5 cSt (4.0 – 4.5 mm^2/s) typical
Vapour density (Air=1):	>1
Evaporation rate:	Not determined

Other information

Pour point:	-60°C typical
Expansion coefficient:	0.0007 /°C typical
Neutralisation value:	0.03 mg KOH g^{-1} maximum

10: STABILITY AND REACTIVITY

Chemical stability:	This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure and will not polymerise.
Conditions to avoid:	Temperatures above 140°C
Materials to avoid:	Strong oxidising agents, such as liquid chlorine, concentrated oxygen, sodium hypochlorite, calcium hypochlorite, peroxides etc, as this may present an explosion hazard.
Hazardous decomposition products:	Carbon monoxide and irritant fumes may be generated if this product is burned in an enclosed space.

11: TOXICOLOGICAL INFORMATION

Basis for assessment:	Toxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the toxicology of similar products.
Acute toxicity:	Oral LD50 expected to be >5000 mg/kg (rat) Inhalation LC50/4hr expected to be >1.8 mg/l (rat) Dermal LD50 expected to be >2000 mg/kg (rabbit)
Corrosivity/irritation:	
Eye:	May be slightly irritant
Skin:	May be slightly irritant
Respiratory tract:	If mists are inhaled, slight irritation of the respiratory tract may occur
Skin sensitisation:	Not expected to be a skin sensitiser
Repeated-dose toxicity:	Prolonged and/or repeated contact may lead to irritation and possibly dermatitis, especially under conditions of poor personal hygiene.
Mutagenicity:	Not expected to be a mutagen.
Carcinogenicity:	Not expected to be a carcinogen.
Reproductive toxicity:	The preparation has not been assessed at all for this end-point, so its hazardous property in this regard is not known.

12: ECOLOGICAL INFORMATION

Basis for assessment:	Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products.
Ecotoxicity:	Poorly soluble mixture. Product is not expected to be ecotoxic to fish/daphinia/algae, or sewage bacteria. This preparation is expected to be removed in a wastewater treatment facility
Mobility:	Liquid under most environmental conditions. Floats on water. If it enters soil, it will adsorb to soil particles and will not be mobile.
Persistence and degradability:	Readily biodegradable. Soils degradation – half life approx. 15 days. Natural waters degradation – half life approx. 4 – 9 days.
Bioaccumulative potential:	May have the potential to bioaccumulate

13: DISPOSAL CONSIDERATIONS

Disposal must be in accordance with local and national legislation.

Unused Product:	Dispose of through an authorised waste contractor to a licensed site. May be incinerated.
Used/Contaminated Product:	Dispose of through an authorised waste contractor to a licensed site. May be incinerated.
Packaging:	Dispose of through an authorised waste contractor. May be steam cleaned and recycled.

14: TRANSPORT INFORMATION

This product is not classified as dangerous for transport.

15: REGULATORY INFORMATION

Classification/Symbol: Not Regulated

This preparation is not classified as Dangerous according to EU Directives

This safety data sheet is intended to assist in compliance with the following UK legislation:

- Chemicals (Hazard Information and Packaging for Supply) Regulations 2002
- Control of Substances Hazardous to Health Regulations 2002.
- Health and Safety at Work, etc. Act 1974.
- Environmental Protection Act 1990
- Environmental Protection (Duty of Care) Regs. 1991
- COSHH essentials: Easy steps to control chemicals. Control of Substances Hazardous to Health Regulations

Further Guidance
The following guidance notes are available from HMSO or HSE.

Occupational exposure limits (EH 40). Effects of mineral oil on the skin (SHW 397).
Preventing dermatitis at work (INDG 233)
A step by step guide to COSHH assessment (HSG 97)
Assessing and managing risks at work from skin exposure to chemical agents (HSG 205)
The selection, use and maintenance of respiratory protective equipment: A practical guide (HSG 53)
Relevant EC Directives:

- Dangerous Substances Directive (DSD)
- Dangerous Preparations Directive (DPD)
- Safety Data Sheets Directive (SDSD)
- Health & Safety Framework Directive

16: OTHER INFORMATION

This data sheet was prepared in accordance with Commission Directive 2001/58/ECand SI 2002 No. 1689 (CHIP 3)

Key References:

- Chemicals (Hazard Information and Packaging for Supply) Regulations 2002
- The compilation of safety data sheets. Approved Code of Practice (third edition)
- Approved supply list (7th Edition). Information approved for the classification and labelling of substances and preparations dangerous for supply. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002
- Approved classification and labelling guide. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002. Guidance on regulations (Fifth edition).
- EH40/2005 Workplace Exposure Limits 2005
- COSHH essentials: Easy steps to control chemicals. Control of Substances Hazardous to Health Regulations
- European Inventory of Existing Commercial Substances (EINECS)

The data and advice given apply when the product is sold for the stated application or applications. The product is not sold as suitable for any other application. Use of the product for applications other than as stated in this sheet may give rise to risks not mentioned in this sheet. You should not use the product other than for the stated application or applications without seeking advice from us.

If you have purchased the product for supply to a third party for use at work, it is your duty to take all necessary steps to secure that any person handling or using this product is provided with the information in this sheet.

If you are an employer, it is your duty to tell your employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken.

We believe, in good faith and to the best of our knowledge that the preceding information is accurate. However, we give no guarantee or warranty in this respect. The information provided herein may not be adequate for all individuals and/or all situations. The purchaser/user of the product remains responsible for storing, using or dealing with the product safely and in accordance with all applicable laws and regulations.

Safety Data Sheet
(93/112/EC)

Date of edition: October 1995

1. Identification of Substance/Preparation and Company

Product name:
Masse 106
Supplier:
FELTEN & GUILLEAUME Energietechnik AG
Schanzenstraße 24-30
51063 Köln
Emergency telephone number: 0221/676-3333

2. Composition/Information on Ingredients

Blend of highly refined mineral oils and additives.
On the basis of available information, the components of this preparation are not expected to impart hazardous properties to this product.

3. Hazards Identifikation

Human Health Hazards

If swallowed, aspiration into the lungs may cause chemical pneumonitis.
Prolonged or repeated exposure may give rise to dermatitis.
No specific hazards under normal use conditions.

Safety hazards

The preparation contains mineral oil, for which an exposure limit for oil mist applies.

Environmental hazards

Avoid spillage.
The poduct is not readily biodegradable.

4. First Aid Measures

Inhalation

Remove to fresh air.
If breathing but unconscious, place in the recovery position.
If breathing has stopped, apply artificial respiration.
Medical attention is to be obtained immediately.

Skin

Remove contaminated clothing and wash affected skin with soap and water.

If high pressure injection injuries occur, obtain medical attention immediately.

Eye

Rinse immediately with plenty of water for ar least 10 minutes and seek medical advice.

Ingestion

Do not induce vomiting.
Aspiration into the lungs may occur directly or following ingestion. This can cause chemical pneumonitis which may be fatal.
If breathing but unconscious, place in the recovery position.
If breathing has stopped, apply artificial respiration.
Medical attention is to be obtained immediately.

Advice to physicians

Treat symptomatically

5. Fire Fighting Measures

Extinguishing media

Foam, dry chemical powder, carbon dioxide, sand or earth.

Safety Data Sheet
(93/112/EC)

Date of edition: October 1995

Product name: Masse 106

5. Fire Fighting Measures (continued)

Unsuitable extinguishing media

Do not use water in a jet

Specific hazards

- Combustion is likely to give rise to a complex mixture of gases and airborne particulates, including carbon monoxide, oxides of sulphur and unidentified organic and inorganic compounds.

6. Accidental Release Measures

Personal precautions

Ventilate contaminated area thoroughly.

Minimise contact with skin.

Environmental precautions

Prevent further leakage or spillage and prevent from entering drains.

Prevent from spreading or entering into drains, ditches or rivers by using sand, earth or other appropriate barriers.

Clean-up methods

Absorb or contain liquid with sand, earth or spill control material.

Shovel into a suitable, clearly marked container for disposal or reclamation in accordance with local regulations.

7. Handling and Storage

Handling

When using do not eat or drink.

When handling product in drums, safety footwear should be worn and proper handling equipment should be used

Prevent spillages.

Storage

Keep container tightly closed and in a well ventilated place. Avoid direct sunlight, heat sources and strong oxidising agents.

Recommended materials: mild steel, high density polyethylene for containers or container linings.

8. Exposure Controls/Personal Protection

Engineering control measures

Use only in well ventilated areas.

Occupational exposure standards

Component name	Limit type	Value/Unit	Other information
Oil mist	8 h TWA	5 mg/m³	ACGIH
	10 min STEL	10 mg/m³	ACGIH

Respiratory Protection

Not normally required.

If oil mist cannot be controlled, a respirator fitted with an organic vapour cartrige combined with a particulate prefilter should be used.

Hand Protection

PVC or nitril rubber gloves if splashes are likely to occur and if applicable.

Eye Protection

Safety spectacles

Body Protection

Minimise all forms of skin contact.

Safety Data Sheet
(93/112/EC)

Date of edition: October 1995

Product name: Masse 106

8. Exposure Controls and Personal Protection (continued)

Hygiene measures

Don't keep oily rags in your pockets.
Wash hands before eating and drinking.

9. Physical and Chemical Properties

form	liquid	
colour	yellow	
pourpoint	< -60°C	DIN ISO 3016
flashpoint	145°C	DIN 51758
flammability - lower limit (vol%)	0,6	
flammability - upper limit (vol%)	6,5	
vapour pressure (20°C)	< 0,01 hPa	
density (15°C)	888 kg/m³	DIN 51757
solubility in water (20°C)	negligible	
n-octanol/water partition coeff.	na	
kinematic viscosity (40°C)	8,5 mm²/s	DIN 51562

10. Stability/Reactivity

Stability

stable under normal use conditions

Materials to avoid

strong oxidising agents

Hazardous decomposition products

Hazardous decomposition products are not expected to form during normal storage.

11. Toxicological Information

Toxicological Data:

Acute toxicity - oral

LD 50 is expected to be > 2000 mg/kg.

Irritation of skin, irritation of eye

The product is expected to be slightly irritant.

Sensitisation of skin

The produkt is not expected to be a skin sensitiser.

Prolonged and/or repeated contact

Prolonged/repeated contact may cause defatting of the skin, which can lead to dermatitis and may make the skin more susceptible to irritation and penetration by other materials.

Carcinogenicity

Product is based on mineral oils of types shown to be non-carcinogenic in animal skin-painting studies. Other components are not known to be associated with carcinogenic effects.

Other information

Aspiration into the lungs may occur directly or following ingestion. This can cause chemical pneumonitis which may be fatal.

Information given is based on a knowledge of the toxicology of similar products.

Safety Data Sheet
(93/112/EC)

Date of edition: October 1995

Product name: Masse 106

12. Ecological Information

Basis for assessment

Information given is based on data on the components and the ecotoxicology of similar products.

Mobility

Product floats on water. It is liquid under most environmental conditions.
If it enters soil, it will be adsorbed to soil particles and will not be mobile.
Product has the potential to bioaccumulate.

Ecotoxicity

Product is expected to be practically non-toxic to aquatic organisms, LC/EC50 > 100 mg/L.

13. Disposal Considerations

Product

Precautions: Dispose to licensed disposal contractor.
Waste disposal Nr. (D): 54106

Container disposal

Drain container thoroughly.
Dispose to licensed disposal contractor.

Recomanded cleaning procedure

Cleaning by disposal contractor

14. Transport Information

Product is not dangerous for conveyance under UN, IMO, ADR/RID and IATA/ICAO codes. (According ADR/RID regulations from 1.1.1995)

15. Regulatory Information

Classification

The Product is not classified as dangerous under EC criteria.

16. Other Information

Additional informations

Concawe Report 5/87 Health Aspects of Lubricants.

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should therefore not be construed as guaranteeing any specific property of the product.

Material Safety Data Sheet

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

Material Name : **Shell Diala Cable Oil**
Uses : Insulating oil.
Product Code : 001D8369

Manufacturer/Supplier : **Shell UK Oil Products Limited**
PO BOX 3
Ellesmere Port
CH65 4HB
United Kingdom

Telephone : +44 (0) 151-350-4000
Fax : +44 (0) 151-350-4000
Email Contact for MSDS : If you have any enquiries about the content of this MSDS please email lubricantSDS@shell.com

Emergency Telephone Number : +44-(0) 151-350-4595

2. HAZARDS IDENTIFICATION

EC Classification : Harmful.

Health Hazards : Repeated exposure may cause skin dryness or cracking. Harmful: may cause lung damage if swallowed.

Signs and Symptoms : If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance. Ingestion may result in nausea, vomiting and/or diarrhoea.

Safety Hazards : Not classified as flammable but will burn.
Environmental Hazards : Not classified as dangerous for the environment.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Preparation Description : Alkyl benzene.

Hazardous Components

Chemical Identity	CAS	EINECS	Symbol(s)	R-phrase(s)	Conc.
Benzene, C10-C13 alkyl derivitives	67774-74-7	267-051-0	Xn	R65; R66	90.00 - 100.00 %

Additional Information : Refer to chapter 16 for full text of EC R-phrases.

4. FIRST AID MEASURES

Inhalation	:	No treatment necessary under normal conditions of use. If symptoms persist, obtain medical advice.
Skin Contact	:	Remove contaminated clothing. Flush exposed area with water and follow by washing with soap if available. If persistent irritation occurs, obtain medical attention.
Eye Contact	:	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion	:	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (37° C), shortness of breath, chest congestion or continued coughing or wheezing.
Advice to Physician	:	Treat symptomatically. Potential for chemical pneumonitis. Consider: gastric lavage with protected airway, administration of activated charcoal. Call a doctor or poison control center for guidance.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Specific Hazards	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide. Unidentified organic and inorganic compounds.
Suitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use water in a jet.
Protective Equipment for Firefighters	:	Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. See Chapter 13 for information on disposal. Observe the relevant local and international regulations.

Protective measures	:	Avoid contact with skin and eyes. Use appropriate containment to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers.
Clean Up Methods	:	Slippery when spilt. Avoid accidents, clean up immediately. Prevent from spreading by making a barrier with sand, earth or other containment material. Reclaim liquid directly or in an absorbent. Soak up residue with an absorbent such as clay, sand or other suitable material and dispose of properly.
Additional Advice	:	Local authorities should be advised if significant spillages

cannot be contained.

7. HANDLING AND STORAGE

General Precautions	:	Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.
Handling	:	Avoid prolonged or repeated contact with skin. Avoid inhaling vapour and/or mists. When handling product in drums, safety footwear should be worn and proper handling equipment should be used.
Storage	:	Keep container tightly closed and in a cool, well-ventilated place. Use properly labelled and closeable containers. Storage Temperature: 0 - 50°C / 32 - 122°F The storage of this product may be subject to the Control of Pollution (Oil Storage) (England) Regulations. Further guidance maybe obtained from the local environmental agency office.
Recommended Materials	:	For containers or container linings, use mild steel or high density polyethylene.
Unsuitable Materials	:	PVC.
Additional Information	:	Polyethylene containers should not be exposed to high temperatures because of possible risk of distortion. Exposure to this product should be reduced as low as reasonably practicable. Reference should be made to the Health and Safety Executive's publication "COSHH Essentials".

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

If the American Conference of Governmental Industrial Hygienists (ACGIH) value is provided on this document, it is provided for information only.

Occupational Exposure Limits

Exposure Controls	:	The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Adequate ventilation to control airborne concentrations. Where material is heated, sprayed or mist formed, there is greater potential for airborne concentrations to be generated.
Personal Protective Equipment	:	Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.
Respiratory Protection	:	No respiratory protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid breathing of material. If engineering controls do not maintain airborne

		concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Select a filter suitable for combined particulate/organic gases and vapours [boiling point >65 °C (149 °F)] meeting EN141.
Hand Protection	:	Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: PVC, neoprene or nitrile rubber gloves. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, glove thickness, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.
Eye Protection	:	Wear safety glasses or full face shield if splashes are likely to occur. Approved to EU Standard EN166.
Protective Clothing	:	Skin protection not ordinarily required beyond standard issue work clothes. It is good practice to wear chemical resistant gloves.
Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.
Environmental Exposure Controls	:	Minimise release to the environment. An environmental assessment must be made to ensure compliance with local environmental legislation.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Colourless. Liquid at room temperature.
Odour	:	Slight hydrocarbon.
pH	:	Not applicable.
Initial Boiling Point and Boiling Range	:	> 280 °C / 536 °F estimated value(s)
Pour point	:	< -60 °C / -76 °F Data not available
Flash point	:	Typical 140 °C / 284 °F (PMCC / ASTM D93)
Upper / lower Flammability or Explosion limits	:	Typical 1 - 10 %(V)
Auto-ignition temperature	:	> 320 °C / 608 °F
Vapour pressure	:	< 0.5 Pa at 20 °C / 68 °F (estimated value(s))
Density	:	Typical 857 kg/m3 at 20 °C / 68 °F
Water solubility	:	Negligible.
n-octanol/water partition coefficient (log Pow)	:	> 6 (based on information on similar products)
Kinematic viscosity	:	Typical 4.2 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	> 1 (estimated value(s))
Evaporation rate (nBuAc=1)	:	Data not available

10. STABILITY AND REACTIVITY

Stability	:	Stable.
Conditions to Avoid	:	Extremes of temperature and direct sunlight.
Materials to Avoid	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Hazardous decomposition products are not expected to form during normal storage.

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	:	Information given is based on data on the components and the toxicology of similar products.
Acute Oral Toxicity	:	Expected to be of low toxicity: LD50 > 5000 mg/kg , Rat Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.
Acute Dermal Toxicity	:	Expected to be of low toxicity: LD50 > 5000 mg/kg , Rabbit
Acute Inhalation Toxicity	:	Not considered to be an inhalation hazard under normal conditions of use.
Skin Irritation	:	Expected to be slightly irritating. Repeated exposure may cause skin dryness or cracking.
Eye Irritation	:	Expected to be slightly irritating.
Respiratory Irritation	:	Inhalation of vapours or mists may cause irritation.
Sensitisation	:	Not expected to be a skin sensitiser.
Repeated Dose Toxicity	:	Not expected to be a hazard.
Mutagenicity	:	Not considered a mutagenic hazard.
Carcinogenicity	:	Components are not known to be associated with carcinogenic effects.
Reproductive and Developmental Toxicity	:	Not expected to be a hazard.
Additional Information	:	Used oils may contain harmful impurities that have accumulated during use. The concentration of such impurities will depend on use and they may present risks to health and the environment on disposal. ALL used oil should be handled with caution and skin contact avoided as far as possible.

12. ECOLOGICAL INFORMATION

Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products.

Acute Toxicity	:	Poorly soluble mixture. May cause physical fouling of aquatic organisms. Expected to be practically non toxic: LL/EL/IL50 > 100 mg/l (to aquatic organisms) (LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract).
Mobility	:	Liquid under most environmental conditions. Floats on water. If it enters soil, it will adsorb to soil particles and will not be mobile.
Persistence/degradability	:	Expected to be inherently biodegradable.
Bioaccumulation	:	Has the potential to bioaccumulate.
Other Adverse Effects	:	Product is a mixture of non-volatile components, which are not

expected to be released to air in any significant quantities. Not expected to have ozone depletion potential, photochemical ozone creation potential or global warming potential.

13. DISPOSAL CONSIDERATIONS

Material Disposal	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses.
Container Disposal	:	Dispose in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.
Local Legislation	:	Disposal should be in accordance with applicable regional, national, and local laws and regulations. EU Waste Disposal Code (EWC): 13 03 08 synthetic insulating and heat transmission oils. Classification of waste is always the responsibility of the end user. Hazardous Waste (England and Wales) Regulations 2005.

14. TRANSPORT INFORMATION

ADR
This material is not classified as dangerous under ADR regulations.

RID
This material is not classified as dangerous under RID regulations.

ADNR
This material is not classified as dangerous under ADNR regulations.

IMDG
This material is not classified as dangerous under IMDG regulations.

IATA (Country variations may apply)
This material is not classified as dangerous under IATA regulations.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

EC Classification	:	Harmful.
EC Symbols	:	Xn Harmful.
EC Risk Phrases	:	R65 Harmful: may cause lung damage if swallowed. R66 Repeated exposure may cause skin dryness or cracking.
EC Safety Phrases	:	S62 If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

Chemical Inventory Status

EINECS	:	All components listed or polymer exempt.
TSCA	:	All components listed.
Classification triggering components	:	Contains alkyl benzene derivatives.
Other Information	:	Environmental Protection Act 1990 (as amended). Health and Safety at Work Act 1974. Consumers Protection Act 1987. Control of Pollution Act 1974. Environmental Act 1995. Factories Act 1961. Carriage of Dangerous Goods by Road and Rail (Classification, Packaging and Labelling) Regulations. Chemicals (Hazard Information and Packaging for Supply) Regulations 2002. Control of Substances Hazardous to Health Regulations 1994 (as amended). Road Traffic (Carriage of Dangerous Substances in Packages) Regulations. Merchant Shipping (Dangerous Goods and Marine Pollutants) Regulations. Road Traffic (Carriage of Dangerous Substances in Road Tankers in Tank Containers) Regulations. Road Traffic (Training of Drivers of Vehicles Carrying Dangerous Goods) Regulations. Reporting of Injuries, Diseases and Dangerous Occurrences Regulations. Health and Safety (First Aid) Regulations 1981. Personal Protective Equipment (EC Directive) Regulations 1992. Personal Protective Equipment at Work Regulations 1992.

16. OTHER INFORMATION

R-phrase(s)

R65	Harmful: may cause lung damage if swallowed.
R66	Repeated exposure may cause skin dryness or cracking.

MSDS Version Number	:	1.0
MSDS Effective Date	:	16.09.2010
MSDS Revisions	:	A vertical bar (|) in the left margin indicates an amendment from the previous version.
MSDS Regulation	:	Regulation 1907/2006/EC
MSDS Distribution	:	The information in this document should be made available to all who may handle the product.
Disclaimer	:	This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

APPENDIX E

WATER FRAMEWORK DIRECTIVE RIVER, GROUNDWATER BODY AND DUBLIN BAY REPORTS

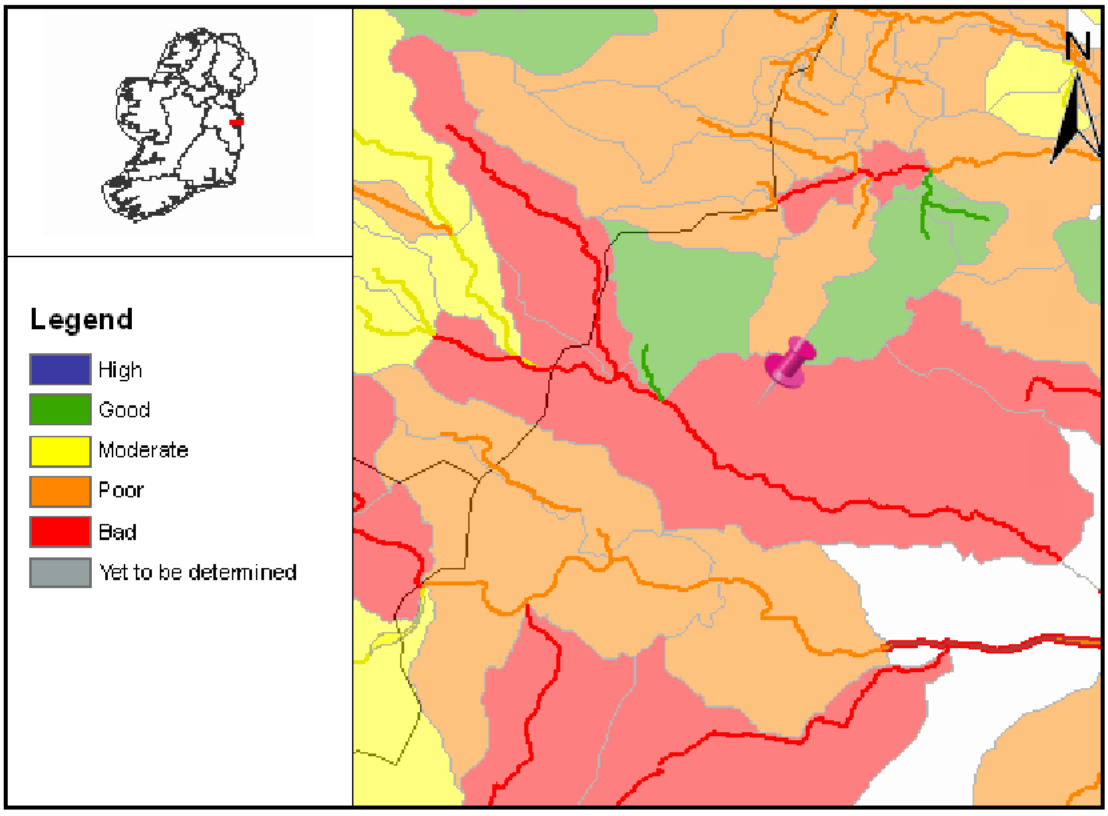
water matters
'Our Plan'

Status Report

Water Management Unit:	IE_EA_Tolka
WaterBody Category:	River Waterbody
WaterBody Name:	Tolka Lower
WaterBody Code:	IE_EA_09_1868
Overall Status Result:	Bad
Heavily Modified:	No

Report data based upon final RBMP, 2009-2015.

The information provided above is a summary of the principal findings related to the selected waterbody. Further details and explanation of individual elements of the report are outlined in the following pages.



Date Report Created 08/07/2019

water matters
'Our Plan'

Status Report

Water Management Unit:	IE_EA_Tolka
WaterBody Category:	River Waterbody
WaterBody Name:	Tolka Lower
WaterBody Code:	IE_EA_09_1868
Overall Status Result:	Bad
Heavily Modified:	No

Report data based upon final RBMP, 2009-2015.

	Status Element Description	Result
	Status information	
Q	Macroinvertebrate status	Bad
PC	General physico-chemical status	Moderate
FPQ	Freshwater Pearl Mussel / Macroinvertebrate status	N/A
DIA	Diatoms status	N/A
HYM	Hydromorphology status	N/A
FIS	Fish status	Poor
SP	Specific Pollutants status (SP)	N/A
ES	Overall ecological status	Bad
CS	Overall chemical status (PAS)	n/a
EXT	Extrapolated status	N/A
MON	Monitored water body	YES
DON	Donor water bodies	N/A

n/a - not assessed

Status
By 'Status' we mean the condition of the water in the waterbody. It is defined by its chemical status and its ecological status, whichever is worse. Waters are ranked in one of 5 status classes: High, Good, Moderate, Poor, Bad. However, not all waterbodies have been monitored, and in such cases the status of a similar nearby waterbody has been used (extrapolated) to assign status. If this has been done the first line of the status report shows the code of the waterbody used to extrapolate.

You can read more about status and how it is measured in our RBMP Document Library at www.wfdireland.ie (Directory 15 Status).

Date Report Created 08/07/2019

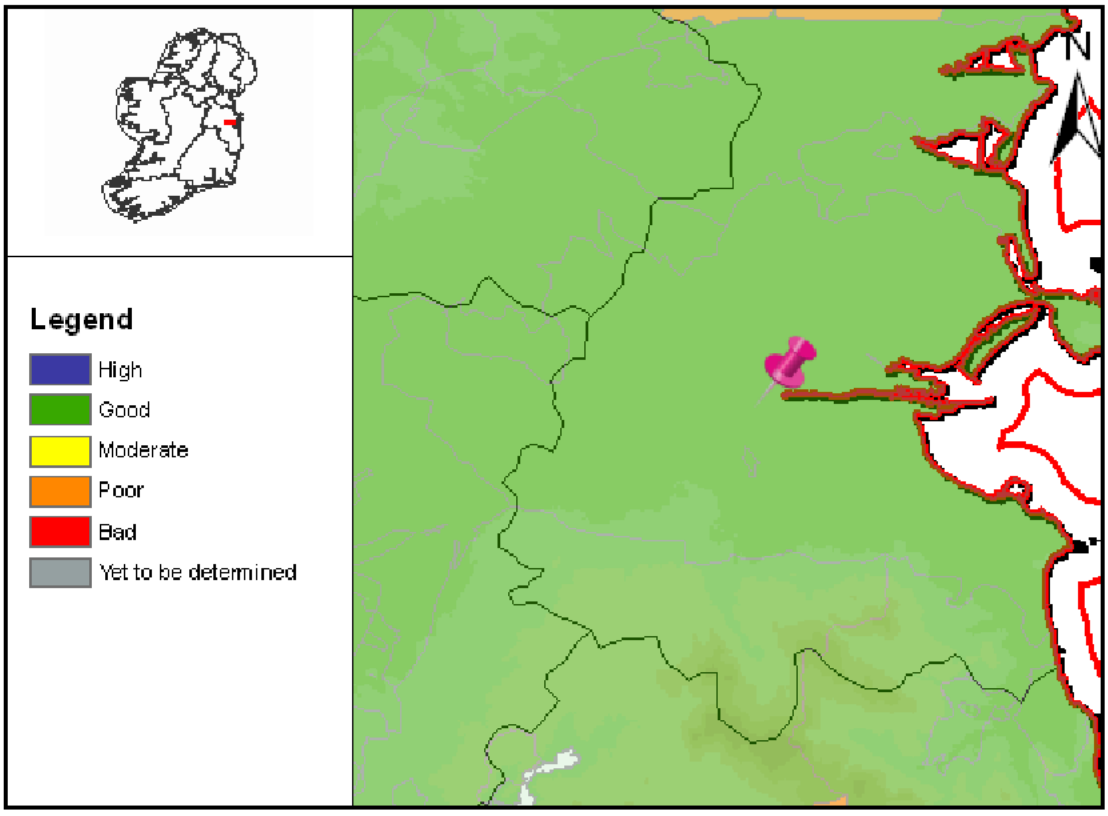
water matters
'Our Plan'

Chemical and Quantitative Status Report

Water Management Unit:	N/A
WaterBody Category:	Groundwater Waterbody
WaterBody Name:	Dublin Urban
WaterBody Code:	IE_EA_G_005
Overall Status Result:	Good
Heavily Modified:	No

Report data based upon final RBMP, 2009-2015.

The information provided above is a summary of the principal findings related to the selected waterbody. Further details and explanation of individual elements of the report are outlined in the following pages.



Date Report Created 08/07/2019

water matters
'Our Plan'

Chemical and Quantitative Status Report

Water Management Unit:	N/A
WaterBody Category:	Groundwater Waterbody
WaterBody Name:	Dublin Urban
WaterBody Code:	IE_EA_G_005
Overall Status Result:	Good
Heavily Modified:	No

Report data based upon final RBMP, 2009-2015.

	Status Element Description	Result
	Status information	
INS	Status associated with saline intrusion into groundwater	N/A
DWS	Status associated with exceedances of water quality above specific standards	N/A
DS	Chemical status of groundwater due to pressure from diffuse sources of pollution	N/A
CLS	Chemical status of groundwater due to pressure from contaminated soil or land.	N/A
MS	Chemical status of groundwater due to pressure from mine sites (active or closed).	N/A
UAS	Chemical status of groundwater due to pressures from urban areas	N/A
GWS	General groundwater quality status	N/A
RPS	Status associated with MRP loading to rivers	N/A
TNS	Status associated with nitrate loading to transitional and coastal waters	N/A
SWS	Overall status associated with nutrient loadings to rivers and transitional and coastal waters	N/A
SQS	Status associated with dependant surface water quantitative status	N/A
GDS	Groundwater dependant terrestrial ecosystems status	N/A
QSO	Quantitative status overall	Good
CSO	Chemical status overall	Good
OS	Overall status	Good

Date Report Created 08/07/2019

GS -HC : Good status High Confidence
GS- LC : Good status Low Confidence
n/a - not assessed

Status
By 'Status' we mean the condition of the water in the waterbody. It is defined by its chemical status and quantitative status, whichever is worse. Groundwaters are ranked in one of 2 status classes: Good or Poor.

You can read more about status and how it is measured in our RBMP Document Library at www.wfdireland.ie (Directory 15 Status).

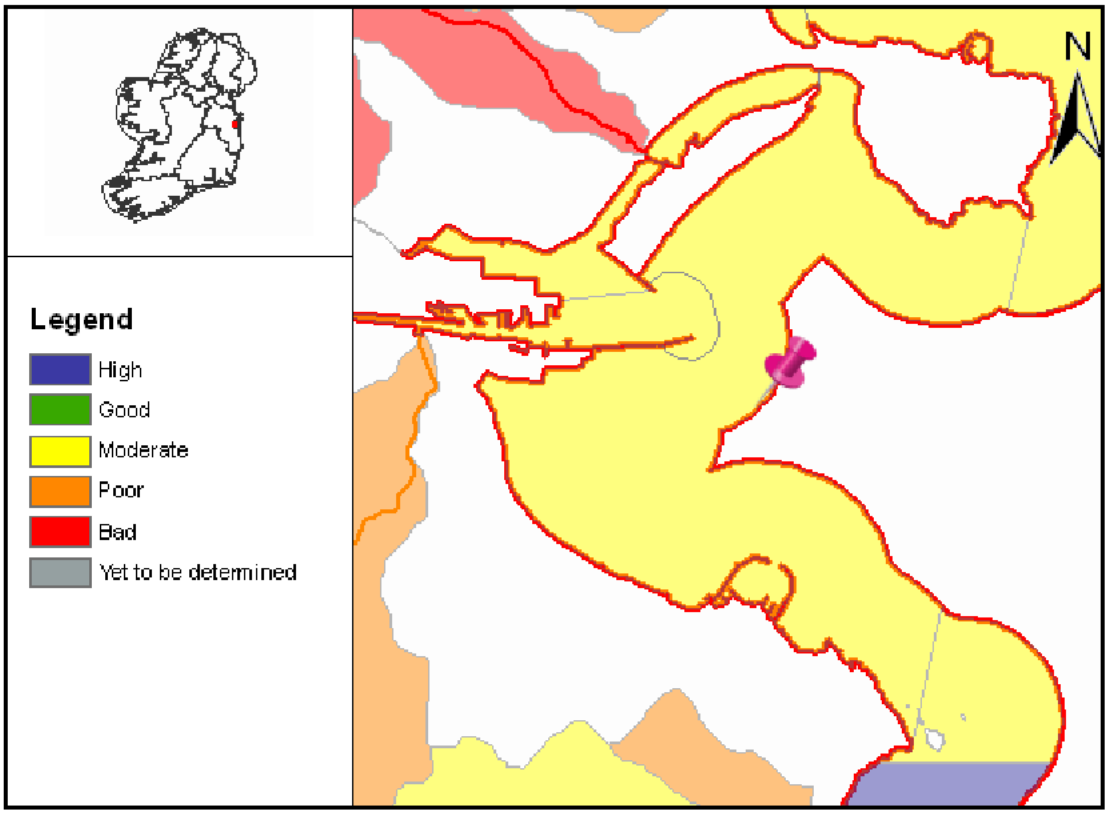
water matters
'Our Plan'

Status Report

Water Management Unit:	N/A
WaterBody Category:	Coastal Waterbody
WaterBody Name:	Dublin Bay
WaterBody Code:	IE_EA_090_0000
Overall Status Result:	Moderate
Heavily Modified:	No

Report data based upon final RBMP, 2009-2015.

The information provided above is a summary of the principal findings related to the selected waterbody. Further details and explanation of individual elements of the report are outlined in the following pages.



Date Report Created 08/07/2019

water matters
'Our Plan'

Status Report

Water Management Unit:	N/A
WaterBody Category:	Coastal Waterbody
WaterBody Name:	Dublin Bay
WaterBody Code:	IE_EA_090_0000
Overall Status Result:	Moderate
Heavily Modified:	No

Report data based upon final RBMP, 2009-2015.

	Status Element Description	Result
	Status information	
DIN	Dissolved Inorganic Nitrogen status	N/A
MRP	Molybdate Reactive Phosphorus status	N/A
DO	Dissolved oxygen as per cent saturation status	N/A
BOD	Biochemical Oxygen Demand (5-days) status	N/A
PHY	Macroalgae - phytobiomass status	N/A
OPP	Macroalgae - opportunistic algae status	N/A
RSL	Macroalgae - reduced species list status	N/A
ANG	Angiosperms - Seagrass and Saltmarsh status	N/A
BIN	Benthic Invertebrates status	N/A
FIS	Fish status	N/A
HYD	Hydrology status	N/A
MOR	Morphology status	N/A
SP	Specific Pollutant Status	N/A
PAS	Overall protected area status	N/A
ES	Ecological Status	Moderate
CS	Chemical Status	Fail
SWS	Surface Water Status	N/A
EXT	Extrapolated status	N/A
DON	Donor water bodies	N/A

Date Report Created 08/07/2019

n/a - not assessed

Status
By 'Status' we mean the condition of the water in the waterbody. It is defined by its chemical status and its ecological status, whichever is worse. Waters are ranked in one of 5 status classes: High, Good, Moderate, Poor, Bad. However, not all waterbodies have been monitored, and in such cases the status of a similar nearby waterbody has been used (extrapolated) to assign status. If this has been done the first line of the status report shows the code of the waterbody used to extrapolate.

You can read more about status and how it is measured in our RBMP Document Library at www.wfdireland.ie (Directory 15 Status).

APPENDIX F

SITE INVESTIGATION REPORT 1993 AT CLONTARF

June 1993.

29/235E 1935

Report No. 930

Box No. 45

Investigation ID. 62570 - 62583
(14)

CLONTARF,
DUBLIN
**MALLAGH LUCE **
DUBLIN CORPORATION

FOREWORD

Notes on Site Investigation Procedure

The following notes should be read in conjunction with the report .Any modifications to the procedures outlined below are indicated in the main text .

GENERAL

The recommendations made and opinions expressed in the Report are based on the Boring Records, an examination of samples and the results of the site and laboratory tests. No responsibility can be held for conditions which have not been revealed by the boreholes, for example, between borehole positions . Whilst the report may express an opinion on a possible configuration of strata both between borehole positions and below the maximum depth of the investigation , this is for guidance only and no liability can be accepted for its accuracy.

BORING TECHNIQUE

Unless otherwise stated, the 'Shell and Auger'technique of soft ground boring has been employed. Whilst this technique allows the maximum data to be obtained on strata conditions, a degree of mixing of some layered soils, (e.g. thin layers of coarse and fine granular material) is inevitable. Specific attention is drawn to this factor where evidence of such a condition is available .

GROUND WATER

The ground water conditions entered on the Boring Records are those appertaining at the time of the investigation . The normal rate of boring does not usually permit the recording of an equilibrium water level for any one water strike. Moreover , ground water levels are subject to variations caused by seasonal effects or changes in local drainage conditions. The table of each Boring Record shows the ground water level at the quoted borehole and casing depths , usually at the start of the day's work. The word ' none ' indicates that ground water was sealed off by the borehole casing.

ROUTINE SAMPLING

Undisturbed samples of predominately cohesive soils are obtained in a 102mm diameter open-drive sampler , complying with the requirements of the British Standard Code of Practice B.S 5930. Large disturbed samples of granular soils , or of soils in which undisturbed sampling is not possible or appropriate , are taken from the boring tools and sealed into polythene bags . Small disturbed samples are taken at frequent intervals of depth and sealed into 0.5kg glass jars or polythene bags for subsequent visual classification . Where encountered in sufficient quantity , samples of groundwater are taken.

Unless otherwise stated in the main text , disturbed soil samples may not be at their natural water content.

CONTENTS

APPENDICES

REPORT ON A SITE INVESTIGATION
AT
CLONTARF, DUBLIN
FOR
MALLAGH LUCE AND PARTNERS
AND DUBLIN CORPORATION

REPORT NO. 2233 **DATE ; JUNE 1993**

I. INTRODUCTION

A site on the Clontarf Road, just east of the main Dublin Belfast railway line is to be developed.

Mallagh Luce and Partners, acting on behalf of their client, Dublin Corporation, have ordered an investigation of subsoil conditions which was carried out by IGSL in May 1993.

The programme of the investigation included the boring of exploratory holes at six locations and the opening of trial pit excavations at eight positions . Some further shallow exploratory excavations were undertaken by the consulting engineer to locate services . Monitor pipework was installed in a number of boreholes and trial pits to establish concentrations of Methane , Carbon Dioxide and Hydrogen Sulphide .

The fieldwork was followed by a laboratory test programme carried out by IGSL and a specialised environmental laboratory.

This report details the findings of the investigation in the field and laboratory and discusses the findings relative to the site development.

II. FIELDWORK

The site is located east of the Dublin-Belfast railway line and south of the Clontarf Road in parkland and wooded ground surrounding the existing Dublin Corporation Traffic School.

The site and borehole and trial pit positions thereon are shown on the site plan enclosed in Appendix V to this report. The ground is fairly level, being a foreshore area reclaimed in the sixties.

(a) Boreholes :

Six holes were bored using 450mm diameter cable-tool equipment. Descriptions and depths of the strata encountered are given on the detailed boring records in Appendix IA. These records also give details of samples taken and in-situ tests carried out and note any obstruction to normal boring requiring the use of chiselling methods. Groundwater strikes were recorded and monitored.

Boreholes revealed similar stratification with a surface covering of made ground extending to an average depth of 4.00 metres. The fill is variable, glass, paper, cinders, ash, bottles, bones, clay and gravel being identified.

In Boreholes 3, 4 and 5, a thin stratum of gravel underlies the fill. The gravel stratum ranges in thickness from 0.40 to 1.00 metres.

Below the gravel in Boreholes 3, 4 and 5, and directly below the fill in Boreholes 1, 2 and 6, is a stratum of very stiff grey black silty sandy gravelly clay (Black Boulder Clay or Glacial Till).

Underlying the boulder clay is limestone bedrock, generally weathered and layered with clay bands at its upper horizon, but becoming more massive with penetration.

The weathered upper horizon varies from 5.50 metres (Boreholes 1, 2 and 3) to 8.50 metres in Borehole 4. The rock dips towards the centre of the old channel.

Chiselling methods were used to proof-bore the limestone and details are given on the boring records. Water was noted in all boreholes except No. 1, standing some 3.0 metres below ground level. Long-term monitoring was not carried out.

(b) Trial Pits :

A wheeled Atlas excavator was used to open excavations in eight locations. Details of each excavation are given on the trial pit records found in Appendix IB.

Pits 1 and 4 were opened at the request of Dublin Corporation to establish the location of services . Where encountered, services are shown on the records.

Pits 5 to 8 were excavated to examine the constitution of the fill deposits. The material is widely variable from organic domestic refuse to demolition material to ash and cinder. The compaction of the fill also varies from loose to medium dense.

Water was noted in a number of pits, generally at depths of from 2.70 to 3.00 metres. Details of water strikes are given on the records.

Samples of the fill deposits were taken for laboratory examination.

Three samples of topsoil were also taken for laboratory examination on the instructions of the consulting engineers.

(c) Gas Monitoring :

Standard slotted pipes were installed in four locations in boreholes and trial pits. The pipes were sealed by bentonite and surrounded by gravel to permit gas ingress. Non-return valves prevent venting of gases to the atmosphere.

Gas readings have been taken on three separate visits to the site and the report on the findings is enclosed in Appendix III. This appendix also includes comment and interpretation of the results.

III. TESTING

During the course of the investigation, samples were taken from each stratum while in-situ standard penetration tests were carried out to establish relative soil strength.

All samples were returned to the laboratory and a range of tests carried out to establish soil classification and chemical content. Most of the testing was carried out by IGSL in their Newbridge laboratory, however, four samples were tested by an environmental laboratory to establish the level of contaminants. These results are detailed and discussed in Appendix IV to this report .

The various field and laboratory tests are described in the following paragraphs.

(a) FIELD TESTS

(1) Standard Penetration Tests :

Tests were carried out at intervals in each stratum and results are presented in the right-hand column of the borehole records. The test involves driving a standard apparatus 300mm into the subsoil and recording the resistance in blows per 300mm. Where full penetration cannot be achieved (i.e. on boulders or rock) the number of blows for a specific penetration is recorded .

The range of N values in the various strata can be summarised as follows .

Stratum	N Value Range	Comment
Made Ground	5 - 27	Loose to medium dense but very variable.
Gravel	51	Very compact.
Black Boulder Clay	39 - 67 (Numerous refusals)	Stiff to hard
Limestone	Refusals	-

(b) LABORATORY TESTS

(1) Visual Assessment ; All disturbed samples have been opened and examined by our laboratory staff for accurate descriptive purposes . Following this examination a number of samples have been submitted for further analyses as follows .

(ii) Gradings : The particle size distribribution of two gravel samples from Boreholes 3 and 5 has been determined by wet sieve analysis . The results are presented graphically.

In the case of Borehole 3 the material is a clean fine to coarse slightly sandy gravel while in Borehole 5 the gravel contains a higher silt\sand percentage .

Two samples of the black boulder clay have also been analysed by wet sieve analyses and hydrometer . These grading curves present the typical Dublin black boulder clay pattern , with almost straight line characteristics from the clay\silt fraction to the gravel range .

(iii) Index Properties ; The liquid and plastic limits of four samples of the black clay have been determined for classification purposes . Values of liquid limit , plotted against plasticity index are shown on the standard Casagrande chart .The material is of low plasticity and uniform

(iv) Sulphate Content\pH : Five samples of the made ground from boreholes and trial pits have been analysed to determine sulphate content and pH . Results show sulphates ranging from 0.13 (Class I) to 0.37 (High Class 2) per cent in soil .

The results indicate that sulphate resisting cement should be used for any foundation concrete in contact with the fill material .

(v) Special Chemical Tests ; A range of tests has been performed on four samples of the fill and results are presented in Appendix IV. The appendix also contains comment on the results.

IV.DISCUSSION

Development on the site is to consist of light structures with new access roads and associated service installations.

The investigation has shown made ground deposits of approximately 4.00 metres overlying in some instances compact gravels with a base stratum of hard grey black silty stony clay (Dublin boulder clay).

Limestone bedrock occurs at depths of from 5.50 to 8.50 metres . Groundwater was noted some 2.50 to 3.00 metres below surface . The made ground is extremely variable both in strength and in constitution . N values of from 5 to 27 confirm the strength variability and visual inspection of the pits confirms the variability in constitution with cinders , ash , clay , rubble , glass , bones , paper etc . all included . A strong organic odour was recorded at Pits 6 and 7 . Examination of newspaper in the fill would date its placement in the early nineteen sixties .

The made ground must be regarded as unsuitable as a founding medium for structural foundations and consequently transferrance of loads to the underlying gravel\boulders clays or to bedrock is recommended .

The thickness of the fill with associated groundwater table would tend to preclude the use of deep excavations for footings , consequently the use of piling techniques is envisaged . Various pile types are available and

specialist contractors will advise on the most suitable techniques for the site

A precast concrete pile , driven to refusal (probably on the bedrock) would support loads of from 60 to 100 tonnes (depending on pile size) and may represent the most economic piling option available .

Roads ; The deposits of relatively recent fill deposits overlying the site will result in ongoing settlements , affecting the construction of site roads .

The total removal of the fill under roads and its replacement by compacted hardcore will result in a totally satisfactory environment for road construction , however the cost implications will be prohibitive .

The removal of part of the fill (say 1.00 metre), placement of a terram membrane and well compacted selected fill should be satisfactory for road construction . Some element of movement in the road should still be expected . The use of lightweight fill (PFA) would assist in reduction of settlements .

Site Drainage : During the course of the investigation (Following periods of very heavy rain) some lodgement of surface water was noted .

Examination of samples of 'topsoil' shows the material to vary considerably from very clayey and relatively impermeable to very sandy friable material .

It is likely that the fill deposits were covered by a capping layer of soil and in many instances the amount of actual topsoil may be minimal with clay material present rather than topsoil .

To increase the permeability of the surface , the existing material could be removed and replaced by more permeable material . Alternatively the material could be rotovated and granular material incorporated prior to rolling . Spiking and sanding of spike holes can also be successful .

APPENDIX IA - Boring Records

APPENDIX IB - Trial Pit Records

II. DISCUSSION

Four locations were checked for gas build-up over a period of three site visits . Locations of gas pipes are shown on the site plan which may be found in Appendix III of the main report .

Readings for Methane range from 15ppm to 75,000 ppm . These readings are inside the explosive range of Methane in air and as such should be considered hazardous .

High results were also noted for Carbon Dioxide which in some instances was as high as 28%.

Tests for Hydrogen Sulphide also showed readings in excess of TLV (Threshold Limit Values).

All gas test results are listed in Appendix I of this section.

III.CONCLUSION

Gas monitoring at this location reveals very high concentrations of landfill gases , particularly at the southern end of the site (with highest readings being recorded at Trial Pit No.8) . High concentrations of these gases were however , also observed at Borehole 6 on the eastern side of the site. Levels at Borehole 6 may be a result of gas migration or an indication of further pockets of landfill waste (degradable material) . It may be necessary to put down a grid of gas monitoring pipes to plot gas migration and note any further areas of high gas concentrations .

All structures erected on this site (permanent or otherwise) should have full gas protective schemes incorporated into them .

We would recommend that the client refers to Waste Managment Paper No.27 'Control of Landfill Gas ' and the Building Research Establishment Report 1991 on ' Construction of new buildings in gas contaminated land'.

APPENDIX I - Gas Monitoring Results

GAS TECH FID (Flame Ionisation Detector)

TP.4

Site Visit	1	2	3
Weather	dry	dry	-
Air Pressure	1015	1017	-
Machine	Gas Tech	Gas Tech	-
Surface Reading	5ppm	7ppm	-
Pipe Reading	15ppm	25ppm	-

TP.8

Site Visit	1	2	3
Weather	dry	dry	-
Air Pressure	1015	1015	-
Machine	Gas Tech	Gas Tech	-
Surface Readings	500ppm	400ppm	-
Pipe Reading	75,000ppm	75,000ppm	-

TP.7

Site Visit	1	2	3
Weather	DRY	DRY	-
Air Pressure	1016	1016	-
Machine	Gas Tech	Gas Tech	-
Surface Readings	15	198	-
Pipe Readings	3,000ppm	3,500ppm	-

BH.6

Site Visit	1	2	3
Weather	dry	dry	-
Air Pressure	1016	1017	-
Machine	Gas Tech	Gas Tech	-
Surface Reading	15	17	-
Pipe Reading	6,000ppm	6,500ppm	-

GA 90 Infra Red

Second Site Visit

Location	Time Span	Atmos. Pressure	Methane	Oxygen	Carbon\ Dioxide
TP.8	2min	1017	27%vv	1.8%	25%
TP.7	2mins	1015	4%	0.65	24%
TP.4	2mins	1016	0%	17%	2%
BH.6	2mins	1014	2.8%	7%	2,7%

(Condensation noted in all pipes)

Third Site Visit

Location	Time Span	Atmos. Pressure	Methane	Oxygen	Carbon Dioxide
TP.8	1min	1007	11.3%	1.8%	9.6%
	2min	1009	14.7	2	28.7
	3min	1006	13.8	2.6	28.2
	4mins	1008	14.0	2.4	27.5
TP.7	1min	1007	0	2	20.9
	2min	1008	0	2.1	20.4
BH.6	1min	1008	0.3	14.2	2.2
	2min	1008	0.5	14.1	2.9
	3min	1010	0.4	14.3	2.8

KITTIGAWA GAS DETECTOR SYSTEM

Location	Reading
TP.8	20ppm
TP.7	No Reading registered
TP.4	No Reading registered
BH.6	5ppm

APPENDIX IV - Specialist Chemical Tests

APPENDIX IV - CHEMICAL ANALYSES

Three samples of the fill were analysed over a range of possible contaminants and the test results are attached. The samples selected were:

B.H.1 6746 3.00m
B.H.4 6262 1.00m
B.H.5 6770 3.00m

TEST METHODS ;

Arsenic, cadmium and lead were determined by ICP-ES. Coal tar derivatives, mineral oils and toluene extractable matter were determined gravimetrically after solvent extraction. pH was measured electrometrically. Sulphide was determined titrimetrically. Cyanide was determined photometrically. Total phenol was determined photometrically after distillation. Dry solids were measured gravimetrically. Chloride and sulphate were determined by ion chromotography.

Results, while quite variable, generally indicate that the site conditions are non-hazardous, representing results consistent with domestic/light industrial landfill.

The sulphate contents confirm that below ground structural concrete should be of good quality, the use of a rich mix or possibly sulphate-resisting cement is indicated.

Where localised high levels of contaminants occur (i.e. B H 5 - Lead) it is likely to represent a localised concentration of material in that sample and not be representative of the site as a whole.

CHEMICAL ANALYSIS REPORT

CLONTARF/FAIRVIEW

TEST	UNIT	SAMPLE REFERENCE BH 1 6746	BH 4 6262	BH 5 6770
Arsenic	mg/Kg	5.53	4.21	7.98
Cadmium	mg/Kg	0.41	0.70	0.59
Lead	mg/Kg	44.2	78.71	438.6
Chloride	mg/Kg	57.3	68.7	70.2
Sulphate	% By Weight	0.36	0.19	0.25
Coal Tar Derivative	mg/Kg	845	722	945
pH		7.59	7.62	7.65
Sulphide	mg/Kg	<1,9	<1.0	<1.0
Toluene Ex.Matter	mg/Kg	1073	840	901
Total Cyanide	mg/Kg	<0.05	<0.05	<0.05
Total Phenol	mg/Kg	0.07	0.04	0.04
Dry Solids	%	63	53	59

APPENDIX II - Laboratory Data (Soils)

APPENDIX III - Gas Monitoring

GAS MONITORING
AT A SITE AT CLONTARF , DUBLIN
FOR
MALLAGH LUCE / DUBLIN CORPORATION

(I) INTRODUCTION

A preliminary investigation of gas conditions was carried out by I.G.S.L. engineers during the period of June 1993 at a proposed site at Clontarf, Dublin. The investigation was carried out at the request of the clients Mallagh Luce and Dublin Corporation.

Gas monitoring pipes were installed by I.G.S.L. during the course of conventional site investigation. All pipes were cut to ground level and capped to create an environment of maximum gas concentrations.

Observations of gas concentrations were carried out at four locations using the following types of gas monitoring equipment,

A) Gas-Tech FID Hydrocarbon / Methane detector which monitors for Methane or Petroleum based gases.

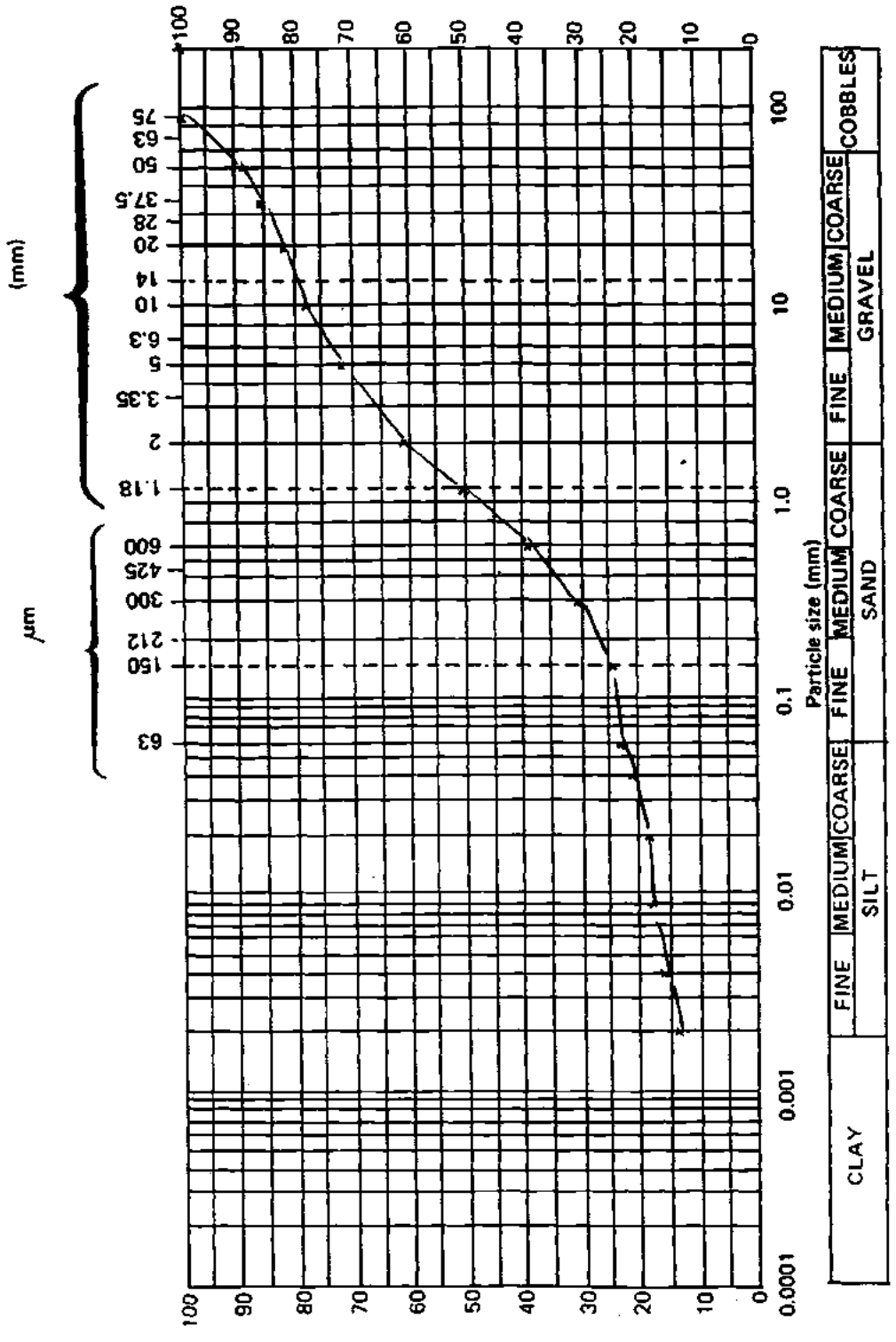
B) The GA 90 Infra Red Gas Detector which monitors Oxygen , Carbon Dioxide and Methane.

C) The Kitigawa Precision Gas Detector System which monitors Hydrogen Sulphide gas .

Report No. 2233	PARTICLE SIZE ANALYSIS	IGSL
Contract **CLONTARF**	Borehole No. **2**	
Method of Test **Wet Sieve & Hydro**	Sample No. **6753**	
	Depth **4.50**	

Sample Description

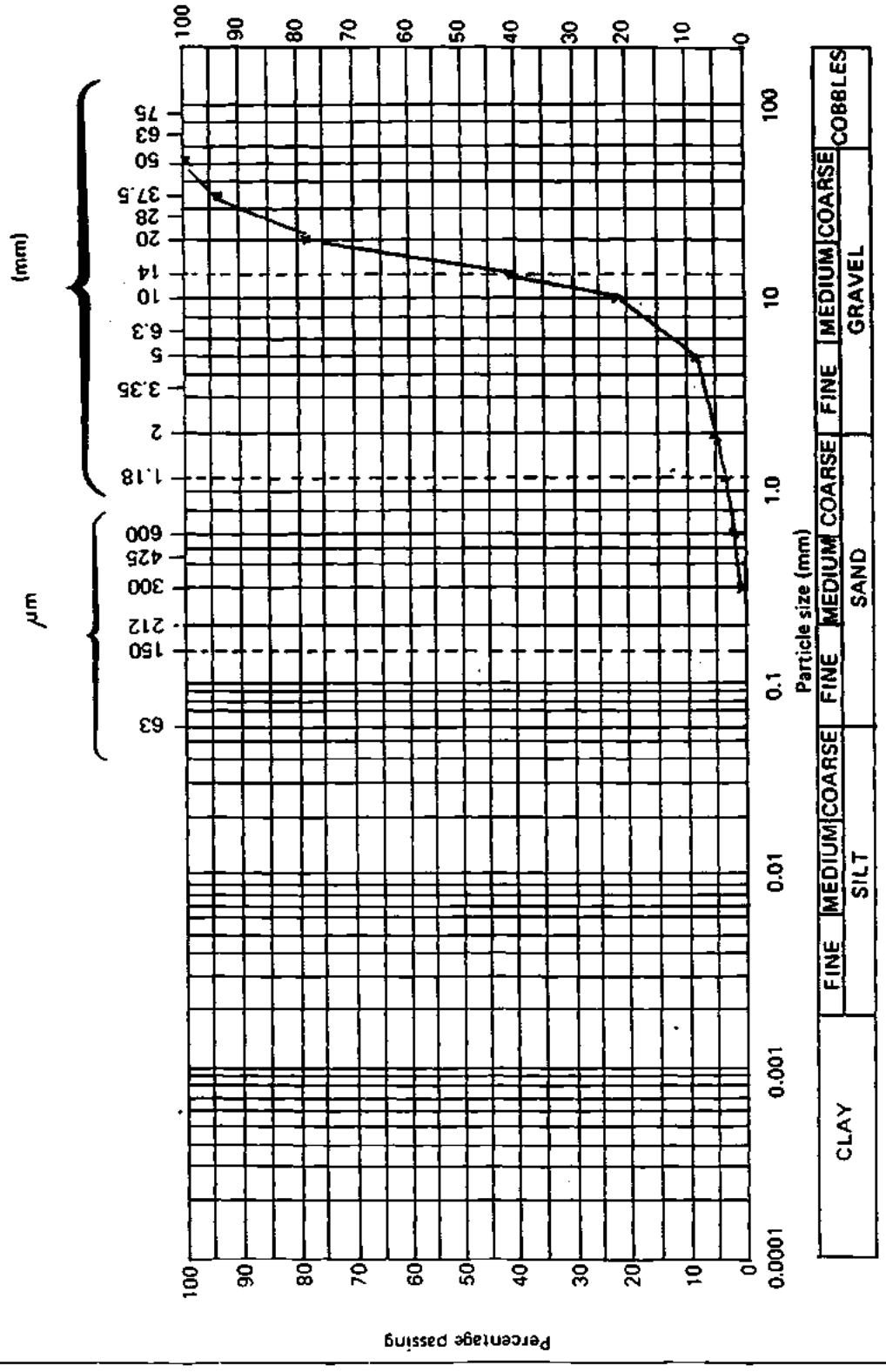
Black grey silty sandy gravelly CLAY



Report No. 2233	PARTICLE SIZE ANALYSIS	IGSL
Contract CLONTARF	Borehole No. 3	
Method of Test Wet Sieve	Sample No. 6759	
	Depth 4.40	

Samole Description

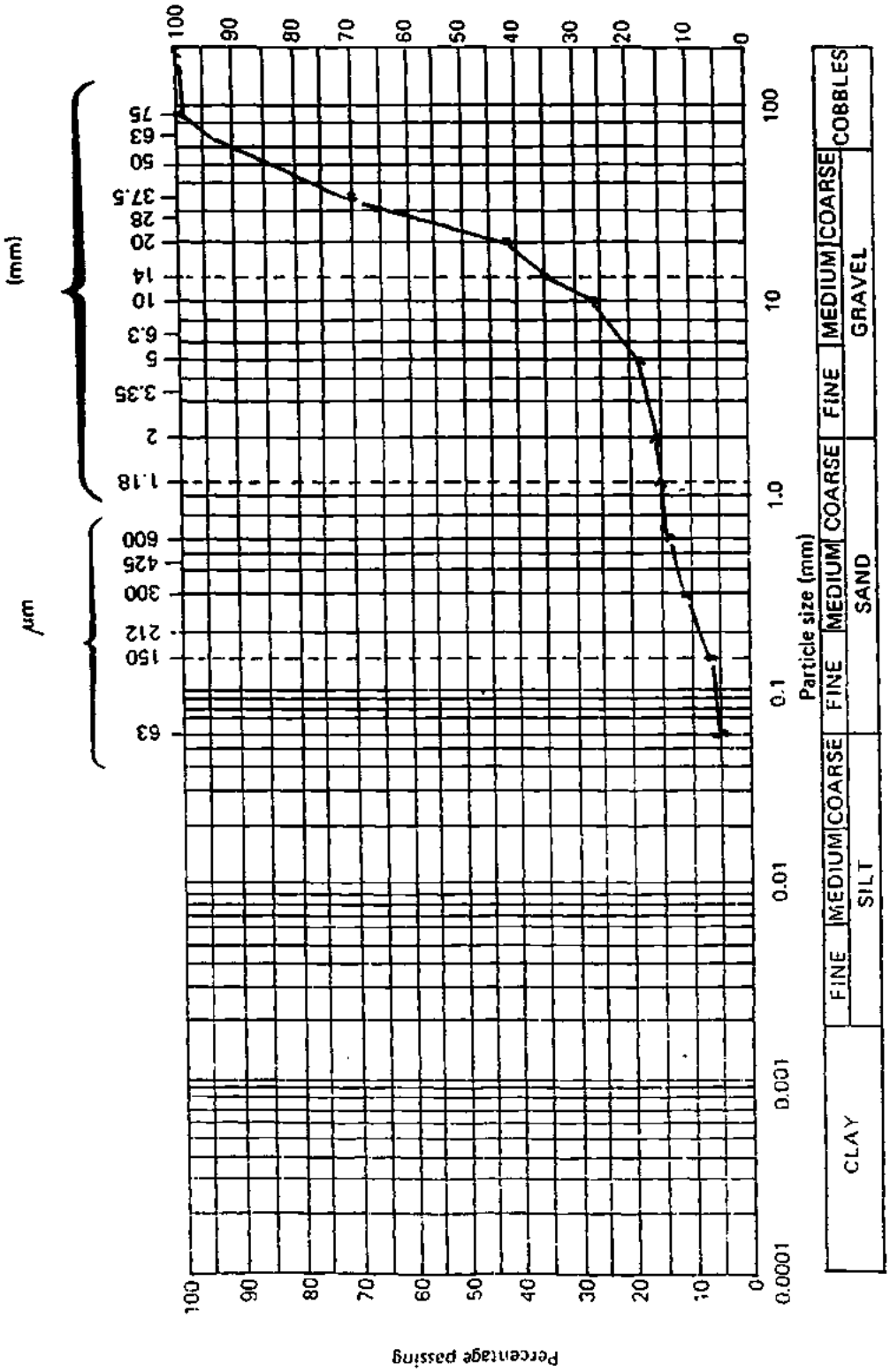
Fine to coarse slightly sandy GRAVEL



Report No.	PARTICLE SIZE ANALYSIS	IGSL
Contract **CLONTARF**	Borehole No. **5**	
Method of Test **Wet Sieve**	Sample No. **6771**	
	Depth **4.10**	

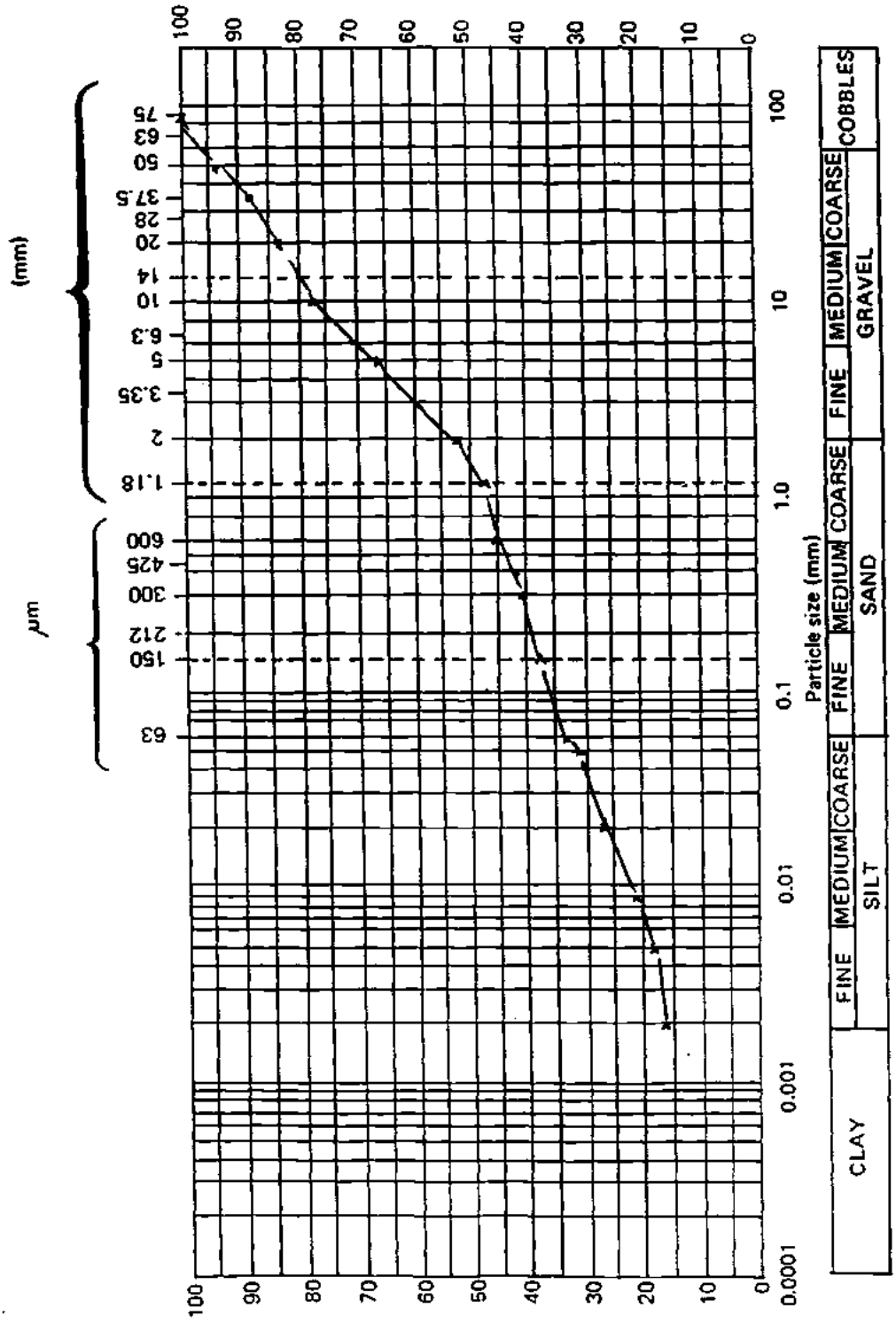
Sample Description

Grey silty sandy fine to coarse GRAVEL



Report No.	PARTICLE SIZE ANALYSIS	IGSL
Contract: **CLONTARF**	Borehole No. **6**	
Method of Test: **Wet Sieve & Hydro**	Sample No. **6780**	
	Depth **5.50**	

Sample Description
Grey black silty sandy gravelly CLAY



Report No. 2233	CLASSIFICATION TEST RESULTS	IGSL

Contract **CLONTARF**

Borehole No.	Sample No.	Depth (Metres)	Sample Description	Percentage Passing 425 μm Sieve	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Water Content %
1	6747	5.00	Grey silty sandy gravelly CLAY		25	13	12	11.3
3	6760	5.00	Grey black silty sandy gravelly CLAY		26	12	14	10.9
4	6766	6.50	Grey black silty sandy gravelly CLAY		26	13	13	10.4
6	6769	4.00	Grey black silty sandy gravelly CLAY		25	14	11	13.5

REPORT NO. 2233

CHEMICAL ANALYSIS

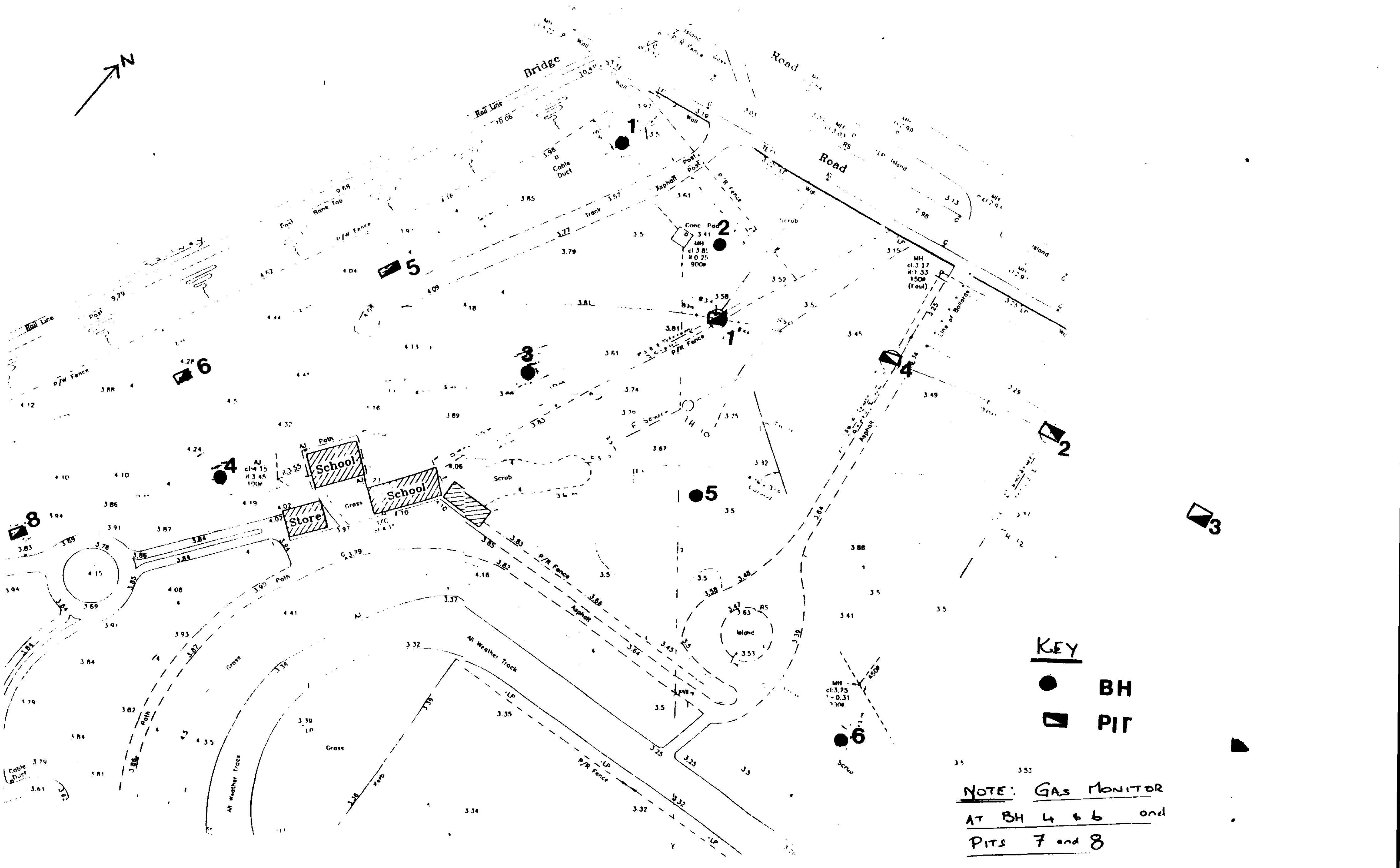
IGSL

CONTRACT **CLONTARF**

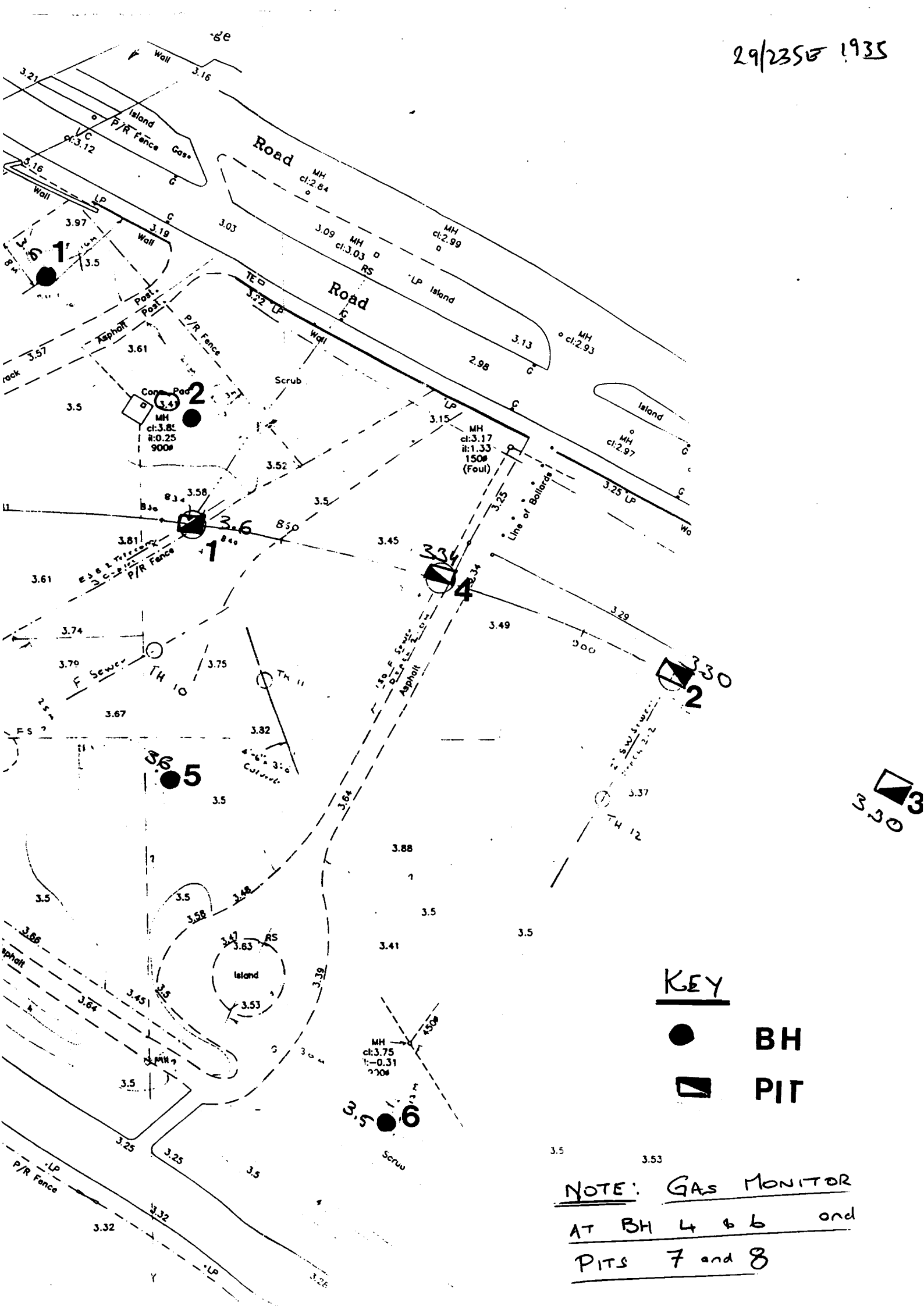
BOREHOLE NO.	SAMPLE NO.	DEPTH (METRES)	SAMPLE TYPE	TEST CODE	SULPHUR TRIOXIDE		pH VALUE
					PARTS SO_3 PER 100,000 WATER	PER CENT SO_3 SOIL	
2	6751	1.50	FILL-ash, cinders etc.	S		0.37	7.6
4	6763	3.00	FILL-ash, paper, clay etc.	S		0.13	7.5
6	6777	1.20	FILL-ash, clay, cinders	S		0.22	7.6
Pit 5	1472	2.00	FILL-ash, bones, clay	S		0.17	7.6
Pit 7	1473	1.50	FILL-Peat, ash, glass, paper etc.	S		0.31	7.6

TEST CODE W -WATER S .- SOIL A - AQUEOUS SOIL EXTRACT.

APPENDIX V - Site Plan


N
Bridge
Rail Line
Road
Road
School
School
Store
Path
Asphalt
P/R Fence
All Weather Track
Grass
Scrub
Track
Cable Duct
Island
Line of Bollards
KEY
BH
PIT
NOTE: GAS MONITOR
AT BH 4 & 6 and
PITS 7 and 8

29/235E 1935


Road
Road
Island
Island
Scrub
Asphalt
P/R Fence
Wall
Line of Bollards
TH 10
TH 11
TH 12
MH cl:2.84
MH cl:2.99
MH cl:3.03
MH cl:2.93
MH cl:2.97
MH cl:3.17 il:1.33 150ø (Foul)
MH cl:3.75
Culvert
1
2
3
4
5
6
KEY
BH
PIT
NOTE: GAS MONITOR AT BH 4 & 6 and PITS 7 and 8

Report No. 2233	TRIAL PIT RECORD	IGSL

Contract: FAIRVIEW	Sheet No.	Trial Pit No. 6
Location: DUBLIN	Excavation Method: JCB 62581	
Client: MALLAGH LUCE & PARTNERS/3 DUBLIN CORPORATION	Ground Level	
	Date: 24.5.93	

Description	Depth	Legend	Samples: Ref. No.	Samples: Type	Samples: Depth
TOPSOIL with numerous roots	0.40				
MADE GROUND - Very mixed fill with cinders, ash, paper, glass, metal, bones, tins etc. (Quite organic with strong odour)	2.90				

Ground Water Conditions
Water noted at 2.90m , after 30mins water at - 2.50

Remarks
Pit loose and unstable

62571

Report No. 2233	CORING RECORD	IGSL

Contract: **FAIRVIEW**

Borehole No. 2

Sheet

Location: **DUBLIN**

Type and Diameter: **Cable Tool 450mm**

Client: **MALLAGH LUCE & PARTNERS / DUBLIN CORPORATION**

Ground Level

Date: **20.5.93**

Description	Reduced Level	Legend	Depth	Samples Ref. No.	Samples Type	Samples Depth	Field Records And Tests
TOPSOIL over MADE GROUND of cinders, domestic fill, clay etc.				6751	D	1.50	(1.50)N=12
				6752	D	3.00	(3.00)N=13
			4.00				
Hard black silty sandy very gravelly CLAY				6753	D	4.50	(4.50)N=67
			5.50				
Broken grey LIMESTONE				6754	D	6.00	(6.00)50/50mm & refusal
			7.00	6755	D	7.00	

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
20.5.93	3.00	3.00	3.00	Water noted
	7.00	Nil	3.00	End of boring

Remarks

Chiselling 4.00-7.00=2½hrs

Sample/Test key

U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

Report No. 2233	TRIAL PIT RECORD	IGSL

Contract: FAIRVIEW		Sheet No.	Trial Pit No. 8
		Excavation Method: JCB 62583	
Location: DUBLIN			
Client: MALLAGH LUCE & PARTNERS DUBLIN CORPORATION		Ground Level	
		Date: 25.5.93	

Description	Depth	Legend	Samples		
			Ref. No.	Type	Depth
TOPSOIL	0.20				
Compact hardcore FILL with brick,concrete, gravel	0.75				
Very loose very dark organic FILL with paper,glass,brick,ash,bone etc. (Paper dated 1963)			1474	D	2.00
	3.00				

Ground Water Conditions

Water ingress in granular fill at 0.50m. Water at 2.90m

Remarks

Pit loose and collapsing

62570

Report No. 2233	BORING RECORD	IGSL

Contract: **FAIRVIEW**

Borehole No. **1**

Sheet

Location: **DUBLIN**

Type and Diameter: **Cable Tool 450mm**

Client: **MALLAGH LUCE & PARTNERS / DUBLIN CORPORATION**

Ground Level

Date: **18.5.93**

Description	Reduced Level	Legend	Depth	Samples Ref. No.	Samples Type	Samples Depth	Field Records And Tests
MADE GROUND - with ash,cinders, clay,glass,paper				6745	D	1.00	(1.50)N=27
				6746	D	3.00	(3.00)N=19
			4.00				
Stiff to hard black silty sandy very gravelly CLAY with cobbles and boulders				6747	D	5.00	(4.50)N=47
			5.50	6748	D	5.50	
Broken grey LIMESTONE with bands of grey clay							(6.00)33/25mm & refusal
			6.50	6749	D	6.50	
Hard grey LIMESTONE			7.00	6750	D	7.00	

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
18.5.93	7.00	7.00	Nil	No free water

Remarks: Chiselling 5.50-7.00=3hrs

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

62572

Report No. 2233

BORING RECORD

IGSL

Contract: **FAIRVIEW**

Borehole No. 3

Sheet

Location: **DUBLIN**

Type and Diameter: **Cable Tool 450mm**

Client: **MALLAGH LUCE & PARTNERS / DUBLIN CORPORATION**

Ground Level

Date: **21.5.93**

Description	Reduced Level	Legend	Depth	Samples Ref. No.	Type	Depth	Field Records And Tests
TOPSOIL over MADE GROUND of ash,rubble,glass,paper,brick, gravel				6756	D	1.00	(1.20)N=9
				6757	D	2.00	(3.00)N=22
			3.50	6758	D	3.50	
Grey very silty clayey GRAVEL			4.00				(4.00)N=51
Compact fine to coarse GRAVEL			4.50	6759	D	4.40	
Hard black silty sandy gravelly CLAY				6760	D	5.00	(5.00)N=39/150mm
Broken grey LIMESTONE			5.50	6761	D	6.00	(6.00)50/50mm & refusal
			6.50				

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
21.5.93	3.00	3.00	3.00	Water noted
	6.00	6.00	6.00	Water noted

Remarks

Chiselling 5.50-6.50=3hrs

Sample/Test key

U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

62573

Report No. 2233	BORING RECORD	IGSL

Contract: **FAIRVIEW**	Borehole No. **4** Sheet
Location: **DUBLIN**	Type and Diameter: **Cable Tool 450mm**
Client: **MALLAGH LUCE & PARTNERS / DUBLIN CORPORATION**	Ground Level
	Date: **22.5.93**

Description	Reduced Level	Legend	Depth	Samples Ref. No.	Samples Type	Samples Depth	Field Records And Tests
MADE GROUND - Topsoil over ash, rubble, bags, paper, clay				6762	D	1.00	(1.20)N=11
				6763	D	3.00	(3.00)N=14
Compact grey silty GRAVEL			4.10				
			4.50	6764	D	4.50	(4.50)N=49
Stiff to hard grey black silty sandy gravelly CLAY with cobbles and boulders				6765	D	5.50	(6.00)N=57
Hard black very gravelly CLAY with traces of limestone			6.50	6766	D	6.50	(7.50)N=49/150mm
				6767	D	8.00	
Hard grey LIMESTONE			8.50	6768	D	8.50	(8.50)50/25mm & refusal
			8.80				

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
22.5.93	3.00	3.00	3.00	Seepage
	6.50	6.50	6.50	Water noted
	8.80	Nil	3.00	Final level

Remarks

Chiselling in boulder clay = 1½hrs
Chiselling in Limestone = 2hrs

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

62574

Report No. 2233	BORING RECORD	IGSL

Contract	Borehole No. 5
FAIRVIEW	Sheet
Location DUBLIN	Type and Diameter Cable Tool 450mm
Client MALLAGH LUCE & PARTNERS DUBLIN CORPORATION	Ground Level
	Date 24.5.93

Description	Reduced Level	Legend	Depth	Samples Ref. No.	Type	Depth	Field Records And Tests
MADE GROUND - Topsoil over rubble,ash,stones,glass,paper, tins etc.				6769	D	1.20	(1.20)N=7
				6770	D	3.00	(3.00)N=14
Grey silty GRAVEL			4.00	6771	D	4.10	
Stiff to hard black silty stony CLAY with cobbles and boulders and traces of grey Limestone below 6.00m			4.50	6772	D	4.70	(4.50)N=39
				6773	D	6.00	(6.00)N=47
				6774	D	7.80	(7.50)N=61
Grey LIMESTONE			8.00	6775	D	8.30	
			8.30	6776	W	WATER	

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
24.5.93	3.30	3.30	3.30	Seepage
	7.00	7.00	7.00	Water noted
	8.30	8.00	3.00	End of borin

Remarks
Chiselling in boulders and in Limestone = 3hrs

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

62575

Report No. 2233	BORING RECORD	IGSL

Contract: **FAIRVIEW**

Borehole No. **6**

Sheet

Location: **DUBLIN**

Type and Diameter: **Cable Tool 450mm**

Client: **MALLAGH LUCE & PARTNERS / DUBLIN CORPORATION**

Ground Level

Date: **25.5.93**

Description	Reduced Level	Legend	Depth	Samples Ref. No.	Samples Type	Samples Depth	Field Records And Tests
TOPSOIL over MADE GROUND of clinkers,ash,loose paper, glass,metal etc. below 2.00m				6777	D	1.20	(1.20)N=11
				6778	D	3.00	(3.00)N=5
Hard grey black very silty sandy gravelly CLAY			4.00	6779	D	4.00	(4.50)N=43
				6780	D	5.50	
Grey LIMESTONE fragments			6.00	6781	D	6.00	(6.00)36/75mm & refusal
			6.50	6782	W	WATER	

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
25.5.93	3.00	3.00	3.00	Seepage
	4.00	4.00	Nil	Water sealed
	6.50	Nil	3.00	Final level

Remarks

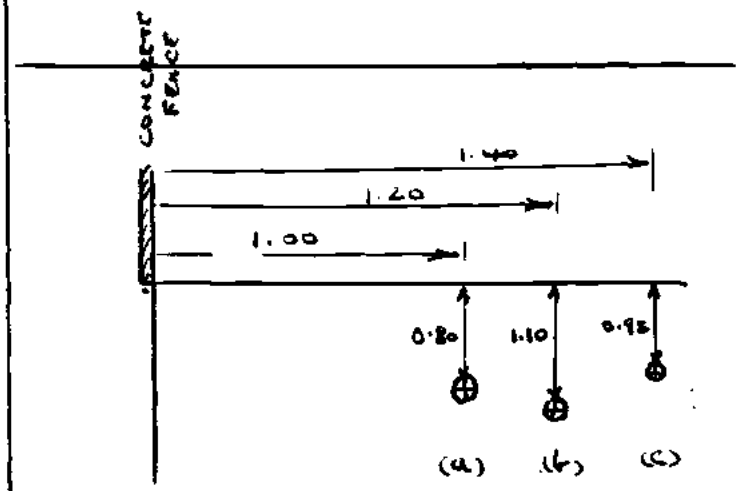
Chiselling 4.00-6.50=2hrs in boulders and limestone

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

Report No. 2233	TRIAL PIT RECORD	IGSL

Contract: FAIRVIEW	Sheet No.	Trial Pit No. 1 62576
Location: DUBLIN	Excavation Method: By Hand	
Client: MALLAGH LUCE & PARTNERS	Ground Level	
	Date: 25.5.93	

Description	Depth	Legend	Samples: Ref. No.	Type	Depth
Topsoil over made ground of rubble, ash, clay etc.	1.50				



(a)75mm PVC
(b)50mm PVC
(C)50mm Cast Iron

Ground Water Conditions

DRY

Remarks

SERVICES LOCATED AS SHOWN

Report No. 2233	TRIAL PIT RECORD	IGSL

Contract	FAIRVIEW	Sheet No.	Trial Pit No. 2
Location	DUBLIN	Excavation Method JCB	62577
Client	MALLAGH LUCE & PARTNERS / DUBLIN CORPORATION	Ground Level	
		Date 24.5.93	

Description	Depth	Legend	Samples		
			Ref. No.	Type	Depth
TOPSOIL	0.20				
MADE GROUND - clay,rubble,brick,concrete fragments,ash & cinders	2.20				

Ground Water Conditions

DRY

Remarks

No services noted
Pit sides slightly unstable .

Report No. 2233	TRIAL PIT RECORD	IGSL

Contract	FAIRVIEW	Sheet No.	Trial Pit No. 3
Location	DUBLIN	Excavation Method	62578 JCB
Client	MALLAGH LUCE & PARTNERS/ DUBLIN CORPORATION	Ground Level	
		Date	24.5.93

Description	Depth	Legend	Samples		
			Ref. No.	Type	Depth
TOPSOIL	0.20				
MADE GROUND - clay,ash,glass,cinders, bricks etc.					
CONCRETE	1.90				

Ground Water Conditions

Seepage at 1.70m.

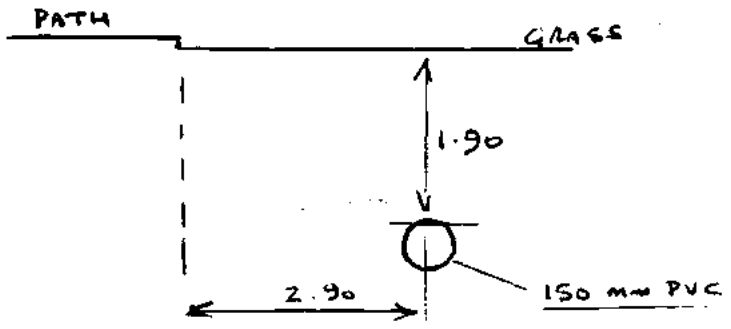
Remarks

Concrete Haunch to pipe recorded at 1.90m in pit centre.

Report No. 2233	TRIAL PIT RECORD	IGSL

Contract	FAIRVIEW	Sheet No.	Trial Pit No. 4
		Excavation Method	JCB 62579
Location	DUBLIN		
Client	MALLAGH LUCE & PARTNERS DUBLIN CORPORATION	Ground Level	
		Date	25.5.93

Description	Depth	Legend	Samples		
			Ref. No.	Type	Depth
TOPSOIL	0.20				
MADE GROUND - granular rubble, gravel, bones and glass	2.00				



Ground Water Conditions

DRY

Remarks

150mm Wavin Sewer noted.
1.90m to crown of pipe from surface.
Pipe at 2.90m in from edge of footpath .

Report No. 2233	TRIAL PIT RECORD	IGSL

Contract: FAIRVIEW		Sheet No.	Trial Pit No. 5
Location: DUBLIN		Excavation Method: JCB	62580
Client: MALLAGH LUCE & PARTNERS / DUBLIN CORPORATION		Ground Level	
		Date: 24.5.93	

Description	Depth	Legend	Samples		
			Ref. No.	Type	Depth
TOPSOIL with tree roots	0.30				
MADE GROUND - Cinders,ash,bones,glass, metal,sand and gravel *Root growth to 0.75m			1472	D	2.00
	3.20				

Ground Water Conditions

Water ingress at 3.00m

Remarks

Pit reasonably stable.
Very wet weather conditions .

Report No. 2233	TRIAL PIT RECORD	IGSL

Contract	FAIRVIEW	Sheet No.	Trial Pit No. 7
Location	DUBLIN	Excavation Method	JCB 62582
Client	MALLAGH LUCE & PARTNERS / DUBLIN CORPORATION	Ground Level	
		Date	25.5.93

Description	Depth	Legend	Samples		
			Ref. No.	Type	Depth
TOPSOIL with root fibres					
	0.45				
Loose to medium dense dark organic FILL with paper , glass,cardboard,wire, chipboard etc.					
Strong organic odour					
(Paper dated 1963)			1473	D	1.50
	2.70				

Ground Water Conditions

Water noted at 2.70m

Remarks

Pit collapsing from 2.00m

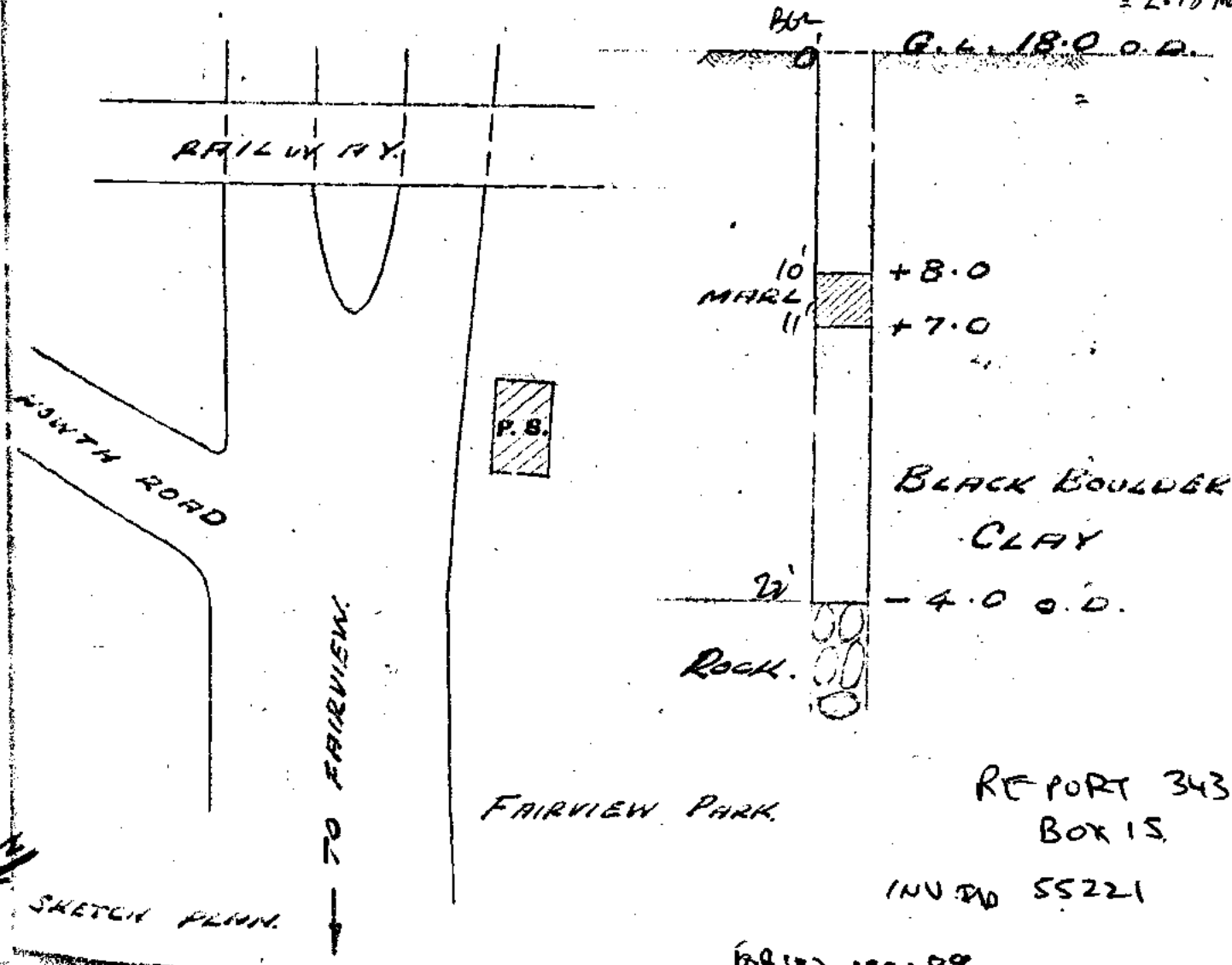
APPENDIX F

CLONTARF PUMP STATION BOREHOLE DETAILS

CLONTARF P.S.

BED ROCK −4·0 O.D.

= 2.78 m Metric



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BOX 15
INV NO 55221

FOR '82 see 189