



Preliminary Site Assessment Report for Monaghan Road, Cork City

ESB Site Ref: 38
Marina – Trabeg Two 110kV

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LIMITATION

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This report is intended as a preliminary stage assessment of the site in question and, as such, all assessments and analysis of the environmental aspects of the site, whilst based on the best-available data and information, are theoretical and conservative in nature. Any risks identified within this report are entirely potential in nature and based on the most-conservative risk analysis scenario and the available information. This is in-keeping with best practice guidelines and does not necessarily reflect the actual environmental scenario on site. Further environmental information, as it becomes available, would likely change the assessments and analysis contained within this report.

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EXECUTIVE SUMMARY

This preliminary environmental site assessment consists of a review of the potential environmental impact associated with a known hydrocarbon leak that occurred from a buried power cable on Monaghan Road, Cork City (ESB Ref: 38). There was another leak within 15m of this location on Monaghan Road, in November 2005, identified as ESB Site Ref: 51 Marina – Trabeg Two 110 kV. This nearby leak point is the subject of a separate report.

This report is intended as a preliminary stage assessment of the site in question and, as such, all assessments and analysis of the environmental aspects of the site, whilst based on the best-available data and information, are theoretical and conservative in nature. Any risks identified within this report are entirely potential in nature and based on the most-conservative risk analysis scenario and the available information. This is in-keeping with best practice guidelines and does not necessarily reflect the actual environmental scenario on site. Further environmental information, as it becomes available, would likely change the assessments and analysis contained within this report.

There was an approximate volume of 3,555 litres of cable fluid consisting of linear alkyl benzene (LAB) lost to ground from the leak on Monaghan Road over an unknown period of time up to October 2008. The leak was repaired in October 2008.

The known leak point is located on the northern side of Monaghan Road, underneath the footpath, adjacent to a disused/vacant green area of vegetation. The primary land use in the area is mixed commercial and industrial with small areas of open space defined throughout the surroundings; typically, along roadsides and near drainage channels. The nearest residential property is located 200m southeast of the leak point. There is evidence of abundant site services in the roadway, the grass verge and concrete footpaths with manhole covers and service kiosks. There is no physical evidence of hydrocarbon contamination on the surface in terms of oil odours/staining or impact to vegetation.

The cable section in question is underlain by a large, regionally important gravel aquifer (Rg), as classified by the GSI. This aquifer represents the primary environmental receptor for any contaminants. This aquifer is thought to be highly permeable and more than 10m thick (up to 50m locally).

The cable section is underlain by several bedrock formations. The northern section of the site is underlain by a locally important, moderately productive (LI), bedrock aquifer of the Cuskinny Member of the Kinsale Formation. The central section of the site, and location of the leak point, is underlain by the locally important bedrock aquifer (LI), Ballysteen Formation. The southern section of the site is underlain by Waulsortian Limestones which are comprised a regionally important, karstified, diffuse production, bedrock aquifer (Rk).

The groundwater vulnerability in the northern and central areas of the cable route are classified as Moderate, suggesting some combination of moderate-low permeability soils and subsoils of 5-10m in thickness. The groundwater vulnerability in the southern-most section of the cable route, proximal to the leak point, is classified as High, suggesting that the area is underlain by some combination of higher permeability soils of lesser thickness. Bedrock is exposed to the immediate south of the leak point, at the location of a historic quarry site. Moderately permeable Made Ground subsoils are mapped across the cable length.

The nearest surface watercourse is an artificial drainage channel located 45m north of the leak point which drains eastwards into Atlantic Pond and, in turn, the Lee Estuary. Also in the area, are other drainage channels which lie along the southern and northern sides of Centre Park Road; also draining to Atlantic Pond.

There are no known groundwater abstraction wells within 1km of the site; however, several apparent geotechnical boreholes are recorded in the GSI well database within 1km of the leak point.

At the time of reporting, Irish Water have examined all available drinking water quality sample data and have concluded that there is no evidence that COPCs from the leak site have infiltrated the local drinking water supply. This evaluation is based on a review of all samples taken from customer-points, between 2014 and 2019; which showed no evidence that the COPCs (PAHs and Benzenes) were present in the water supply at levels above drinking water standards (PAHs: 0.1µg/L; Benzene: 1.0µg/L). These results (which are from samples taken at the customer tap) would not indicate that leaks from fluid filled cables have contaminated the drinking water supply for these areas, or at least to an extent where any contamination arising has resulted in a breach of the parametric value for PAHs and Benzene (Appendix G).

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 a potential Low risk posed by LAB 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 contact with suspected contamination in the soil and groundwater through permeation of contamination through plastic water pipes or through low-pressure infiltration of possible soil contamination into water pipes via nearby breaks or leaks;
- hydrocarbon vapours in preferential pathways such as services ducts to nearby building users;

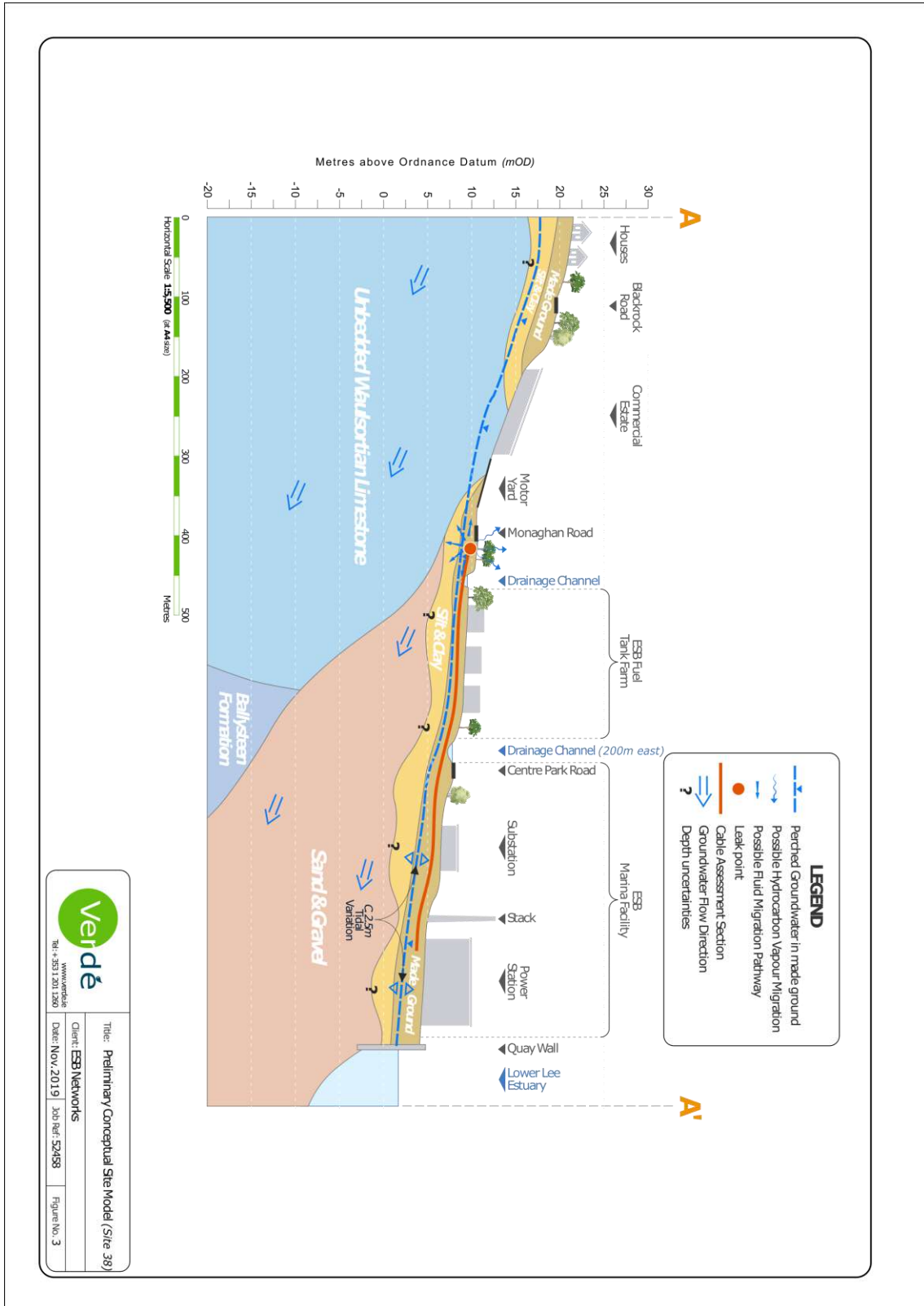
There is a Low/Moderate risk posed by LAB in suspected contamination in the soil and groundwater through;

- 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 commercial urban and tidally influenced setting.

There is a potentially Moderate risk posed by LAB in suspected contamination in the soil and groundwater through;

- hydrocarbon migration to the Atlantic Pond and Lee Estuary given the existence of a hydrogeological pathway between the leak site and the local drainage channels and the Atlantic Pond downstream.
- hydrocarbon migration downwards to the underlying aquifer given the possible connection to shallow groundwater through shallow rock and gravels in the area indicated by the moderate to high vulnerability.

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: 52582 | 6 th March 2020 | Draft |
| 1.2 | DETAILED SITE ASSESSMENT | | | |
| 1.3 | QUANTITATIVE RISK ASSESSMENT | | | |
| STAGE 2: CORRECTIVE ACTION FEASIBILITY & DESIGN | | | | |
| 2.1 | OUTLINE CORRECTIVE ACTION STRATEGY | | | |
| 2.2 | FEASIBILITY STUDY & OUTLINE DESIGN | | | |
| 2.3 | DETAILED DESIGN | | | |
| 2.4 | FINAL STRATEGY & IMPLEMENTATION PLAN | | | |
| STAGE 3: CORRECTIVE ACTION IMPLEMENTATION & AFTERCARE | | | | |
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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 several locations where there were leaks of cable fluids. This report focuses on a hydrocarbon leak on Monaghan Road from a decommissioned 110 kV power cable associated with the Marina substation facility in the Marina Commercial Park, Cork City. (ESB Ref: 38 Marina – Trabeg Two 110 kV).

A site visit was undertaken by an experienced Verde Environmental Consultant on 15th November 2019 to examine the area of the known cable leak point and to record evidence of contamination and relevant observations with regard surrounding land use 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 supplied 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 operate 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 cables can develop leaks due to corrosion / fracture/ defects in the cable sheath and in joints and terminations. When such leaks occur, there is potential for contamination to occur and impact upon surface water, groundwater, soils and ecology.

This preliminary environmental site assessment consists of a review of the potential environmental impact associated with a known hydrocarbon leak that occurred from a buried power cable on Monaghan Road, Cork City (ESB Ref: 38). It is estimated 3,555 litres (l) of cable fluid, consisting of linear alkyl benzene (LAB) was lost to ground from the leak adjacent to Monaghan Road over a one-month period from October 2008 until the repair date also in October 2008. There was another leak within 15m of this location on Monaghan Road, in November 2005, identified as ESB Site Ref: 51 Marina – Trabeg Two 110 kV. This nearby leak point is the subject of a separate report.

The preliminary site conceptual model illustrating the contamination source, possible pathways and receptors is presented in Figure 3 and Figure 4 and is discussed in detail in this report.

Details on the physical and chemical aspects of the hydrocarbon products used as insulating fluids in the cables 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 recommended in best practice documents produced by the Environmental Protection Agency (Agency) 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 Agency 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 to meet the objectives of the brief, the following scope of works was completed:

- A desk study review of available historical, geological, 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. Detailed maps on cable routes with indicative leak locations and likely joint sections of leaks was provided by the ESB and taken into consideration.
- Site walkover to establish as much information as possible regarding site operations, surrounding activities and land use, observed evidence of contamination and remedial measures.
- Preparation of report in accordance with best practice guidance, including description of desk study findings and site walkover observations and develop a preliminary conceptual model for the site.

1.5. SCOPE OF ANALYSIS & CONCLUSIONS

This report is intended as a preliminary stage assessment of the site in question and, as such, all assessments and analysis of the environmental aspects of the site, whilst based on the best-available data and information, are theoretical and conservative in nature. Any risks identified within this report are entirely potential in nature and based on the most-conservative risk analysis scenario and the available information. This is in-keeping with best practice guidelines and does not necessarily reflect the actual environmental scenario on site. Further environmental information, as it becomes available, would likely change the assessments and analysis contained within this report.

As such, the reader is encouraged to view the findings, conclusions and recommendations contained within this report as the most-conservative, theoretically possible environmental scenario; and not necessarily the actual scenario currently persisting on the site question.

2. SOURCE AUDIT FINDINGS – PRODUCTION & OPERATIONAL HISTORY

2.1. CURRENT SITE OPERATIONS

The leak is understood to have occurred in October 2008 and was repaired later in October 2008. The known leak point is located on the northern side of Monaghan Road, underneath the footpath, adjacent to a disused/vacant green area of vegetation. An estimated quantity of 3,555 litres of linear alkyl benzene (LAB) is understood to have escaped. No discernible evidence of hydrocarbon contamination on the surface in terms of odours or staining or impact to vegetation was observed.

Possible evidence of remediation/investigation works are evident in the form of the replacement of a section of footpath above the known leak point (Appendix C). There is no indication that vegetation in the grass verge has been impacted by the leak (no discoloration or noticeable impact of nearby tree growth).

Immediately north of the leak point, a green vegetated and apparently disused area is observable. 50m to the north of the leak point, a shallow, wide drainage channel runs from southwest to northeast. This channel makes up a part of the network of storm drainage channels that drain the Marina Commercial Park and surrounding areas. The channels are typically low-flow and often semi-stagnant. North of this drainage channel, the southern boundaries of two large active, and decommissioned fuel storage depots is located. Between 60-100m to the northeast and northwest of the leak point, on the south side of the Centre Park Road, there are two former and current fuel storage depots. The depot to the northwest is now defunct, with the storage tanks removed. The site now contains tank footprints within a large concrete-bermed plot which is largely overgrown and containing rainwater. Immediately to the east of this disused tank farm, another tank farm is located with large existing tanks present above ground. Both of these tank farms are/were used to store fuel for the generation of electricity in the former Marina power station which operated as a coal and oil-fired power station from 1954 to 1979. In 1979, ESB converted the station to a combined cycle generation facility with the addition of a gas turbine unit. The power generation facility was decommissioned in 2018/2019 and is currently idle. The coal storage depot of the former power plant is located 450m northeast of the known leak point and can be seen to contain some coal materials.

Progressing to the north, the cable route crosses the drainage channel and into an ESB fuel storage facility. The cable follows along the western side of a chain link fence within the facility, underneath a gravel access route. No physical evidence of contamination was noticed in the gravel pack during a separate site visit by Verde personnel on 30th July 2019.

Across the Centre Park Road to the north of the fuel storage areas, the entrance to the ESB Marina generation facility is located. Along the concrete road that runs from south to north within the ESB's Marina facility, the cable follows along the western side of the road. A distinct concrete section of roadway can be seen along the route which is associated with the cable (Appendix C). The cable runs for 200m along this road until it crosses to the eastern side of the road and enters a substation/transformer unit within the grounds of the ESB Marina facility. No visible signs of contamination were observed along this route during a separate site visit by Verde personnel on 30th July 2019 (Appendix C).

Walking eastwards from the entrance of the ESB Marina facility, along the Centre Park Road, an earthen drainage channel was observed on the north side of the road, approximately 150m from the leak point (Appendix C). This channel was seen to host a very low flow of clear water and was relatively slow moving/near stagnant at the time of the walkover. Across the road at this point, another drainage channel was observed on the south side of the Centre Park Road which showed a

similarly low, clear and stagnant level of water.

Immediately south of the known leak point; the southern side of Monaghan Road is occupied by varied commercial and retail premises, including a portacabin leasing premises and the large office building of Tellengana House; which hosts several financial and commercial enterprises.

Immediately to the east of the known leak point, and along Monaghan Road; a Greenstar municipal recycling centre is located.

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 potential for preferential lateral migration from the leak point along the underground services routes.

2.2. PREVIOUS SITE OPERATIONS

This area of Cork was used as the “Town Park” and racing grounds up to some point in the early 20th century as shown in the historical desk study maps in Appendix B. There is a notable change in land use seen between the 25-inch maps (1883-1913) and the Cassini 6-Inch Maps (likely 1940’s). Between these periods, the land use changed from the largely recreational and open-space parkland of the “City Park” and racecourse to a commercial and industrial area containing industries such as the Ford and Dunlop Works (automotive and tyre manufacturers).

The ESB power cable was installed in the area in 1972. Further details on the site history are presented in section 3.2.

2.3. CHEMICALS OF POTENTIAL CONCERN (COPC)

The fluid in the electrical cables is Linear Alkyl Benzenes (T3788). Material Safety Data Sheets (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 (0.041 mg/l), 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;
- 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 under aerobic conditions 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, 2011);

- Does not bio accumulate;
- The Predicted No Effect Concentration (PNEC) is the concentration of a chemical which marks the limit at which below 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, 2011).

3. SITE ENVIRONMENTAL SETTING

3.1. GENERAL INTRODUCTION

The cable of interest and leak site is located on the northern side of Monaghan Road. The main land use in the area is commercial with some roadside green spaces and buffer zones. The nearest residential property is located approximately 200m to the southeast of the leak point. The cable route runs north to south from the Marina Commercial Park in the North, across the Centre Park Road and south as far as the leak point on Monaghan Road. The northern section of the cable, which runs through the Marina Commercial Park, is adjacent to several commercial premises including a furniture outlet, architecture office, fitness gym and crash repair facility. The cable then progresses from the leak point, westward, along Monaghan Road, along which; multiple commercial and retail premises are located.

The nearest surface watercourses were observed during a site walkover on 15th of November 2019. The closest drainage channel is located at 45m north of the leak point, which flows towards the Atlantic Pond; which then drains into the Lee Estuary. Several other drainage channels were also observed in the site area. A drainage channel runs along the south side of the Centre Park Road, which appears to serve as an artificial storm water drainage channel that flows to the east towards the Atlantic Pond and the Lee Estuary. These drainage channels were seen, during the walkover, to be very low flow systems with some visible signs of contamination, in the form of a greyish-blue cloudy hue; as seen in Appendix C. Considering the location and low-flow nature of the drainage channel, it is not certain if the discolouration is related in, any manner, to the loss of cable fluids nearby.

The River Lee/Lee Estuary is located 600m to the north of the leak point and 180m north of the northernmost section of cable this report is concerning. Topographic data from the GSI (LiDAR) and EPA (contours) show that the Marina Commercial Park is generally flat with sea level being defined by the quayside wall to the north of the commercial park. The ground level begins to slightly increase southwards from the southern boundary of the commercial estate.

Under the Water Framework Directive, the Lower Lee Estuary (WFD ID: IE_SW_060_0900) transitional water body, has been assigned “Moderate” overall status and has also been classed as being “At Risk” of deteriorating in the future, as presented in the Water Framework Directive transitional water body report in Appendix E.

The Lower Lee Estuary connects to the Cork Harbour Special Protection Area (SPA) (Site Code: 4030). This SPA is located approximately 3.0km east of the nearest point of the Lower Lee Estuary to the leak location. Cork Harbour is designated as a SPA for its role in supporting a number of bird and invertebrate species. The two drainage channels located 200m south and 250m east of the leak point, both drain eastwards into the Atlantic Pond and, subsequently, the Lee Estuary, approximately 1km east of the leak point.

The cable section in question is underlain by a large, regionally important gravel aquifer (Rg), as classified by the GSI, extending from the lower marina quays, as far as the Upper Lee Valley, approximately 15km to the west. This aquifer represents the primary environmental receptor for any contaminants. Typically, the aquifer types support regionally important water abstractions such as large public water supplies with typically excellent yields of >400m³ /day. This aquifer is thought to be highly permeable, more than 10m thick (up to 50m locally) and covers an area of 11.58km²;

comprising the majority of the Lee Valley. Groundwater flow in this aquifer is typified by intergranular flow through relatively uniform gravel pack. The groundwater gradient in this part of the aquifer is relatively low, with both the topography and water table being nearly flat. There is a generally strong interaction between gravel aquifers and surface water with a vice-versa relationship of discharge directions between the two depending on water levels and recharge.

The groundwater body in this area is described in the Water Framework Directive the “CorkCity2” groundwater body (WFD ID: IE_SW_G_031), which covers the majority of the Lee Valley and corresponds to the Lee Valley Gravel aquifer. This groundwater body has been assigned “Good” overall status and has also been classed as being “At Risk” of deteriorating in the future, as presented in the Water Framework Directive River Body report in Appendix E.

There are no known groundwater wells within 1km of the site; however, several boreholes (geotechnical) are recorded in the GSI well database within 1km of the leak point. A cluster of boreholes are located approximately 750m to the south of the leak point, in Ballintemple, whilst another cluster is recorded 800m to the west in the location of the Marina Filling Station on Victoria Road. The database indicates that both these clusters of boreholes are related to geotechnical investigations and are not thought to be producing groundwater wells.

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 | <p>National Monuments Service:</p> <p>There are several monuments and listed structures located within 1km of the site according to the National Monument Service. The closest of these are two souterrains recorded on the Blackrock Road and Boreenmanna Road, 650m and 800m to the southeast of the site respectively. Also within 1km of the site are several other national monuments, most of which are various churches and house on the north side of the Lee Estuary. Within 1km of the site, there are numerous listed structures designated on the National Inventory of Architectural Heritage (NIAH) which include a wide range of iconic, distinct and historical structures.</p> |
| | <p>Historic Mapping:</p> <p>OSI 6 inch map (Black and White) (1837-1842):</p> <p>From this map it appears that the area of the wider Marina Commercial Park and the now-developed Cork docklands, comprised a large greenspace called City Park. This area appears to have been a large, open parkland likely resulting from drained estuary lands. Contained within the park, a large racetrack for horses; with associated grandstands to the southwest, training tracks and access routes. Approximately 1km to the southwest of the site, in the</p> |

| | |
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| | <p>current location of Gas Network Ireland’s HQ; a gas works site is shown on the map. These maps show several “Gasometers” or large gas holding tanks, tar tanks and other handling infrastructure. The boundary of the Lee Estuary appears to be relatively natural in these maps, with no artificial embankment, railway or boat ramps visible. It is likely that the Lee Estuary in these maps was generally unmodified and narrower.</p> <p>OSI 25 inch map (Black and White) (1888-1913):</p> <p>The area of the leak point remains largely unchanged from the previous map; with the City Park still in place and no evidence of commercial or industrial activity in the site area. Several notable changes in the surrounding area include the addition of the Cork, Blackrock & Passage railway which follows the southern boundary of the City Park, along part of what is now Monahan’s Road. A slightly older OSI map from 1869 shows the railway following north of the City Park, along the Marina Walk area. It is possible the railway was reconstructed to the south to accommodate the development of the Marina Commercial area. Also noted, is the modification of the estuary boundary, with a wharf and associated landing places recorded. The position of the wharf resembles that of the modern day quay.</p> <p>Cassini 6 inch (1830-1930):</p> <p>This map series shows a marked change in the area from recreational and greenspace to industrial and commercial development. The City Park has been replaced with several large industrial premises including; the Ford Works and Dunlop Works, both of which were large automotive industries. The Centre Park Road is noted in this map as well as several additional drainage channels, likely installed to dewater and stabilise the former parkland for commercial use. Considering the level of development seen in this map series, it is likely that the map represents a later edition of the Cassini 6-inch mapping series; possibly in the early 20th century.</p> <p>The ESB power cable is reported to have been laid in the area in the 1972.</p> |
| <p>Aerial Photos</p> | <p>Aerial Photo 1995:</p> <p>The area is similar to that of present day with the Marina Commercial Park and associated warehouses, depots and Power Station visible. The road layout and position of commercial and nearby residential properties remains largely the same as present times. The western tank farm on the south side of the Centre Park Road appears to still be in use, with the tanks and berms in place. Also notable, is the absence of the newer Marina substation unit within the ESB Marina facility.</p> <p>Aerial Photo 2000:</p> <p>The road layout, positions of residential and commercial properties remains the same as the previous image. The notable change is that the gas works site to the southwest of the Marina Commercial Park, appears to have been decommissioned; and the development of the current office building was underway.</p> <p>Aerial Photo 2005:</p> <p>The road layout, positions of residential and commercial properties remains the same as the previous image. The lot to the immediate east of the Marina Power Station shows evidence of stockpiling of coal. The purpose and use of this coal is not certain but it is not thought that</p> |

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| | coal was being used as fuel in the station at this point and it is more likely that the stockpile relates to local coal suppliers in the area. |
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3.3 REGIONAL GEOLOGY AND HYDROGEOLOGY

The cable section in question runs for a length of approximately 450m over the boundary of several geological formations; which is oriented east west, thus dividing the ground underlying cable section into a northern, central and southern area as illustrated in Appendix B.

The nearest surface watercourses were observed in the Marina area during a site walkover on 30th of July and 15th November 2019. Several drainage channels were observed in the area of the proposed site. A drainage channel runs along the south side of the Centre Park Road, which appears to serve as an artificial storm water drainage channel that flows to the east towards the Atlantic Pond and the Lee Estuary. Another drainage channel is located at the southern end of the cable section, which also flows towards the Atlantic Pong which then drains into the Lee Estuary. These drainage channels were seen, during the walkover, to be very low flow systems with no visible signs of contamination as seen in Appendix C.

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.

- Cork City Council (Planning and Environment Sections)
- Ordnance Survey 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 | <p>The site is overall, generally flat with a very gently slope to the north and northeast towards the nearby Lee Estuary. The site occupies a historically reclaimed section of tidal estuary and is largely artificially surfaced. Topographic data from the GSI (LiDAR) and EPA (contours) show that the Marina Commercial Park is generally flat with sea level being defined by the quayside wall to the north of the commercial park. To the south, the ground level begins to slightly increase southwards from the southern boundary of the commercial estate towards Blackrock from 5mOD to 25mOD.</p> |
| Geology | <p>Overburden:</p> <p>The GSI and EPA databases describe the soils and subsoils at the site as Made Ground. Geotechnical reports from within the Marina Commercial Park, show approximately 3-4m of Made Ground and 3-5m of silt and clay which is underlain by up to 50m of sand and gravel known as the Lee Valley Gravels.</p> <p>Solid Geology:</p> <p>The cable section in question runs north to south across several geological formation boundaries which comprise the northern limb of the Cork geological syncline. The formations underlying the site, generally dip at a high angle (70-80°) to the south. The site is also located on the southern side of the Lee River Valley, and as such, bedrock shallows rapidly to the south, with outcropping bedrock recorded 375m to the south of the leak point.</p> <p>The northern section of the site is underlain by the flaser bedded sandstones and mudstones of the Cuskinny Member of the Kinsale Formation. The central section of the site, and location of the leak point, is underlain by the dark muddy limestones of the Ballysteen Formation. The southern section of the site is underlain by Waulsortian Limestones which are comprised of massive unbedded limestones (typically fine-grained micrites).</p> |
| Hydrogeology | <p>Regional Classification:</p> <p>According to the GSI the Lee Valley Gravels, which are up to the 50m thick and underlie the entirety of the site, represent a regionally important gravel aquifer (Rg). These gravels extend from the lower marina quays, as far as the Upper Lee Valley, approximately 15km to the west. This aquifer represents the primary environmental receptor for any contaminants. Typically, the aquifer types support regionally important water abstractions such as large public water supplies with typically excellent yields of >400m³/day. This aquifer is thought to be highly permeable, more than 10m thick (up to 50m locally) and covers an area of 11.58km²; comprising the majority of the Lee Valley.</p> <p>Underlying the Lee Valley Gravels, at an unknown depth, are several bedrock aquifers. The northern section of the site is underlain by a locally important, moderately productive (LI), bedrock aquifer of the Cuskinny Member of the Kinsale Formation. The central section of the site, and location of the leak point, is underlain by the locally important bedrock aquifer (LI), composed of the Ballysteen Formation. The southern section of the site is underlain by Waulsortian Limestones which represent a regionally important, karstified, diffuse production, bedrock aquifer (RK).</p> <p>Vulnerability:</p> <p>The groundwater vulnerability in the northern and central areas of the site is classified as Moderate, suggesting some combination of moderate-low permeability soils and subsoils of 5-10m in thickness. The groundwater vulnerability in the southern-most section of the site is classified as High, reflecting the shallowing of bedrock to surface and the thinning of</p> |

| | |
|-------------------------------|--|
| | <p>overlying, less-permeable silt and clay subsoils. Geological Survey of Ireland and Teagasc soil and subsoil maps show that the entire length of the cable section is classed as moderately permeable Made Ground deposits. The presence of Waulsortian Limestone in the southern areas of the site may represent an additional risk to groundwater due to the tendency of such bedrock to host karstic features.</p> <p>Groundwater Body:</p> <p>The groundwater body in this area is described in the Water Framework Directive as the Cork_City_2 groundwater body (WFD ID: IE_SW_G_031) which covers the majority of the Lee Valley and corresponds to the Lee Valley Gravel aquifer. This groundwater body has been assigned “Good” overall status and has also been classed as being “At Risk” of deteriorating in the future, as presented in the WFD report in Appendix E.</p> <p>Well Search:</p> <p>There are no known groundwater wells within 1km of the site. Several boreholes (geotechnical) are recorded in the GSI well database within 1km of the leak point. A cluster of boreholes are located approximately 750m to the south of the leak point, in Ballintemple, whilst another cluster is recorded 800m to the west in the location of the Marina Filling Station on Victoria Road. The database indicates that these clusters of boreholes are related to geotechnical investigations and are not thought to be producing groundwater wells.</p> |
| <p>Hydrology</p> | <p>Surface Water Courses/Abstractions:</p> <p>The nearest surface watercourses were observed during a site walkover on 15th November 2019. Several drainage channels were observed in the area of the proposed site. A drainage channel runs along the south side of the Centre Park Road, which appears to serve as an artificial storm water drainage channel that flows to the east towards the Atlantic Pond and the Lee Estuary. Another drainage channel is located 45m north of the leak point which also flows towards the Atlantic Pond; which then drains into the Lee Estuary. These drainage channels were seen, during the walkover, to be very low flow systems with some visible signs of contamination in the form of a greyish-blue cloudy hue; as seen in Appendix C. The River Lee/ Lee Estuary is located 600m to the north of the leak point with the northernmost section of cable being 180m from the waterbody.</p> |
| <p>Protected Areas</p> | <p>Cork Harbour Special Protection Area</p> <p>The closest protected area to the site is the Cork Harbour Special Protection Area (SPA), which is approximately 2.8km east of the site; along the estuary. A closer portion of the SPA is located approximately 1.7km to the south of the site but this is thought to be less connected to the site due to the significant topography between the site and the SPA area to the south. Cork Harbour is designated as a SPA for its role in supporting a number of bird and invertebrate species.</p> <p>Douglas River Estuary Proposed Natural Heritage Area (pNHA)</p> <p>The Douglas River Estuary Proposed Natural Heritage Area overlies much of the same area of the Cork Harbour SPA and is approximately the same distance and location from the proposed site.</p> |
| <p>Flooding</p> | <p>According to OPW flood mapping (Appendix B) the site appears to be at risk of fluvial and coastal flooding in extreme events (Annual Exceedance Probability of 0.1%).</p> |
| <p>Zoning</p> | <p>The primary land use in the area is commercial with rare areas of open space and public amenity designated locally in the surrounding area. The Cork City Council Development Plan 2015-2021 (Appendix B) shows much of the area designated as Mixed Use Development, with District Centre designated along part of the cable section.</p> |

3.4 SITE GEOLOGY AND HYDROGEOLOGY

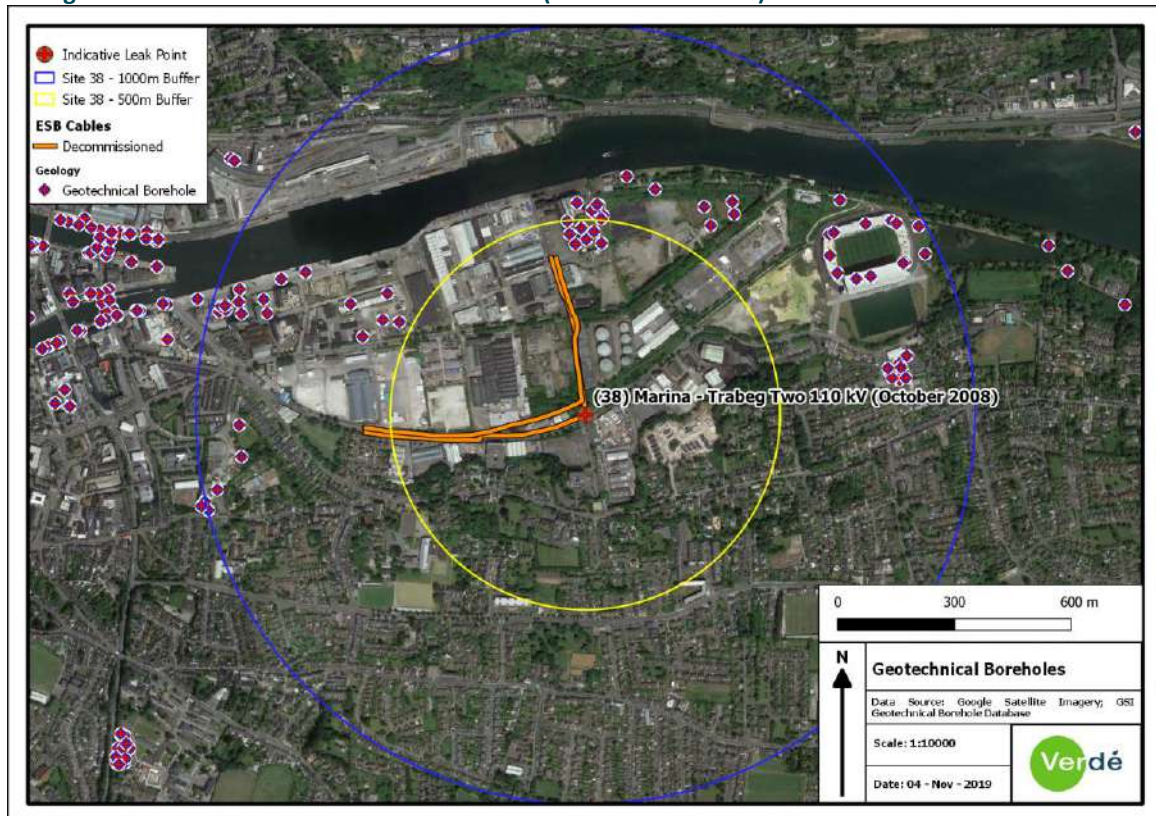
The details of the typical cable and trench dimensions for 110kV fluid filled cables include the following;

- Depth to the base of trench 1200mm
- Depth to top of cable 900mm
- Thickness of sand surrounding cables 250mm
- Width of trench 600mm
- Backfill can be either arisings or Clause 804.

According to the GSI Database the site is underlain by several geological formations; the northern section of the site is underlain by the flaser bedded sandstones and mudstones of the Cuskenny Member of the Kinsale Formation. The central section of the site, and location of the leak point, is underlain by the dark muddy limestones of the Ballysteen Formation. The southern section of the site is underlain by Waulsortian Limestones which are comprised of massive unbedded limestones (typically fine-grained micrites). These bedrock formations are overlain by approximately 3-4m of Made Ground and 3-5m of silt and clay which is underlain by up to 50m of sand and gravel known as the Lee Valley Gravels.

There have been several intrusive investigations in the vicinity of the site; the closest site investigation was that completed on the site of the Marina Power Station in 1974 (Appendix F), in preparation for the installation of a gas turbine unit. A series of 15 boreholes were completed on the site; the greatest depth of excavation was 46.6mBGL. Some of the boreholes were completed after a 10ft pit was dug and logged. A summary of the log details is available in Appendix F.

Figure 3.1 – Geotechnical Borehole locations (from GSI Database). Power station SI holes labelled.



A site investigation report from the 1950's site feasibility work prior to the development of the Marina Power Station, details the groundwater level variations on the site in response to tidal influence. A diurnal groundwater variation of 2-3m was recorded in a series of 3-4 groundwater monitoring wells on the ESB station facility (Appendix F).

The topography of the area as obtained from the GSI database show the leak point is located at approximately 6m above the ordnance datum (mOD) with the Lee Estuary downgradient at 0mOD. The topographic contours are orientated approximately east to west which infers that the groundwater flow direction is likely to be in a north/north-easterly flow direction, as presented in Figure 2 and within the CSM in Figure 3.

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 limestone derived glacial till and made ground is reported to be of low to moderate permeability with a thickness of 2 to 6m (above the gravel aquifer).

At the time of reporting, Irish Water have examined all available drinking water quality sample data and have concluded that there is no evidence that COPCs from the leak site have infiltrated the local drinking water supply. This evaluation is based on a review of all samples taken from customer-points, between 2014 and 2019; which showed no evidence that the COPCs (PAHs and Benzenes) were present in the water supply at levels above drinking water standards (PAHs: 0.1µg/L; Benzene: 1.0µg/L). These results (which are from samples taken at the customer tap) would not indicate that leaks from fluid filled cables have contaminated the drinking water supply for these areas, or at least to an extent where any contamination arising has resulted in a breach of the parametric value for PAHs and Benzene (Appendix G).

The ESB Marina Generating facility operated under an EPA IPPC emission license (ID: P0578-03) up until 2018 when the plant was fully decommissioned. As part of this license, the ESB regularly reported noise, groundwater, surface water and air quality conditions on the site. The results of these samples were reported to the EPA as per the license agreements in place.

A summary of the Environmental and Human Health Pollutant Linkages for the COPCs (TPH fractions, Speciated PAHs, BTEX Compounds, SVOCs, VOCs) in relation to the known leak point details and available desk study information is presented in Section 4.0.

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.

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. The Water Policy Regulations (S.I. No. 722 of 2003), Surface Waters Regulations (S.I. No. 272 of 2009) and Groundwater Regulations (S.I. No. 9 of 2010) 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 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 | | | | |
| <p>Historical leak of cable fluid from underground power cable comprising of an approximate volume of 3,555 litres of linear alkyl benzene (LAB); repaired October 2008</p> <p>PCOCs include: TPH fractions, Speciated PAHs BTEX Compounds Mineral Oil SVOCs VOCs</p> | <p>LAB 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.</p> | <p>Commercial or retail building users</p> | <p>Y</p> | <p>There are commercial and retail properties in the immediate vicinity and downgradient of the leak point. 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.</p> |
| | <p>LAB 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.</p> | <p>Commercial or retail building users</p> | <p>Y</p> | <p>There are commercial and retail properties in the immediate vicinity and downgradient of the leak. 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.</p> |
| | <p>LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase). Then permeation through plastic potable water supply pipes and ingestion.</p> | <p>Nearby commercial or retail building users</p> | <p>Y</p> | <p>The water supply pipes could potentially run through contaminated zones. LAB have the potential to permeate through the wall of plastic supply pipes and also 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.</p> |

| | | | | |
|---|--|--|---|--|
| | LAB 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 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 | | | | |
| <p>Historical leak of cable fluid from underground power cable comprising of an approximate volume of 3,555 litres of linear alkyl benzene (LAB); repaired October 2008</p> <p>PCOCs include: TPH fractions, Speciated PAHs BTEX Compounds Mineral Oil SVOCs VOCs</p> | LAB 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 | Y | LAB 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 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 | Nearby drainage channels and connected Atlantic Pond and Lee Estuary | Y | The nearest drainage channel intersects the southern end of the cable section whilst but is 250m from the leak point. These nearby channels drain surface and excess groundwater towards the Atlantic Pond and onto the Lee Estuary c.850m to the east. |
| | LAB migration downwards through glacial till to Limestone bedrock aquifer and then lateral migration | Gravel and Limestone bedrock aquifer / Groundwater Users | Y | There are no known groundwater abstraction wells within 1km of the site. The surrounding properties are serviced by mains water. Downward contaminant migration into the gravel and limestone aquifer is possible due to the general vulnerability of both aquifers locally. |

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 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

| Source | Pathway | Receptor | Severity | Likelihood | Potential Risk Level | Comments |
|--|---|--|----------|------------|----------------------|--|
| Human Health | | | | | | |
| Historical leaks of cable fluid from underground power cables comprising of an approximate volume of 3,555 litres of linear alkyl benzene (LAB); repaired October 2008 PCOCs include: TPH fractions, BTEX Compounds Speciated PAHs Mineral Oil SVOCs VOCs | LAB 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 | Commercial or retail building users & residents. | Medium | Unlikely | Low | Has the potential to migrate along preferential pathways such as service trenches. No residential receptors downgradient or proximal to site. 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 commercial customers is low. |
| | LAB 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 | Commercial or retail building users & residents. | 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. |

| | | | | | | |
|--|---|--|--------|----------|-----|--|
| | <p>LAB partitioning to soil (sorbed phase), groundwater (dissolved phase) and as NAPL (free phase).</p> <p>Then permeation through plastic potable water supply pipes and ingestion</p> | Users of the water mains | Medium | Unlikely | Low | <p>Water supply pipes could potentially be present next to electrical cables 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. Also, Irish Water reviews of sampling data and subsequent risk assessments suggest that there has been no impact to potable water pipes based on the absence of COPC detections and the high-pressure nature of supply pipes. Risk rating may change if evidence of dynamic hydrological regime is observed or significant free phase product is observed proximal to pipe.</p> |
| | <p>LAB volatilisation from soil, groundwater and LNAPL into soil pore spaces (Vapour Phase in unsaturated soils), upward migration to outdoor air and then inhalation</p> | Workers undertaking any subsurface works | Medium | Unlikely | Low | <p>Potential 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.</p> |
| | <p>LAB partitioning to soil (sorbed phase), groundwater</p> | Workers undertaking | Medium | Unlikely | Low | <p>Potential risk to workers from localised areas of contamination will be short term</p> |



| | | | | | | |
|--|---|----------------------|------|--------|--------------|--|
| | (dissolved phase) and as NAPL (free phase). Then direct dermal contact/ingestion of soils and or dusts, inhalation of soil dusts | any subsurface works | | | | and can be managed with the correct PPE and H&S procedures. |
| Environmental – Water Receptors | | | | | | |
| Historical leaks of cable fluid from underground power cables comprising of an approximate volume of 3,555 litres of linear alkyl benzene (LAB); repaired October 2008 | LAB 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 | Likely | Low/Moderate | Low/Moderate potential risk due to alkyl benzene contamination strongly absorbs to soil, has low mobility, readily biodegrades in aerobic conditions in both soil and water. Shallow groundwater in made ground and glacial till unlikely to be used as an actual resource due location in a commercial urban area and influence of saline tidal intrusion in groundwater. Overall potential risk is low/moderate. |



| | | | | | | |
|---|--|--|--------|--------|----------|--|
| PCOCs include: TPH fractions, Speciated PAHs BTEX Compounds Mineral Oil SVOCs, VOCs, | LAB 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 | Drainage Channels, Atlantic Pond and Lee Estuary | Medium | Likely | Moderate | 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. There was a loss (3,555L) from the cable which is likely to be transmitted to the adjacent environmental receptor (45m) to the leak point. The potential risk is moderate. The observation of bluish-grey discoloration in the waters of the drainage channel may or may not be related to the loss of cable fluids nearby. As such, further investigation (water sampling, etc.) may be required. |
| | LAB migration downwards through glacial till to Limestone bedrock aquifer and then lateral migration | Gravel and Limestone bedrock aquifer / Groundwater Users | Medium | Likely | Moderate | Due to the moderate to high vulnerability and exposed bedrock in the area, there may be a linkage between the groundwater in the underlying aquifer and the shallow ground water in the overlying made ground and subsoils. The occurrence of low-moderately permeable clays and silt subsoils may offer some natural protection to the underlying gravel and bedrock aquifers. Given there are no groundwater users in the area downgradient the potential risk is moderate. |

4.4 SUMMARY OF PQRA

A desktop study and site walkover were conducted in relation to a recorded cable leak location on Monaghan Road, Cork City. It is reported that 3,555 litres of linear alkyl benzene were lost from the cable over a one-month period in October 2008; which was repaired later in October 2008. Results of the PQRA are summarised below:

4.4.1 Human Health:

- There is a potentially Low risk posed by LAB vapours in suspected contamination in the soil and groundwater through preferential pathways such as services ducts to commercial or other building users;
- There is a potentially Low risk posed by LAB from contact with suspected contamination in the soil and groundwater through direct dermal/inhalation and ingestion contact to commercial or other building users;
- There is a potentially Low risk posed by LAB contact from ingestion contact with suspected contamination in the soil and groundwater through permeation of contamination through plastic water pipes;
- There is a potentially 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 potentially Low/Moderate risk posed by LAB to shallow groundwater from suspected contamination in the shallow made ground and sand and gravel 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 commercial urban and tidally-influenced setting.
- There is a potentially Moderate risk posed by LAB to the nearby drainage channels that feed into the Atlantic Pond and the Lee estuary, from the suspected contamination within shallow groundwater.
- There is a potentially Moderate risk posed by LAB to the underlying Gravel and Limestone Bedrock Aquifers given the moderate-high vulnerability indicating shallow to outcropping rock in the area and the known extent of sand and gravel below the site. The occurrence of low-moderately permeable clays and silt subsoils may offer some natural protection to the underlying gravel and bedrock aquifers.

4.5 SUMMARY AND CONCLUSIONS

This preliminary environmental site assessment consists of a review of the potential environmental impacts associated with a cable fluid leak from a power cable on Monaghan Road in Cork City (ESB Ref: 38). There was another leak within 15m of this location on Monaghan Road, in November 2005, identified as ESB Site Ref: 51 Marina – Trabeg Two 110 kV. This nearby leak point is the subject of a separate PSA report.

There was an approximate volume of 3,555 litres of cable fluid consisting of linear alkyl benzene lost to ground from the leak on Monaghan Road over a one-month period in October 2008. The leak was repaired later in October 2008.

The known leak point is located on the northern side of Monaghan Road, Cork City. There is evidence of abundant site services in the roadway, the grass verge and concrete footpaths with manhole covers and service kiosks. There is no physical evidence of hydrocarbon contamination on the surface in terms of oil odours/staining or impact to vegetation.

The site is underlain by the regionally important gravel aquifer of the Lee Valley Gravels which is underlain by the locally important bedrock aquifers of the Ballysteen and Kinsale Formations as well as the regionally important karstic aquifer of the Waulsortian Limestones. The vulnerability is Moderate to High, however there are some moderate to low permeability limestone till subsoils (estuarine clays and silts), which provide some natural protection to the underlying gravel and bedrock aquifers. To the south of the leak point, however, bedrock appears to be at surface and extremely vulnerable.

The nearest surface watercourse is an artificial drainage channel located 45m north of the leak point which drains eastwards into Atlantic Pond and, in turn, the Lee Estuary. Also in the area, are other drainage channels which lie along the southern and northern sides of Centre Park Road; also draining to Atlantic Pond. There are no known groundwater wells or ecologically sensitive receptors located within a 1km radius of the site. Groundwater in the bedrock aquifer, north of the leak point, is likely to be semi-confined by the moderate-low permeability subsoils with groundwater flow direction in a northerly to north-easterly direction following site topography.

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 a potentially Low risk posed by LAB 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 contact with suspected contamination in the soil and groundwater through permeation of contamination through plastic water pipes or through low-pressure infiltration of possible soil contamination into water pipes via nearby breaks or leaks;
- hydrocarbon vapours in preferential pathways such as services ducts to residents or nearby commercial building users;

There is a potentially Low/Moderate risk posed by LAB in suspected contamination in the soil and groundwater through;

- 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 commercial urban and tidally influenced setting.

There is a potentially Moderate risk posed by LAB in suspected contamination in the soil and groundwater through;

- hydrocarbon migration to the Atlantic Pond and Lee Estuary given the existence of a hydrological pathway between the leak site and the local drainage channels and the Atlantic Pond downstream.
- hydrocarbon migration to the underlying aquifer given the possible connection to shallow groundwater through shallow rock and gravels in the area indicated by the moderate to high vulnerability.

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, as previously referenced.

5 REFERENCES

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- Code of Practice for Site Investigations, BS 5930:2015, published by BSI, 2015.
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- The LQM/CIEH S4ULs for Human Health Risk Assessment, Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3484, All rights reserved, November 2014.
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- European Communities Environmental Objectives (Groundwater) Regulations, 2010, S.I. No.9 of 2010.
- European Union Environmental Objectives (Surface Waters) (amendment) Regulations 2015, European Communities Environmental Objectives (Surface Waters) Regulations 2009.
- <http://www.epa.ie/pubs/advice/drinkingwater/drinkingwatersupplies>.
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- Classification of Hazardous and Non-Hazardous Substances in Groundwater 2010, EPA 2010.
- Report on a Site Investigation at Marina Generating Station, Cork for ESB, Report No.1167, October 1974.
- Report on a Site Investigation at C.A.B Motor, Monahan Road, Cork for C.A.B Motor Co., Report No.1177, April 1974.



oo0oo

Respectfully submitted

On behalf of Verde Environmental Consultants

[Redacted Signature]


Senior Environmental Consultant

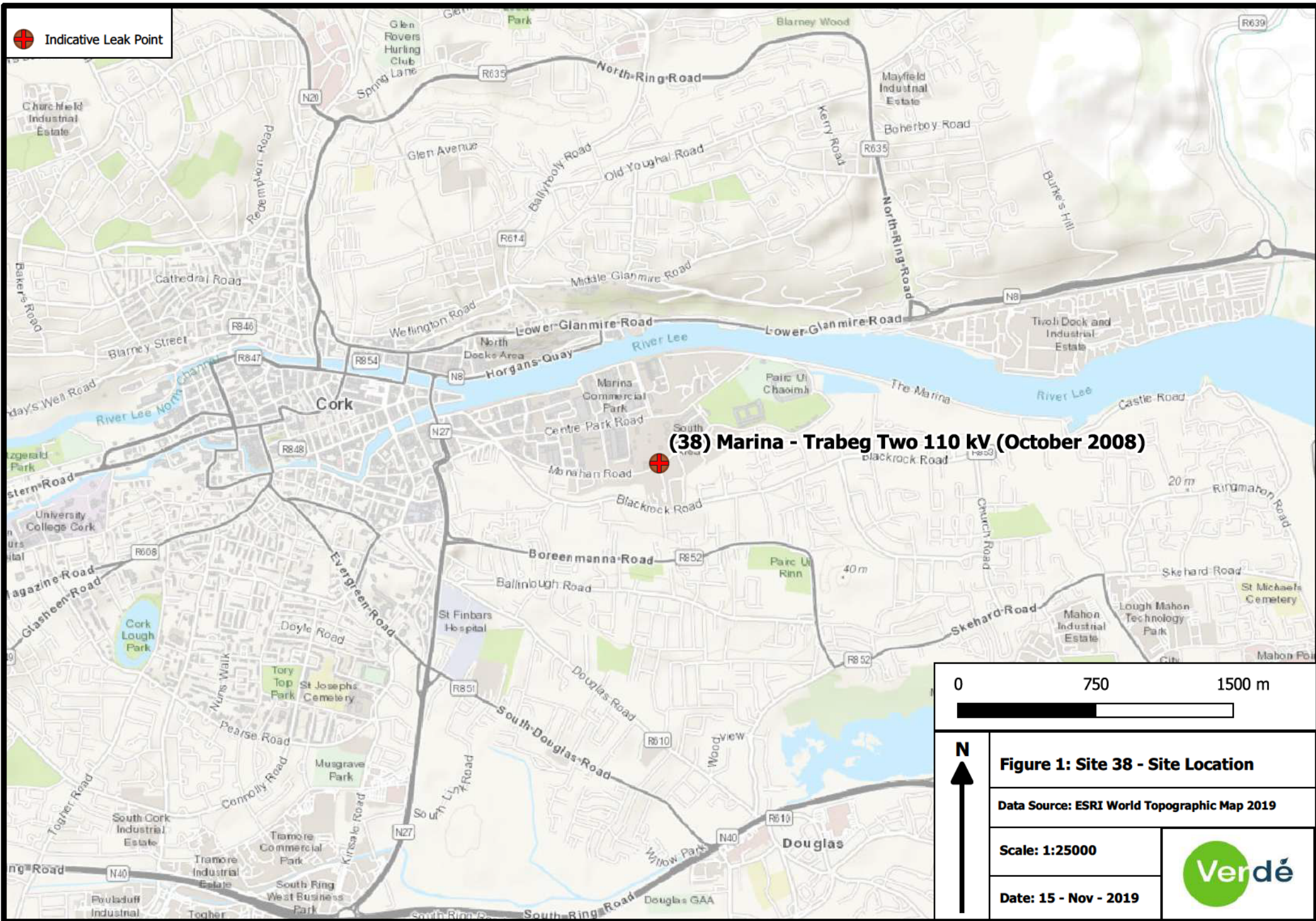
[Redacted Signature]

Project Director



FIGURES

 Indicative Leak Point



(38) Marina - Trabeg Two 110 kV (October 2008)

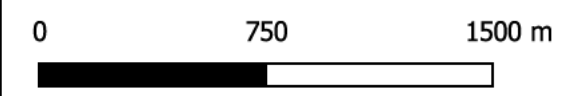


Figure 1: Site 38 - Site Location

Data Source: ESRI World Topographic Map 2019

Scale: 1:25000

Date: 15 - Nov - 2019



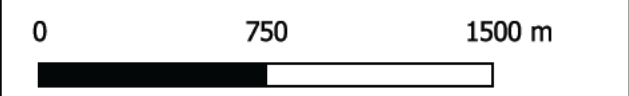
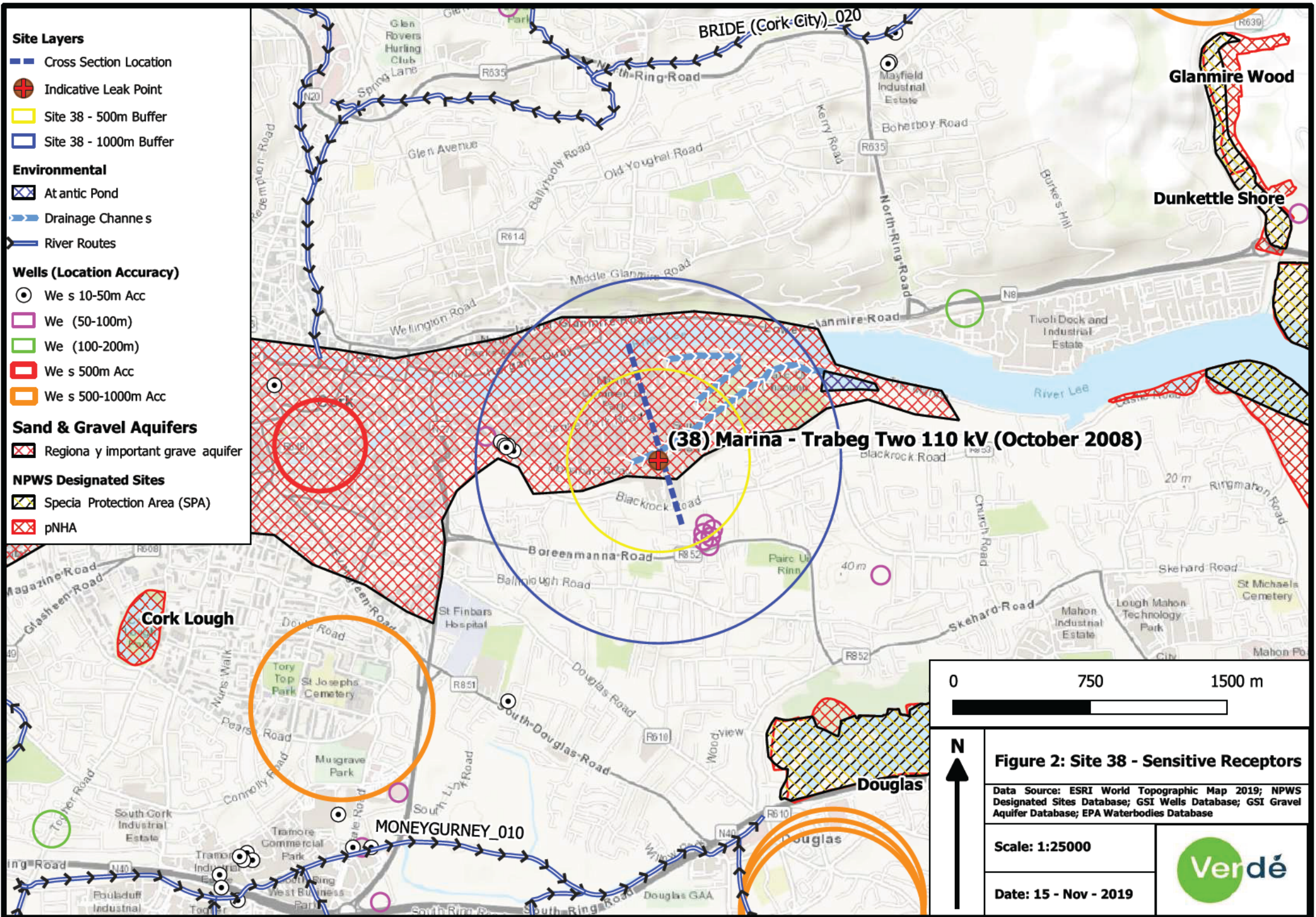
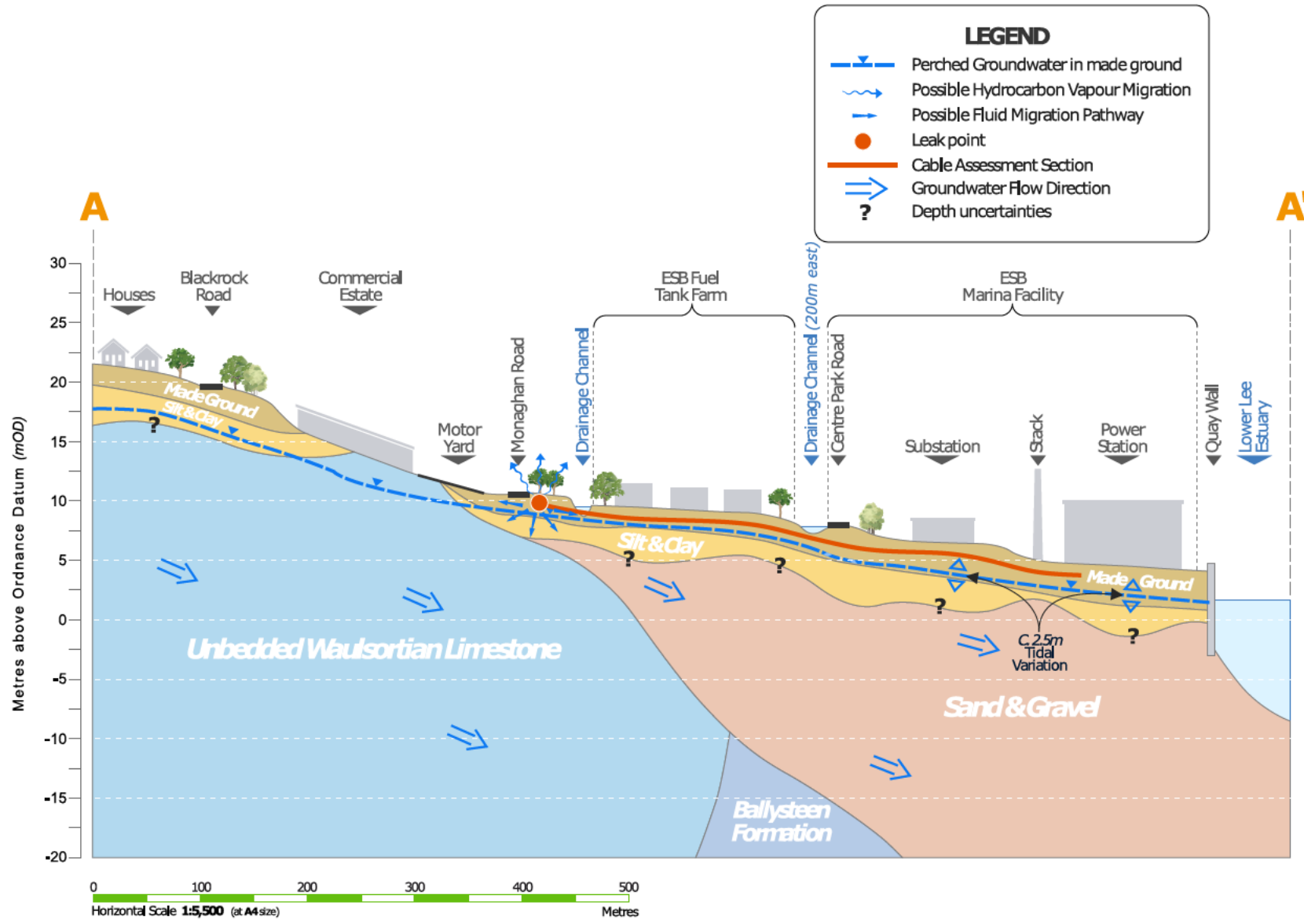


Figure 2: Site 38 - Sensitive Receptors

Data Source: ESRI World Topographic Map 2019; NPWS Designated Sites Database; GSI Wells Database; GSI Gravel Aquifer Database; EPA Waterbodies Database

Scale: 1:25000


Date: 15 - Nov - 2019

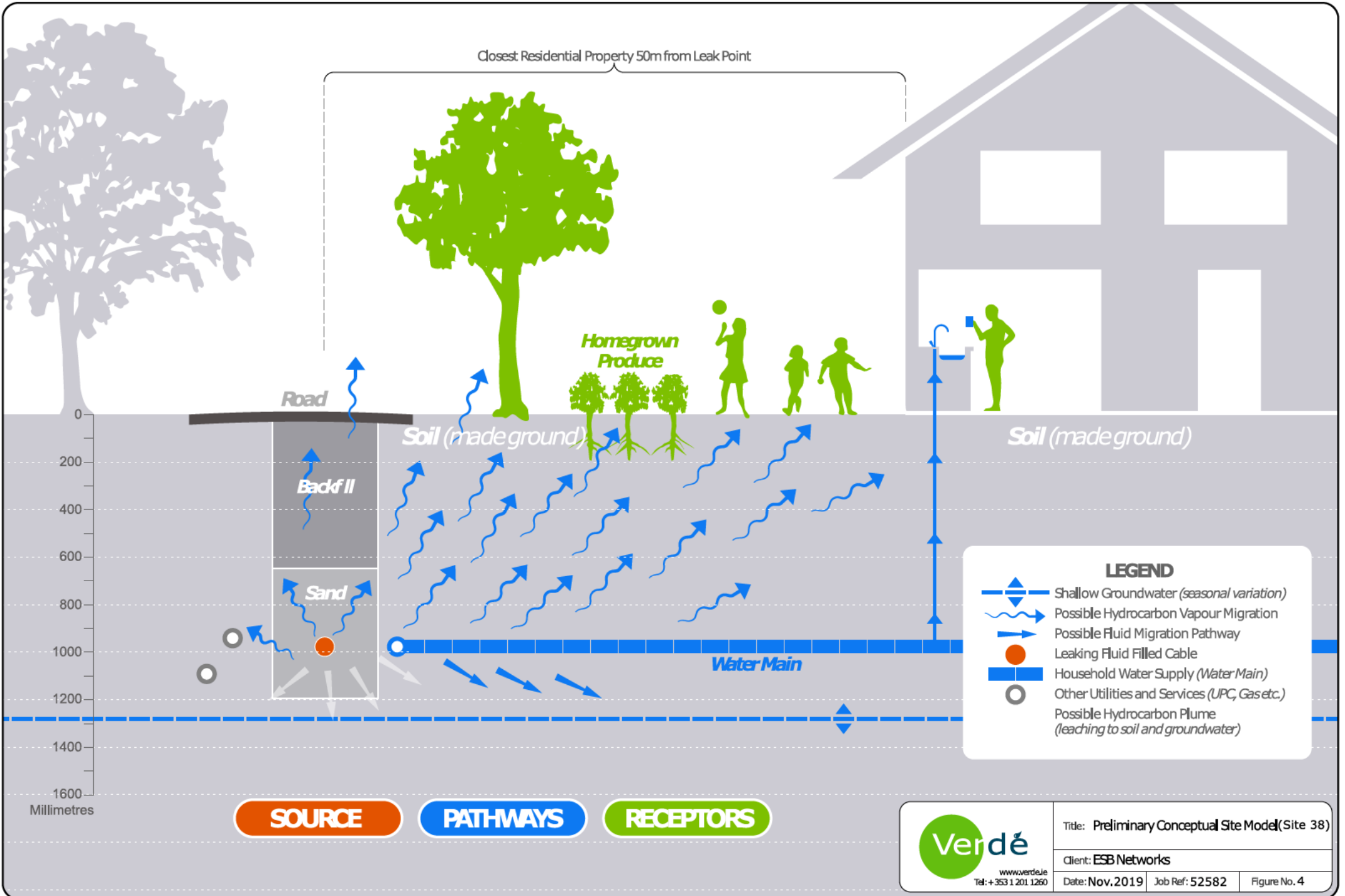


LEGEND

- Perched Groundwater in made ground
- Possible Hydrocarbon Vapour Migration
- Possible Fluid Migration Pathway
- Leak point
- Cable Assessment Section
- Groundwater Flow Direction
- Depth uncertainties

0 100 200 300 400 500
 Horizontal Scale 1:5,500 (at A4 size) Metres

| | | |
|---|--|--------------|
|  <small>www.verde.ie Tel: +353 1 201 1260</small> | Title: Preliminary Conceptual Site Model (Site 38) | |
| | Client: ESB Networks | |
| Date: Nov. 2019 | Job Ref: 52458 | Figure No. 3 |



Title: Preliminary Conceptual Site Model (Site 38)

Client: ESB Networks

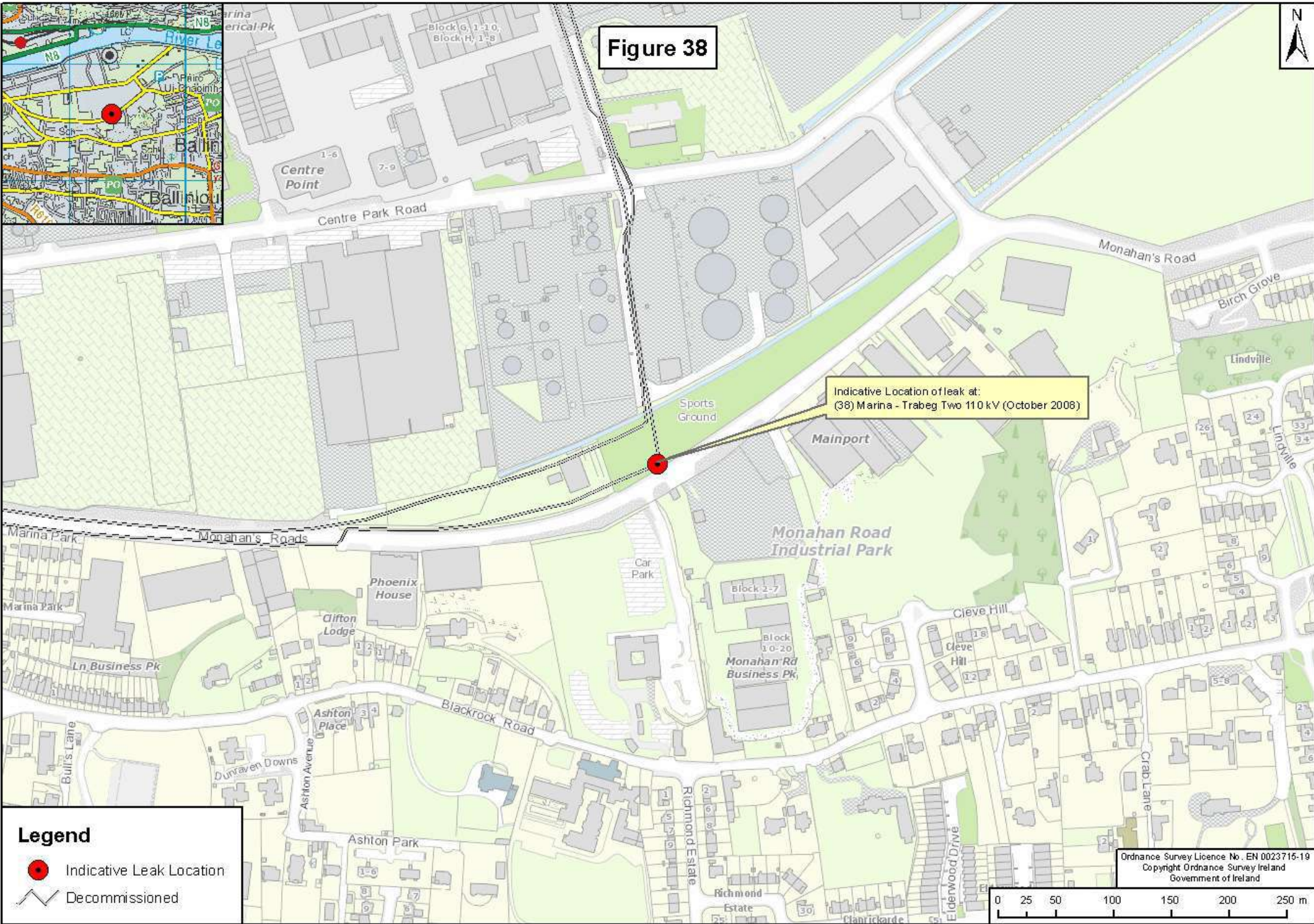
Date: Nov, 2019 Job Ref: 52582 Figure No. 4



APPENDIX A

ESB SITE LAYOUT PLAN WITH INDICATIVE CABLE FLUID LEAKAGE LOCATION

Figure 38



Indicative Location of leak at:
(38) Marina - Trabeg Two 110 kV (October 2008)

Legend

-  Indicative Leak Location
-  Decommissioned





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Government of Ireland

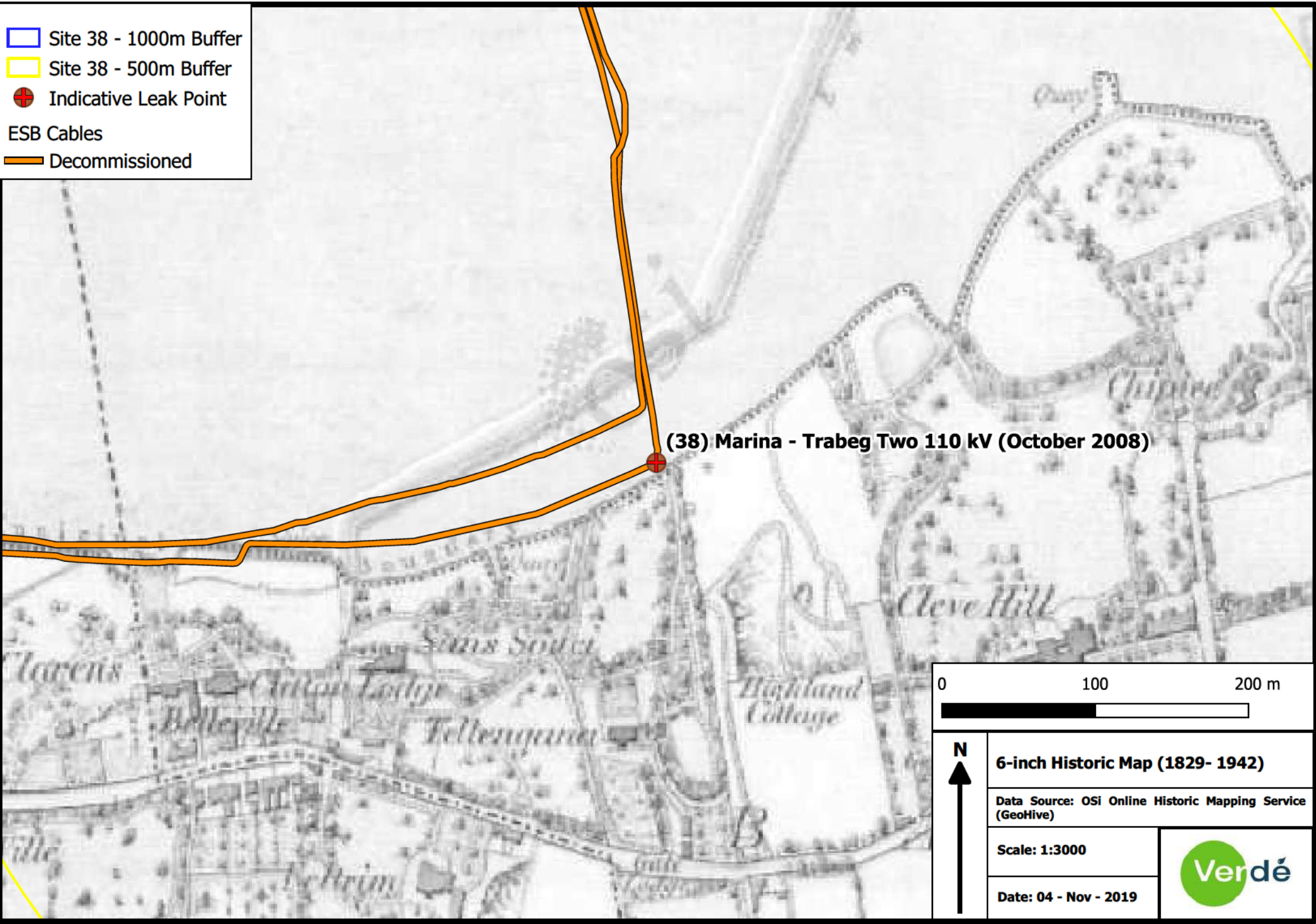




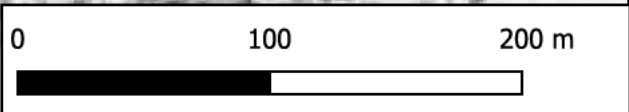
APPENDIX B



DESK STUDY MAPS





-  Site 38 - 1000m Buffer
-  Site 38 - 500m Buffer
-  Indicative Leak Point
- ESB Cables
-  Decommissioned

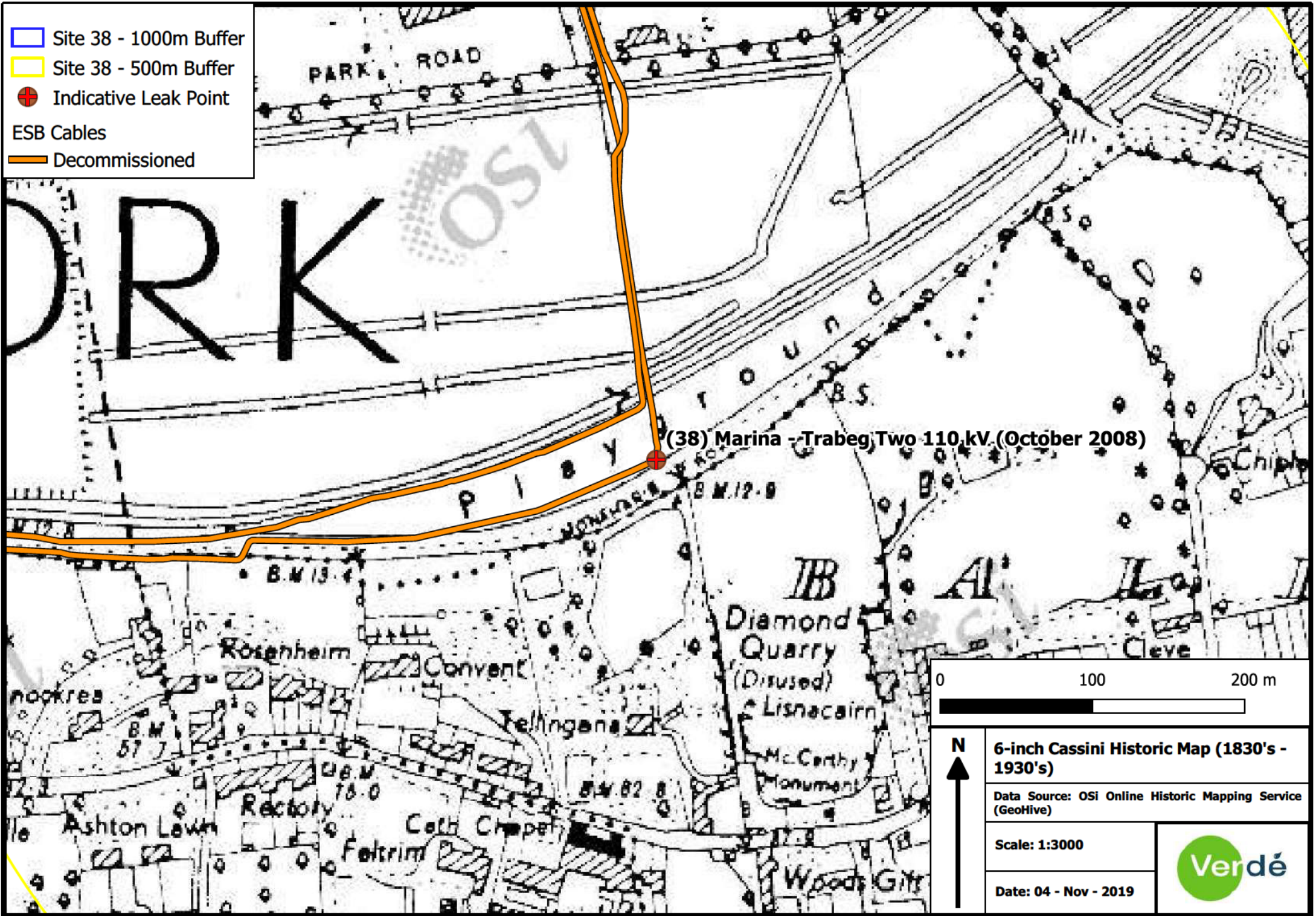


(38) Marina - Trabeg Two 110 kV (October 2008)

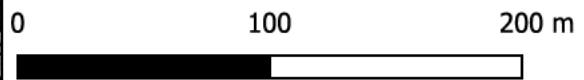


| | | |
|---|--|---|
|  <p>N</p> | 6-inch Historic Map (1829- 1942) | |
| | Data Source: OSi Online Historic Mapping Service (GeoHive) | |
| | Scale: 1:3000 |  |
| | Date: 04 - Nov - 2019 | |

-  Site 38 - 1000m Buffer
-  Site 38 - 500m Buffer
-  Indicative Leak Point
- ESB Cables
-  Decommissioned



(38) Marina - Trabeg; Two 110.kV. (October 2008)




N
↑

6-inch Cassini Historic Map (1830's - 1930's)

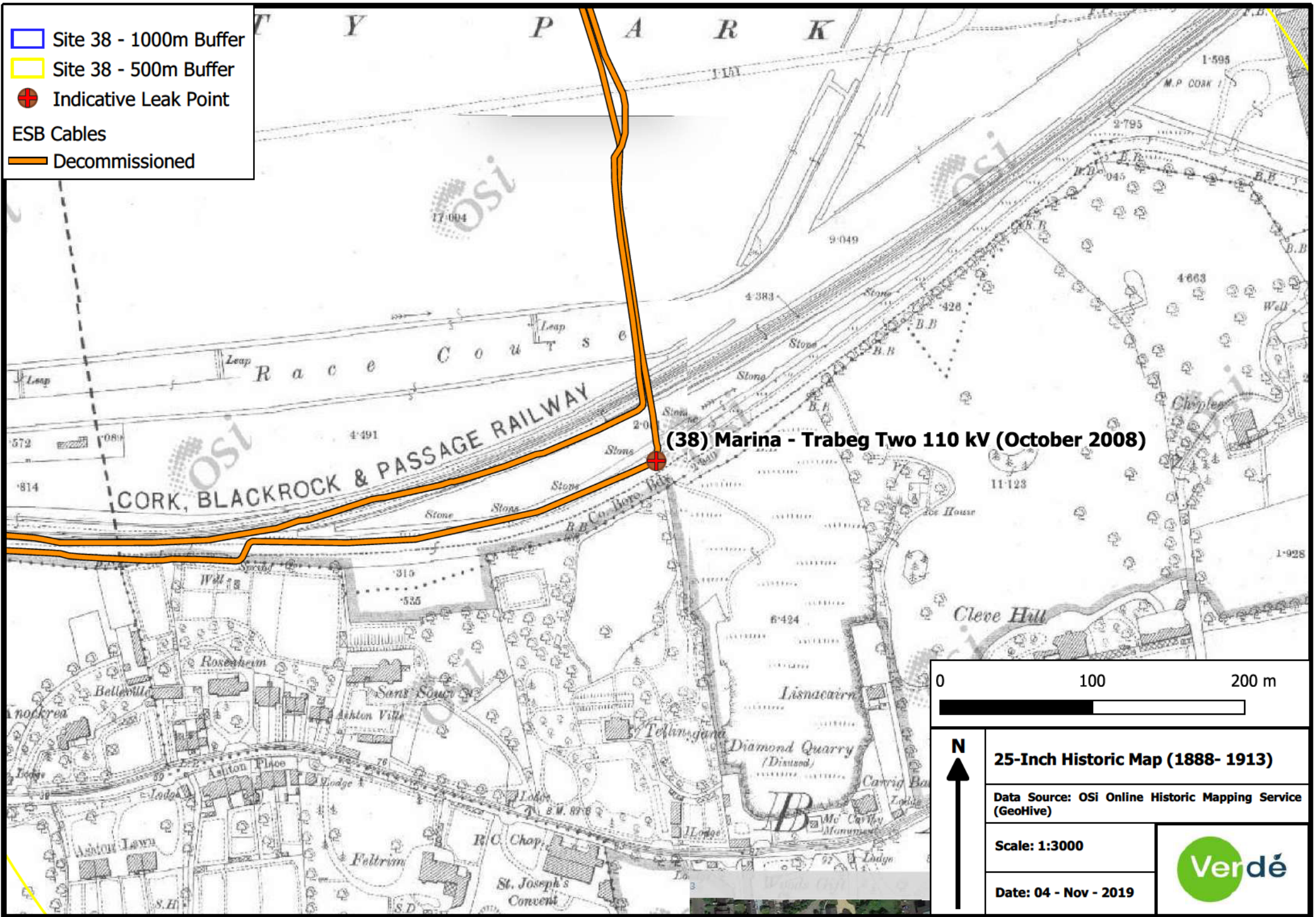
Data Source: OSI Online Historic Mapping Service (GeoHive)

Scale: 1:3000

Date: 04 - Nov - 2019



- Site 38 - 1000m Buffer
- Site 38 - 500m Buffer
- + Indicative Leak Point
- ESB Cables
- Decommissioned



(38) Marina - Trabeg Two 110 kv (October 2008)

0 100 200 m



25-Inch Historic Map (1888- 1913)

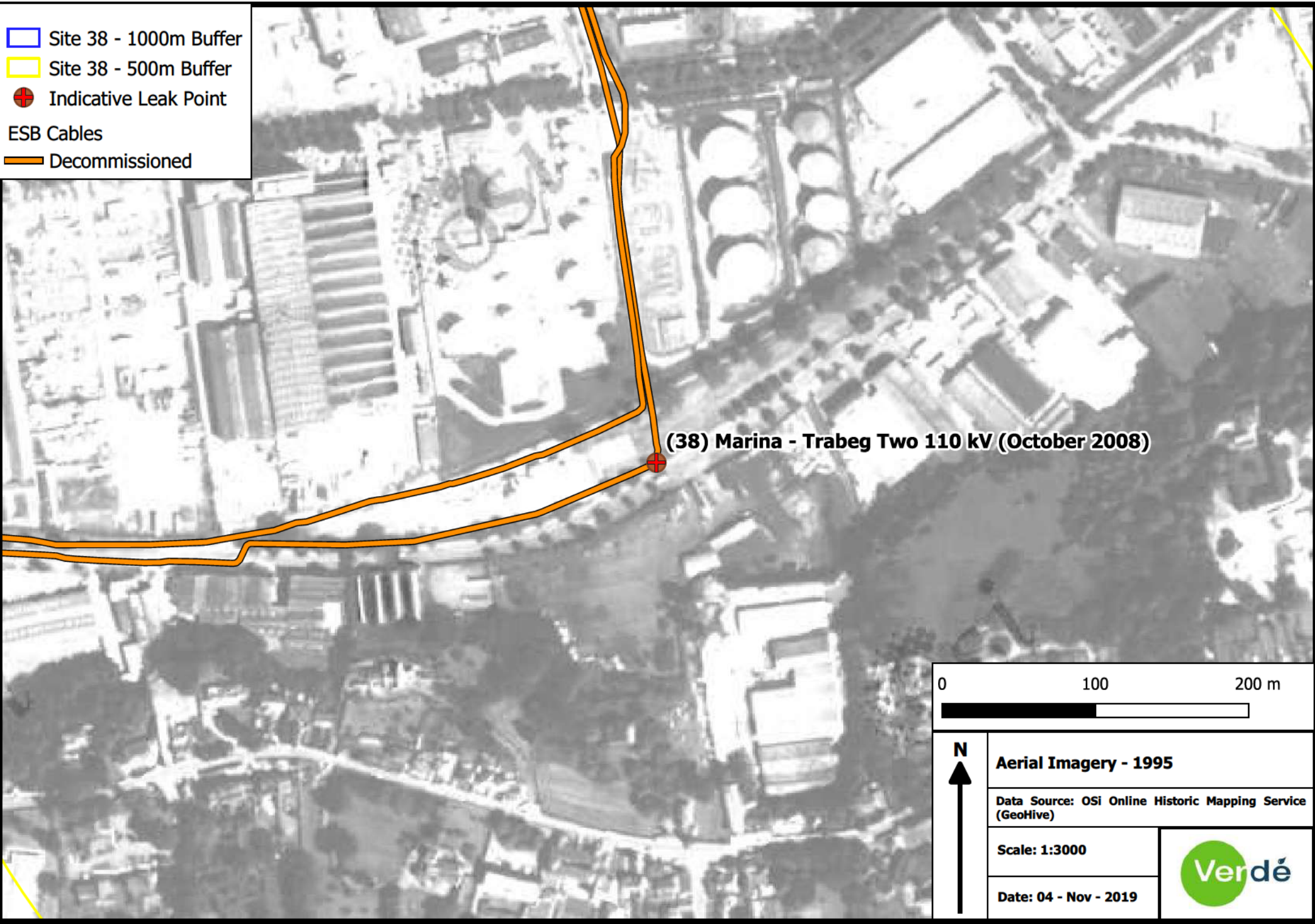
Data Source: OSi Online Historic Mapping Service (GeoHive)





Scale: 1:3000

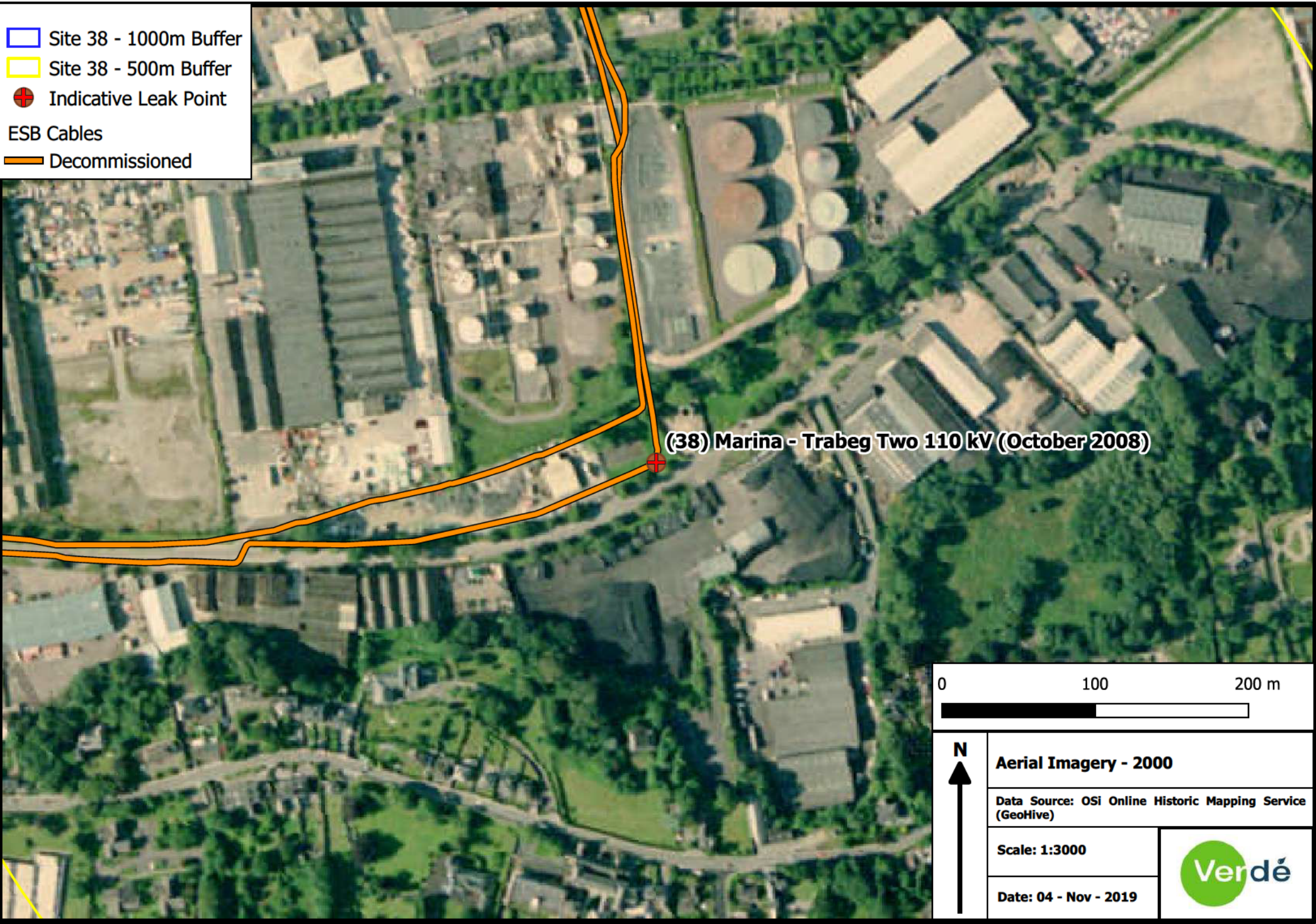
Date: 04 - Nov - 2019



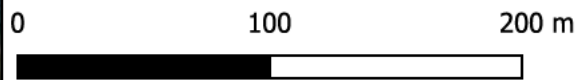
- Site 38 - 1000m Buffer
- Site 38 - 500m Buffer
- Indicative Leak Point
- ESB Cables
- Decommissioned









-  Site 38 - 1000m Buffer
-  Site 38 - 500m Buffer
-  Indicative Leak Point
- ESB Cables
-  Decommissioned

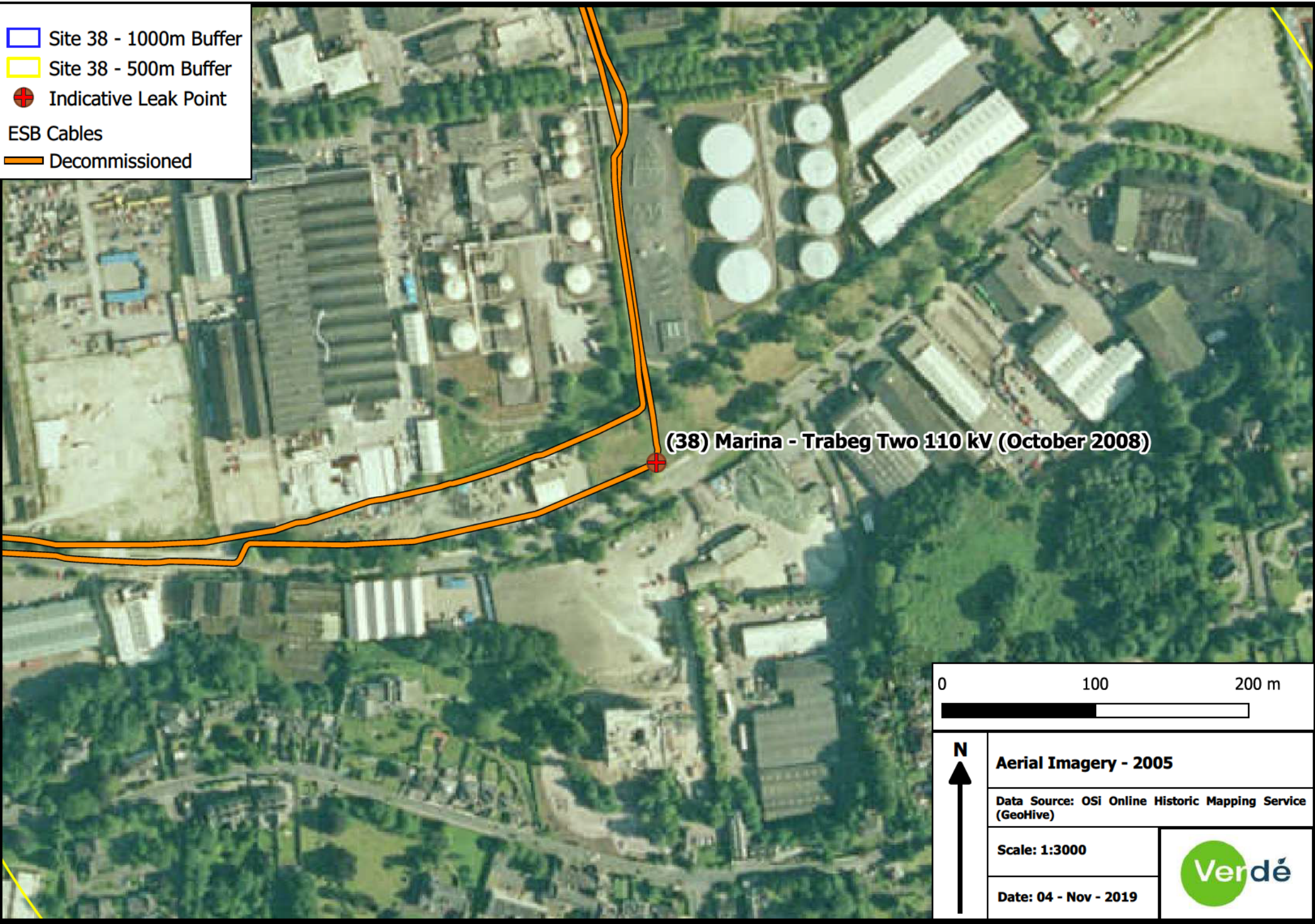


(38) Marina - Trabeg Two 110 kV (October 2008)

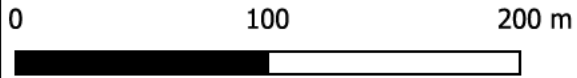




| | | |
|---|--|---|
|  | Aerial Imagery - 2000 | |
| | Data Source: OSi Online Historic Mapping Service (GeoHive) | |
| | Scale: 1:3000 |  |
| | Date: 04 - Nov - 2019 | |





-  Site 38 - 1000m Buffer
-  Site 38 - 500m Buffer
-  Indicative Leak Point
- ESB Cables
-  Decommissioned

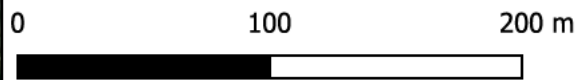



(38) Marina - Trabeg Two 110 kV (October 2008)



| | | |
|---|--|---|
|  | Aerial Imagery - 2005 | |
| | Data Source: OSi Online Historic Mapping Service (GeoHive) | |
| | Scale: 1:3000 |  |
| | Date: 04 - Nov - 2019 | |

-  Site 38 - 1000m Buffer
-  Site 38 - 500m Buffer
-  Indicative Leak Point
- ESB Cables
-  Decommissioned



| | |
|--|---|
| Aerial Premium Imagery | |
| Data Source: OSi Online Historic Mapping Service (GeoHive) | |
| Scale: 1:3000 |  |
| Date: 04 - Nov - 2019 | |

 Indicative Leak Point

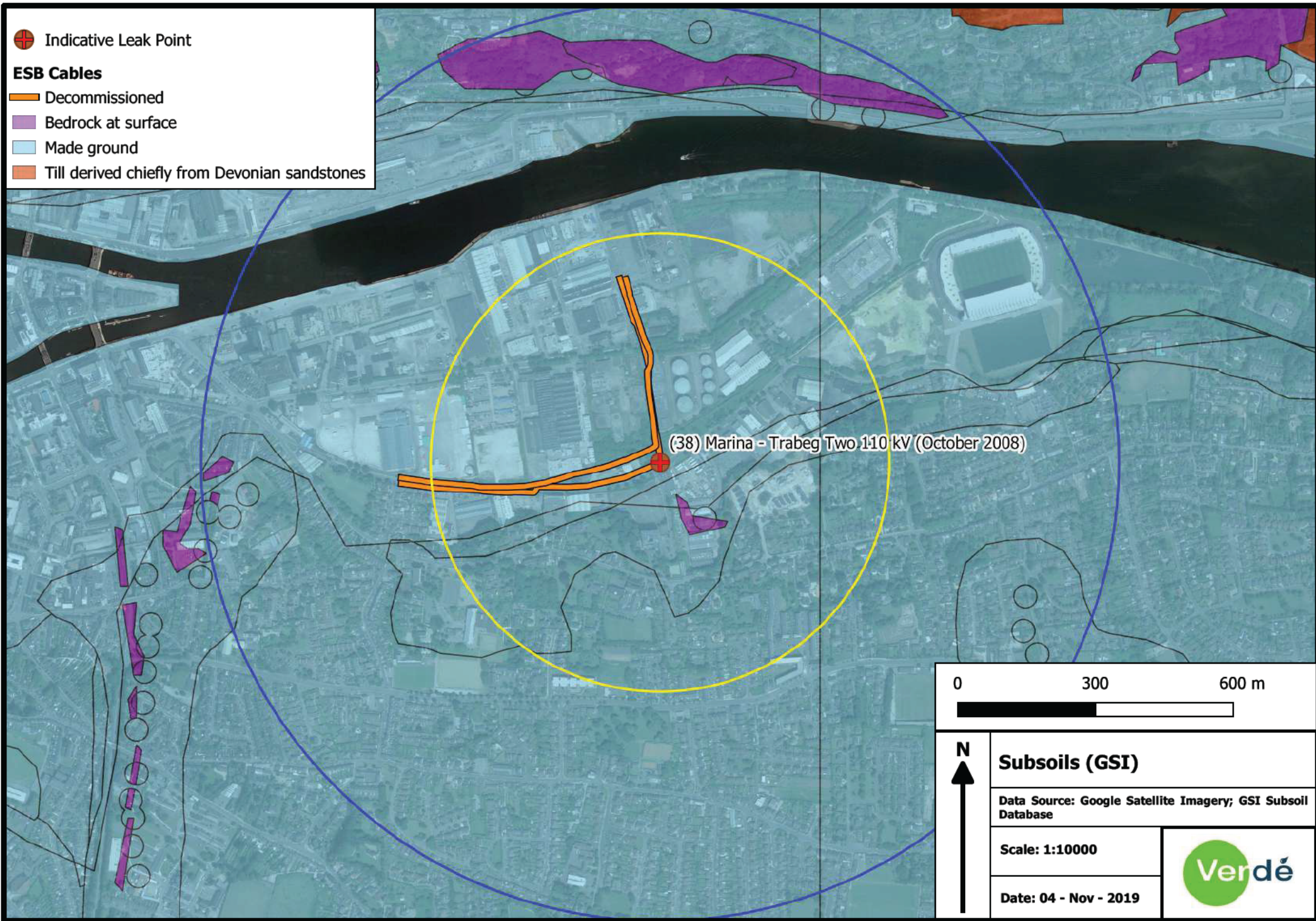
ESB Cables

 Decommissioned

 Bedrock at surface

 Made ground

 Till derived chiefly from Devonian sandstones



(38) Marina - Trabeg Two 110 kV (October 2008)



Subsoils (GSI)

Data Source: Google Satellite Imagery; GSI Subsoil Database

Scale: 1:10000

Date: 04 - Nov - 2019




 Indicative Leak Point

ESB Cables


 Decommissioned

National Soils (EPA)

 Deep well-drained mineral soil, Derived from mainly acidic parent materials

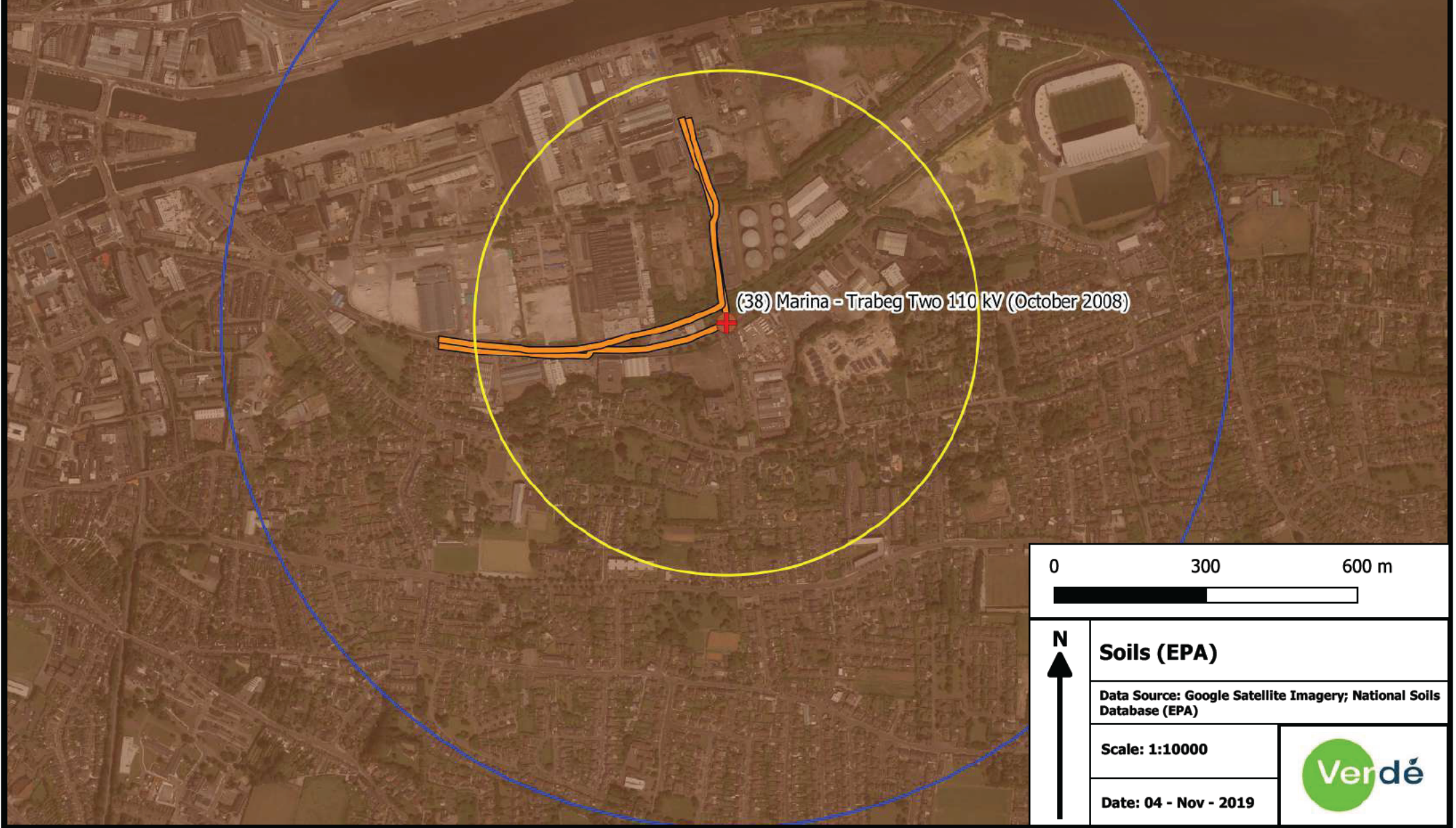
 Shallow reasonable drained mineral soil derived from mainly acidic parent materials

 Shallow well drained mineral soil derived from mainly acidic parent materials

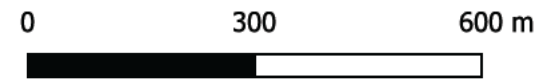
 Peaty shallow reasonable drained mineral soil derived from mainly basic parent materials

 Shallow well drained mineral soil derived from mainly basic parent materials

 Made Ground



(38) Marina - Trabeg Two 110 kV (October 2008)



Soils (EPA)

Data Source: Google Satellite Imagery; National Soils Database (EPA)

Scale: 1:10000

Date: 04 - Nov - 2019



 Indicative Leak Point

ESB Cables

 Decommissioned

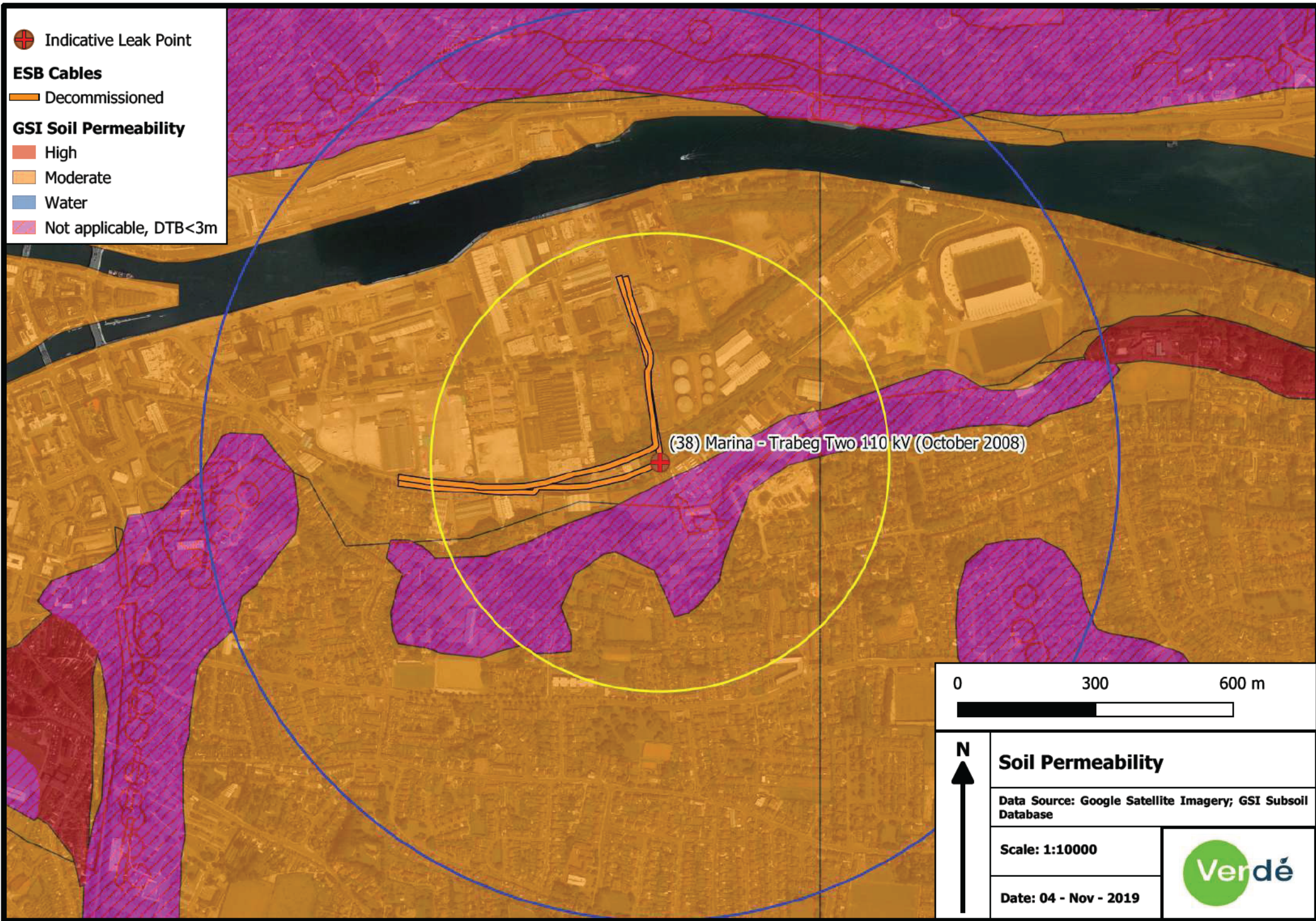
GSI Soil Permeability

 High

 Moderate

 Water

 Not applicable, DTB<3m



(38) Marina - Trabeg Two 110 kV (October 2008)

0 300 600 m



Soil Permeability

Data Source: Google Satellite Imagery; GSI Subsoil Database

Scale: 1:10000

Date: 04 - Nov - 2019



⊕ Indicative Leak Point

ESB Cables

— Decommissioned

Catchments

➤ Drainage Channels

▭ WFD Transitional Waters

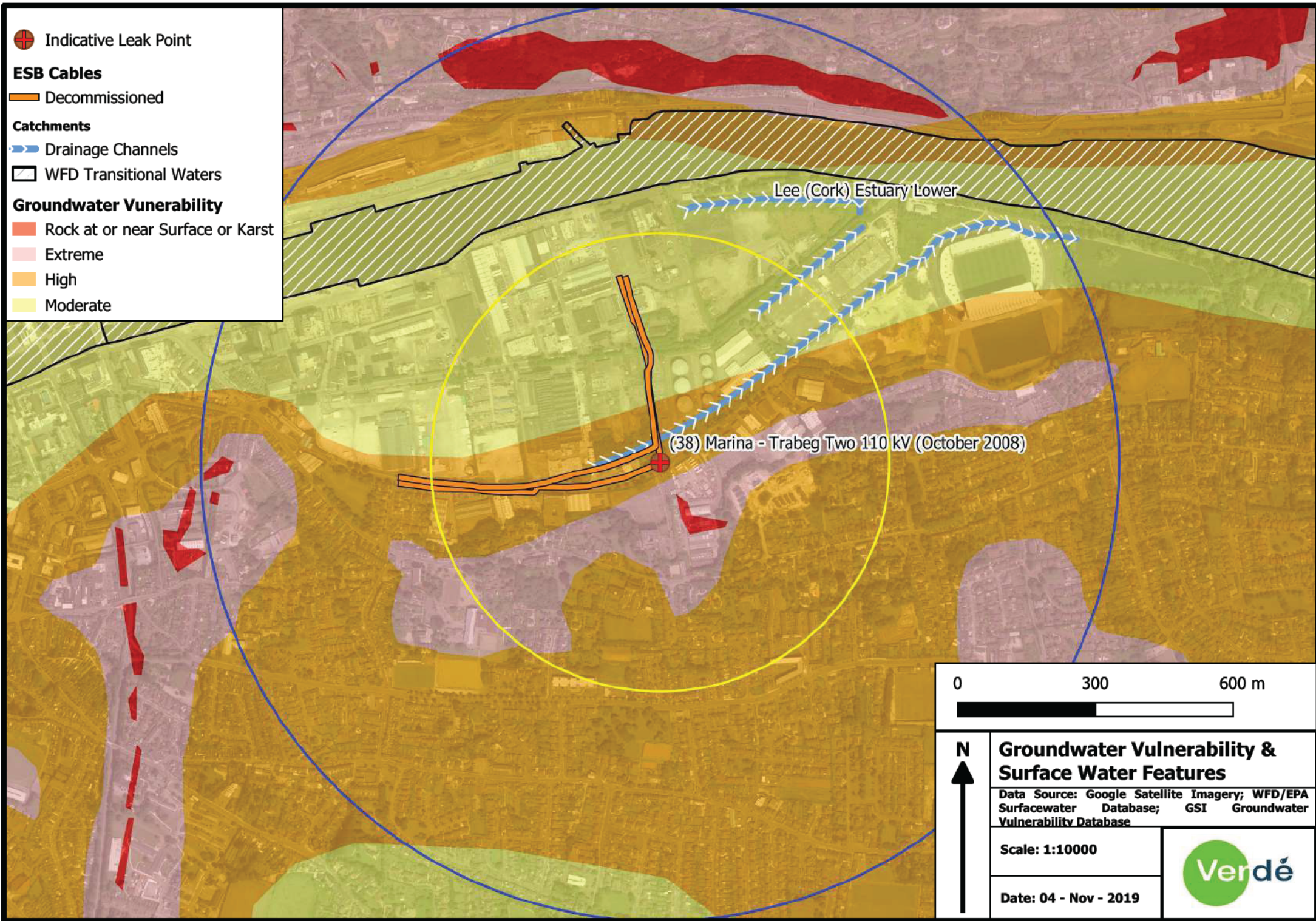
Groundwater Vulnerability

■ Rock at or near Surface or Karst

■ Extreme

■ High

■ Moderate



Lee (Cork) Estuary Lower

(38) Marina - Trabeg Two 110 kV (October 2008)



Groundwater Vulnerability & Surface Water Features

Data Source: Google Satellite Imagery; WFD/EPA Surfacewater Database; GSI Groundwater Vulnerability Database

Scale: 1:10000

Date: 04 - Nov - 2019





 Indicative Leak Point

ESB Cables

 Decommissioned

Wells (Location Accuracy)

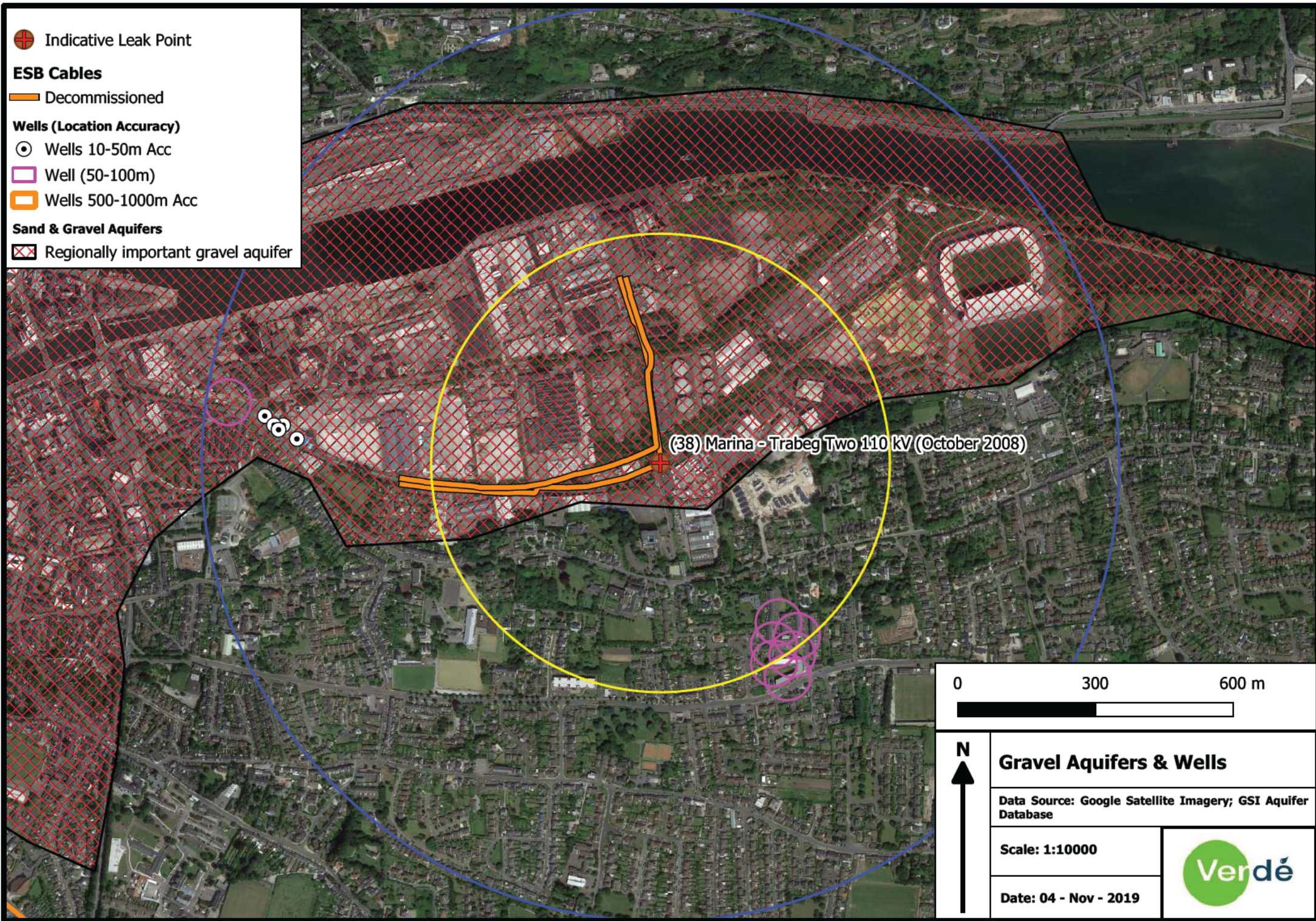
 Wells 10-50m Acc

 Well (50-100m)

 Wells 500-1000m Acc

Sand & Gravel Aquifers

 Regionally important gravel aquifer



(38) Marina - Trabeg Two 110 KV (October 2008)



Gravel Aquifers & Wells
Data Source: Google Satellite Imagery; GSI Aquifer Database

Scale: 1:10000
Date: 04 - Nov - 2019



Indicative Leak Point

ESB Cables

Decommissioned

Wells (Location Accuracy)

Wells 10-50m Acc

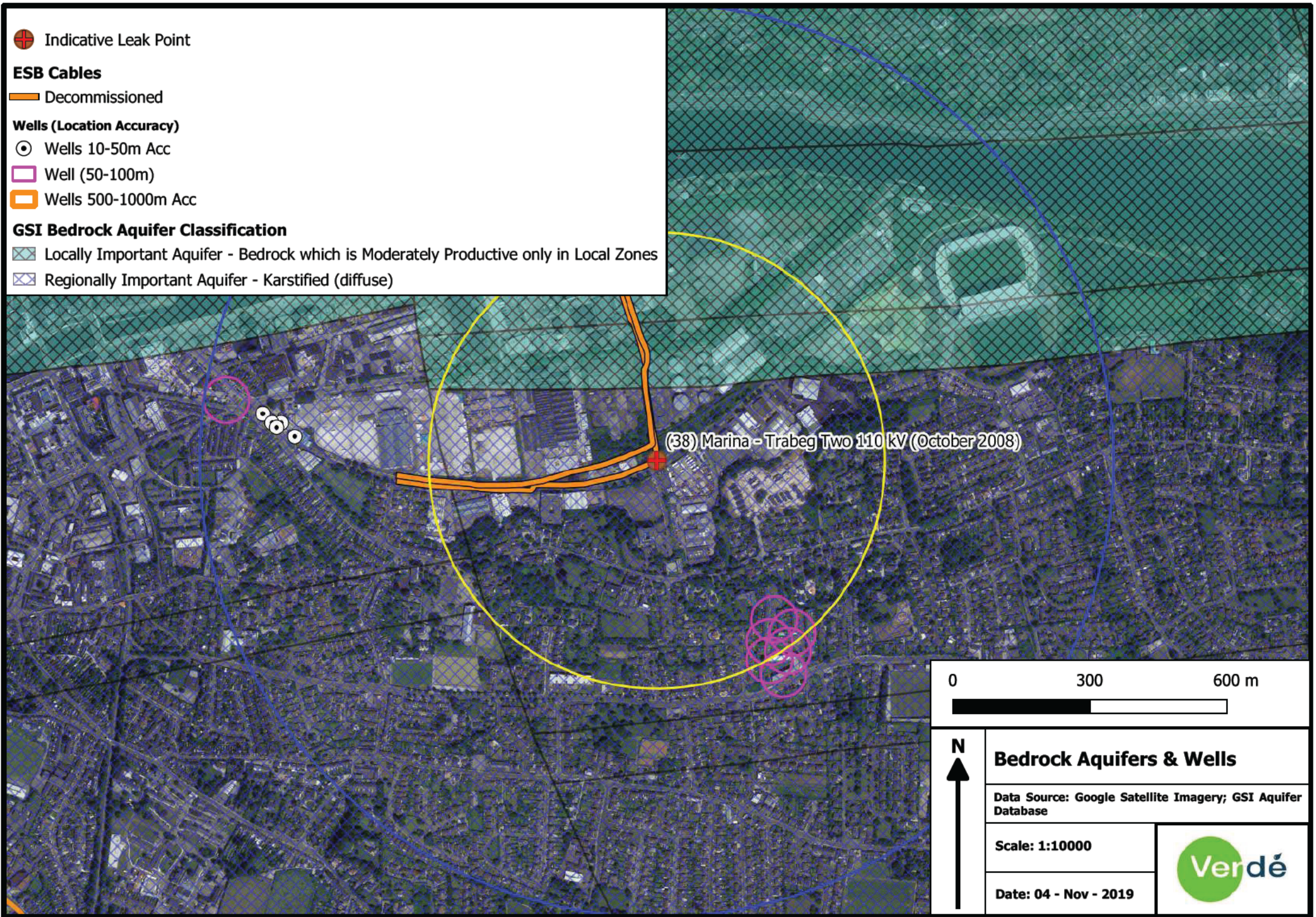
Well (50-100m)

Wells 500-1000m Acc

GSI Bedrock Aquifer Classification

Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

Regionally Important Aquifer - Karstified (diffuse)



(38) Marina - Trabeg Two 110 kV (October 2008)

0 300 600 m



Bedrock Aquifers & Wells

Data Source: Google Satellite Imagery; GSI Aquifer Database

Scale: 1:10000

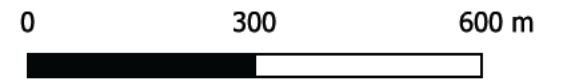
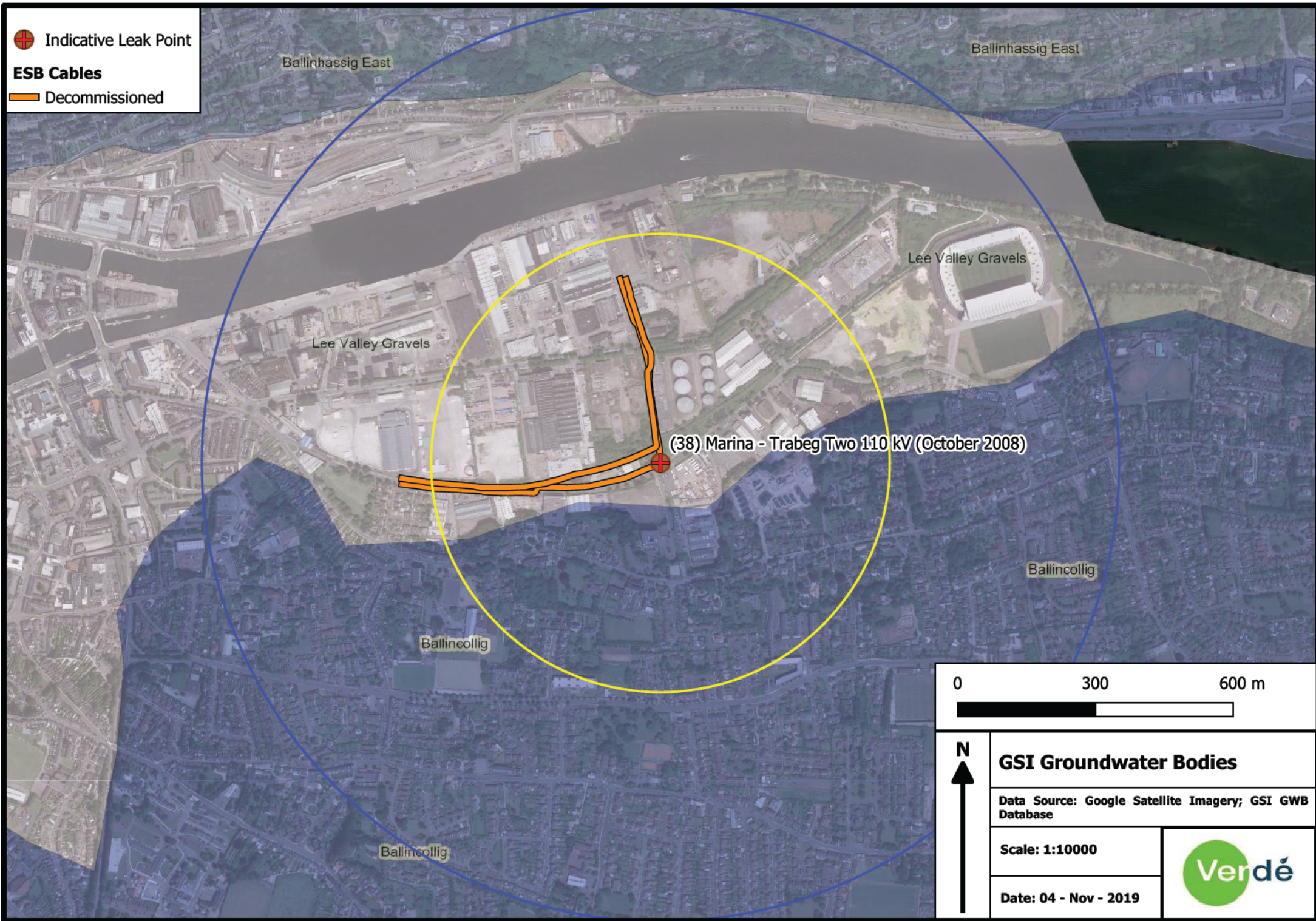
Date: 04 - Nov - 2019



 Indicative Leak Point

ESB Cables

 Decommissioned



GSI Groundwater Bodies
Data Source: Google Satellite Imagery; GSI GWB Database

Scale: 1:10000

Date: 04 - Nov - 2019



 Indicative Leak Point

ESB Cables

 Decommissioned

Geology

 Bedrock Outcrop

 Fault

 Ringmoylan Shale Formation

 Ballysteen Formation

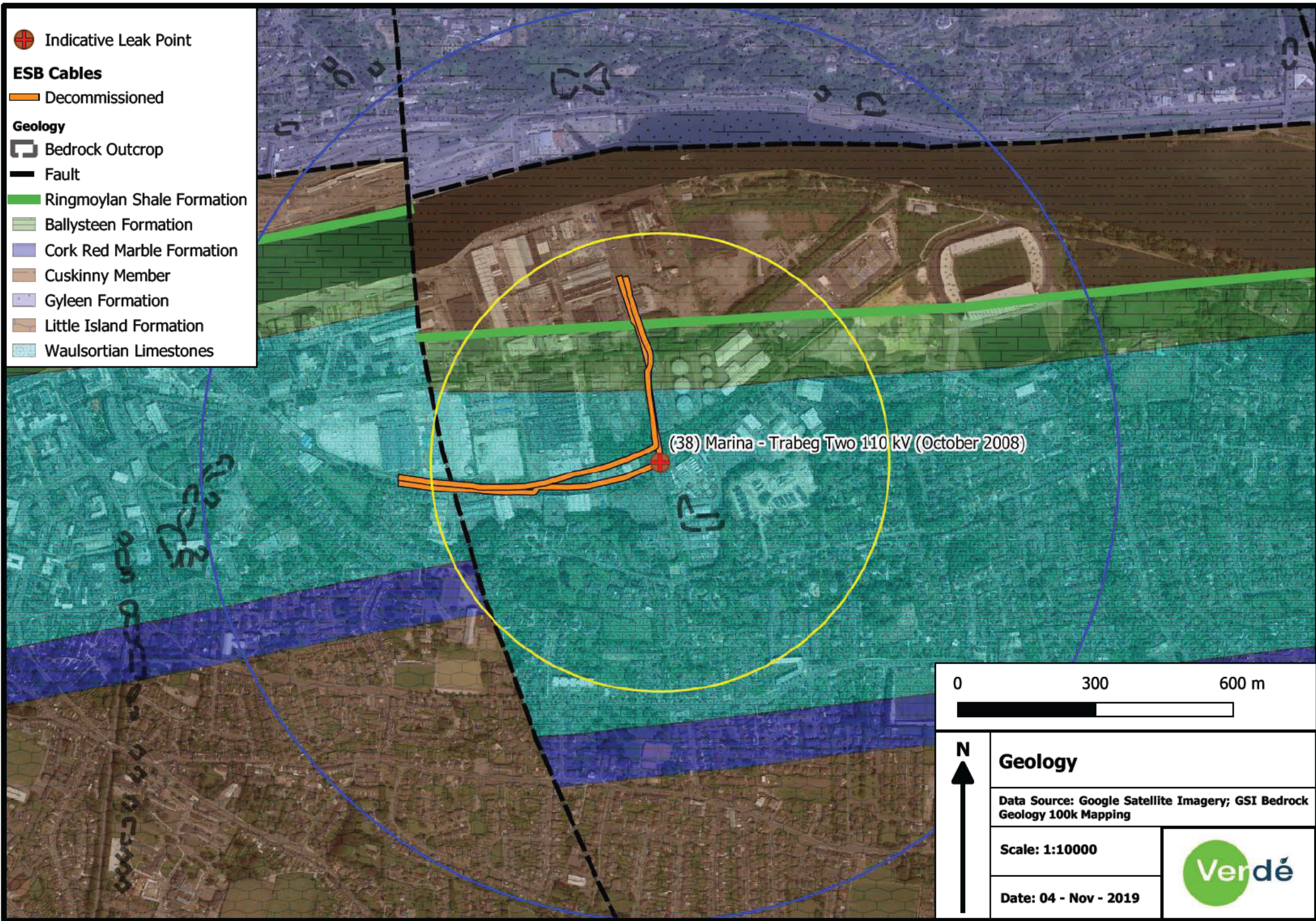
 Cork Red Marble Formation

 Cuskinny Member

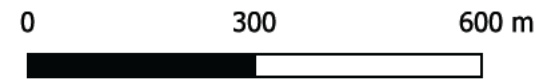
 Gyleen Formation

 Little Island Formation

 Waulsortian Limestones



(38) Marina - Trabeg Two 110 kV (October 2008)








Geology

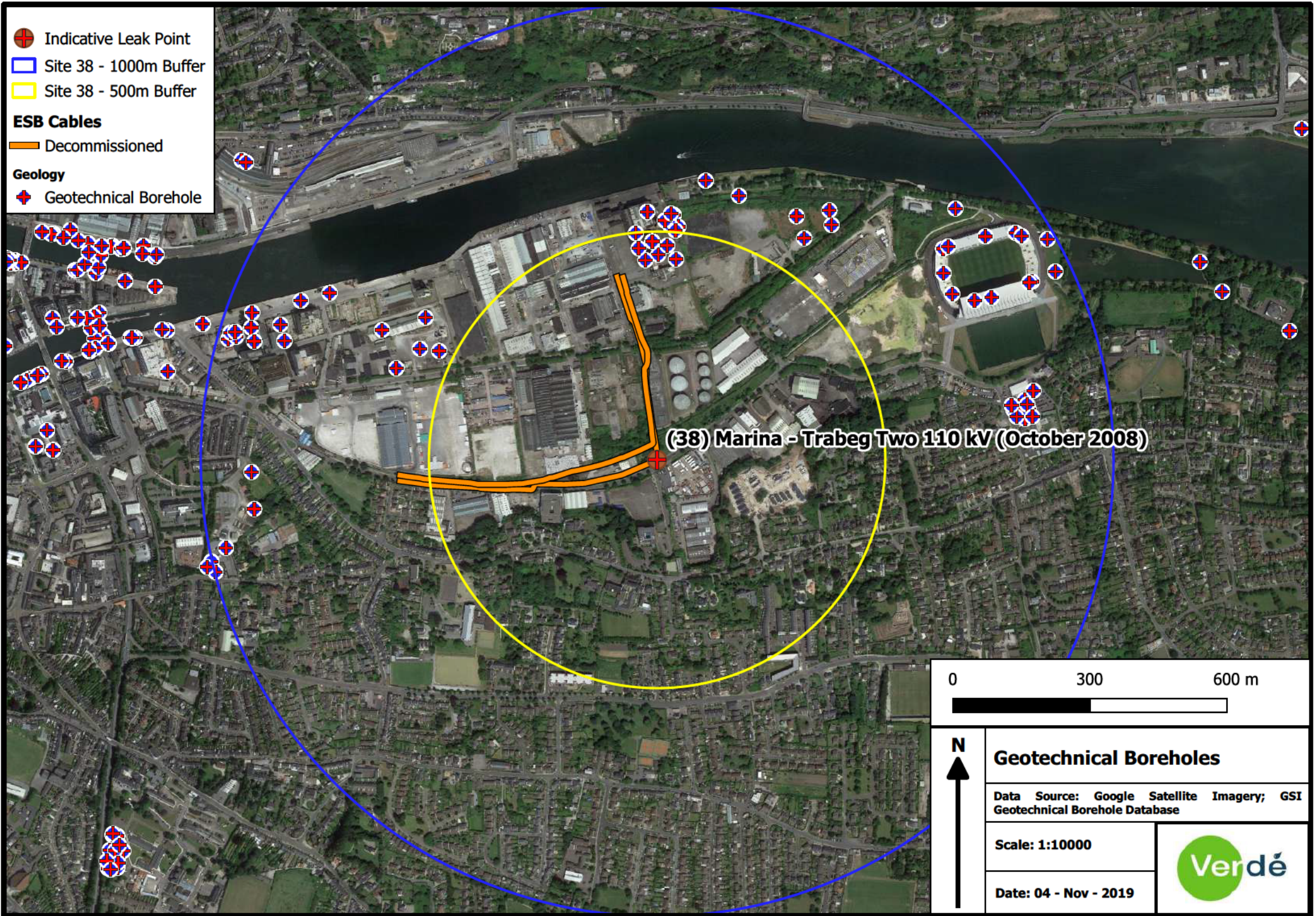
Data Source: Google Satellite Imagery; GSI Bedrock Geology 100k Mapping

Scale: 1:10000

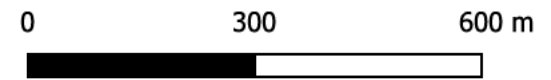
Date: 04 - Nov - 2019









-  Indicative Leak Point
-  Site 38 - 1000m Buffer
-  Site 38 - 500m Buffer
- ESB Cables**
-  Decommissioned
- Geology**
-  Geotechnical Borehole

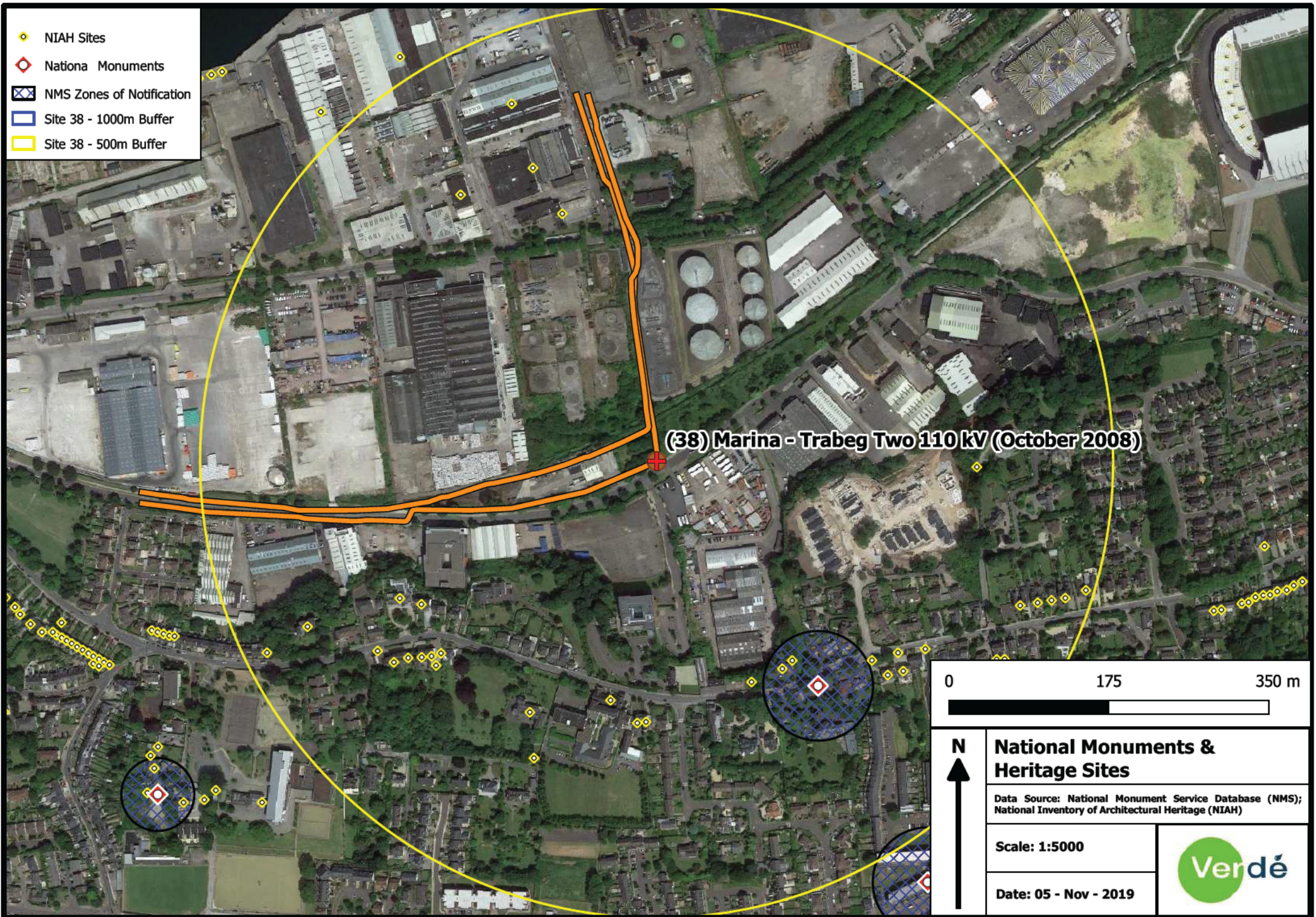


(38) Marina - Trabeg Two 110 kV (October 2008)

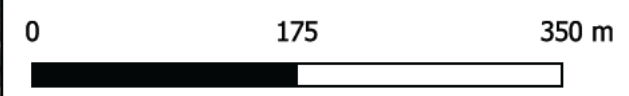


| | |
|---|---|
| Geotechnical Boreholes | |
| Data Source: Google Satellite Imagery; GSI Geotechnical Borehole Database | |
| Scale: 1:10000 |  |
| Date: 04 - Nov - 2019 | |

-  NIAH Sites
-  National Monuments
-  NMS Zones of Notification
-  Site 38 - 1000m Buffer
-  Site 38 - 500m Buffer



(38) Marina - Trabeg Two 110 kV (October 2008)



| | | |
|---|--|---|
|  <p>N</p> | National Monuments & Heritage Sites | |
| | Data Source: National Monument Service Database (NMS); National Inventory of Architectural Heritage (NIAH) | |
| | Scale: 1:5000 |  |
| Date: 05 - Nov - 2019 | | |



APPENDIX C

SITE PHOTOGRAPHS

Photo 1: View north from Monaghan Road looking into section of concrete pathway that is associated with the leak point. Cable progresses north and west from this point. Note green area in background extends for c.50m to north where drainage channel is located.



Photo 2: Looking east from entrance to nearby office complex; view of Monaghan Road. Note that cable leak point is located under pathway on left side of image. Also note the ESB substation on the right of the image.

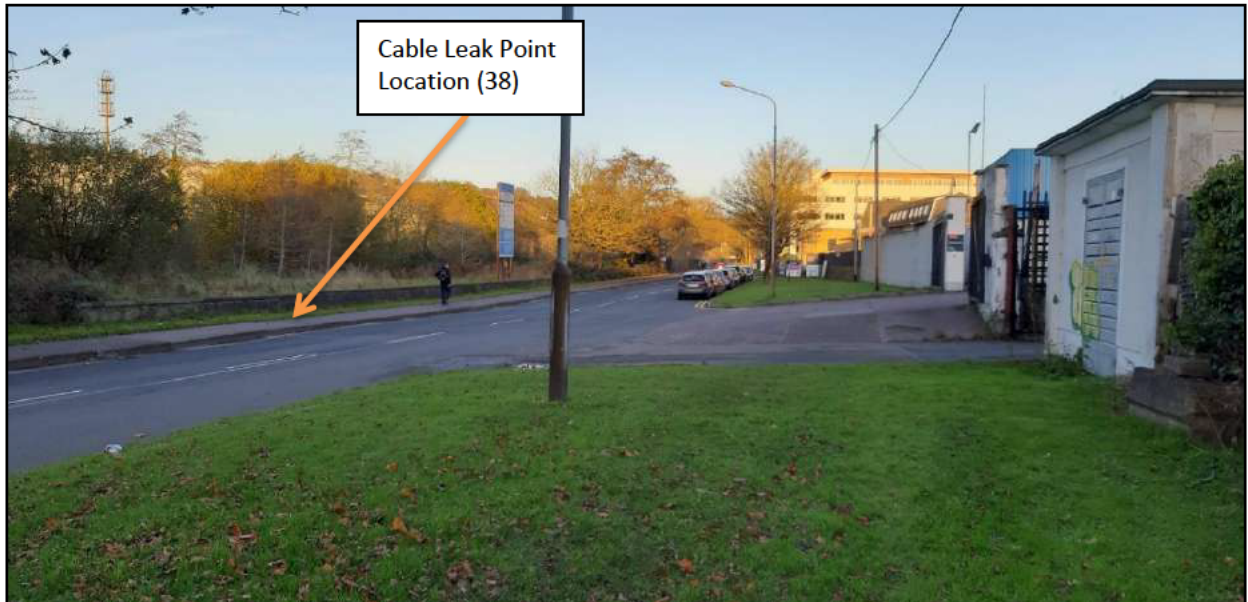


Photo 3: View west looking towards Tellangana House office development and leak point 51 which is located under pathway on right side of image. Note presence of storm drains on curbside.

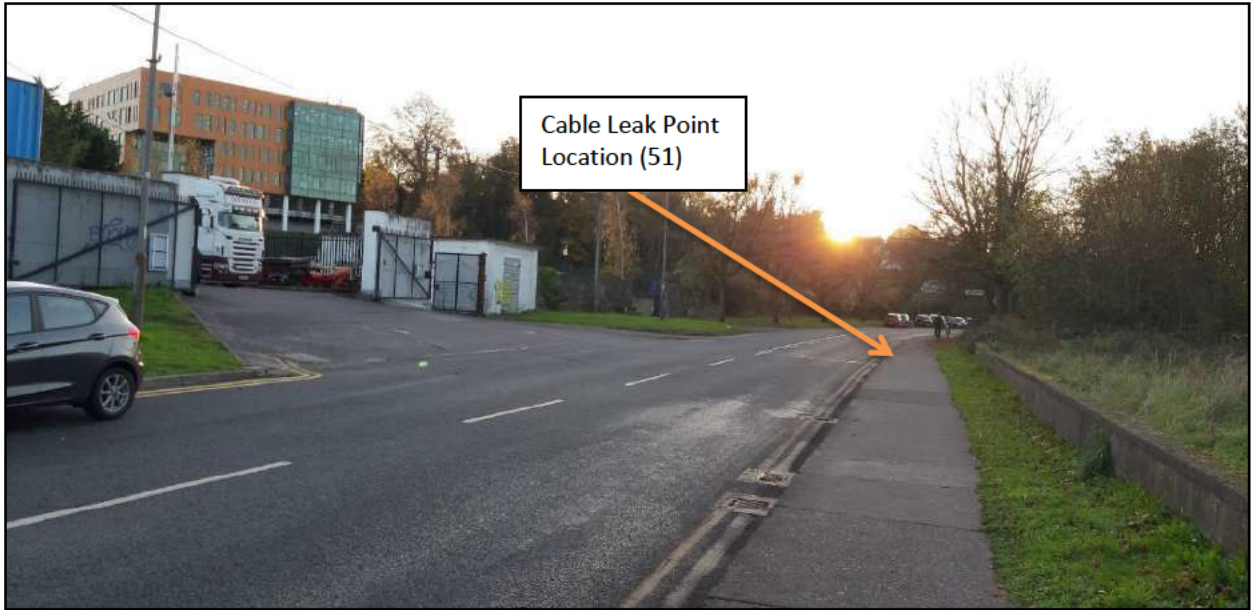


Photo 4: View looking south on Monaghan Road, of entrances to commercial premises. Also note, the ESB substation structure.

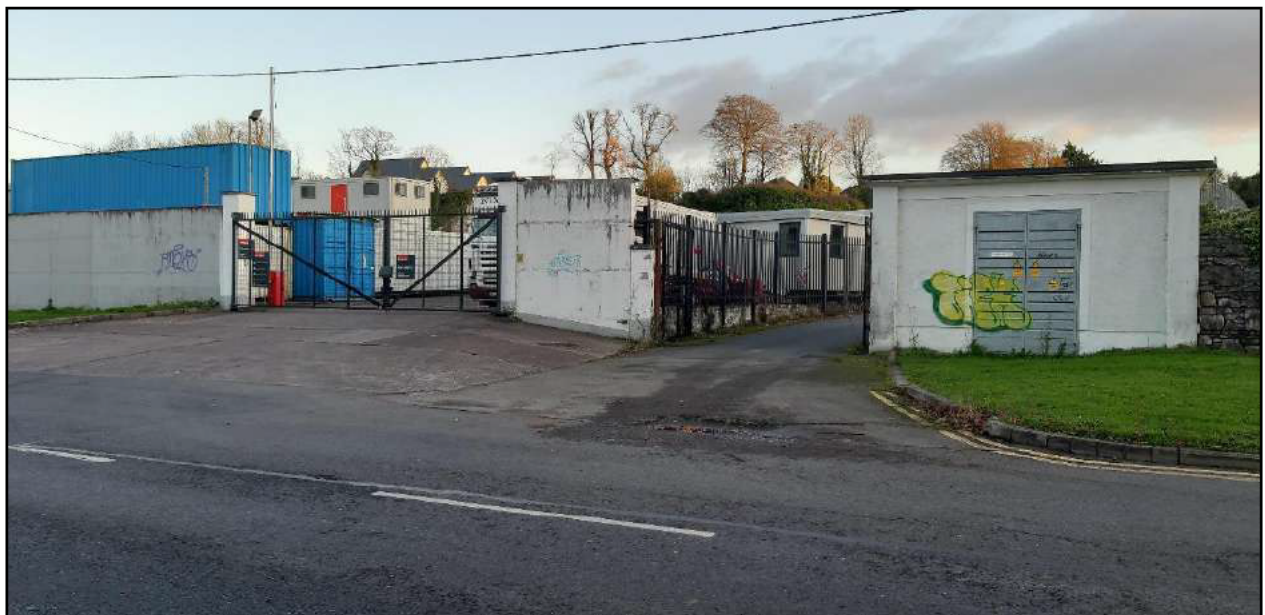


Photo 5: Image of drainage channel, looking west, located c.45m north of leak point. Note greyish-blue appearance of water and near-stagnant state of water.



Photo 6: Image of nearest drainage channel, north of leak point, showing the poor water quality and stagnant water observed.



Photo 7: Image of nearest drainage channel north of leak point; looking west. Note the fence marks the rear boundary of the fuel storage depot (decommissioned).



Photo 8: View, looking east, of a commercial property c.280m west of leak point, showing the concrete, culverted route of the drainage channel (flowing east). Note the Greenstar recycling facility in the far background.

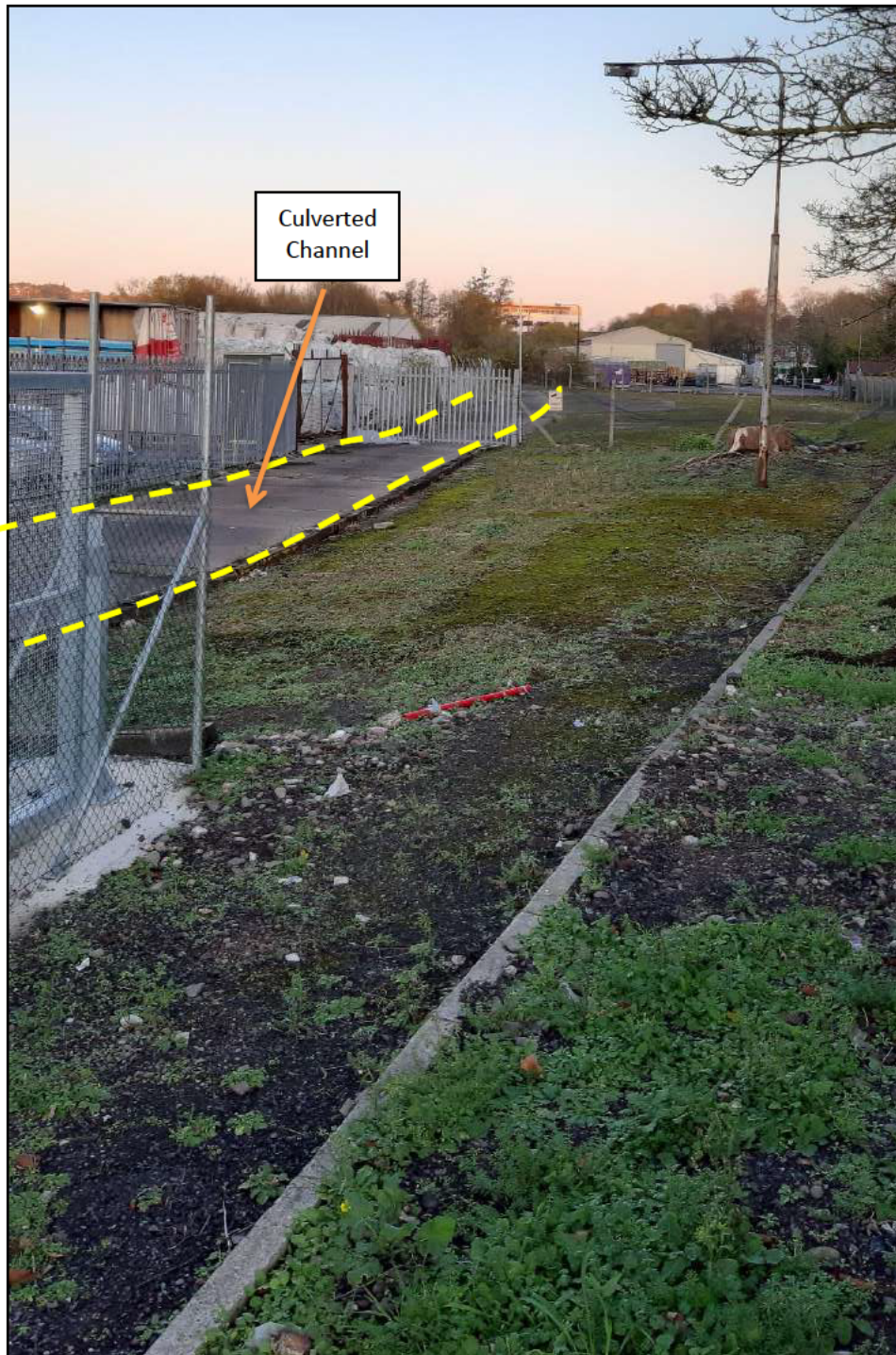


Photo 9: View of drainage channel at location of photo 8 (upstream); looking westward, showing occurrence of apparent hydrocarbon contamination in drainage waters.



Photo 10: View from north side of decommissioned fuel storage depot on southern side of Centre Park Road. Note that the tree line in the background marks the boundary of the fuel facility and the location of the drainage channel. The 110kV cable runs along the left hand side of this image, towards the leak point.



APPENDIX D

MATERIAL SAFETY DATA SHEETS FOR CONTAMINANTS OF CONCERN (COPC)

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-phrases(s) | Conc. |
|------------------------------------|------------|-----------|-----------|--------------|------------------|
| Benzene, C10-C13 alkyl derivatives | 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.

Material Safety Data Sheet

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

Material Safety Data Sheet

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

Material Safety Data Sheet

| | |
|--|--|
| | 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/m ³ 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 mm ² /s at 40 °C / 104 °F |
| Vapour density (air=1) | : > 1 (estimated value(s)) |
| Evaporation rate (nBuAc=1) | : Data not available |

Material Safety Data Sheet**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 |

Material Safety Data Sheet

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.

Material Safety Data Sheet**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-phrases(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. |

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-phrases(s) | Conc. |
|------------------------------------|------------|-----------|-----------|--------------|------------------|
| Benzene, C10-C13 alkyl derivatives | 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.

Material Safety Data Sheet

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

Material Safety Data Sheet

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

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- 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

Material Safety Data Sheet

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 |

Material Safety Data Sheet

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.

Material Safety Data Sheet**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-phras(e)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 WATERBODY DOCUMENTATION



Full Report for Waterbody CorkCity_2



River Basin Management Plans (RBMPs) have been published for all River Basin Districts in Ireland in accordance with the requirements of the Water Framework Directive. The WaterMaps viewer is an integral part of the River Basin Management Plan and provides access to information at individual waterbody level and at Water Management Unit level for all the River Basin Districts in Ireland.

The following report provides summary plan information about the selected waterbody (indicated by the pin in the map above) relating to its status, risks, objectives, and measures proposed to retain status where this is adequate, or improve it where necessary. Waterbodies can relate to surface waters (these include rivers, lakes, estuaries [transitional waters], and coastal waters), or to groundwaters. Other relevant information not included in this report can be viewed using the WaterMaps viewer, including areas listed in the Register of Protected Areas.

You will find brief notes at the bottom of some of the individual report sheets that will help you in interpreting the information presented. More detailed information can be obtained in relation to all aspects of the RBMPs at www.wfdireland.ie.



Summary Information:

Water Management Unit: N/A
WaterBody Category: Groundwater Waterbody
WaterBody Name: CorkCity_2
WaterBody Code: IE_SW_G_031
Overall Status: Good
Overall Objective: Protect
Overall Risk: 1a At Risk
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.



Chemical and Quantitative Status Report

Water Management Unit: N/A
WaterBody Category: Groundwater Waterbody
WaterBody Name: CorkCity_2
WaterBody Code: IE_SW_G_031
Overall Status Result: **Good**
Heavily Modified: No



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

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).



Risk Report

Water Management Unit: N/A
WaterBody Category: Groundwater Waterbody
WaterBody Name: CorkCity_2
WaterBody Code: IE_SW_G_031
Overall Risk Result: 1a At Risk
Heavily Modified: No



| | Risk Test Description | Risk |
|-----|---|-------------|
| | Groundwater Dependent Terrestrial Ecosystems | |
| TE | GWDTE Risk | N/A |
| | Groundwater Quality | |
| DIF | Diffuse Elements (General) Risk | N/A |
| DW | Drinking Waters Risk | N/A |
| INT | Intrusions Risk | N/A |
| WB | Water Balance Risk | N/A |
| | Groundwater Quality (General) | |
| GQ | General Groundwater Quality Risk | N/A |
| | Groundwater Quality (Point Risk) | |
| CL | Contaminated Land Risk | N/A |
| LF | Landfill Risk | N/A |
| MI | Mine Risk | N/A |
| QY | Quarry Risk | N/A |
| UR | Urban Risk | N/A |
| UW | UWWT Risk | N/A |
| | GW Diffuse Risk Sources | |
| WB3 | Mobile Nutrients (NO3) | N/A |
| WB4 | Mobile Chemicals | N/A |
| WB5 | Clustered OSWTSs and leaking urban sewerage systems | N/A |
| | GW Hydrology | |
| WB1 | Water balance - Abstraction | N/A |
| WB2 | Abstraction - Intrusion | N/A |



| GW Point Risk Sources | | |
|------------------------------|--|---------------------|
| WB10 | Risk from Point sources of pollution - Contaminated Land | N/A |
| WB11 | Risk from Point sources of pollution - Trade Effluent Discharges | N/A |
| WB12 | Risk from Point sources of pollution - Urban Wastewater Discharges | N/A |
| WB6 | Risk from Point sources of pollution - Mines | N/A |
| WB7 | Risk from Point sources of pollution - Quarries | N/A |
| WB8 | Risk from Point sources of pollution - Landfills | N/A |
| WB9 | Risk from Point sources of pollution - Oil Industry Infrastructure | N/A |
| Overall Risk | | |
| RA | Groundwater Overall - Worst Case | N/A |
| Risk information | | |
| CLR | Contaminated land risk | 2b Not At Risk |
| DR | Risk of groundwater due to pressure from diffuse sources of pollution | 1a At Risk |
| DWR | Risk associated with exceedances of water quality above specific standards | 2b Not At Risk |
| GDR | Groundwater dependant terrestrial ecosystems risk | 2b Not At Risk |
| GWR | General groundwater quality risk | 1a At Risk |
| INR | Risk associated with saline intrusion into groundwater | 2b Not At Risk |
| LR | Risk due to landfills sites/old closed dump sites | 2b Not At Risk |
| MR | Mines risk | 2b Not At Risk |
| NULL | Diffuse nitrates from agriculture risk | N/A |
| QR | Risk due to quarries | 2b Not At Risk |
| RA | Revised risk assessment | 1a At Risk |
| RPR | Risk associated with MRP loading to rivers | 1a At Risk |
| SQR | Risk associated with dependant surface water quantitative status | 2b Not At Risk |
| SWR | Overall risk associated with nutrient loadings to rivers and transitional and coastal waters | 1a At Risk |
| TNR | Risk associated with nitrate loading to transitional and coastal waters | 1a At Risk |
| UAR | Risk of groundwater due to pressures from urban areas | 1b Probably At Risk |
| UWR | Risk due to direct discharges of urban wastewater | 2b Not At Risk |

Risk

By 'risk' we mean the risk that a waterbody will not achieve good ecological or good chemical status/potential at least by 2015. To examine risk the various pressures acting on the waterbody were identified along with any evidence of impact on water status. Depending on the extent of the pressure and its potential for impact, and the amount of information available, the risk to the water body was placed in one of four categories: 1a at risk; 1b probably at risk; 2a probably not at risk; 2b not at risk. Note that '2008' after the risk category means that the risk assessment was revised in 2008. All other risks were determined as part of an earlier risk assessment in 2005.

You can read more about risk assessment in our 'WFD Risk Assessment Update' document in the RBMP document library, and other documents at www.wfdireland.ie (Directory 31 Risk Assessments).



Objectives Report

Water Management Unit: N/A
WaterBody Category: Groundwater Waterbody
WaterBody Name: CorkCity_2
WaterBody Code: IE_SW_G_031
Overall Objective: Protect
Heavily Modified: No



| Objectives Description | | Result |
|---------------------------------------|--|---------------|
| Extended timescale information | | |
| E1 | Extended deadlines due to agricultural P | No Status |
| E2 | Extended deadlines due to agricultural N | No Status |
| E3 | Extended deadlines due to mines | No Status |
| E4 | Extended deadlines due to urban areas | No Status |
| E5 | Extended deadlines due to contaminated lands | No Status |
| EO | Extended deadlines - overall | No Status |
| Objectives information | | |
| OB1 | Prevent deterioration objective | Protect |
| OB2 | Restore at least good status objective | No Status |
| OB3 | Reduce chemical pollution objective | No Status |
| OB4 | Protected areas objective | No Status |
| OBO | Overall objectives - objective | Protect |

Extended timescales

Extended timescales have been set for certain waters due to technical, economic, environmental or recovery constraints. Extended timescales are usually of one planning cycle (6 years, to 2021) but in some cases are two planning cycles (to 2027).

Objectives

In general, we are required to ensure that our waters achieve at least good status/potential by 2015, and that their status does not deteriorate. Having identified the status of waters (this is given earlier in this report), the next stage is to set objectives for waters. Objectives consider waters that require protection from deterioration as well as waters that require restoration and the timescales needed for recovery. Four default objectives have been set initially:-

- Prevent Deterioration*
- Restore Good Status*
- Reduce Chemical Pollution*
- Achieve Protected Areas Objectives*

These objectives have been refined based on the measures available to achieve them, the latter's likely effectiveness, and consideration of cost-effective combinations of measures. Where it is considered necessary extended deadlines have been set for achieving objectives in 2021 or 2027.



Measures Report

Water Management Unit: N/A
WaterBody Category: Groundwater Waterbody
WaterBody Name: CorkCity_2
WaterBody Code: IE_SW_G_031
Heavily Modified: No



| | Measures Description | Applicable |
|-----|--|-------------------|
| BC | Total number of basic measures which apply to this waterbody | 26 |
| BW | Directive - Bathing Waters Directive | No |
| BIR | Directive - Birds Directive | Yes |
| HAB | Directive - Habitats Directive | No |
| DW | Directive - Drinking Waters Directive | Yes |
| MAE | Directive - Major Accidents and Emergencies Directive | Yes |
| EIA | Directive - Environmental Impact Assessment Directive | Yes |
| SS | Directive - Sewage Sludge Directive | Yes |
| UWT | Directive - Urban Waste Water Treatment Directive | Yes |
| PPP | Directive - Plant Protection Products Directive | Yes |
| NIT | Directive - Nitrates Directive | Yes |
| IPC | Directive - Integrated Pollution Prevention Control Directive | Yes |
| CR | Other Stipulated Measure - Cost recovery for water use | Yes |
| SUS | Other Stipulated Measure - Promotion of efficient and sustainable water use | Yes |
| DWS | Other Stipulated Measure - Protection of drinking water sources | Yes |
| ABS | Other Stipulated Measure - Control of abstraction and impoundment | Yes |
| POI | Other Stipulated Measure - Control of point source discharges | Yes |
| DIF | Other Stipulated Measure - Control of diffuse source discharges | Yes |
| GW | Other Stipulated Measure - Authorisation of discharges to groundwaters | Yes |
| PS | Other Stipulated Measure - Control of priority substances | Yes |
| MOD | Other Stipulated Measure - Controls on physical modifications to surface waters | Yes |
| OA | Other Stipulated Measure - Controls on other activities impacting on water status | Yes |
| AP | Other Stipulated Measure - Prevention or reduction of the impact of accidental pollution incidents | Yes |
| OTS | On-site waste water treatment systems | Yes |
| FPM | Freshwater Pearl Mussel sub-basin plan | No |
| SHE | Shellfish Pollution Reduction Plan | Yes |
| IPR | IPPC licences requiring review | Yes |
| WPR | Water Pollution Act licences requiring review | Yes |
| FOR | Forestry guidelines and regulations | Yes |

Date Reported to Europe: July 2010

Date Report Created 12/08/2019



| | | |
|-----|-----------------------------|-----|
| HQW | Protect high quality waters | Yes |
|-----|-----------------------------|-----|

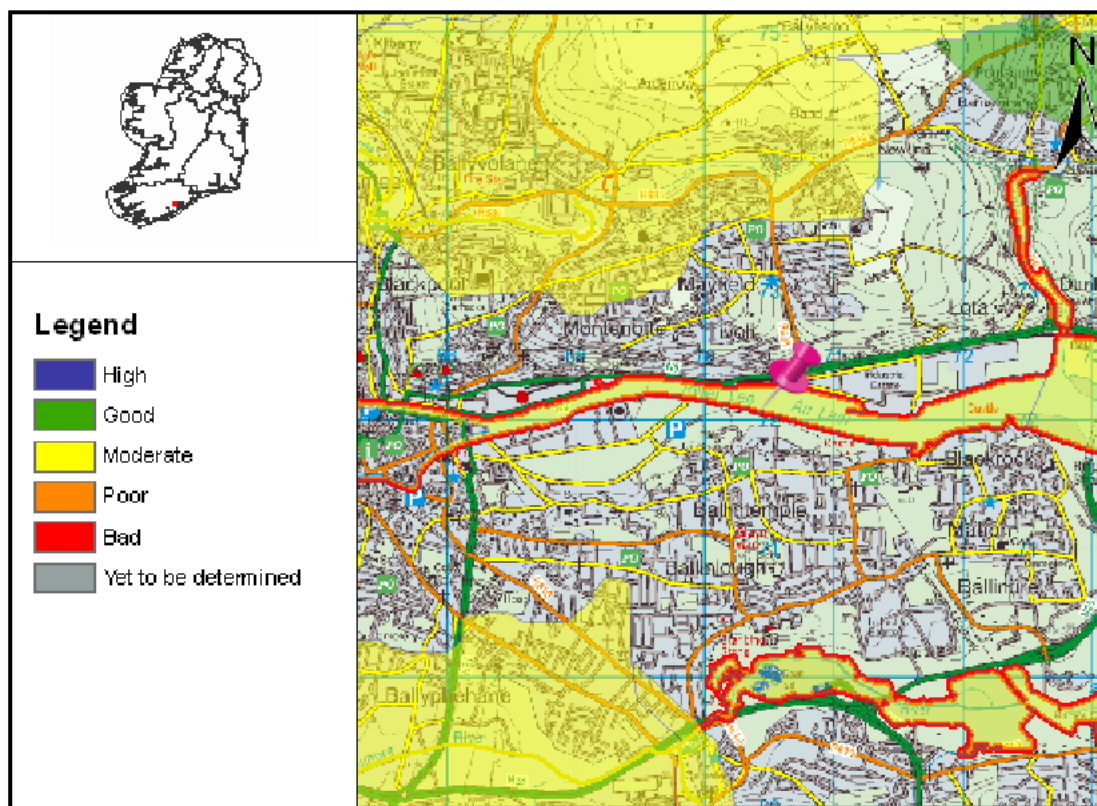
Measures

Measures are necessary to ensure that we meet the objectives set out in the previous page of this report. Many measures are already provided for in national legislation and must be implemented. Other measures have been recently introduced or are under preparation. A range of additional potential measures are also being considered but require further development. Any agreed additional measures can be introduced through the update of Water Management Unit Action Plans during the implementation process.

You can read more about Basic Measures in 'River Basin Planning Guidance' and in other documents in our RBMP Document Library at www.wfdireland.ie.



Full Report for Waterbody Lee (Cork) Estuary Lower



River Basin Management Plans (RBMPs) have been published for all River Basin Districts in Ireland in accordance with the requirements of the Water Framework Directive. The WaterMaps viewer is an integral part of the River Basin Management Plan and provides access to information at individual waterbody level and at Water Management Unit level for all the River Basin Districts in Ireland.

The following report provides summary plan information about the selected waterbody (indicated by the pin in the map above) relating to its status, risks, objectives, and measures proposed to retain status where this is adequate, or improve it where necessary. Waterbodies can relate to surface waters (these include rivers, lakes, estuaries [transitional waters], and coastal waters), or to groundwaters. Other relevant information not included in this report can be viewed using the WaterMaps viewer, including areas listed in the Register of Protected Areas.

You will find brief notes at the bottom of some of the individual report sheets that will help you in interpreting the information presented. More detailed information can be obtained in relation to all aspects of the RBMPs at www.wfdireland.ie.



Summary Information:

Water Management Unit: N/A
WaterBody Category: Transitional Waterbody
WaterBody Name: Lee (Cork) Estuary Lower
WaterBody Code: IE_SW_060_0900
Overall Status: Moderate
Overall Objective: Restore 2021
Overall Risk: 1a At Risk
Heavily Modified: Yes



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.



Status Report

Water Management Unit: N/A
WaterBody Category: Transitional Waterbody
WaterBody Name: Lee (Cork) Estuary Lower
WaterBody Code: IE_SW_060_0900
Overall Status Result: Moderate
Heavily Modified: Yes



| Status Element Description | | Result |
|-----------------------------------|--|----------------|
| Status information | | |
| DIN | Dissolved Inorganic Nitrogen status | Moderate |
| MRP | Molybdate Reactive Phosphorus status | Good |
| DO | Dissolved oxygen as per cent saturation status | Moderate |
| BOD | Biochemical Oxygen Demand (5-days) status | Good |
| PHY | Macroalgae - phytobiomass status | Good |
| 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 | Poor |
| HYD | Hydrology status | N/A |
| MOR | Morphology status | Less than Good |
| SP | Specific Pollutant Status | N/A |
| PAS | Overall protected area status | Less than good |
| ES | Ecological Status | Moderate |
| CS | Chemical Status | N/A |
| SWS | Surface Water Status | N/A |
| EXT | Extrapolated status | N/A |
| 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).



Risk Report

Water Management Unit: N/A
WaterBody Category: Transitional Waterbody
WaterBody Name: Lee (Cork) Estuary Lower
WaterBody Code: IE_SW_060_0900
Overall Risk Result: **1a** At Risk
Heavily Modified: Yes



| Risk Test Description | | | Risk |
|-----------------------------------|---|-----------|-------------|
| Hydrology | | | |
| THY1 | Water balance - Abstraction | 1a | At Risk |
| Marine Direct Impacts | | | |
| TMDI 1 | Dangerous Substances | | N/A |
| TMDI 2 | OSPAR | 1a | At Risk |
| TMDI 3 | UWWT Regs Designations | 1a | At Risk |
| TMDI O | Marine Direct Impacts Overall - Worst Case | 1a | At Risk |
| Morphological Risk Sources | | | |
| TM1 | Channelisation | | N/A |
| TM2 | Deposition | | N/A |
| TM3 | Coastal Defences | | N/A |
| TM4 | Impoundments | | N/A |
| TM5a | Built Structures - Port Tonnage | | N/A |
| TM5b | Built Structures - Industrial Intakes | | N/A |
| TM6 | Intensive Landuse | | N/A |
| TMO | Morphology Overall - Worst Case | | N/A |
| TMO | Overall (MIMAS) Morphological Risk - Worst Case (2008) | | N/A |
| Overall Risk | | | |
| RA | Transitional Overall - Worst CaseOverall (MIMAS) Morphological Risk - Worst Case (2008) | 1a | At Risk |
| Point / MDI Worst Case | | | |
| TPOL | Worst case of Point Overall and MDI OverallOverall (MIMAS) Morphological Risk - Worst Case (2008) | 1a | At Risk |



| Point Risk Sources | | |
|--------------------|---|---------------------|
| TP1 | WWTPs (2008) | 2b Not At Risk |
| TP2 | CSOs | 1b Probably At Risk |
| TP3 | IPPCs (2008) | 2b Not At Risk |
| TP4 | Section 4s (2008) | 2b Not At Risk |
| TP5 | WTPs/Mines/Quarries/Landfills | N/A |
| TPO | Overall Risk from Point Sources - Worst Case (2008) | 1b Probably At Risk |

Risk

By 'risk' we mean the risk that a waterbody will not achieve good ecological or good chemical status/potential at least by 2015. To examine risk the various pressures acting on the waterbody were identified along with any evidence of impact on water status. Depending on the extent of the pressure and its potential for impact, and the amount of information available, the risk to the water body was placed in one of four categories: 1a at risk; 1b probably at risk; 2a probably not at risk; 2b not at risk. Note that '2008' after the risk category means that the risk assessment was revised in 2008. All other risks were determined as part of an earlier risk assessment in 2005.

You can read more about risk assessment in our 'WFD Risk Assessment Update' document in the RBMP document library, and other documents at www.wfdireland.ie (Directory 31 Risk Assessments).



Objectives Report

Water Management Unit: N/A

WaterBody Category: Transitional Waterbody

WaterBody Name: Lee (Cork) Estuary Lower

WaterBody Code: IE_SW_060_0900

Overall Objective: Restore 2021

Heavily Modified: Yes



| | Objectives Description | Result |
|-----|--|---------------|
| | Extended timescale information | |
| E1 | Extended timescales due to time requirements to upgrade WWTP discharges | No Status |
| E2 | Extended timescales due to delayed recovery of chemical pollution and chemical status failures | No Status |
| E3 | Extended timescales due to winter dissolved nitrogen exceedances | 2021 |
| E4 | Extended timescales due to time requirements for status recovery | No Status |
| E5 | Extended timescales from Northern Ireland Environment Agency | No Status |
| E0V | Overall extended timescale - combination of all extended timescales fields | 2021 |
| | Objectives information | |
| OB1 | Prevent deterioration objective | No Status |
| OB2 | Restore at least good status objective | No Status |
| OB3 | Reduce chemical pollution objective | No Status |
| OB4 | Protected areas objective | Restore 2021 |
| OBO | Overall objectives | Restore 2021 |

Extended timescales

Extended timescales have been set for certain waters due to technical, economic, environmental or recovery constraints. Extended timescales are usually of one planning cycle (6 years, to 2021) but in some cases are two planning cycles (to 2027).

Objectives

In general, we are required to ensure that our waters achieve at least good status/potential by 2015, and that their status does not deteriorate. Having identified the status of waters (this is given earlier in this report), the next stage is to set objectives for waters. Objectives consider waters that require protection from deterioration as well as waters that require restoration and the timescales needed for recovery. Four default objectives have been set initially:-

Prevent Deterioration

Restore Good Status

Reduce Chemical Pollution

Achieve Protected Areas Objectives

These objectives have been refined based on the measures available to achieve them, the latter's likely effectiveness, and consideration of cost-effective combinations of measures. Where it is considered necessary extended deadlines have been set for achieving objectives in 2021 or 2027.

Date Reported to Europe: July 2010

Date Report Created 12/08/2019



Measures Report

Water Management Unit: N/A
WaterBody Category: Transitional Waterbody
WaterBody Name: Lee (Cork) Estuary Lower
WaterBody Code: IE_SW_060_0900
Heavily Modified: Yes



| | Measures Description | Applicable |
|-----|--|-------------------|
| BC | Total number of basic measures which apply to this waterbody | 14 |
| BW | Directive - Bathing Waters Directive | No |
| BIR | Directive - Birds Directive | Yes |
| HAB | Directive - Habitats Directive | No |
| MAE | Directive - Major Accidents and Emergencies Directive | Yes |
| EIA | Directive - Environmental Impact Assessment Directive | Yes |
| UWT | Directive - Urban Waste Water Treatment Directive | No |
| PPP | Directive - Plant Protection Products Directive | Yes |
| NIT | Directive - Nitrates Directive | Yes |
| IPC | Directive - Integrated Pollution Prevention Control Directive | Yes |
| POI | Other Stipulated Measure - Control of point source discharges | Yes |
| DIF | Other Stipulated Measure - Control of diffuse source discharges | Yes |
| PS | Other Stipulated Measure - Control of priority substances | Yes |
| MOD | Other Stipulated Measure - Controls on physical modifications to surface waters | Yes |
| OA | Other Stipulated Measure - Controls on other activities impacting on water status | Yes |
| AP | Other Stipulated Measure - Prevention or reduction of the impact of accidental pollution incidents | Yes |
| TP1 | WSIP - Agglomerations with treatment plants requiring capital works | No |
| TP2 | WSIP - Agglomerations with treatment plants requiring further investigation prior to capital works | No |
| TP3 | WSIP - Agglomerations requiring the implementation of actions identified in Shellfish PRPs | No |
| TP4 | WSIP - Agglomerations with treatment plants requiring improved operational performance | No |
| TP5 | WSIP - Agglomerations requiring investigation of CSOs | No |
| TP6 | WSIP - Agglomerations where existing treatment capacity is currently adequate but predicted loadings would result in overloading | No |
| OTS | On-site waste water treatment systems | Yes |
| SHE | Shellfish Pollution Reduction Plan | No |
| IPR | IPPC licences requiring review | Yes |
| WPR | Water Pollution Act licences requiring review | No |



| | | |
|-----|-----------------------------|----|
| HQW | Protect high quality waters | No |
|-----|-----------------------------|----|

Measures

Measures are necessary to ensure that we meet the objectives set out in the previous page of this report. Many measures are already provided for in national legislation and must be implemented. Other measures have been recently introduced or are under preparation. A range of additional potential measures are also being considered but require further development. Any agreed additional measures can be introduced through the update of Water Management Unit Action Plans during the implementation process.

You can read more about Basic Measures in 'River Basin Planning Guidance' and in other documents in our RBMP Document Library at www.wfdireland.ie.

APPENDIX F

HISTORIC GEOTECHNICAL INVESTIGATION REPORTS AND LOG DETAILS

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION BORING RECORD

CONTRACT Marine Generating Station, **BOREHOLE No.** 18
Report No. **Order No.**
Bored for E.S.S.,
Site Address Cork.
Boring Commenced 18.12.1974, **Boring Completed** 8.1.1975,
Type of Boring Percussive and Shell & Auger **Diameter of Borehole** 15 and 8 in.
Ground level 4.74m O.D.
Water Struck (1) 4.35m B.C.L. (2) (3)
Standing Water Level
Remarks Chiselling 6 hours.
 All levels are related to ground level.

| Description of Strata | Depth | | Thickness | Samples | | |
|---|-------|-------|-----------|---------|-------|-------------|
| | From | To | | Ref No. | Type | Depth |
| Concrete. (Chiselling 1 hour). | 0 | 0.15 | 0.15 | | | |
| Filling of clay, silt, stones etc. | 0.15 | | | 6904 | D | 0.60 |
| | | 2.70 | 2.55 | 6901 | U | 1.00 - 1.45 |
| | | | | 6905 | D | 2.00 |
| Soft grey silt with shells. | 2.70 | | | 6906 | D | 2.85 |
| | | 4.35 | 1.65 | 6902 | U | 2.85 - 3.30 |
| | | | | 6903 | U | 3.90 - 4.35 |
| | | | | 6907 | D | 4.00 |
| Loose very sandy grey silt. | 4.35 | | | 6914 | W | 4.30 |
| | | 6.00 | 1.65 | 6908 | D | 4.50 |
| Loose medium to coarse gravel. | 6.00 | 6.50 | 0.50 | 6909 | D | 6.00 |
| Loose very silty sandy gravel. | 6.50 | | | | | |
| | | 8.10 | 1.60 | 6910 | D | 6.65 |
| Fairly compact fine to very coarse gravel. | 8.10 | | | 6911 | D | 8.25 |
| | | 11.25 | 3.12 | 6912 | D | 9.75 |
| Compact very coarse sandy gravel with cobbles. (Chiselling 1 1/2 hours). | 11.25 | | | 6913 | D | 11.25 |
| | | 15.60 | 4.35 | 6915 | D | 12.75 |
| | | | | 6916 | D | 13.40 |
| | | | | 6917 | D | 14.00 |
| Compact coarse gravel with some sand. | 15.60 | | | | | |
| | | 16.00 | 0.40 | 6978 | D | 15.75 |
| Compact coarse sandy gravel with cobbles & some slight traces of clay. (Chis. 3 1/2 hrs). | 16.00 | | | 6979 | D | 17.20 |
| | | | | 6980 | D | 18.75 |
| | | 30.00 | 14.00 | 6981 | D | 21.70 |
| | | | | 6983 | D | 23.20 |
| Final level. | 30.00 | | | 6984 | D | 24.70 |
| | | | | 6985 | D | 26.25 |
| | | | | 6986 | D | 27.70 |
| | | | | 6987 | D | 29.25 |
| | | | 6988 | W | 29.90 | |

Code: U — Undisturbed Sample D — Large Disturbed Sample J — Jar Sample W — Water Sample



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IRISH DUNLOP COMPANY

ELECTRICITY SUPPLY BOARD
CIVIL WORKS DEPARTMENT
DUBLIN

MARINA GENERATING STATION

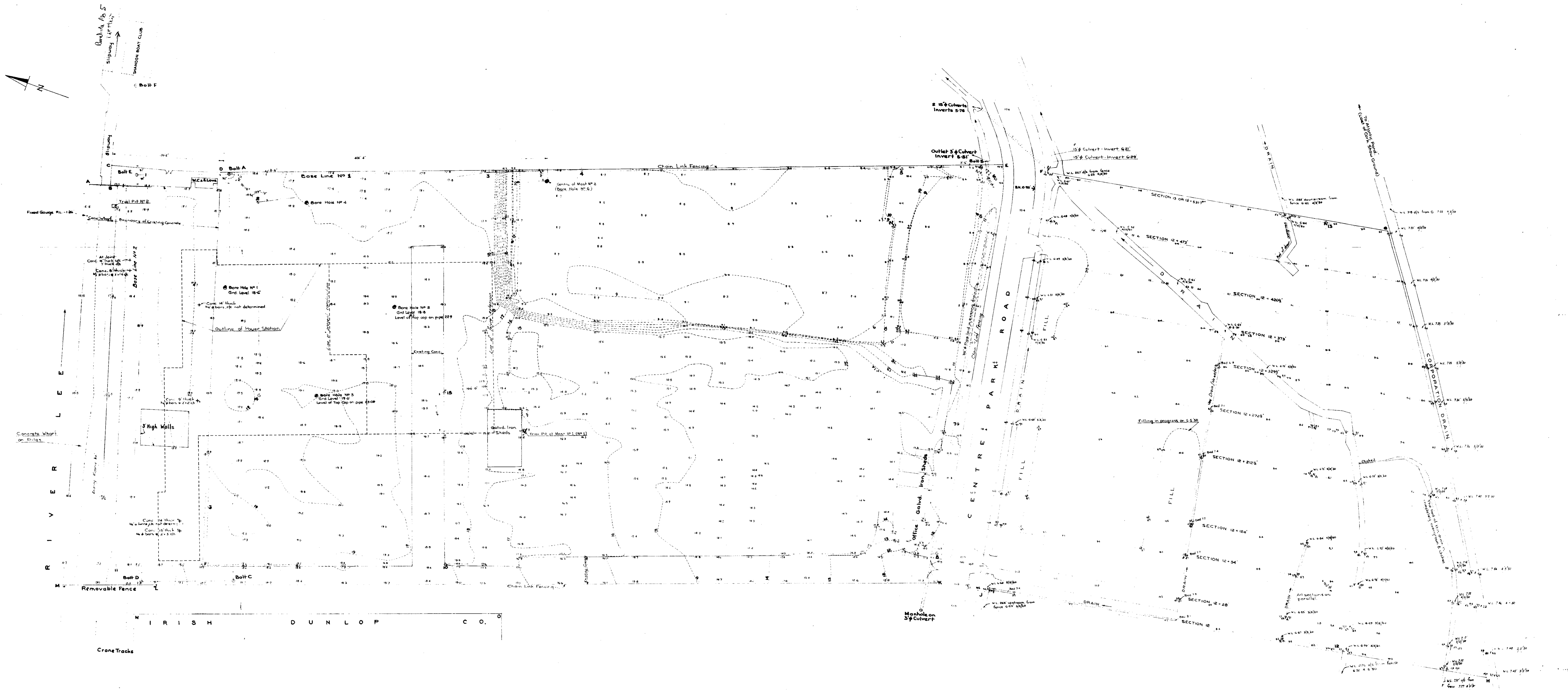
GENERAL LAYOUT WITH
LOCATION OF BOREHOLES

DRG No. C 95072

SCALE: 1/500

Note: For Details of General Basement Plan of Power Station Extension See C 45716
 For Details of Cooling Water System to Power Station Extension See C 47013
 For Plan locating Piled Foundation to See C 48 41
 For Details of Cooling Water Pump House See C 49283
 For Details of Drainage See Dry No. C 45500
 For Details of Bund Area for Oil Service Tanks See C 4438
 For Outside Elevations See C 45463
 For Logs of Bore Holes 7 to 10 incl. See Dry C 43139
 For Logs of Bore Holes 1 to 6 incl. & Trial No. 1 & 2 See Dry CW/D 4811A
 For Details of Frank's Reservoir See Dry No. C 41845

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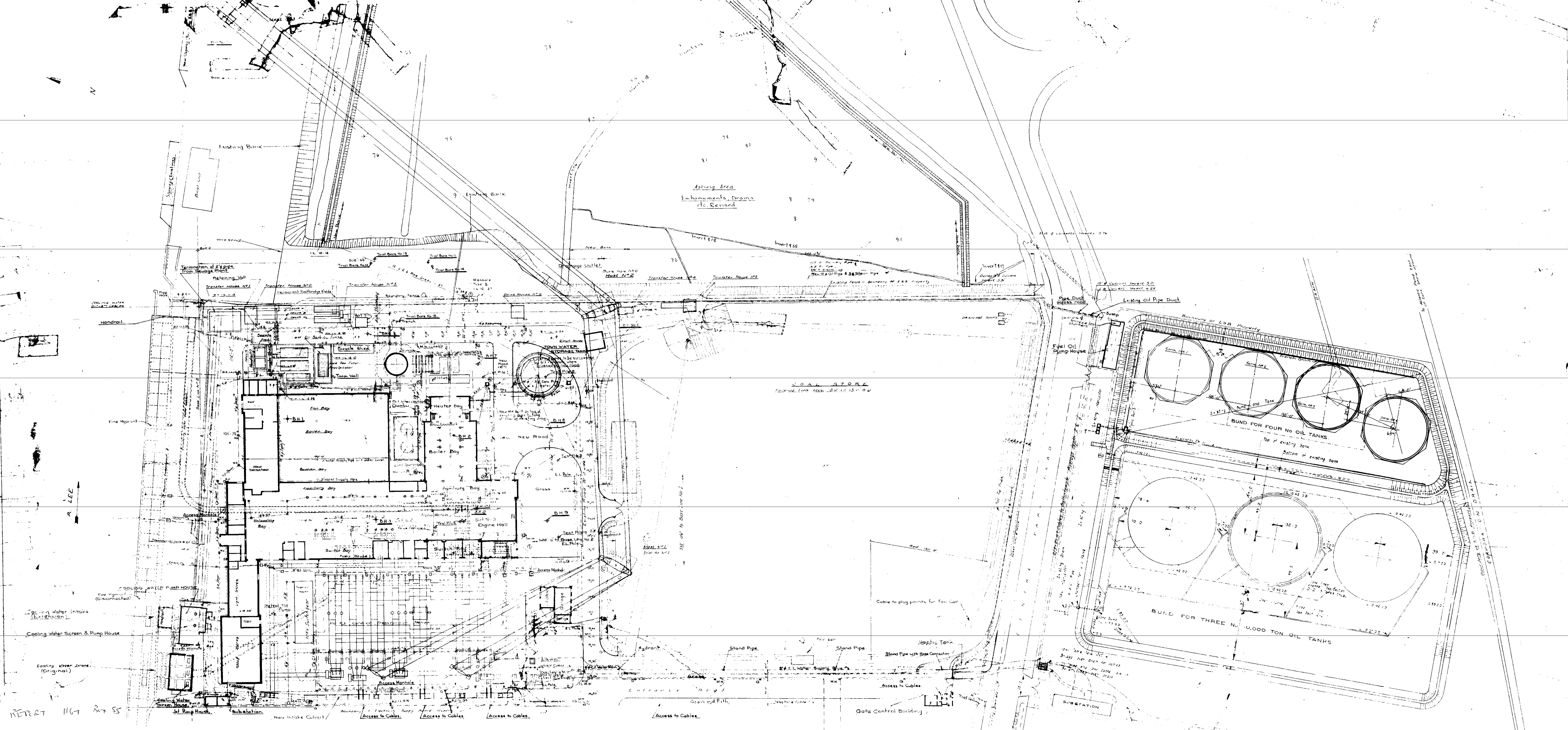


Dimensions of Base Line Survey
 Bolt A to Bolt B 936'-7"
 " E " " A 114'-4 1/2"
 " E " " F 111'-6"
 " E " " D 506'-8"
 " D " " C 114'-5 1/2"

Notes
 1 Convention for Angles
 2 Dimensions given are those for straight lines between the terminal points.
 3 Boundary marks were found at D, F, G, H, J and M. These were rectangular in plan and were taken as being totally outside E.S.B. Property, so that e.g. the line J-H was measured thus:
 J-H
 H-K
 K-L
 L-M
 M-N
 N-O
 O-P
 P-Q
 Q-R
 R-S
 S-T
 T-U
 U-V
 V-W
 W-X
 X-Y
 Y-Z

| LEVELS | | DIMENSIONS (Steel Taped) | | DIMENSIONS (Steel Taped) | | ANGLES | | DIMENSIONS (Steel Taped) | | ANGLES | |
|--------|-------|--------------------------|-------------|--------------------------|--------------|-----------|--------------|--------------------------|------------|-------------|-------------|
| Sta 1 | 17-95 | AB | 26'-2" | 1 2 | 166'-6 1/2" | 11 1 2 | 275'-30" | 1 A | 45'-6" | 11 A | 90° 53' |
| 2 | 18-25 | BC | 24'-10" | 2 3 | 287'-4" | 1 2 3 | 165'-34 1/2" | 1 B | 19'-4 1/2" | 11 B | 91° 30' |
| 3 | 18-11 | CD | 136'-2" | 3 4 | 116'-6 3/4" | 2 3 4 | 185'-50" | 1 C | 31'-3 1/2" | 11 C | 143° 34' |
| 4 | 8-85 | DE | 973'-6" | 4 5 | 398'-11 1/2" | 3 4 5 | 181'-38" | 2 D | 60'-5 1/2" | 1 2 D | 31° 19' |
| 5 | 10-21 | E F | 53'-4" | 5 6 | 117'-1 1/2" | 4 5 6 | 186°-13' | 6 E | 20'-7 1/2" | 5 6 E | 110° 8' |
| 6 | 10-55 | F G | 433'-6" | 6 7 | 308'-7 1/2" | 5 6 7 | 272'-41" | 6 F | 62'-5" | 5 6 F | 165° 8' |
| 7 | 11-04 | F H | 835'-0" | 6 7 8 | 415'-0" | 5 6 7 8 | 181°-18' | 8 G | 36'-10" | 7 8 G | 171° 21' |
| 8 | 11-66 | G H | 570'-2 1/2" | 7 8 | 163'-5 1/2" | 6 7 8 | 180°-29' | 13 G | 78'-0 1/2" | 6 13 G | 160° 1 1/2' |
| 9 | 14-99 | H J | 640'-7 1/2" | 8 12 | 506'-10" | 7 8 12 | 94° 15 1/2" | 12 H | 193'-6" | 8 12 H | 177° 10' |
| 10 | 18-25 | J K | 52'-6" | 12 13 | 531'-7" | 8 12 13 | 75° 36 1/2" | 12 J | 93'-1 1/2" | 12 J | 8° 11' |
| 11 | 18-36 | J F | 528'-3 1/2" | 8 9 | 298'-11 1/2" | 12 13 6 | 98° 15' | 10 D | 55'-9 1/2" | 10 D | 27° 22' |
| 14 | 18-93 | K E | 528'-0" | 9 10 | 314'-11 1/2" | 7 8 9 | 253°-54" | 11 L | 70'-0" | 10 11 L | 28° 25' |
| 15 | 18-25 | K F | 530'-3 1/2" | 10 11 | 408'-7 1/2" | 8 9 10 | 190°-52" | 11 M | 70'-0" | 10 11 M | 160° 54' |
| | | K L | 968'-7" | 11 1 | 473'-5 1/2" | 9 10 11 | 175°-23' | 11 N | 63'-9 1/2" | 10 11 N | 70° 16' |
| | | L M | 116'-7" | 10 11 1 | 271°-53' | 1 2 B.H.4 | 60°-1 1/2" | 2 B.H.4 | 60°-1 1/2" | 1 2 B.H.4 | 173° 51' |
| | | M N | 95'-4" | 14 15 | 230°-0" | 14 B.H.1 | 140°-0" | B.H.1 | 15 14 | 106° 47' | |
| | | M A | 499'-11" | 14 15 | 89°-9 1/2" | 14 B.H.3 | 70°-0" | 15 14 B.H.3 | 70°-0" | 15 14 B.H.3 | 0° 43 1/2' |
| | | | | 15 10 | 270°-30" | 15 B.H.2 | 123°-0" | 14 15 B.H.2 | 123°-0" | 14 15 B.H.2 | 60° 42 1/2' |
| | | | | 15 10 9 | 94° 33' | | | | | | |

REVISIONS
 A Survey of Base Lines added 6.3.51 Drawn P. Kelly
 REPORT 167 BY 55
 YORK GENERATING STATION
 Survey of Site



REPORT 1167 307 SS

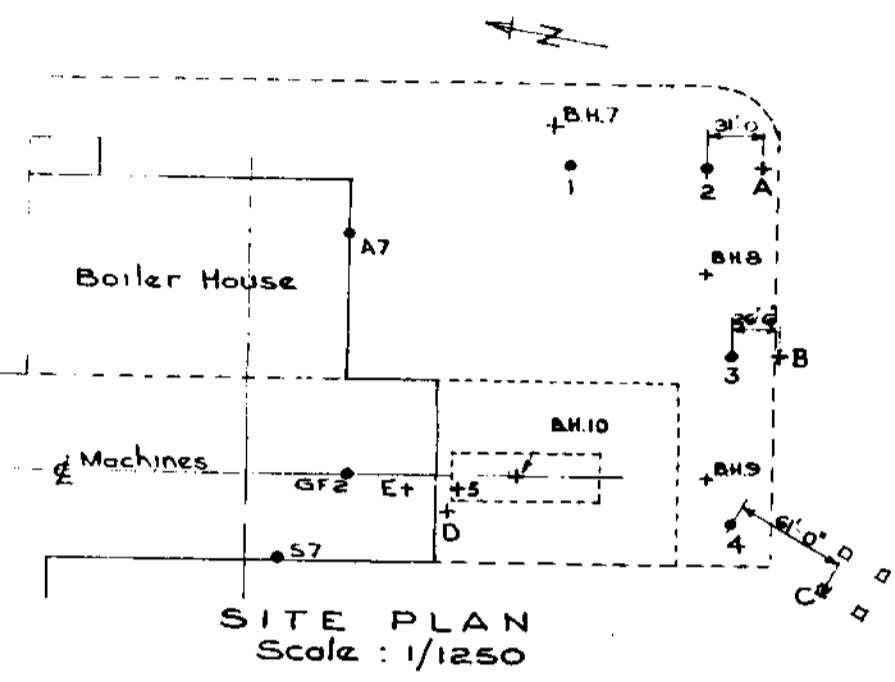
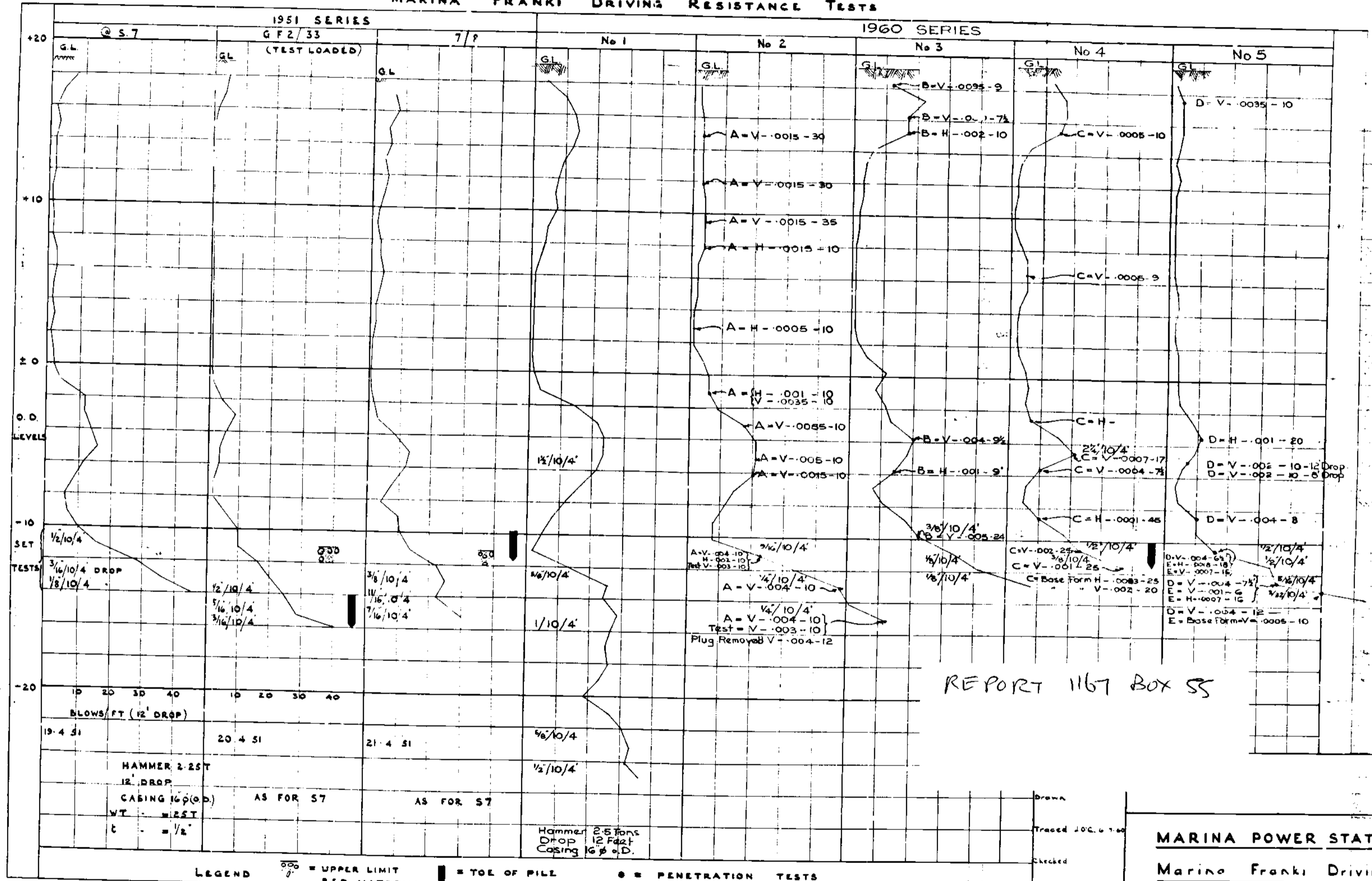
MARINA POWER STATION EXTENSION
General Plan of Works

IRISH DUNLOP COMPANY

Note: For Details of General Basement Plan of Fuel Station Extension See C 45416
 For Details of Cooling Water Intake to Power Station Extension See C 47013
 For Plan locating Piled Foundation to " See C 45741
 For Details of Cooling Water Pump House See C 44253
 For Details of Drainage See Drg No C 45908
 For Details of Bund Area for Oil Service Tanks See C 4477
 For Outside Elevations See C 45463
 For Logs of Bore Holes 7 to 10 in. See Drg E 43139
 For Logs of Bore Holes 1 to 6 in. & Trial Piles 1 & 2 See Drg CW/D 4311A
 For Details of Franki Resistance Tests See Drg No C 41845

Surface Drains indicated thus
 Sewer Drains
 Water Mains
 Oil Pipes
 Cables

MARINA FRANKI DRIVING RESISTANCE TESTS



Vibration Readings are noted thus :-
 A to E = V(or H) - a - n
 A to E = Positions of measurement of vibrations
 V = Vertical Vibration
 H = Horizontal Vibration
 a = Single Amplitude in inches
 n = Frequency in cycles per second

The positions of measurement of vibrations are as follows :-
 A = On Concrete Manhole
 B = On edge of Roadway
 C = On Concrete Plinth over Pile Cap for Transmission Mast
 D = On edge of Pile Cap W.II.
 E = On S.W. corner of G2 Turbine Foundation.

REPORT 1167 BOX 55

Drawn
 Traced J.C.G. 7-60
 Checked
 Approved

MARINA POWER STATION
Marina Franki Driving
Resistance Tests

Scale: 41845

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION BORING RECORD

CONTRACT Marine Generating Station. **BOREHOLE No. 3**
Report No. **Order No.** 97272
Bored for E.S.B.
Site Address Cork.
Boring Commenced 15.1.1975. **Boring Completed** 23.1.1974.
Type of Boring Percussive & Shell & Auger **Diameter of Borehole** 15 and 8 in.
Ground level 4.88m O.D.
Water Struck (1) 4.0m B.G.L. (2) 19.0m B.G.L. (3)
Spring Water Level 1.40m B.G.L. on 23.1.1975.

Remarks Chiselling 16 1/2 hours. All levels are related to ground level.
 Failed to recover undisturbed sample at 18.35m B.G.L.

| Description of Strata | Depth | | Thickness | Samples | | |
|---|-------|-------|-----------|---------|------|---------------|
| | From | To | | Ref No. | Type | Depth |
| Concrete. | 0 | | | | | |
| Chiselling 1 hour. | | 0.15 | 0.15 | | | |
| Filling of silt, ash, brick, etc. | 0.15 | | | 6606 | D | 1.00 |
| | | 2.00 | 1.85 | 6619 | W | 1.50 |
| Soft grey stony silt. | 2.00 | | | 6522 | W | 2.30 |
| | | 2.70 | 0.70 | 6607 | D | 2.15 |
| Dark grey organic silt. | 2.70 | | | 6604 | U | 2.15 - 2.60 |
| | | 4.00 | 1.30 | 6608 | D | 2.75 |
| Loose medium to coarse gravel. | 4.00 | | | 6605 | W | 3.65 - 4.10 |
| | | 5.70 | 1.70 | 6609 | D | 4.15 |
| Soft dark grey organic stony clay. | | | | 6610 | D | 4.55 |
| | 5.70 | | | | | |
| Fine to medium sandy gravel. | | | | 6611 | D | 5.85 |
| | 6.90 | | | | | |
| Grey clayey silt. | | | | 6613 | D | 6.15 |
| | 6.60 | | | | | |
| Compact medium to coarse sandy gravel with cobbles & boulders. (Chiselling 2 1/2 hrs) | | | | 6614 | D | 6.65 |
| | | 7.10 | 0.60 | 6612 | U | 6.65 - 7.10 |
| Stiff grey clay. (Chiselling 8 hours). | 7.10 | | | 6615 | D | 7.25 |
| | | 14.00 | 6.90 | 6616 | D | 8.75 |
| Stiff grey very shelly clay (Chiselling 2 hours). | | | | 6617 | D | 9.65 |
| | 14.00 | | 4.30 | 6618 | D | 11.15 |
| Compact medium to coarse sandy gravel with cobbles & boulders. (Chiselling 6 hrs) | | | | 6620 | D | 12.05 |
| | | 18.30 | 7.20 | 6622 | U | 14.15 - 14.60 |
| Final level. | | | | 6621 | D | 14.15 |
| | 26.00 | | | 6512 | D | 15.65 |
| | | | | 6513 | U | 15.65 - 16.10 |
| | | 18.00 | 0.80 | 6514 | D | 17.15 |
| | | | | 6515 | U | 17.15 - 17.60 |
| | 18.00 | | | 6516 | D | 18.45 |
| | | | | 6517 | D | 19.15 |
| | | 25.00 | 7.20 | 6518 | D | 20.65 |
| | | | | 6519 | D | 22.15 |
| | | | | 6520 | D | 23.65 |
| | | | | 6521 | D | 26.00 |
| | | | | | | |

Code: U — Undisturbed Sample D — Large Disturbed Sample J — Jar Sample W — Water Sample

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION BORING RECORD

CONTRACT Marine Generating Station **BORHOLE No.** 18
Report No. **Order No.** 97279
Bored for C.S.B. s.
Site Address Cork.
Boring Commenced 18.12.1974. **Boring Completed** 8.1.1978.
Type of Boring Percussive and Shell & Auger **Diameter of Borehole** 15 and 8 ins.
Ground level 4.74m O.D.
Water Struck (1) 4.35m BCL. (2) (3)
Standing Water Level
Remarks Chiselling 6 hours.
 All levels are related to ground level.

| Description of Strata | Depth | | Thickness | Samples | | |
|---|-------|-------|-----------|---------|-------|-------------|
| | From | To | | Ref No. | Type | Depth |
| Concrete. (Chiselling 1 hour) | 0 | 0.15 | 0.15 | | | |
| Filling of clay, silt, stones etc. | 0.15 | | | 6904 | D | 0.60 |
| | | 2.70 | 2.55 | 6901 | U | 1.00 - 1.45 |
| | | | | 6905 | D | 2.00 |
| Soft grey silt with shells. | 2.70 | | | 6906 | D | 2.85 |
| | | 4.35 | 1.65 | 6902 | U | 2.85 - 3.30 |
| | | | | 6903 | U | 3.90 - 4.35 |
| | | | | 6907 | D | 4.00 |
| Loose very sandy grey silt. | 4.35 | | | 6914 | W | 4.30 |
| | | 6.00 | 1.65 | 6908 | D | 4.50 |
| Loose medium to coarse gravel. | 6.00 | | | | | |
| | | 6.50 | 0.50 | 6909 | D | 6.00 |
| Loose very silty sandy gravel. | 6.50 | | | | | |
| | | 8.10 | 1.60 | 6910 | D | 6.65 |
| Fairly compact fine to very coarse gravel. | 8.10 | | | | | |
| | | 11.25 | 3.12 | 6911 | D | 8.25 |
| Compact very coarse sandy gravel with cobbles. (Chiselling 1 1/2 hours). | | | | 6912 | D | 9.75 |
| | 11.25 | | | | | |
| | | 15.60 | 4.35 | 6915 | D | 11.25 |
| | | | | 6976 | D | 12.75 |
| Compact coarse gravel with some sand. | 15.60 | | | | | |
| | | 16.00 | 0.40 | 6978 | D | 14.40 |
| Compact coarse sandy gravel with cobbles & some slight traces of clay. (Chis. 3 1/2 hrs). | 16.00 | | | 6979 | D | 15.75 |
| | | | | 6980 | D | 17.20 |
| | | 30.00 | 14.00 | 6982 | D | 19.75 |
| | | | | 6983 | D | 21.70 |
| Final level. | | | | | | |
| | 20.00 | | | 6984 | D | 23.20 |
| | | | | 6985 | D | 24.70 |
| | | | | 6986 | D | 26.25 |
| | | | | 6987 | D | 27.70 |
| | | | 6988 | W | 29.25 | |

Code: U — Undisturbed Sample D — Large Disturbed Sample J — Jar Sample W — Water Sample

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION BORING RECORD

CONTRACT Marine Generating Station, **BOREHOLE No. 9**
Report No. **Bored for** E.S.O. **Order No.**
Site Address Cork,
Boring Commenced 23.11.1974. **Boring Completed** 2.12.1974. 97278
Type of Boring Percussive and Shell & Auger **Diameter of Borehole** 18 and 8 ins.
Ground level 4.51m O.D.
Water Struck (1) 3.45m BGL. (2) (3)
Standing Water Level 1.90m B.G.L. on completion.

Remarks All levels are related to ground level. Failed to recover undisturbed sample at 5.05m B.G.L. Chiselling 6 1/2 hours.

| Description of Strata | Depth | | Thickness | Samples | | |
|---|-------|-------|-----------|--|---------------------------------|---|
| | From | To | | Ref No. | Type | Depth |
| Concrete, | 0 | 0.15 | 0.15 | | | |
| Filling of clay, brick, etc. | 0.15 | 2.00 | 2.05 | 5711 5712 5721 5713 | D D D D | 0.25 0.75 2.10 2.30 |
| Soft grey very silty clay. | 2.00 | 3.45 | 0.65 | 5714 5715 | D U | 2.95 2.95 - 3.30 |
| Soft grey silt with stones. | 3.45 | 4.90 | 0.45 | 5716 5717 | D U | 3.60 3.60 - 4.05 |
| Fine grey clayey silt. | 4.90 | 5.35 | 0.40 | 5718 5719 | D U | 5.05 5.05 - 5.50 |
| Loose medium to coarse sandy gravel with layers of silt. | 5.35 | 7.45 | 2.15 | 5720 5722 | D D | 5.65 6.75 |
| Fine grey clayey silt. | 7.45 | 8.30 | 0.85 | 5723 5724 | D U | 7.60 7.60 - 8.05 |
| Fairly compact coarse sandy gravel with cobbles. | 8.30 | 10.00 | 2.50 | 5725 5726 | D D | 8.15 10.00 |
| Compact coarse gravel with cobbles, boulders and some clay. | 10.00 | 12.00 | 2.00 | 5727 5728 | D D | 10.95 12.50 |
| Very stiff light brown sandy clayey silt with cobbles and boulders. (Chiselling 5 hrs) | 12.00 | 14.15 | 1.35 | 5729 | D | 12.95 |
| Grey silt and coarse sandy gravel with cobbles. | 14.15 | 14.60 | 0.45 | 5730 | D | 14.30 |
| Compact medium to coarse sandy gravel with cobbles. | 14.60 | 17.00 | 2.40 | 5731 5732 | D D | 14.75 16.30 |
| Very compact medium to coarse sandy gravel with cobbles and some clay. (Chiselling 1 1/2 hrs) | 17.00 | 19.00 | 13.00 | 5733 5734 5735 | D D D | 17.15 18.65 19.15 |
| Final level. | 19.00 | | | 5736 5737 5738 5739 5740 5741 5742 | D D D D D D D | 20.60 22.10 23.60 25.10 26.65 28.30 29.80 |

Code: U — Undisturbed Sample D — Large Disturbed Sample J — Jar Sample W — Water Sample

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION BORING RECORD

CONTRACT

Marine Concrete Station,

BOREHOLE No. 9

Report No.

Bored for E. S. S.

Order No.

Site Address Cork.

97297

Boring Commenced 25.1.1975.

Type of Boring Percussive & Shell & Auger

Boring Completed 7.2.1975.

Ground level 4.34m O.D.

Diameter of Borehole 15 and 8 in

Water Struck (1) 4.80m (GL.) (2) (3)

Standing Water Level 1.70m B.G.L. on completion.

Remarks

Chiselling 32 hours. Failed to recover undisturbed sample at 18.70m B.G.L. All levels are related to ground level.

| Description of Strata | Depth | | Thickness | Samples | | |
|---|-------|-------|-----------|---------|------|--------------|
| | From | To | | Ref No. | Type | Depth |
| Concrete. (Chiselling 1 1/2 hours). | 0 | 0.15 | 0.15 | | | |
| Filling of ash, brick, silt, etc. | 0.15 | 2.00 | 1.85 | 6551 | 0 | 1.00 |
| Soft grey clayey silt. | 2.00 | 4.30 | 2.30 | 6552 | 0 | 2.15 |
| Loose coarse silty sandy gravel. | 4.30 | 5.00 | 0.70 | 6553 | 0 | 3.55 |
| | 5.00 | 6.75 | 1.75 | 6554 | 0 | 4.45 |
| Loose fine silty sandy gravel. | 6.75 | 7.40 | 0.65 | 6555 | 0 | 5.95 |
| Fairly compact very coarse sandy gravel with cobbles and boulders. (Chiselling 6 1/2 hrs) | 7.40 | 14.00 | 6.60 | 6556 | 0 | 6.90 |
| | 14.00 | 18.70 | 4.70 | 6557 | 0 | 6.90 - 7.135 |
| Stiff grey/green silty clay. (Chiselling 7 hours). | 18.70 | 19.05 | 0.35 | 6558 | 0 | 7.55 |
| | 19.05 | 19.70 | 0.65 | 6559 | 0 | 7.80 |
| Timber. (Chiselling 5 hours). | 19.70 | 21.60 | 1.90 | 6560 | 0 | 7.80 |
| | 21.60 | 23.70 | 2.10 | 6561 | 0 | 7.80 |
| Stiff grey silty clay with shell fragments. | 23.70 | 25.70 | 2.00 | 6562 | 0 | 7.80 |
| | 25.70 | 29.00 | 3.30 | 6563 | 0 | 7.80 |
| Stiff brown silty clay with shells. (Chiselling 5 hours). | 29.00 | 29.00 | 0.00 | 6564 | 0 | 7.80 |
| | 29.00 | 29.00 | 0.00 | 6565 | 0 | 7.80 |
| Stiff very shelly green very silty clay. (Chiselling 3 hrs) | 29.00 | 29.00 | 0.00 | 6566 | 0 | 7.80 |
| | 29.00 | 29.00 | 0.00 | 6567 | 0 | 7.80 |
| Compact very coarse sandy gravel with cobbles and boulders. (Chiselling 4 hours) | 29.00 | 29.00 | 0.00 | 6568 | 0 | 7.80 |
| | 29.00 | 29.00 | 0.00 | 6569 | 0 | 7.80 |
| Local layers. | 29.00 | 29.00 | 0.00 | 6570 | 0 | 7.80 |
| | 29.00 | 29.00 | 0.00 | 6571 | 0 | 7.80 |

Code: U - Undisturbed Sample D - Large Disturbed Sample I - Jar Sample

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION BORING RECORD

CONTRACT Marine Engineering Station, **BOREHOLE No.** 9
Report No. **Bored for** E.S.B. **Order No.** 97216
Site Address Cork.
Boring Commenced 5.1.1975. **Boring Completed** 18.1.1975.
Type of Boring Percussive and Shell & Auger **Diameter of Borehole** 150 mm
Ground level 4.33m O.D.
Water Struck (1) 4.65m B.G.L. (2) (3)
Standing Water Level 1.20m B.G.L. on completion.
Remarks Chiselling 2 1/2 hours. Failed to recover undisturbed sample at 1.50 & 17.45m B.G.L. All levels are related to ground level.

| Description of Strata | Depth | | Thickness | Samples | | |
|--|-------|-------|-----------|---------|---------------|---------------|
| | From | To | | Ref No. | Type | Depth |
| Concrete. (Chiselling 1 hour). | 0 | 0.15 | 0.15 | | | |
| Filling of stones, silt, etc. | 0.15 | 2.60 | 2.45 | 5615 | D | 0.30 |
| | | | | 5616 | D | 0.70 |
| | | | | 5617 | D | 2.30 |
| Very soft grey/brown organic silty clay. | 2.60 | 4.65 | 2.05 | 5618 | D | 2.75 |
| | | | | 5619 | U | 2.75 - 3.20 |
| | | | | 5620 | D | 3.25 |
| | | | | 5621 | D | 4.20 |
| Loose coarse silty sand. | 4.65 | 5.30 | 0.65 | 5622 | U | 4.20 - 4.65 |
| | | | | 5625 | D | 4.80 |
| Grey gravelly silt with shells. | 5.30 | 6.00 | 0.70 | 5626 | D | 5.45 |
| | | | | 5623 | U | 5.45 - 5.90 |
| Loose fine to coarse sandy gravel. | 6.00 | 7.00 | 1.00 | 5627 | D | 6.25 |
| | | | | | | |
| Grey slightly sandy silt. | 7.00 | 7.80 | 0.80 | 5628 | D | 7.15 |
| | | | | 5624 | U | 7.15 & 7.60 |
| Compact coarse gravel with cobbles. | 7.80 | 10.20 | 2.40 | 5629 | D | 8.00 |
| | | | | 5630 | D | 8.50 |
| Coarse sandy gravel. | 10.20 | 11.00 | 0.80 | 5631 | D | 10.45 |
| | | | | | | |
| Compact very coarse gravel with cobbles and some traces of clay. | 11.00 | 14.65 | 3.65 | 6601 | D | 11.50 |
| | | | | 6602 | D | 12.60 |
| | | | | 6603 | U | 12.70 |
| Stiff grey clay. (Chiselling 3 hours). | 14.65 | 16.40 | 1.75 | 6548 | D | 14.10 |
| | | | | 6549 | U | 14.80 |
| | | | | 6550 | U | 14.80 - 14.25 |
| Stiff grey silty clay with shells. (Chiselling 1 hr). | 16.40 | 17.30 | 0.90 | 6501 | D | 15.25 |
| | | | | 6502 | D | 16.45 |
| | | | 6503 | U | 15.45 - 16.90 | |
| Very stiff light brown silty very stony clay with cobbles. (Chiselling 1 hour). | 17.30 | 18.00 | 1.50 | 6504 | D | 17.45 |
| | | | | | | |
| Compact very coarse sandy gravel with cobbles & boulders. (Chiselling 2 1/2 hours). | 18.00 | 27.00 | 9.20 | 6505 | D | 18.95 |
| | | | | 6506 | D | 20.45 |
| | | | | 6507 | D | 21.50 |
| | | | | 6508 | D | 23.00 |
| Final level. | 27.00 | | | 6509 | D | 24.55 |

Code: U — Undisturbed Sample D — Large Disturbed Sample J — Jar Sample W — Water Sample

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION BORING RECORD

CONTRACT: Marine Engineering Station. **BOREHOLE No. 6**
Report No. **Order No.** 97275
Bored for: E.S.S.
Site Address: Cork.
Boring Commenced: 14.12.1974. **Boring Completed:** 3.1.1975.
Type of Boring: Percussive and Shell & Auger **Diameter of Borehole:** 15 and 8 in.
Original level: 3.97m BGL O.D.
Water Struck (1): 4m B.G.L. (2) (3)
Standing Water Level:
Remarks: Chiselling 7 hours.
 All levels are related to ground level.

| Description of Strata | Depth | | Thickness | Samples | | |
|---|-------|-------|-----------|---------|-------|-------------|
| | From | To | | Ref No. | Type | Depth |
| Concrete. (Chiselling 1 hour). | 0 | 0.15 | 0.15 | | | |
| Filling of silt, brick, etc. stones, etc. | 0.15 | | | 6919 | D | 1.00 |
| | | 2.00 | 1.85 | 6916 | U | 1.00 - 1.54 |
| Soft, grey/brown silt. | 2.00 | | | 6920 | D | 2.10 |
| | | 3.15 | 1.15 | 6917 | DU | 2.10 - 2.55 |
| Soft, grey very sandy silt. | 3.15 | | | 6918 | U | 3.25 & 3.70 |
| | | 4.00 | 0.85 | 6921 | D | 3.50 |
| Loose coarse sandy gravel. | 4.00 | | | | | |
| | | 4.90 | 0.90 | 6922 | D | 4.10 |
| Soft grey silt. | 4.90 | | | | | |
| | | 5.50 | 0.60 | 6923 | D | 4.90 |
| Fairly compact fine gravel with sand. | 5.50 | | | | | |
| | | 6.50 | 1.00 | 6925 | D | 5.65 |
| Soft grey organic silt. | 6.50 | | | 6926 | D | 6.70 |
| | | 8.00 | 1.50 | 6924 | U | 6.70 - 7.15 |
| Compact sand and coarse gravel. | 8.00 | | | 6927 | D | 8.15 |
| | | | | 6928 | D | 9.15 |
| | | 12.00 | 4.00 | 6929 | D | 10.65 |
| Compact very coarse gravel with cobbles and boulders. | 12.00 | | | | | |
| | | 13.30 | 1.30 | 6930 | D | 12.15 |
| Very stiff brown very stony clay with cobbles and boulders. (Chiselling 3 1/2 hours). | 13.30 | | | | | |
| | | 15.00 | 1.70 | 6932 | D | 13.65 |
| Very coarse gravel with cobbles and traces of clay. (Chiselling 1 1/2 hours). | 15.00 | | | | | |
| | | 15.60 | 0.60 | 6989 | D | 15.15 |
| Very compact coarse sandy gravel with cobbles & boulders. (Chiselling 1 hour). | 15.60 | | | 6990 | D | 15.75 |
| | | | 11.40 | 6991 | D | 17.25 |
| | | 27.00 | | 6992 | D | 18.30 |
| | | | | 6993 | D | 18.40 |
| Final level. | 27.00 | | | 6994 | D | 20.00 |
| | | | | 6995 | D | 21.50 |
| | | | | 6996 | D | 22.25 |
| | | | | 6997 | D | 23.00 |
| | | | 6998 | D | 24.00 | |
| | | | 5612 | D | 25.70 | |
| | | | 5613 | D | 27.00 | |
| | | | 5614 | D | 27.00 | |

Note: U — Undisturbed Sample D — Large Disturbed Sample J — Jar Sample W — Water Sample

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION BORING RECORD

CONTRACT Marine Generating Station. **BOREHOLE No.** 5 4
Report No. **Order No.** 97273
Bored for E.S.S.
Site Address Cork.
Boring Commenced 19.1.1975. **Boring Completed** 27.1.1975.
Type of Boring Percussive and Shell & Auger **Diameter of Borehole** 15 and 8 ins.
Ground level 4.28m O.D.
Water Struck (1) 3.05m B.G.L.(2) (3)
Water Level 1.40m B.G.L. on 23.1.1975.

Remarks Chiselling 12 1/2 hours. Failed to recover undisturbed sample at 6.30m B.G.L. All levels are related to ground level. Borehole blowing back approximately 0.60m, between 13.50 & 14.50m B.G.L.

| Description of Strata | Depth | | Thickness | Samples | | |
|--|-------|-------|-----------|---------|------|-------------|
| | From | To | | Ref No. | Type | Depth |
| Concrete. (Chiselling 1 hour) | 0 | 0.15 | 0.15 | | | |
| Filling of silt, gravel, brick, etc. | 0.15 | 2.00 | 1.85 | 6627 | D | 1.00 |
| | | | | 6532 | W | 1.20 |
| Soft grey clayey silt with shells. | 2.00 | 3.50 | 1.50 | 6628 | D | 2.15 |
| | | | | 6624 | U | 1.55 - 2.10 |
| Loose fine clayey sandy gravel. | 3.50 | 6.00 | 1.50 | 6625 | U | 2.50 - 2.95 |
| | | | | 6634 | W | 3.50 |
| Soft grey clayey silt. | 6.00 | 8.00 | 0.80 | 6629 | D | 3.65 |
| | | | | 6630 | D | 5.15 |
| Medium to coarse sandy gravel. | 8.00 | 8.20 | 0.40 | 6626 | U | 5.25 - 5.70 |
| | | | | 6631 | D | 5.95 |
| Soft gravelly silt. | 8.20 | 7.15 | 0.95 | | | |
| | | | | 6632 | D | 6.35 |
| Dark grey silty stony clay. | 7.15 | 8.00 | 0.85 | | | |
| | | | | 6633 | D | 7.30 |
| Fairly compact medium to coarse sandy gravel with cobbles and boulders. (Chiselling 1 1/2 hrs) | 8.00 | 10.35 | 2.35 | 6635 | D | 8.15 |
| | | | | 6636 | D | 9.65 |
| Fine to medium sand. | 10.35 | 15.70 | 4.35 | 6637 | D | 10.50 |
| | | | | 6638 | D | 12.00 |
| | | | | 6639 | D | 13.50 |
| Compact coarse sandy gravel with cobbles and boulders. (Chiselling 10 hours). | 15.70 | 27.00 | 11.30 | 6640 | D | 13.75 |
| | | | | 6623 | D | 15.35 |
| | | | | 6524 | D | 15.85 |
| | | | | 6525 | D | 17.00 |
| Final level. | 27.00 | | | 6526 | D | 18.50 |
| | | | | 6527 | D | 20.20 |
| | | | | 6528 | D | 21.70 |
| | | | | 6530 | D | 24.70 |
| | | | | 6531 | D | 26.30 |

Code: U — Undisturbed Sample D — Large Disturbed Sample J — Jar Sample W — Water Sample

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION BORING RECORD

CONTRACT Marine Connecting Station. **BOREHOLE No.** 2
Report No. **Bored for** E. S. S. **Order No.** 97271
Site Address Cork.
Boring Commenced 12.11.1974. **Boring Completed** 28.11.1974.
Type of Boring Percussive and Shell & Auger **Diameter of Borehole** 15 and 6 in.
Ground level 4.19m O.D.
Water Struck (1) 4.30m B.G.L. (2) (3)
Standing Water Level 1.00m B.G.L. on 20.11.1974.
Remarks Chiselling 19 1/2 hours. All levels are related to ground level. Borehole blowing back approx .30m between 10.90 & 14.15m B.G.L.

| Description of Strata | Depth | | Thickness | Samples | | |
|--|-------|-------|-----------|------------------------------|------------------|----------------------------------|
| | From | To | | Ref No. | Type | Depth |
| Concrete. | 0 | 0.15 | 0.15 | | | |
| Filling of stony clay, traces of brick, etc. | 0.15 | 2.30 | 2.15 | 5681 5682 5683 5684 | D D D D | 0.75 1.20 1.90 2.15 |
| Soft brown and grey silt with some shell fragments. | 2.30 | 3.70 | 1.40 | 5684 5685 | D U | 2.45 2.45 - 2.90 |
| Soft grey sandy silt. | 3.70 | 4.15 | 0.45 | 5686 | D | 3.80 |
| Soft grey silty clay. | 4.15 | 4.30 | 0.15 | 5687 | U | 3.85 - 4.30 |
| Loose sandy gravel with silt. | 4.30 | 5.55 | 1.25 | 5688 | D | 4.80 |
| Soft grey organic silty clay. | 5.55 | 6.10 | 0.55 | 5689 5690 | D U | 5.65 5.65 - 6.10 |
| Fairly compact sandy gravel. | 6.10 | 7.70 | 1.60 | 5691 | D | 6.25 |
| Fairly compact coarse gravel with cobbles. | 7.70 | 10.90 | 3.20 | 5692 5693 | D D | 7.85 9.65 |
| Coarse sand with some gravel. | 10.90 | 16.30 | 5.40 | 5694 5695 5696 | D D D | 11.15 12.65 14.15 |
| Compact coarse sandy gravel with cobbles, boulders and a little clay. (Chiselling 19 1/2 hrs). | 16.30 | 30.50 | 14.20 | 5697 5698 | D D | 15.65 16.45 |
| Final level. | 30.50 | | | 5701 5702 5703 5704 | D D D D | 14.15 19.50 21.50 23.00 |
| | | | | 5705 5706 5707 5708 | D D D D | 24.50 26.00 26.85 27.50 |
| | | | | 5709 5710 | D W | 30.30 30.00 |

Code: U — Undisturbed Sample D — Large Disturbed Sample J — Jar Sample W — Water Sample

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION BORING RECORD

CONTRACT Marine Concrete Station. **BOREHOLE No. 2**
Report No. **Order No.** 97270
Bored for E.S.O. P.
Site Address Cork.
Boring Commenced 31.10.1974. **Boring Completed** 10.11.1974.
Type of Boring Percussive & Shell and Auger; **Diameter of Borehole** 16 and 8 ins.
Ground level 4.23m O.D.
Water Struck (1) 5.05m S.G.L.(2) (3)
~~Water~~ **Water Level** 2.80m S.G.L. on 10.11.1974.
Remarks Chiselling 6 hrs. All levels are related to ground level.
 Borehole blowing back approx. .60m between 18.90 and 20.50m S.G.

| Description of Strata | Depth | | Thickness | Samples | | |
|---|-------|-------|-----------|---------|------|-------------|
| | From | To | | Ref No. | Type | Depth |
| Concrete. | 0 | | | | | |
| | | 0.15 | 0.15 | | | |
| Filling of silt with stones and some cokes. | 0.15 | | | 5651 | D | 0.45 |
| | | 2.00 | 2.65 | 5652 | D | 2.00 |
| Soft grey silty clay. | 2.00 | | | 5653 | D | 2.90 |
| | | 4.90 | 2.10 | 5654 | U | 2.95 - 3.35 |
| | | | | 5655 | D | 4.25 |
| | | | | 5656 | U | 4.25 - 4.70 |
| Soft grey organic silt. | 4.90 | | | | | |
| | | 5.05 | 0.15 | 5657 | D | 4.95 |
| Coarse very clayey gravel. | 5.05 | | | | | |
| | | 5.20 | 0.15 | 5658 | D | 6.10 |
| Soft grey silt. | 5.20 | | | | | |
| | | 5.80 | 0.60 | 5659 | D | 6.35 |
| Loose slightly clayey sandy gravel. | 5.80 | | | 5660 | D | 5.95 |
| | | 7.10 | 1.30 | 5661 | D | 7.25 |
| Soft black organic clay. | 7.10 | | | 5699 | D | 8.25 |
| | | 8.90 | 1.80 | 5662 | U | 8.25 - 8.70 |
| Fairly compact coarse gravel | 8.90 | | | 5663 | D | 9.00 |
| | | 11.00 | 2.10 | 5664 | D | 10.75 |
| Fairly compact medium sand with some gravel. | 11.00 | | | 5666 | D | 12.65 |
| | | 16.90 | 5.90 | 5667 | D | 14.15 |
| | | | | 5668 | D | 15.70 |
| Medium to coarse gravel with some sand and cobbles. | 16.90 | | | 5669 | D | 17.05 |
| | | 20.50 | 3.60 | 5670 | D | 18.60 |
| | | | | 5671 | D | 20.10 |
| Compact coarse sandy gravel with cobbles, boulders and a little clay. | 20.50 | | | 5672 | D | 21.40 |
| | | 30.00 | 10.30 | 5673 | D | 21.55 |
| | | | | 5674 | D | 23.10 |
| Final level. | 30.00 | | | 5675 | D | 24.70 |
| | | | | 5676 | D | 26.20 |
| | | | | 5677 | D | 27.70 |
| | | | | 5678 | D | 29.25 |
| | | | | 5679 | D | 30.50 |

REPORT 1167 Box 55

sample J → Jar Sample W → Water Sample

64816

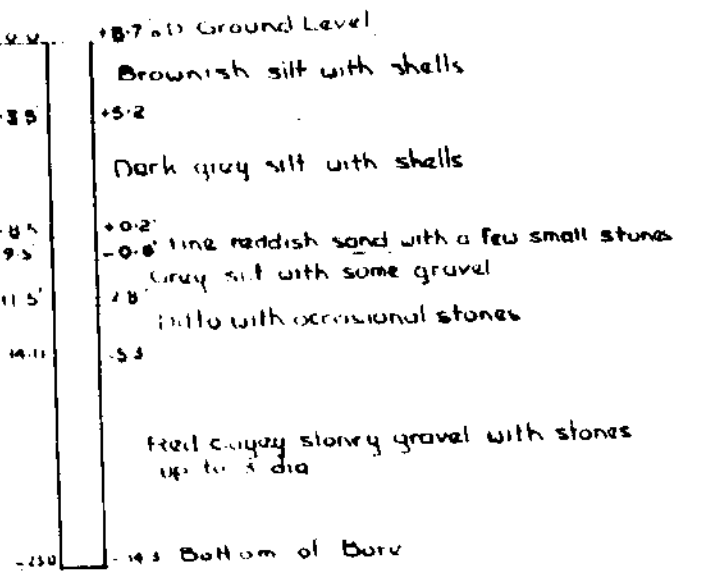
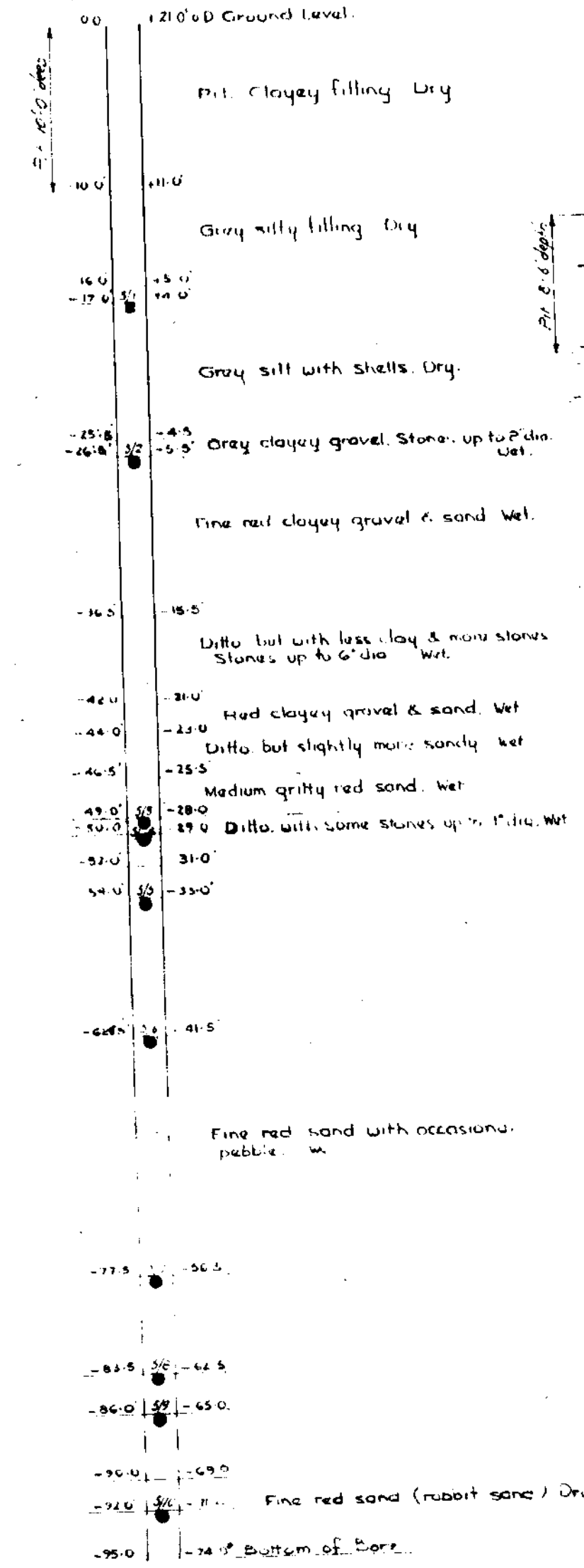
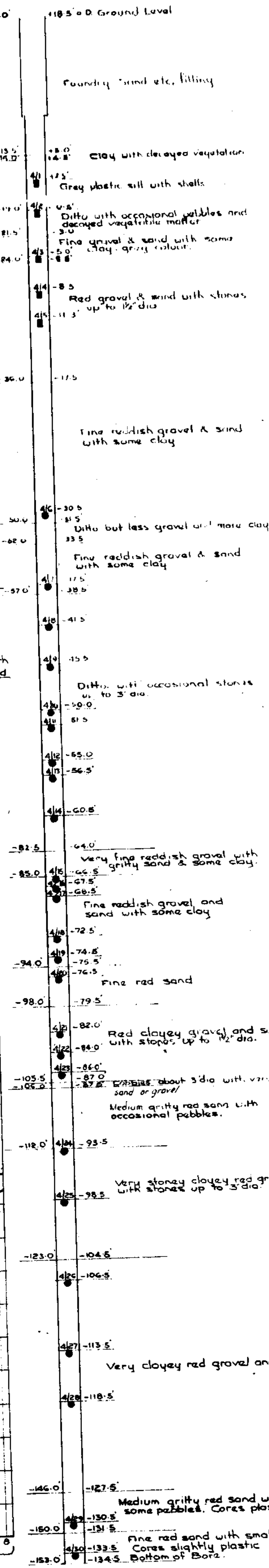
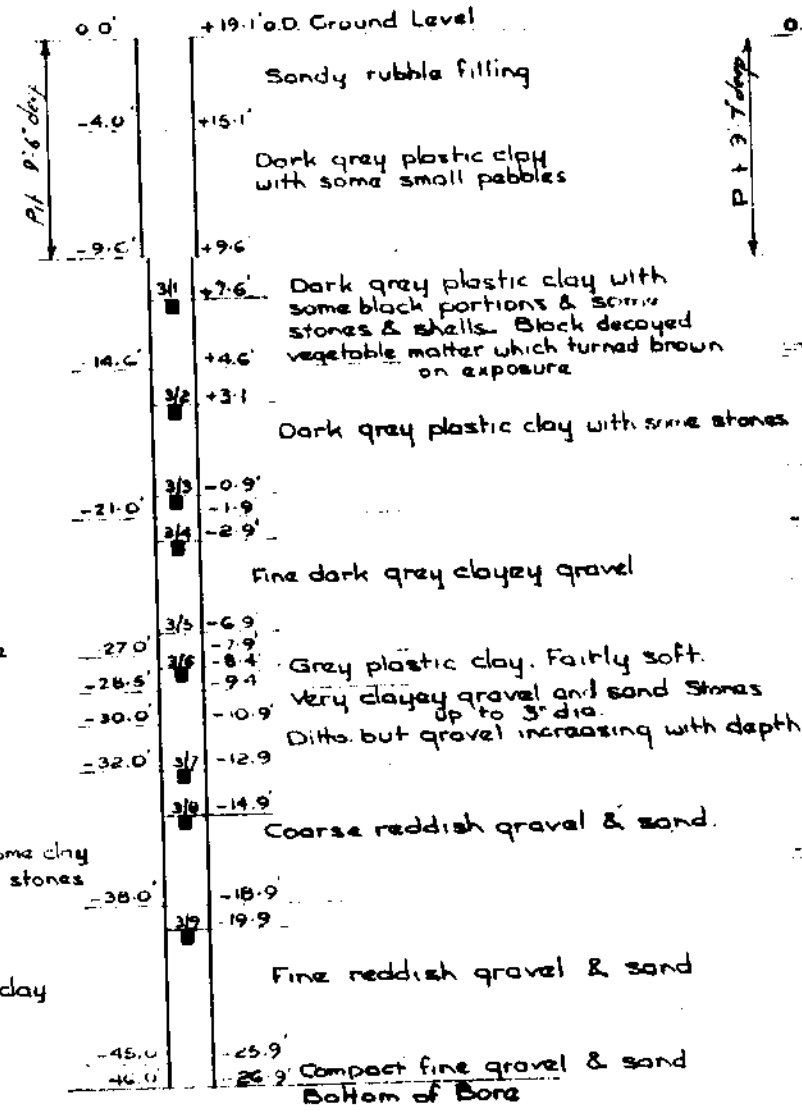
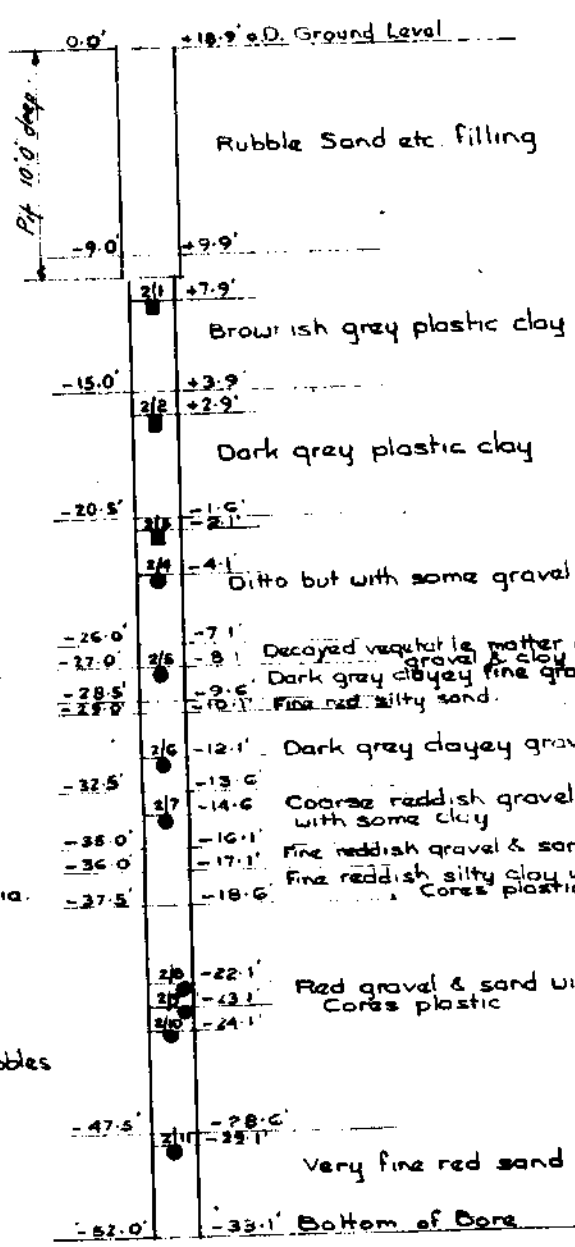
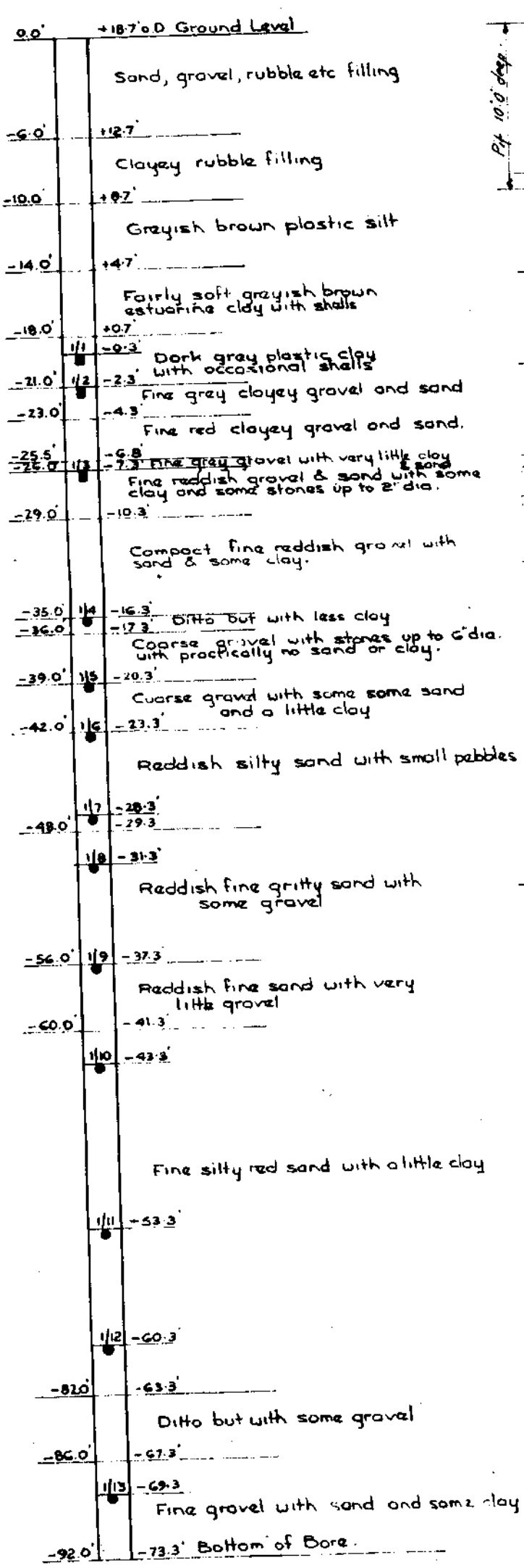
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Notes on liners
 Pit 10' depth 8" liners to 15' 6" liners to 36'
 5" liners to 60'
 Bored samples stored at site. Samples taken at 11'0", 16'0", 21'0", 27'0", 33'0", 41'0", 48'0", 43'0", 48'0".
Sounding Well
 The hole was backfilled with clay up to depth 40'0". A 2" G.B. pipe with its lowest 10' perforated and covered with fine gauze was placed from depth 40' to above ground surface. The perforated portion was surrounded with screened sand and the remainder with clay to ground level. The water level in the pipe varies with the tide.

Notes on liners
 Pit 9' G depth 8" liner to 12' 6" liner to 36'
 No liner 36' to 46'.
 Bored samples stored at site. Samples taken at 11'0", 16'0", 20'0", 28'0", 36'0", 42'0", 47'0", 52'0", 54'0", 59'0".
Sounding Well
 The hole was backfilled with clay up to depth 20' and filled with a pipe perforated, covered with gauze and surrounded by sand between 20' & 10' and the remainder of the hole filled with clay to surface level.

Notes on liners
 Pit 10' depth 8" liner to 15' 6" liner to 40'
 5" liner to 64'7"
 Bore Hole dry to depth of 25' 6". Water arose to tide level after that and then varied with the tide.

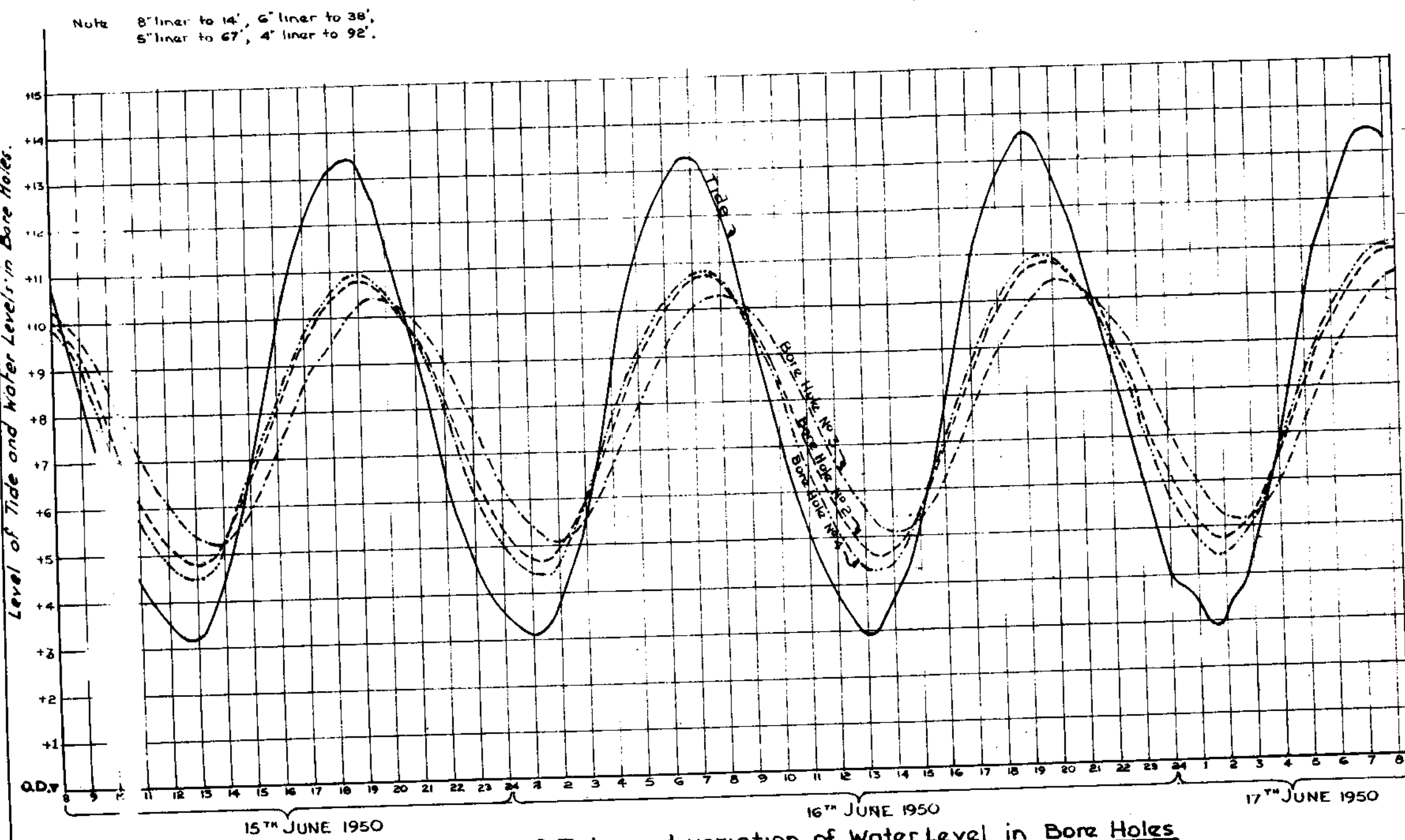
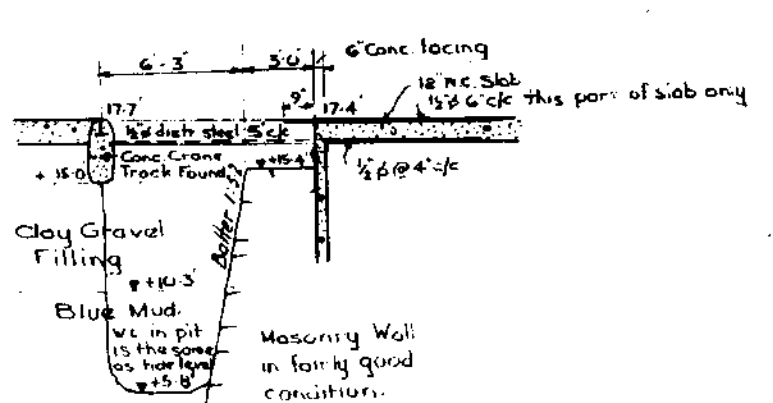


Chart showing Level of Tide and variation of Water Level in Bore Holes



No 2 - Pit 9' 7" depth 8" liner to 14' 6" liner to 49' 5" liner to 100' 4" liner to 147' 9"
 A 2" G.B. pipe is being installed in the hole with perforated section 49' to 39' approx.

REPORT 1167 Box 58

Note Materials denoted above are as described on site.

Disturbed Sample ●
 Undisturbed Sample ■

REVISIONS
 (A) Chart of W.L. added 7.4.51

LOGS OF BORE HOLES 1 TO 6
 LOGS OF TRIAL PITS 1 & 2
 CHART SHOWING VARIATION OF W.L. IN BORING
 1/100
 4811 A

SITE INVESTIGATIONS LTD.

SOIL INVESTIGATION BORING RECORD

CONTRACT Marine Engineering Station, **BOREHOLE No.** 3
Report No. **Order No.** 97274
Bored for K.S.B.
Site Address Cork.
Boring Commenced 18.12.1975, **Boring Completed** 13.1.1976.
Type of Boring Percussive and Shell & Auger, **Diameter of Borehole** 15 and 8 ins.
Ground level 3.98m O.D.
Water Struck (1) 4.60m B.C.L.(2) (3)
Standing Water Level 1.20m B.C.L.
Remarks Chiselling 29 hours.
 All levels are related to ground level.

| Description of Strata | Depth | | Thickness | Samples | | |
|---|-------|-------|-----------|------------------------------|------------------|--|
| | From | To | | Ref No. | Type | Depth |
| Concrete. (Chiselling 1 hour) | 0 | 0.15 | 0.15 | | | |
| Filling of gravel, silt, sand, etc. | 0.15 | 2.00 | 1.85 | 6935 | D | 1.00 |
| Grey organic silt. | 2.00 | 4.00 | 2.00 | 6936 6937 6938 | D D D | 2.15 2.15 - 2.60 2.75 |
| Dark grey very silty gravel. | 4.00 | 4.60 | 0.60 | 6938 | D | 4.15 |
| Medium to coarse sandy gravel. | 4.60 | 6.00 | 1.40 | 6939 | D | 4.75 |
| Soft grey silt. | 6.00 | 6.50 | 0.50 | 6941 6940 | D U | 6.15 6.15 - 6.60 |
| Coarse sandy gravel with cobble and boulders. (Chiselling 1 hour) | 6.50 | 13.70 | 7.20 | 6942 6943 6944 | D D D | 6.75 7.00 8.15 |
| Stiff grey/green silty clay (Chiselling 8 hours). | 13.70 | 17.50 | 3.80 | 6945 6946 6947 | D D D | 10.25 10.75 11.60 |
| Compact coarse sandy gravel with cobbles and boulders. (Chiselling 18 hours). | 17.50 | 27.30 | 9.80 | 5633 5634 5635 5636 | D D D D | 13.10 14.00 14.50 - 14.95 15.50 |
| Final level. Coarse gravel with cobbles and boulders. | 27.30 | | | 5637 5638 5639 5640 | D D D D | 16.50 17.00 18.95 19.75 |
| Stiff brown very silty with cobbles and boulders. | | | | 5641 5642 5643 | D D D | 20.05 21.50 22.15 |
| Coarse gravel with sand and layers of clay. | | | | 5644 5645 5646 | D D D | 22.15 23.00 24.00 |
| Compact coarse sandy gravel with cobbles & boulders. | | | | 5647 | D | 26.00 |

Code: U — Undisturbed Sample D — Large Disturbed Sample J — Jar Sample W — Water Sample

BOREHOLE No. 11. 64826 DIAMETER:-
GROUND LEVEL:- +17.43' O.D. DATE:- 1-6-65 TO 4-6-65

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF TEST (FT) | NO. OF BLOWN (S) |
|---|---------------|---------------|--------|-----------|---------------------------|--------------------|------------------|
| LOOSE CLAYEY GRAVEL ETC. FILLING | +17.43 | | 0-0 | 5-0 | | | 3 (S) |
| FILLING MATERIAL CLAYEY GRAVEL AND FOUNDRY SLAG LOOSE | +18.4 | | 5-0 | 6-0 | | | 2 (S) |
| FINE DARK GRAY CONCRETE SILT WITH SOME CLAY FINE | +1.4 | | 16-0 | 8-0 | | | 0 (S) |
| COARSE AND MEDIUM GRAVEL UP TO 1 1/2" WITH SOME SAND AND VERY LITTLE SILT | +1.6 | | 19-0 | 5-0 | | | 8 (S) |
| FINE MEDIUM AND COARSE RED GRAVEL, SOME SAND, COBBLES UP TO 4" | +2.9 | | 24-0 | 6-0 | | | 10 (S) |
| AS ABOVE | +12.6 | | 30-0 | 5-0 | | | 10 (S) |
| AS ABOVE BUT WITH MORE FINE RED SAND | +17.6 | | 35-0 | 5-0 | | | 3 (S) |
| AS ABOVE WITH LESS FINE RED SAND, BIGGER COBBLES | +22.6 | | 40-0 | 5-0 | | | 8 (S) |
| AS ABOVE WITH COBBLES UP TO 6" | +27.6 | | 45-0 | 5-0 | | | 33 (S) |
| AS ABOVE WITH INCREASED FINE SAND | +27.6 | | 50-0 | 10-0 | | | 22 (H) |
| AS ABOVE BUT MORE COBBLES UP TO 4" | +27.6 | | 55-0 | 5-0 | | | 73 (H) |
| | +52.6 | | 70-0 | 5-0 | | | 20 (H) |
| | | | 21.33M | | | | |

BOREHOLE No. 12. 64827 DIAMETER:-
GROUND LEVEL:- +18.04' O.D. DATE:- 5-4-65 TO 11-6-65

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF TEST (FT) | NO. OF BLOWN (S) |
|---|---------------|---------------|--------|-----------|---------------------------|--------------------|------------------|
| BROWN CLAY GRAVEL FILLING | +18.04 | | 0-0 | 5-0 | | | 10 (H) |
| BLACK FOUNDRY SAND | +19.0 | | 5-0 | 5-0 | | | 5 (H) |
| FINE DARK GRAY SILT WITH SOME VERY FINE SAND AND CLAY CONCRETE | +8.0 | | 10-0 | 5-0 | | | 3 (H) |
| AS ABOVE CHANGING TO MED. AND FINE GRAVEL WITH MORE SAND | +3.0 | | 15-0 | 7-6 | | | 6 (H) |
| 1" LAYER OF VEGETATION COMPRESSED LEAVES FEEN ETC. | +4.5 | | 18-0 | 2-0 | | | 2 (H) |
| FINE MEDIUM AND COARSE GRAVEL, SOME FINE RED SAND, COBBLES UP TO 2" | +7.0 | | 20-0 | 10-0 | | | 28 (H) |
| AS ABOVE WITH SOME MORE GRAVEL AND FINE RED SAND | +17.0 | | 30-0 | 5-0 | | | 34 (H) |
| AS ABOVE WITH FEWER, AND SMALLER, COBBLES UP TO 2" | +22.0 | | 40-0 | 5-0 | | | 41 (H) |
| AS ABOVE WITH LESS FINE SAND AND MORE COBBLES UP TO 6" | +30.0 | | 48-0 | 1-0 | | | 17 (H) |
| ONE BOULDER 10" x 8" (GASTONITE) | +31.0 | | 49-0 | 6-0 | | | 13 (H) |
| AS ABOVE WITH MORE COBBLES UP TO 4" | +40.0 | | 60-0 | 10-0 | | | 9 (H) |
| AS ABOVE BUT WITH COBBLES UP TO 6" | +52.0 | | 70-0 | 5-0 | | | 15 (H) |
| | | | 21.33M | | | | |

BOREHOLE No. 13. 64828 DIAMETER:-
GROUND LEVEL:- +18.1' O.D. DATE:- 6-8-65 TO 17-8-65

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF TEST (FT) | NO. OF BLOWN (S) |
|---|---------------|---------------|-------|-----------|---------------------------|--------------------|------------------|
| MADE GROUND PREDOMINATELY SAND AND SILT WITH SOME BRICK RUBBLE | +18.1 | | 0-0 | 15-0 | | | 4 (H) |
| GREY, SANDY SILT | +15.1 | | 15-0 | 2-0 | | | 6 (H) |
| GREY SILT AND FINE AND MEDIUM GRAVEL | +10.1 | | 20-0 | 3-0 | | | 6 (H) |
| GREY ORGANIC SILT-BECOMING SANDY WITH DEPTH | +5.1 | | 25-0 | 5-0 | | | 10 (H) |
| COARSE, MEDIUM AND FINE GRAVEL AND OCCASIONAL COBBLES | -5.4 | | 30-0 | 9-0 | | | 18 (H) |
| COBBLES AND COARSE MEDIUM AND FINE GRAVEL GRADING TO COBBLES WITH DEPTH | -16.4 | | 38-0 | 8-0 | | | 26 (S) |
| MEDIUM GRAVEL WITH SOME FINE TO COARSE SAND | -22.4 | | 40-0 | 5-0 | | | 24 (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | -24.5 | | 42-0 | 2-0 | | | 20 (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | -27.5 | | 45-0 | 2-0 | | | 20 (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | -32.5 | | 50-0 | 3-0 | | | 24 (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND COBBLES 3"-4" | -35.5 | | 53-0 | 2-0 | | | 22 (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | -37.5 | | 55-0 | 5-0 | | | 23 (S) |
| COMPACT MEDIUM GRAVEL | -42.5 | | 60-0 | 2-0 | | | 23 (S) |
| MEDIUM GRAVEL WITH COARSE SAND | -44.5 | | 62-0 | 2-0 | | | 25 (S) |
| MEDIUM GRAVEL WITH COARSE SAND | -46.5 | | 64-0 | 2-0 | | | 26 (S) |
| MEDIUM GRAVEL WITH COARSE SAND AND SOME COBBLES | -48.5 | | 66-0 | 4-0 | | | 27 (S) |
| MEDIUM GRAVEL AND COARSE SAND WITH SOME 3"-4" COBBLES | -52.5 | | 70-0 | 2-0 | | | 26 (S) |
| MEDIUM GRAVEL AND COARSE SAND | -54.5 | | 72-0 | 1-0 | | | 26 (S) |
| COMPACT MEDIUM GRAVEL | -54.5 | | 72-0 | 6-0 | | | 23 (S) |
| VERY SMALL GRAVEL, COMPACT MEDIUM GRAVEL WITH SOME SMALL GRAVEL | -55.5 | | 73-0 | 3-0 | | | 24 (S) |
| VERY SMALL COMPACT GRAVEL | -55.5 | | 73-0 | 4-0 | | | 31 (S) |
| COMPACT MEDIUM GRAVEL AND SOME COARSE SAND | -57.5 | | 75-0 | 8-0 | | | 27 (S) |
| SOILING TERMINATED AT DEPTH 95'-0" DUE TO DIFFICULTY IN DRIVING CASING. | -77.5 | | 95-0 | 21.49M | | | 29 (S) |

BOREHOLE No. 14. 64829 DIAMETER:-
GROUND LEVEL:- +17.5' O.D. DATE:- 18-8-65 TO 24-8-65

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF TEST (FT) | NO. OF BLOWN (S) |
|---|---------------|---------------|-------|-----------|---------------------------|--------------------|------------------|
| MADE UP GROUND, DARK SOIL AND SLAG WITH SOME STONES, SCRAP METAL, ASH, ETC. | +17.5 | | 0-0 | 9-0 | | | 4 (H) |
| AS ABOVE, CHANGING TO GREY SILT | +15.5 | | 9-0 | 1-0 | | | 4 (H) |
| VERY SOFT GREY SILT WITH SOME TRACES OF SAND | +10.5 | | 10-0 | 7-0 | | | 2 (H) |
| SOFT GREY SANDY SILT | +0.5 | | 17-0 | 2-0 | | | 19 (H) |
| SILT AND SMALL GRAVEL, SOME FINE SAND | -4.5 | | 19-0 | 3-0 | | | 20 (S) |
| VERY SMALL GRAVEL WITH SOME FINE SAND | -6.5 | | 21-0 | 2-0 | | | 19 (S) |
| MEDIUM GRAVEL WITH SOME FINE SAND | -7.5 | | 22-0 | 2-0 | | | 33 (S) |
| AS ABOVE, CHANGING TO MEDIUM GRAVEL, SOME COARSE SAND, MEDIUM GRAVEL, COARSE SAND | -11.5 | | 26-0 | 2-0 | | | 33 (S) |
| MEDIUM GRAVEL WITH SOME COBBLES 3"-4" | -15.5 | | 30-0 | 2-0 | | | 29 (S) |
| MEDIUM AND SMALL GRAVEL WITH SOME COBBLES AND COARSE SAND | -17.5 | | 32-0 | 2-0 | | | 30 (S) |
| MEDIUM GRAVEL WITH SOME FINE TO COARSE SAND | -20.5 | | 34-0 | 2-0 | | | 30 (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | -22.5 | | 36-0 | 2-0 | | | 30 (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | -24.5 | | 38-0 | 2-0 | | | 22 (S) |
| COMPACT MED. GRAVEL & FINE SAND SOME 4" COBBLES WITH COARSE SAND | -27.5 | | 41-0 | 2-0 | | | 24 (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | -32.5 | | 46-0 | 5-0 | | | 24 (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND & COBBLES 3"-4" | -35.5 | | 49-0 | 3-0 | | | 22 (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | -37.5 | | 51-0 | 2-0 | | | 22 (S) |
| MEDIUM GRAVEL WITH 50% FINE BROWN SAND | -40.5 | | 54-0 | 5-0 | | | 23 (S) |
| ONE 8" SANDSTONE BOULDER | -42.5 | | 56-0 | 2-0 | | | 23 (S) |
| MEDIUM GRAVEL WITH COARSE SAND | -44.5 | | 58-0 | 2-0 | | | 25 (S) |
| MEDIUM GRAVEL WITH COARSE SAND | -46.5 | | 60-0 | 2-0 | | | 25 (S) |
| MEDIUM GRAVEL WITH COARSE SAND AND SOME COBBLES | -48.5 | | 62-0 | 4-0 | | | 27 (S) |
| MEDIUM GRAVEL AND COARSE SAND WITH SOME 3"-4" COBBLES | -52.5 | | 66-0 | 2-0 | | | 26 (S) |
| MEDIUM GRAVEL AND COARSE SAND | -54.5 | | 68-0 | 1-0 | | | 26 (S) |
| COMPACT MEDIUM GRAVEL | -54.5 | | 68-0 | 6-0 | | | 23 (S) |
| VERY SMALL GRAVEL, COMPACT MEDIUM GRAVEL WITH SOME SMALL GRAVEL | -55.5 | | 69-0 | 3-0 | | | 24 (S) |
| VERY SMALL COMPACT GRAVEL | -55.5 | | 69-0 | 4-0 | | | 31 (S) |
| COMPACT MEDIUM GRAVEL AND SOME COARSE SAND | -57.5 | | 71-0 | 8-0 | | | 27 (S) |
| SOILING TERMINATED AT DEPTH 95'-0" DUE TO DIFFICULTY IN DRIVING CASING. | -77.5 | | 95-0 | 21.49M | | | 29 (S) |

BOREHOLE No. 15. 64830 DIAMETER:-
GROUND LEVEL:- +19.0' O.D. DATE:- 26-8-65 TO 1-9-65

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF TEST (FT) | NO. OF BLOWN (S) |
|---|---------------|---------------|-------|-----------|---------------------------|--------------------|------------------|
| TARMAC AND CONCRETE | +19.0 | | 0-0 | 1-0 | | | 4 (H) |
| MADE UP GROUND CONSISTING OF DARK SOIL, SOME STONES, SCRAP METAL, ETC. | +18.0 | | 1-0 | 5-0 | | | 4 (H) |
| MADE UP GROUND CONSISTING OF FOUNDRY SLAG, STONES, SCRAP METAL, ETC. | +15.0 | | 6-0 | 1-0 | | | 4 (H) |
| VERY SOFT GREY SILT WITH SOME SHELLS | +10.0 | | 11-0 | 4-0 | | | 15 (H) |
| VERY SOFT GREY SANDY SILT | +2.0 | | 15-0 | 2-0 | | | 19 (H) |
| VERY SMALL GRAVEL, VERY SILTY | -4.0 | | 17-0 | 2-0 | | | 16 (H) |
| SMALL GRAVEL | -6.0 | | 19-0 | 1-0 | | | 19 (H) |
| VERY SMALL GRAVEL WITH SOME SILT | -8.0 | | 21-0 | 1-0 | | | 16 (H) |
| SMALL GRAVEL | -10.0 | | 23-0 | 2-0 | | | 24 (S) |
| SMALL GRAVEL | -12.0 | | 25-0 | 2-0 | | | 24 (S) |
| GRAVEL 1/2" TO 1" SOME COARSE SAND | -14.0 | | 27-0 | 2-0 | | | 24 (S) |
| MEDIUM GRAVEL AND SOME COARSE SAND | -20.0 | | 33-0 | 2-0 | | | 51 (S) |
| COMPACT MEDIUM GRAVEL WITH 6" COBBLES | -22.0 | | 35-0 | 2-0 | | | 26 (S) |
| MEDIUM GRAVEL WITH SOME COBBLES MEDIUM TO LARGE GRAVEL WITH SOME COARSE SAND | -24.0 | | 37-0 | 1-0 | | | 30 (S) |
| COMPACT MEDIUM GRAVEL WITH SOME COBBLES | -26.0 | | 39-0 | 2-0 | | | 26 (S) |
| MEDIUM GRAVEL | -30.0 | | 43-0 | 2-0 | | | 28 (S) |
| MEDIUM GRAVEL AND COARSE SAND | -32.0 | | 45-0 | 0-6 | | | 30 (S) |
| SMALL GRAVEL AND COARSE SAND | -34.0 | | 47-0 | 2-0 | | | 27 (S) |
| COMPACT MEDIUM GRAVEL | -36.0 | | 49-0 | 2-0 | | | 27 (S) |
| MEDIUM GRAVEL | -38.0 | | 51-0 | 3-6 | | | 28 (S) |
| MEDIUM GRAVEL AND COARSE SAND | -40.0 | | 53-0 | 0-6 | | | 39 (S) |
| AS ABOVE, ONE LARGE COBBLE 8" DIA. WITH SOME FINE SAND, VERY COMPACT COARSE SAND AND SMALL GRAVEL | -42.0 | | 55-0 | 2-0 | | | 28 (S) |
| MEDIUM GRAVEL WITH COARSE SAND, VERY COMPACT | -44.0 | | 57-0 | 5-0 | | | 28 (S) |
| SOILING TERMINATED AT DEPTH 95'-0" DUE TO DIFFICULTY IN DRIVING CASING. | -76.0 | | 95-0 | 23.16M | | | |

BOREHOLE No. 16. 64831 DIAMETER:-
GROUND LEVEL:- DATE:-

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF TEST (FT) | NO. OF BLOWN (S) |
|-------------|---------------|---------------|-------|-----------|---------------------------|--------------------|------------------|
| | | | | | | | |

NOTES:-
1. FIGURES SHOWN IN THE COLUMN ENTITLED 'STANDARD PENETRATION TESTS' INDICATE NUMBER OF BLOWS/FOOT OF PENETRATION, USING A 140LBS WEIGHT DROPPING THROUGH 2'-6" TO DRIVE THE STANDARD HOLLOW CUTTING SHOE, 2" O.D., 1 1/4" I.D. IN SOME CASES, THE SOLID CONE WAS USED, DIMENSIONS SIMILAR TO ABOVE, BUT POINTED
2. 'BOILING UP' OF FINE GRAVEL AND SAND INSIDE THE CASING TOOK PLACE IN BOREHOLE No. 12 AT DEPTH 35'-0" - 40'-0". MATERIAL ROSE APPROX. 3'-6" IN CASING OVERNIGHT AT 35'-0" AND IT CAME UP 1'-0" IN CASING DURING PENETRATION TEST AT 40'-0".
3. BOREHOLE No. 11 WAS BACKFILLED UP TO GROUND LEVEL WITH LOOSE CLEAN GRAVEL (3/4"). BOTTOM OF SOUNDING PIPE WAS SET AT -4'-5" O.D.
4. BOREHOLE No. 12 WAS BACKFILLED THUS:-
-52'-0" O.D. TO -13'-0" O.D. CLEAN GRAVEL
-13'-0" O.D. TO +2'-0" O.D. DENSE BLUE CLAY WELL RAMMED.
+2'-0" O.D. TO GROUND LEVEL, LOOSE CLEAN GRAVEL.
THE BOTTOM OF THE SOUNDING PIPE WAS SET AT +2'-0" O.D. TUBING TO THE BOTTOM OF WHICH WAS FITTED A 2'-0" LENGTH OF PERFORATED STEEL PIPE, SEALED AT THE LOWER END.
6 (S) DENOTES TEST DONE WITH SOLID CONE
(H) DENOTES TEST DONE WITH HOLLOW SHOE.
• DENOTES DISTURBED SAMPLE.
Δ DENOTES WATER SAMPLE.

REPORT 1167 Box 5F

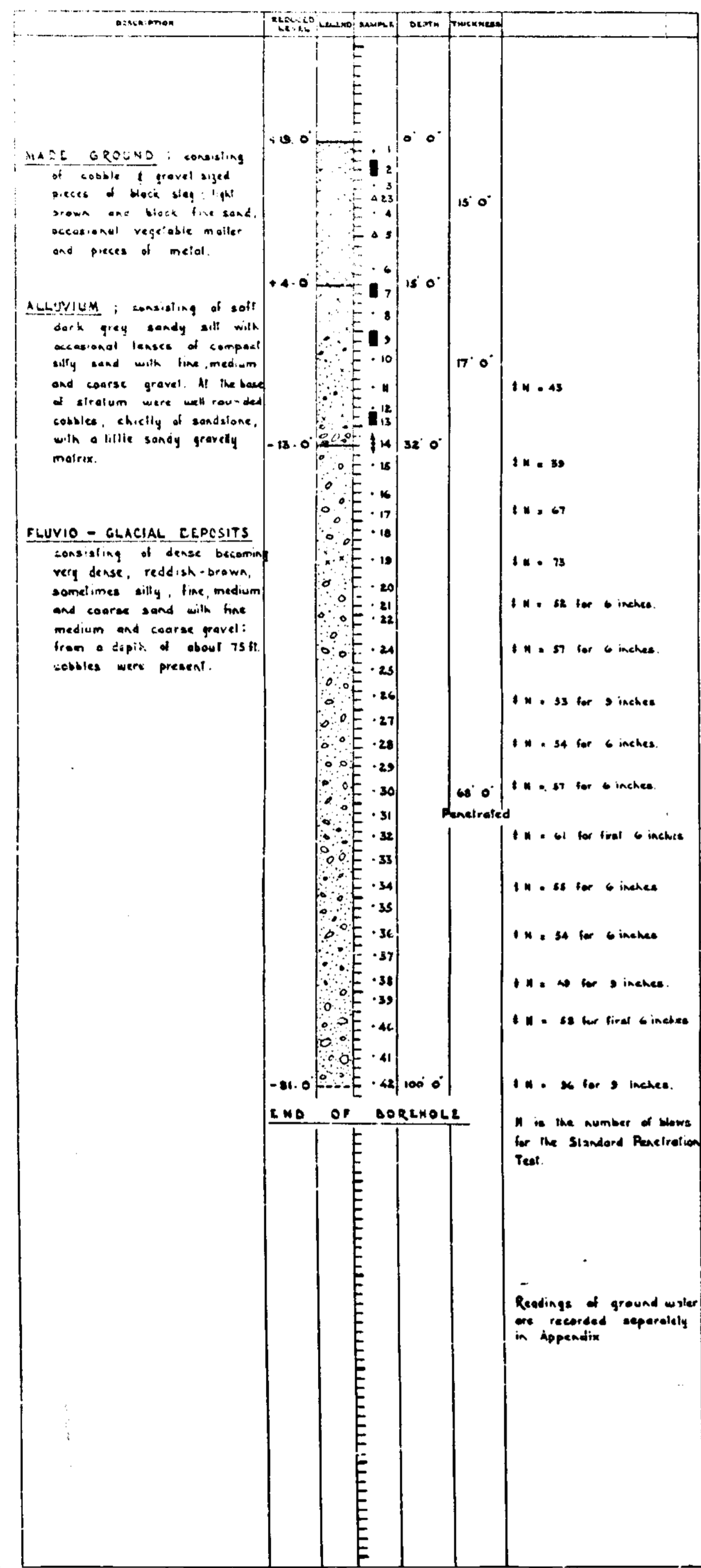
| | | |
|-----------|------|----|
| REVISIONS | DATE | BY |
| | | |

SA. 2010-65

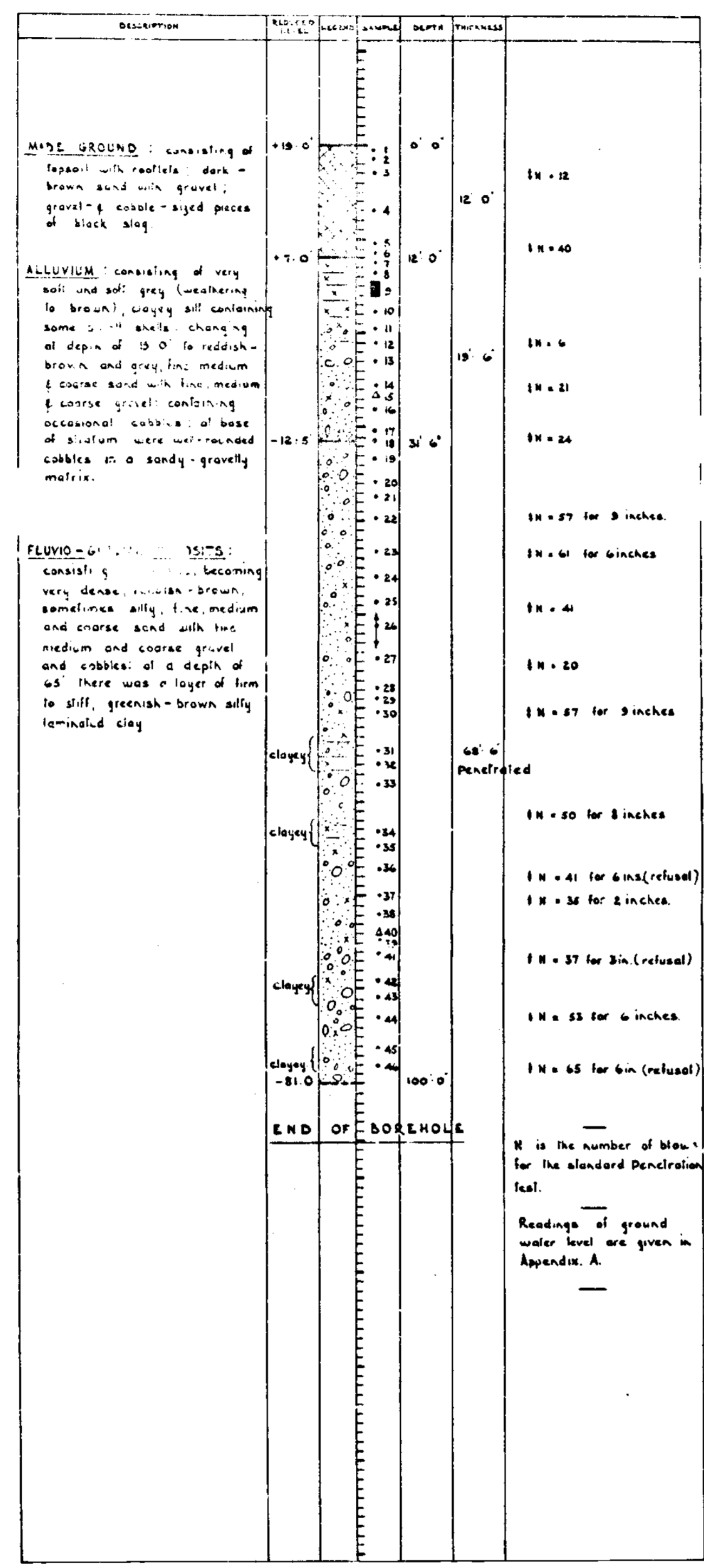
MARINA POWER STATION
LOGS OF BOREHOLES 11-15 INCL.
(COMPILED FROM RECORDS OF
MESSRS. SOIL MECHANICS LTD.)

62016

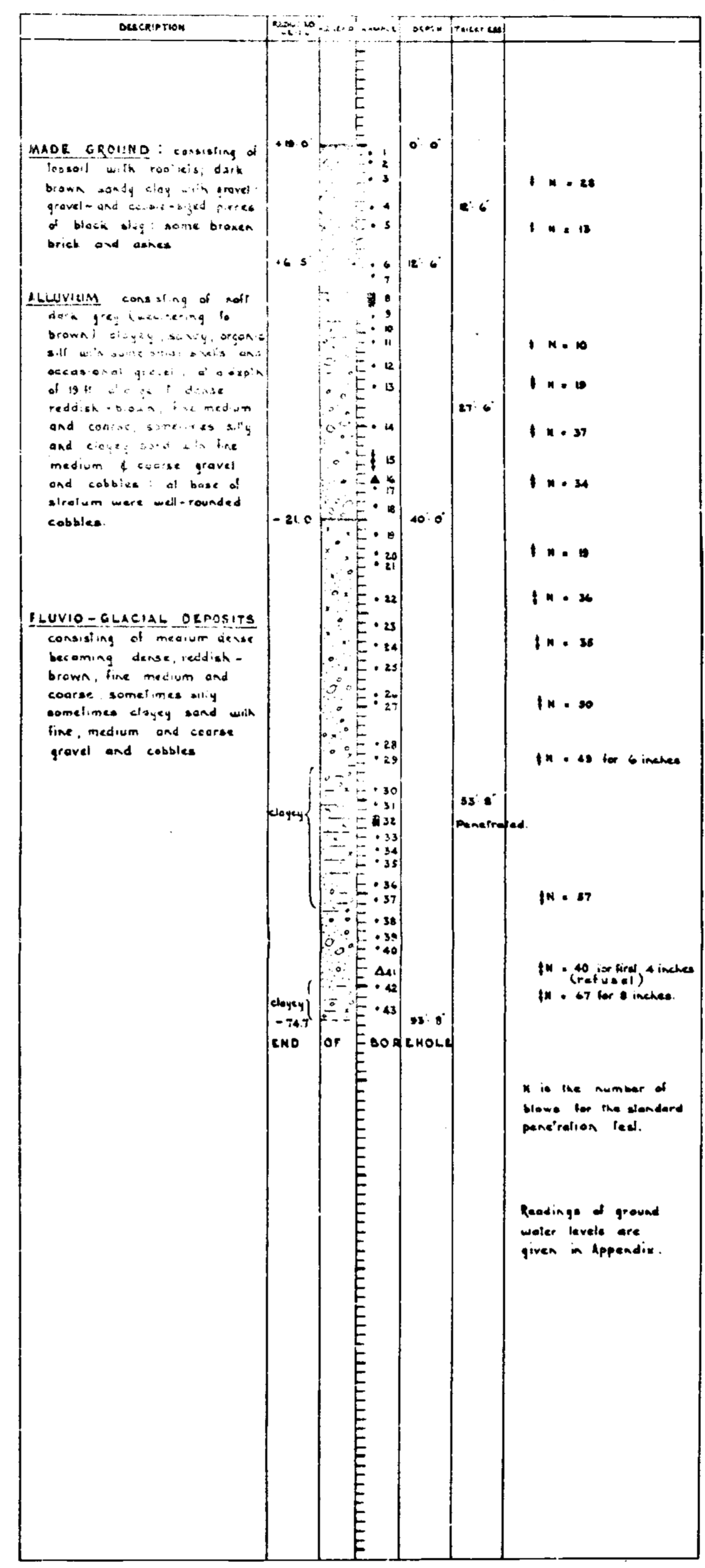
64822
 BOREHOLE NO. 7 DIAMETER: 10, 8 f 6 inch
 GROUND LEVEL: 19 feet above I.O.D. DATE: July 14 - August 16, 1960



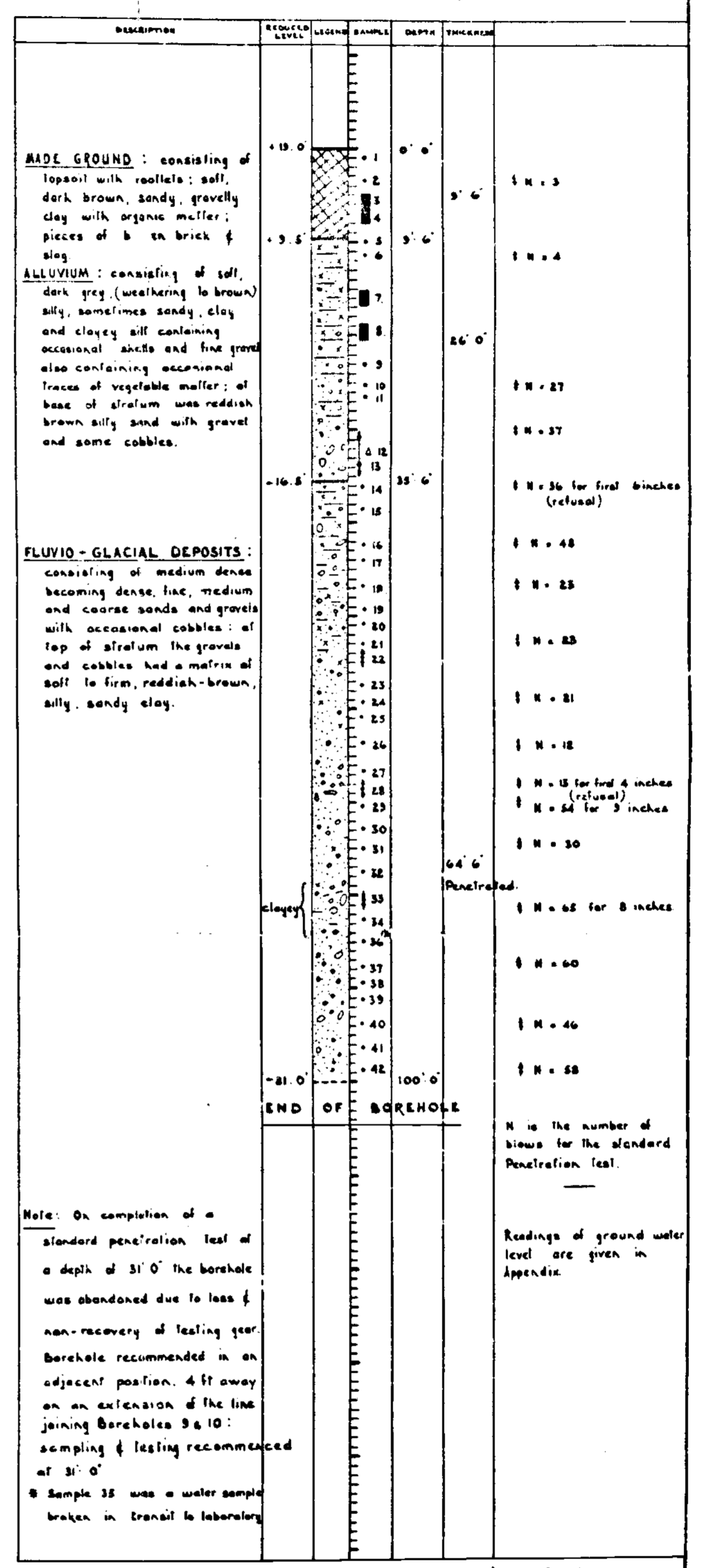
64823
 BOREHOLE NO. 8 DIAMETER: 10, 8 f 6 inch
 GROUND LEVEL: 19.0 feet above I.O.D. DATE: August 9 - 24th, 1960



64824
 BOREHOLE NO. 9 DIAMETER: 10, 8, f 6 inch.
 GROUND LEVEL: 19.0 feet above I.O.D. DATE: August 25 - September 10, 1960



64825
 BOREHOLE NO. 10 DIAMETER: 10, 8 f 6 inch.
 GROUND LEVEL: 19.0 feet above I.O.D. DATE: September 13 - October 13, 1960

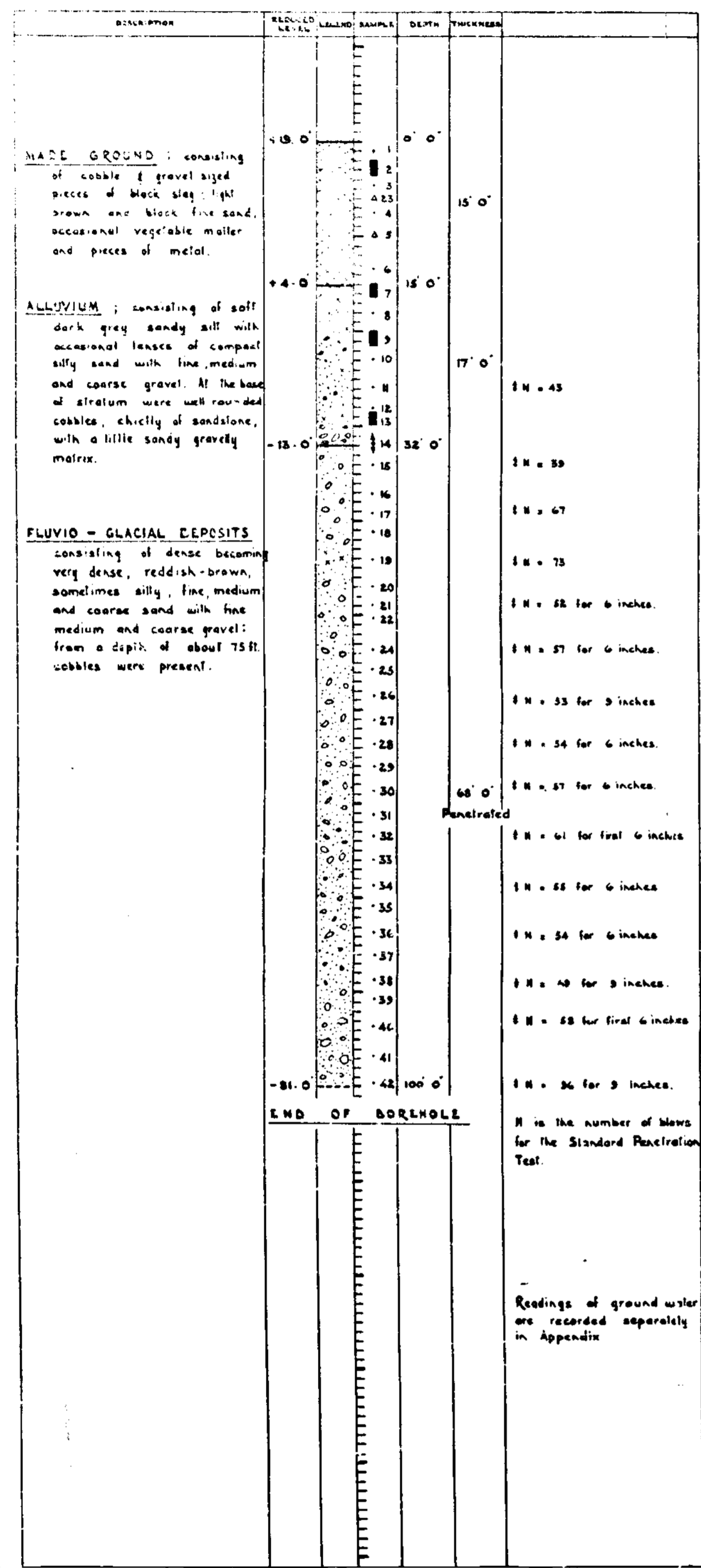


REPORT 1167 Box 35

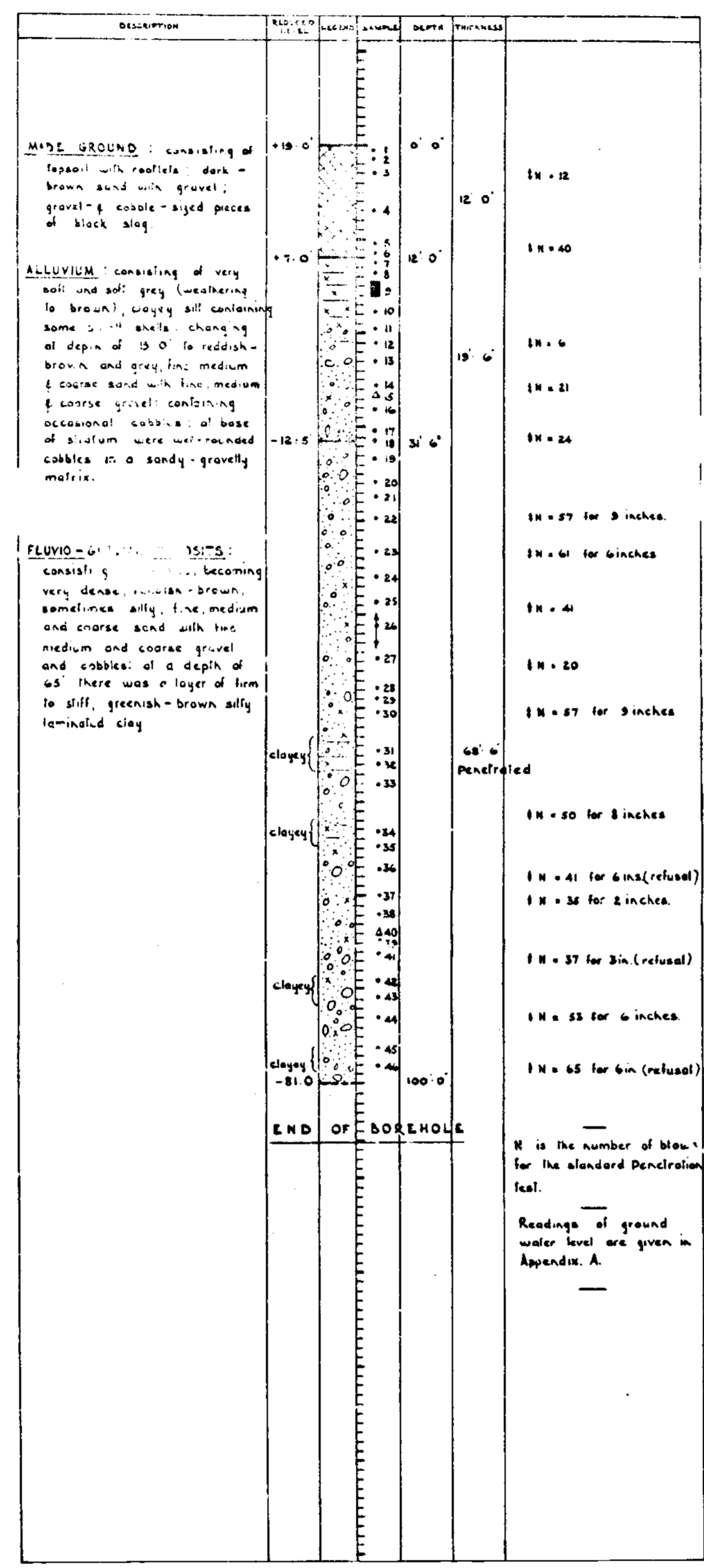
Note: For description of logs by R.E. see File E.5101.

| | | |
|---|-------------------------|--|
| Revisions A Revised to agree with Report by Soil Mechanics | Drawn T. Wood | ELECTRICITY SUPPLY BOARD, CIVIL WORKS DEPARTMENT MARINA POWER STATION Logs of Bore Holes 7 to 10 incl (Traced from Records of Messrs Soil Mechanics Ltd.) |
| | Checked P. H. Kelly | |
| | Approved D. J. Kelly | |
| | Date 1/120 | 43139A |

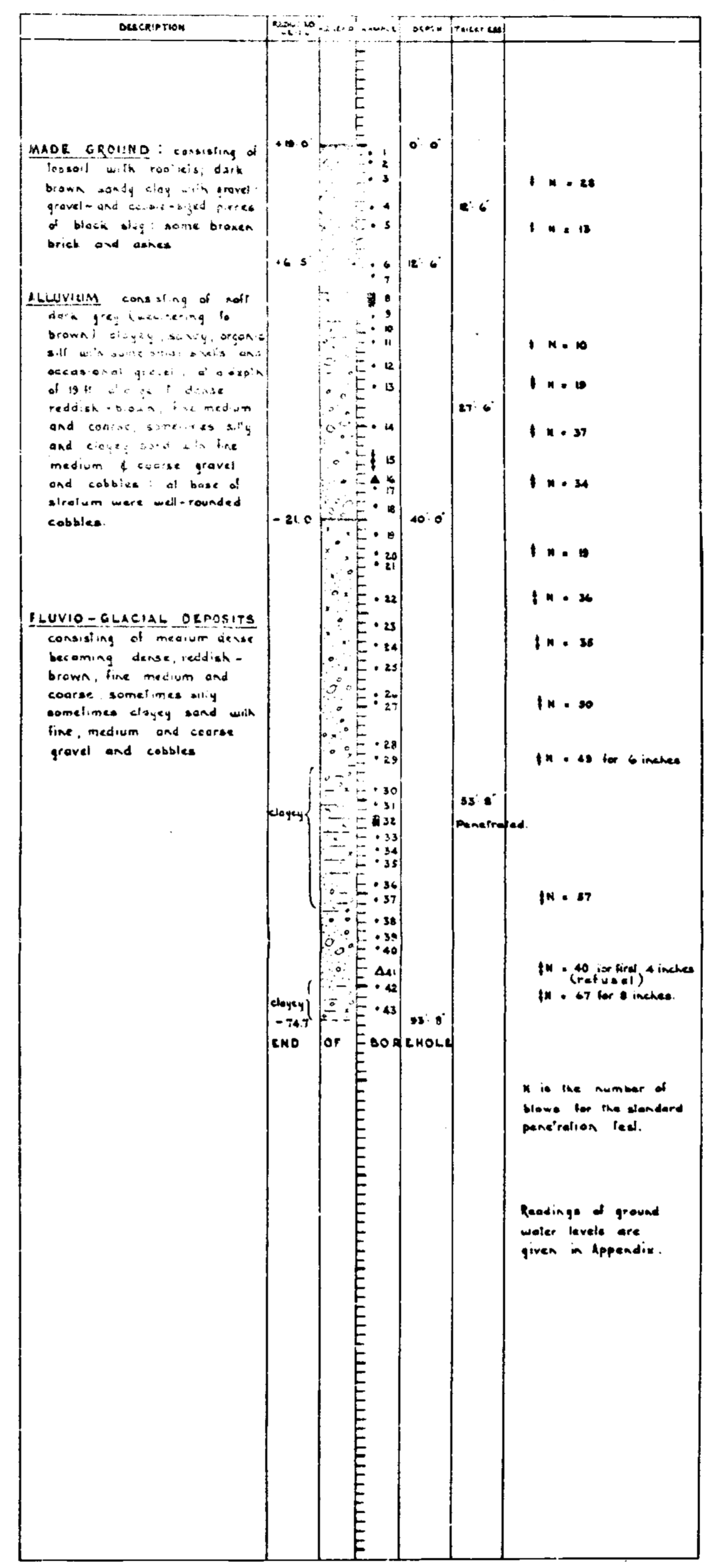
64822
 BOREHOLE NO. 7 DIAMETER: 10, 8 $\frac{1}{2}$ inch
 GROUND LEVEL: 19 feet above I.O.D. DATE: July 14 - August 16, 1960



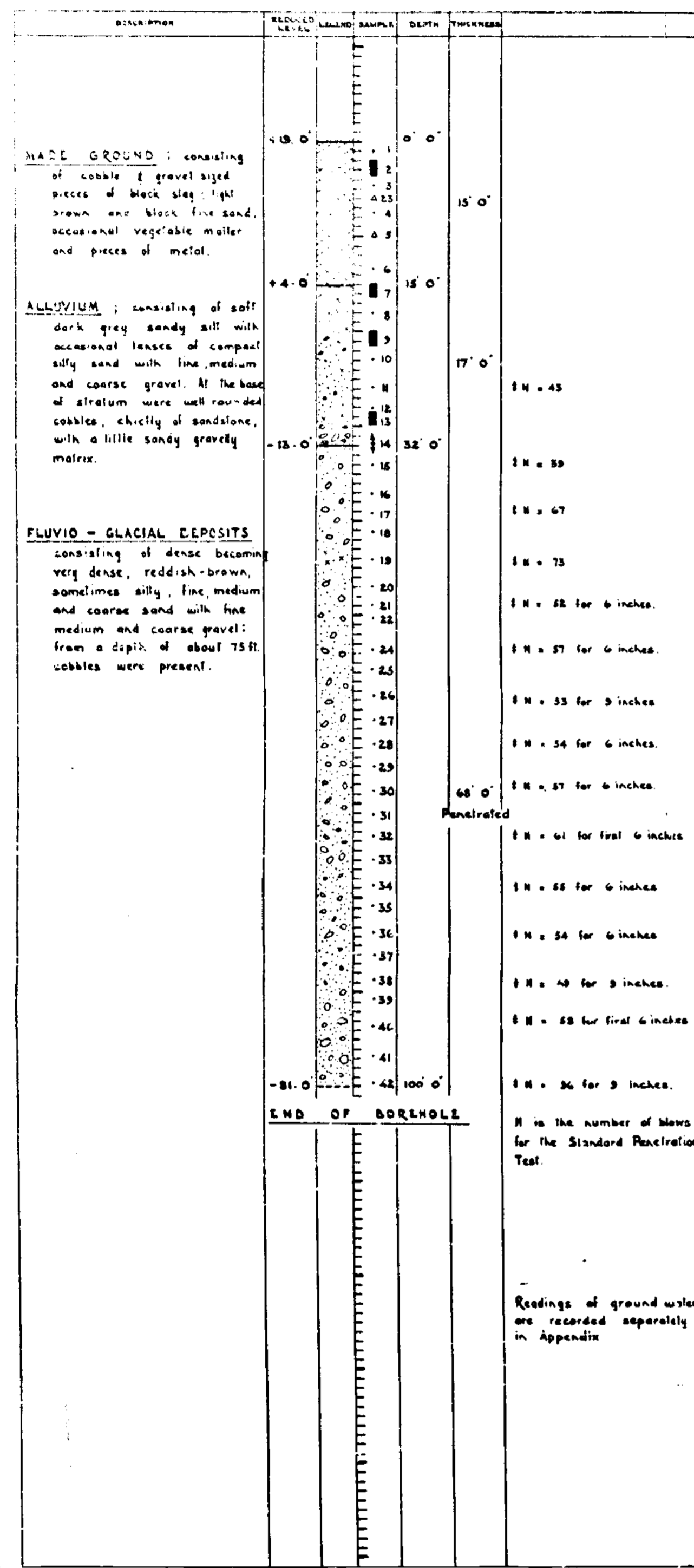
64823
 BOREHOLE NO. 8 DIAMETER: 10, 8 $\frac{1}{2}$ inch
 GROUND LEVEL: 19.0 feet above I.O.D. DATE: August 9 - 24th, 1960



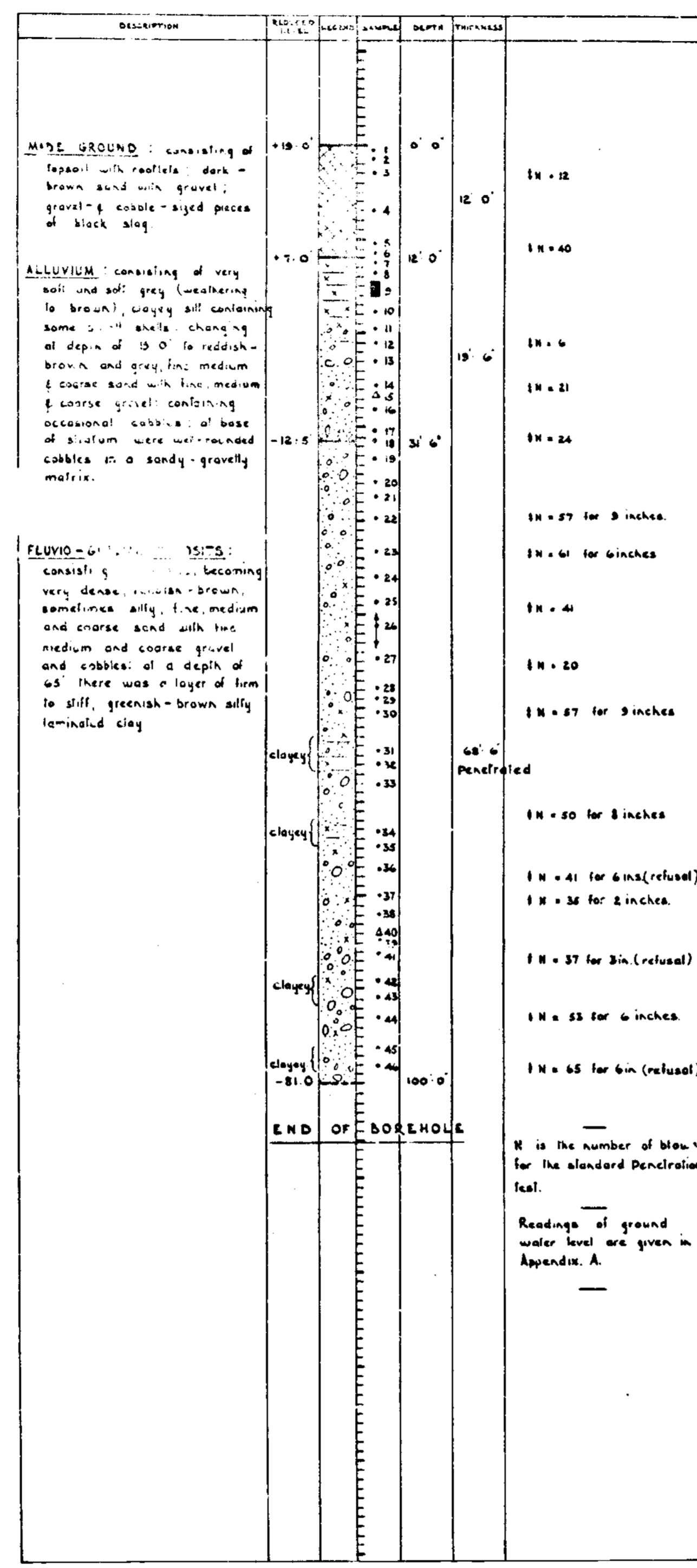
64824
 BOREHOLE NO. 9 DIAMETER: 10, 8 $\frac{1}{2}$ inch
 GROUND LEVEL: 19.0 feet above I.O.D. DATE: August 25 - September 10, 1960



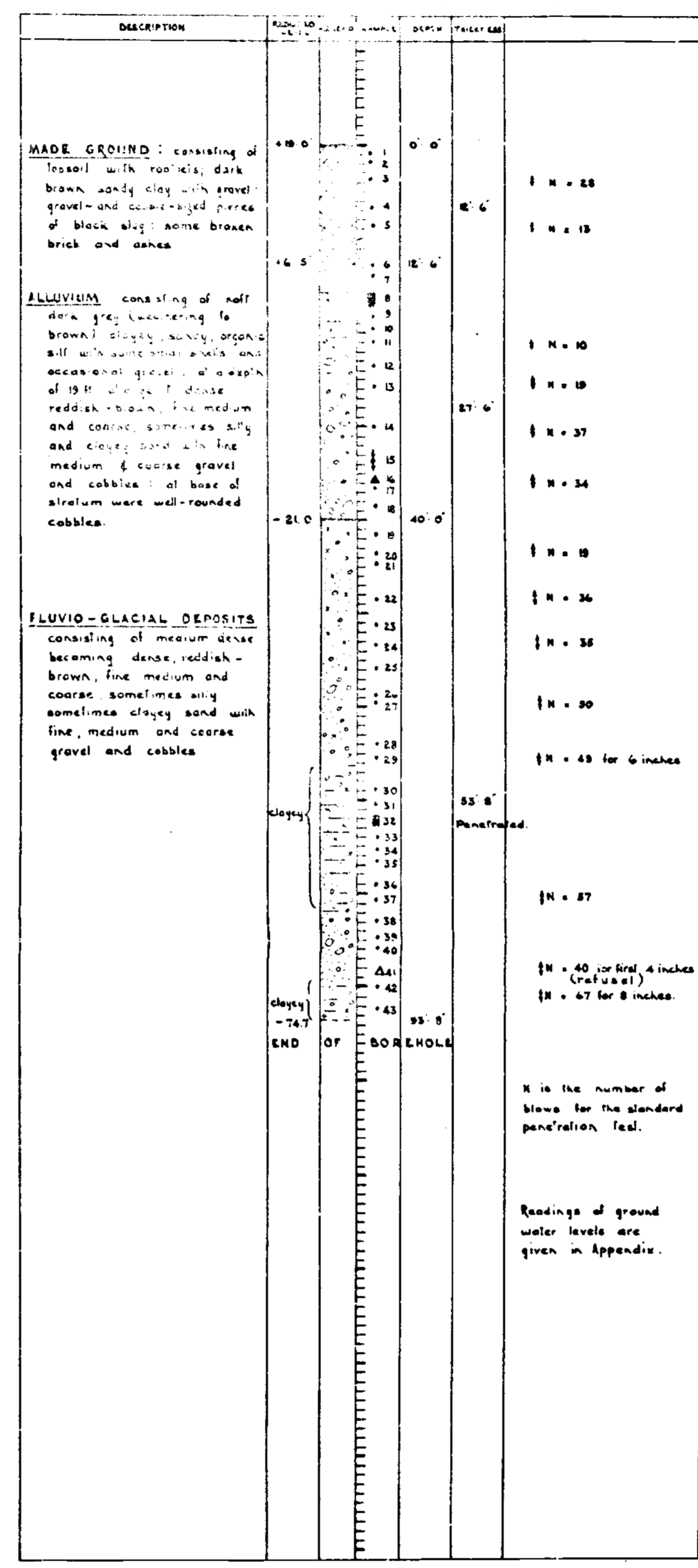
64822
BOREHOLE NO. 7 DIAMETER: 10, 8 & 6 inch
GROUND LEVEL: 19 feet above I.O.D. DATE: July 14 - August 16, 1960



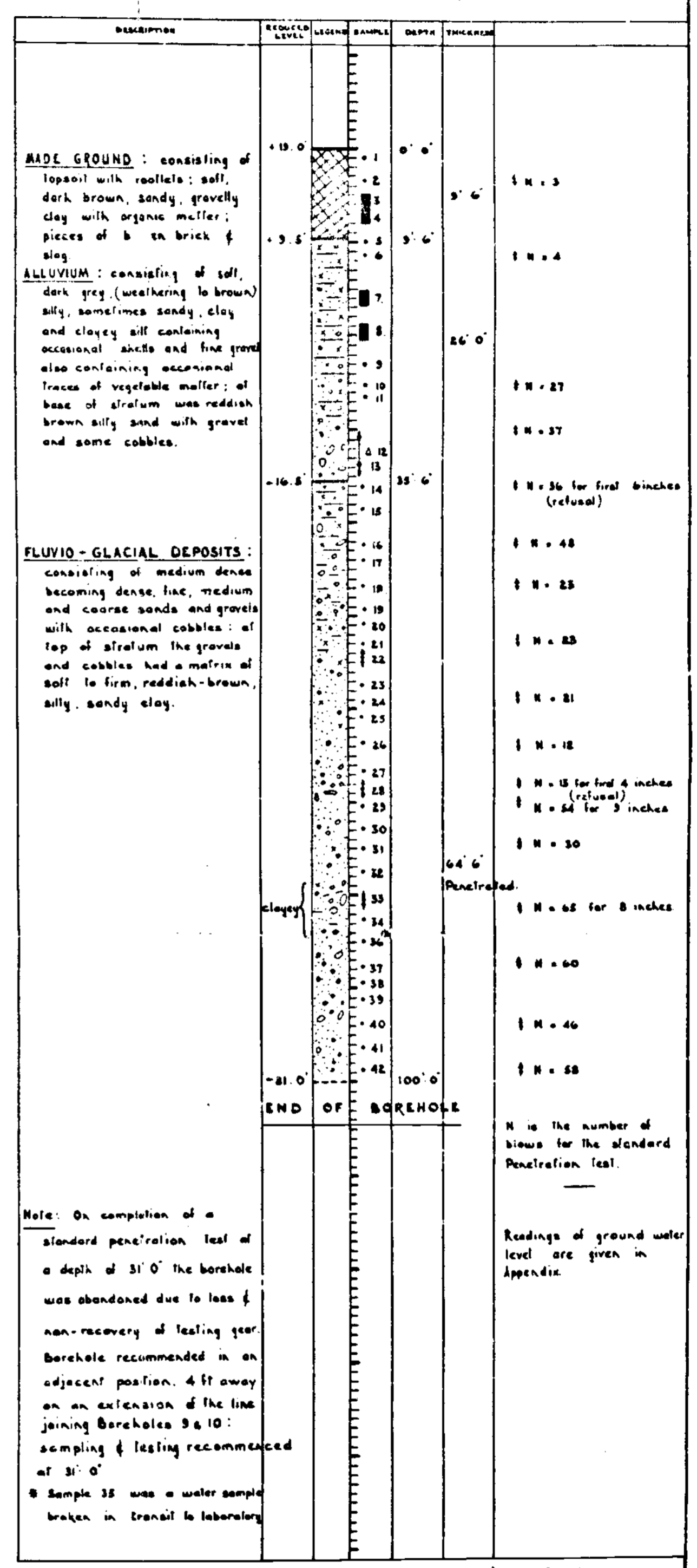
64823
BOREHOLE NO. 8 DIAMETER: 10, 8 & 6 inch
GROUND LEVEL: 19.0 feet above I.O.D. DATE: August 9 - 24th, 1960



64824
BOREHOLE NO. 9 DIAMETER: 10, 8, & 6 inch
GROUND LEVEL: 19.0 feet above I.O.D. DATE: August 25 - September 10, 1960



64825
BOREHOLE NO. 10 DIAMETER: 10, 8 & 6 inch
GROUND LEVEL: 19.0 feet above I.O.D. DATE: September 13 - October 13, 1960

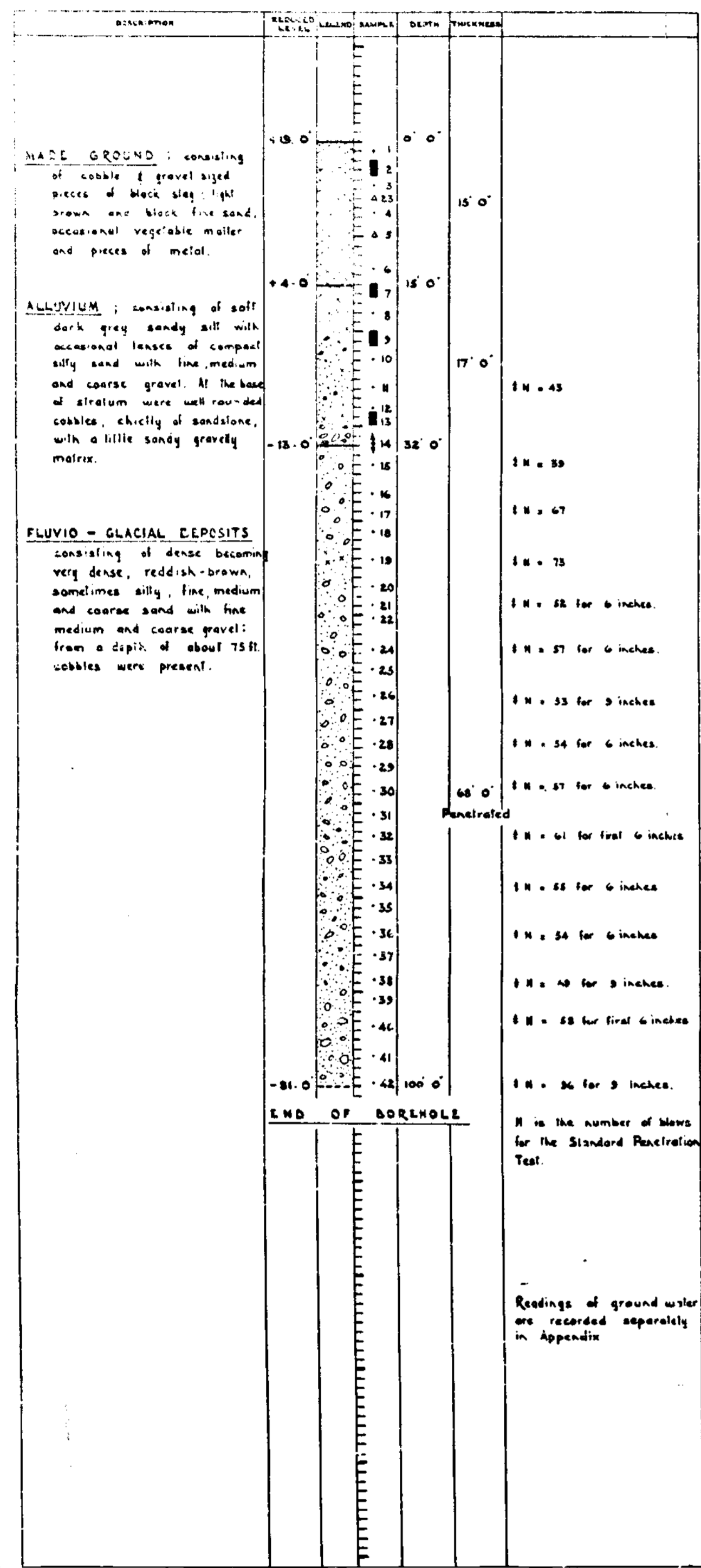


REPORT 117 Box 35

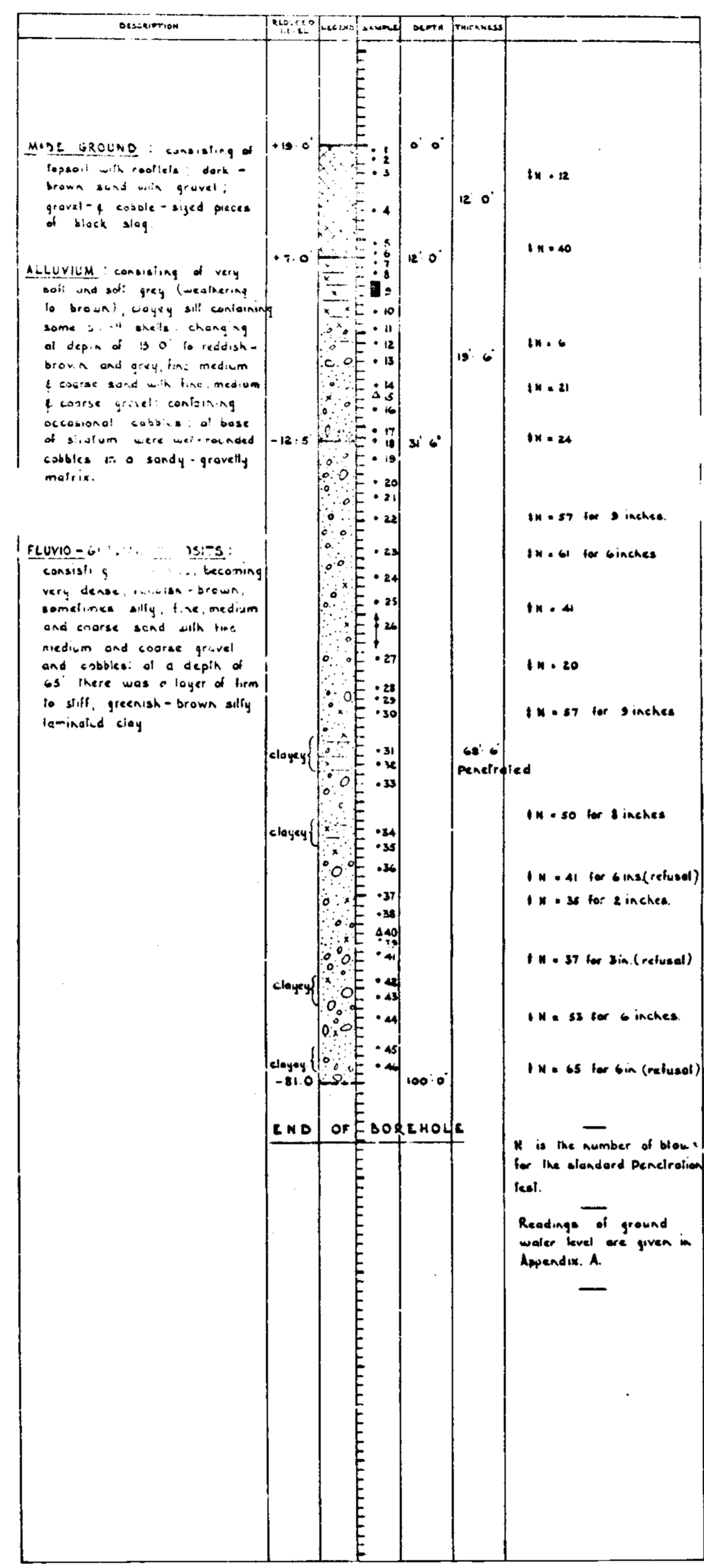
Note: For description of logs by R.E. see File E.5101.

| | | |
|---|----------------------|---|
| Revisions A Revised to agree with Report by Soil Mechanics | Drawn T. Wood | ELECTRICITY SUPPLY BOARD, CIVIL WORKS DEPARTMENT MARINA POWER STATION Logs of Bore Holes 7 to 10 incl (Traced from Records of Messrs Soil Mechanics Ltd) |
| | Checked P. H. ... | |
| | Date 1/120 | 43139A |

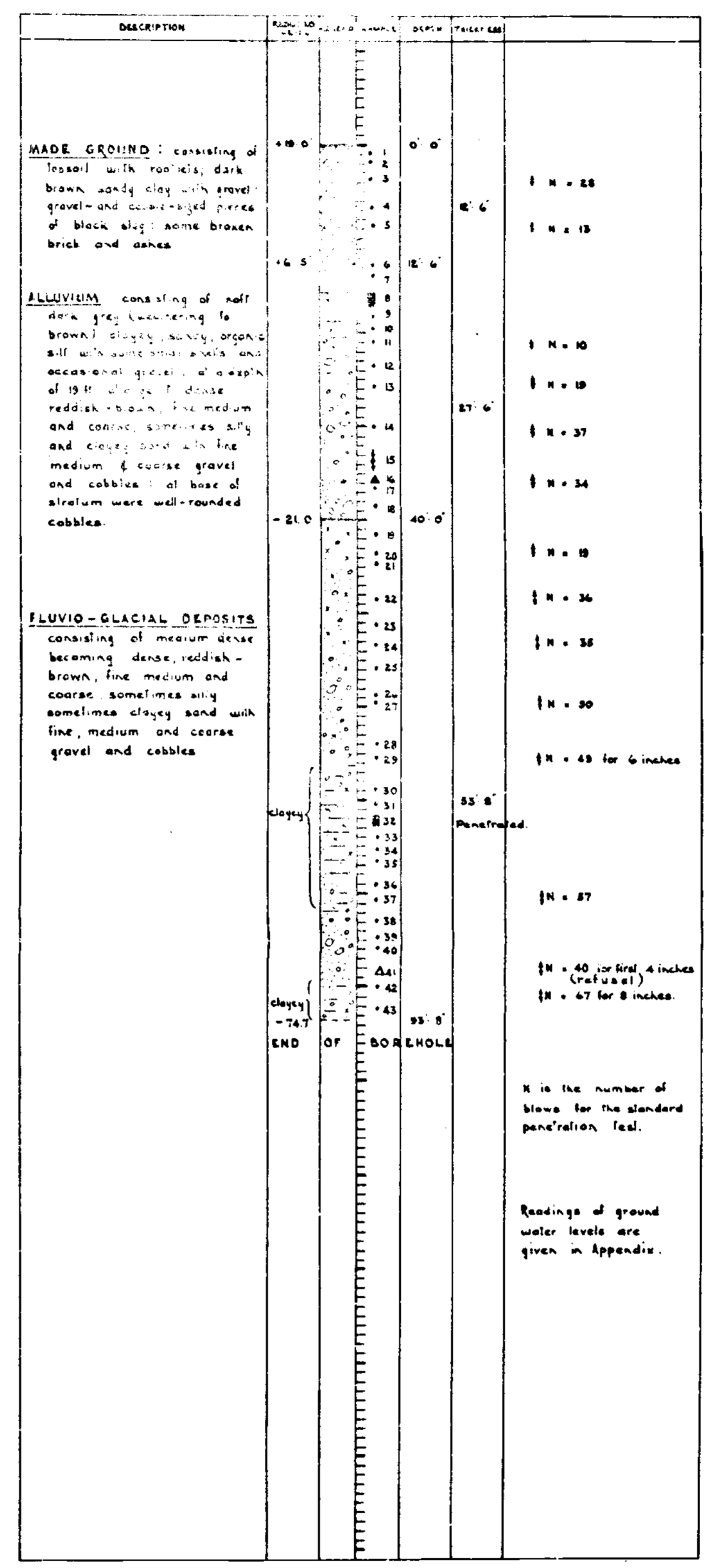
64822
 BOREHOLE NO. 7 DIAMETER: 10, 8 f 6 inch
 GROUND LEVEL: 19 feet above I.O.D. DATE: July 14 - August 16, 1960



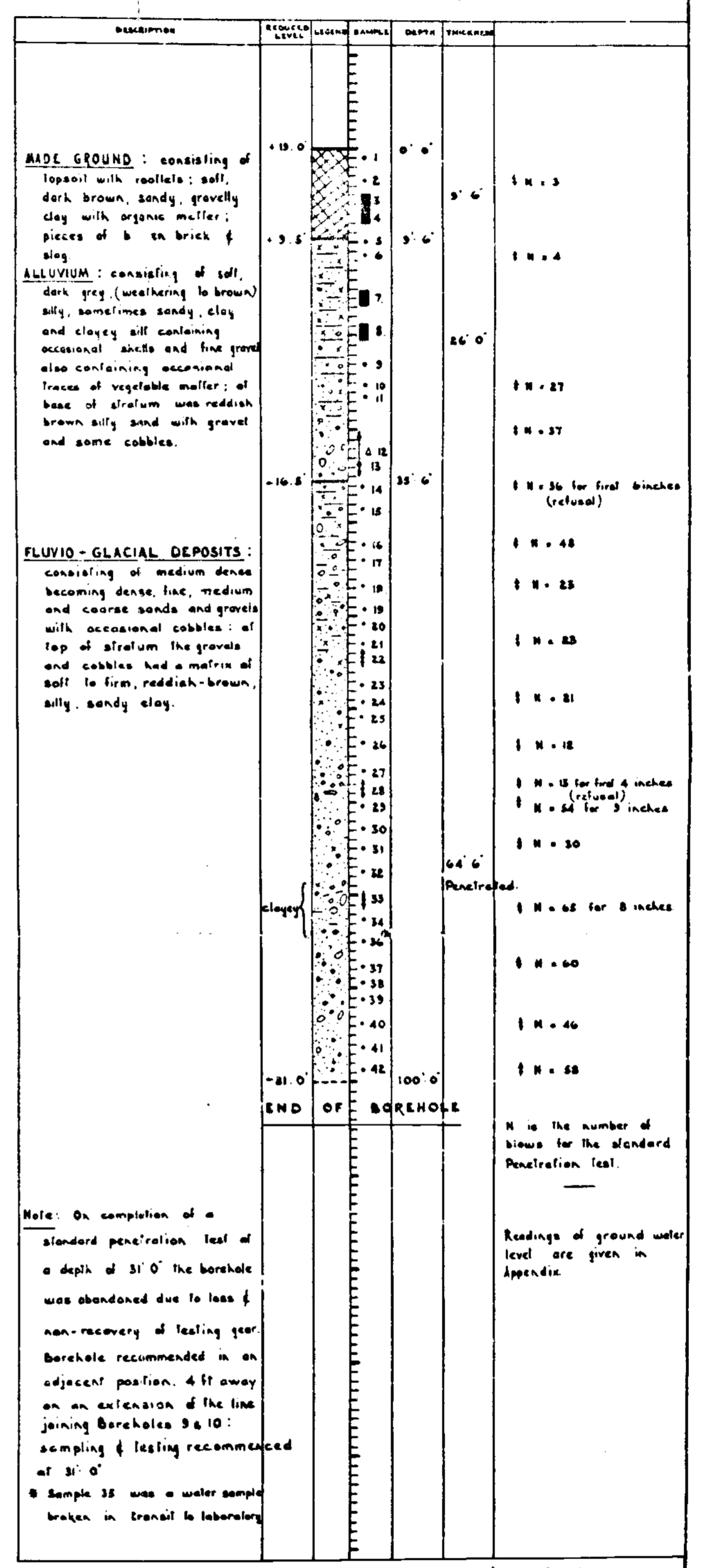
64823
 BOREHOLE NO. 8 DIAMETER: 10, 8 f 6 inch
 GROUND LEVEL: 19.0 feet above I.O.D. DATE: August 9 - 24th, 1960



64824
 BOREHOLE NO. 9 DIAMETER: 10, 8 f 6 inch
 GROUND LEVEL: 19.0 feet above I.O.D. DATE: August 25 - September 10, 1960



64825
 BOREHOLE NO. 10 DIAMETER: 10, 8 f 6 inch
 GROUND LEVEL: 19.0 feet above I.O.D. DATE: September 13 - October 13, 1960



REPORT 1167 Box 35

Note: For description of logs by R.E. see File E.5101.

| | | |
|---|--|--|
| Revisions A Revised to agree with Report by Soil Mechanics | Drawn T. Wood Checked P. H. Kelly Approved Date 1/120 | ELECTRICITY SUPPLY BOARD, CIVIL WORKS DEPARTMENT MARINA POWER STATION Logs of Bore Holes 7 to 10 incl (Traced from Records of Messrs Soil Mechanics Ltd.) 43139A |
|---|--|--|

| BOREHOLE No. 11 64826 | | | | | | BOREHOLE No. 12 64827 | | | | | | BOREHOLE No. 13 64828 | | | | | | BOREHOLE No. 14 64829 | | | | | | BOREHOLE No. 15 64830 | | | | | | |
|--|---------------|---------------|--------|-----------|---------------------------|---|---------------|---------------|--------|-----------|---------------------------|---|---------------|---------------|-------|-----------|---------------------------|---|---------------|---------------|-------|-----------|---------------------------|---|---------------|---------------|-------|-----------|---------------------------|--|
| DIAMETER:- | | | | | | DIAMETER:- | | | | | | DIAMETER:- | | | | | | DIAMETER:- | | | | | | DIAMETER:- | | | | | | |
| GROUND LEVEL:- +17.43' O.D. | | | | | | GROUND LEVEL:- +18.04' O.D. | | | | | | GROUND LEVEL:- +18.1' O.D. | | | | | | GROUND LEVEL:- +17.5' O.D. | | | | | | GROUND LEVEL:- +19.0' O.D. | | | | | | |
| DATE:- 1-6-65 TO 4-6-65 | | | | | | DATE:- 5-4-65 TO 11-6-65 | | | | | | DATE:- 6-8-65 TO 17-8-65 | | | | | | DATE:- 18-8-65 TO 24-8-65 | | | | | | DATE:- 26-8-65 TO 1-9-65 | | | | | | |
| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | |
| LOOSE CLAYEY GRAVEL ETC. FILLING | +17.43 | | 0.0 | 5.0' | 3 (S) | BROWN CLAY GRAVEL FILLING | +18.04 | | 0.0 | 5.0' | 10 (H) | MADE GROUND PREDOMINATELY SAND AND SILT WITH SOME BRICK RUBBLE. | +18.1 | | 0.0 | 15.0' | | MADE UP GROUND, DARK SOIL AND SLAG WITH SOME STONES, SCRAP METAL, ASH, ETC. | +17.5 | | 0.0 | 9.0' | | TARMAK AND CONCRETE. | +19.0 | | 0.0 | 1.0' | | |
| FILLING MATERIAL CLAYEY GRAVEL AND FOUNDRY SLAG LOOSE. | +18.4 | | 5.0 | 6.0' | 2 (S) | BLACK FOUNDRY SAND | +19.0 | | 5.0 | 5.0' | 5 (H) | GREY, SANDY SILT. | +18.1 | | 5.0 | 2.0' | 4 (H) | AS ABOVE, CHANGING TO GREY SILT. | +18.5 | | 5.0 | 7.0' | 4 (H) | MADE UP GROUND CONSISTING OF SOIL, SOME STONES AND SAND, SCRAP METAL ETC. | +18.0 | | 5.0 | 5.0' | | |
| FINE DARK GRAY CONCRETE SILT WITH SOME CLAY FINE | +1.4 | | 16.0 | 8.0' | 0 (S) | FINE DARK GRAY SILT WITH SOME VERY FINE SAND AND CLAY CONCRETE. | +18.0 | | 10.0 | 5.0' | 3 (H) | GREY SILT AND FINE AND MEDIUM GRAVEL. | +19.1 | | 10.0 | 3.0' | 6 (H) | VERY SOFT GREY SILT WITH SOME TRACES OF SAND. | +18.5 | | 10.0 | 1.0' | 2 (H) | MADE UP GROUND CONSISTING OF FOUNDRY SLAG, STONES, SCRAP METAL, ETC. | +18.5 | | 10.0 | 1.0' | 4 (H) | |
| COARSE AND MEDIUM GRAVEL UP TO 1 1/2" WITH SOME SAND AND VERY LITTLE SILT. | +1.6 | | 19.0 | 5.0' | 8 (S) | 1" LAYER OF VEGETATION COMPRESSED LEAVES FERN ETC. | +18.5 | | 15.0 | 7.0' | 6 (H) | COARSE, MEDIUM AND FINE GRAVEL AND OCCASIONAL COBBLES. | +19.0 | | 15.0 | 5.0' | 10 (H) | SOFT GREY SANDY SILT. | +18.5 | | 15.0 | 2.0' | 19 (H) | VERY SMALL GRAVEL, VERY SILTY. | +18.5 | | 15.0 | 2.0' | 15 (H) | |
| FINE, MEDIUM AND COARSE RED GRAVEL, SOME SAND, COBBLES UP TO 4". | +2.9 | | 24.0 | 5.0' | 10 (S) | FINE, MEDIUM AND COARSE RED GRAVEL, SOME FINE RED SAND, COBBLES UP TO 2". | +18.0 | | 18.0 | 2.0' | 2 (H) | COARSE, MEDIUM AND FINE GRAVEL AND OCCASIONAL COBBLES. | +19.5 | | 18.0 | 9.0' | 18 (H) | AS ABOVE, CHANGING TO MEDIUM GRAVEL, SOME COARSE SAND. | +18.5 | | 18.0 | 2.0' | 19 (S) | VERY SMALL GRAVEL WITH SOME SILT. | +19.0 | | 18.0 | 1.0' | 16 (H) | |
| AS ABOVE | +12.6 | | 30.0 | 5.0' | 10 (S) | AS ABOVE WITH SOME MORE GRAVEL AND FINE RED SAND | +17.0 | | 23.0 | 10.0' | 28 (H) | COBBLES AND COARSE, MEDIUM AND FINE GRAVEL GRADING TO COBBLES WITH DEPTH. | +22.4 | | 23.0 | 8.0' | 26 (S) | MEDIUM GRAVEL WITH SOME COBBLES 3" - 4". | +18.5 | | 23.0 | 4.0' | 33 (S) | GRAVEL 1/2" TO 2" SOME COARSE SAND. | +19.0 | | 23.0 | 2.0' | 24 (S) | |
| AS ABOVE BUT WITH MORE FINE RED SAND | +17.9 | | 35.0 | 5.0' | 3 (S) | AS ABOVE WITH FEWER, AND SMALLER, COBBLES UP TO 2" | +22.0 | | 28.0 | 5.0' | 34 (H) | AS ABOVE WITH FEWER, AND SMALLER, COBBLES UP TO 2" | +22.4 | | 28.0 | 6.0' | 41 (H) | MEDIUM AND SMALL GRAVEL WITH SOME COBBLES AND COARSE SAND. | +17.5 | | 28.0 | 2.0' | 29 (S) | MEDIUM GRAVEL AND COARSE SAND. | +19.0 | | 28.0 | 6.0' | 24 (S) | |
| AS ABOVE WITH LESS FINE RED SAND, BIGGER COBBLES | +22.6 | | 40.0 | 5.0' | 8 (S) | AS ABOVE WITH LESS FINE RED SAND, BIGGER COBBLES UP TO 6" | +32.0 | | 33.0 | 5.0' | 41 (H) | ONE BOULDER 10" x 8" (GASTONSTONE) | +30.0 | | 33.0 | 1.0' | 17 (H) | MEDIUM GRAVEL WITH FINE TO COARSE SAND. | +20.5 | | 33.0 | 3.0' | 33 (S) | COMPACT MEDIUM GRAVEL WITH 6" COBBLES. | +20.0 | | 33.0 | 2.0' | 51 (S) | |
| AS ABOVE WITH COBBLES UP TO 6" | +27.9 | | 45.0 | 10.0' | 23 (S) | FINE, MEDIUM AND COARSE GRAVEL AND A LITTLE COARSE SAND WITH A LITTLE COARSE SAND OCCASIONAL COBBLES. | +37.0 | | 43.0 | 6.0' | 17 (H) | COARSE, MEDIUM AND FINE GRAVEL AND A LITTLE COARSE SAND WITH A LITTLE COARSE SAND OCCASIONAL COBBLES. | +40.0 | | 43.0 | 6.0' | 25 (S) | COMPACT FINE COARSE SAND WITH MEDIUM GRAVEL. | +20.5 | | 40.0 | 2.0' | 24 (S) | MEDIUM GRAVEL WITH SOME COBBLES. | +22.0 | | 40.0 | 2.0' | 26 (S) | |
| AS ABOVE WITH INCREASED FINE SAND | +27.9 | | 55.0 | 10.0' | 16 (H) | AS ABOVE WITH MORE COBBLES UP TO 4" | +40.0 | | 53.0 | 10.0' | 16 (H) | AS ABOVE BUT WITH COBBLES UP TO 6" | +47.9 | | 53.0 | 10.0' | 9 (H) | MEDIUM GRAVEL WITH FINE TO COARSE SAND AND COBBLES 3" - 4". | +21.5 | | 53.0 | 3.0' | 24 (S) | MEDIUM GRAVEL AND COARSE SAND. | +23.0 | | 53.0 | 0.6' | 28 (S) | |
| AS ABOVE BUT MORE COBBLES UP TO 4" | +52.4 | | 70.0 | 5.0' | 20 (H) | AS ABOVE BUT WITH COBBLES UP TO 6" | +52.0 | | 70.0 | 5.0' | 15 (H) | COARSE GRAVEL AND COBBLES | +58.9 | | 70.0 | 10.0' | 30 (S) | MEDIUM GRAVEL WITH FINE TO COARSE SAND WITH SOME 3" - 4" COBBLES. | +23.5 | | 55.0 | 2.0' | 22 (S) | SMALL GRAVEL AND COARSE SAND. | +23.0 | | 55.0 | 2.0' | 30 (S) | |
| | | | 21.33M | | | | | | 21.33M | | | | | | | | | | | | | | | | | | | | | |

- NOTES:-
- FIGURES SHOWN IN THE COLUMN ENTITLED 'STANDARD PENETRATION TESTS' INDICATE NUMBER OF BLOWS/FOOT OF PENETRATION, USING A 140 LBS WEIGHT DROPPING THROUGH 2'-6" TO DRIVE THE STANDARD HOLLOW CUTTING SHOE, 2" O.D., 1 1/4" I.D. IN SOME CASES, THE SOLID CONE WAS USED, DIMENSIONS SIMILAR TO ABOVE, BUT POINTED.
 - 'BOILING UP' OF FINE GRAVEL AND SAND INSIDE THE CASING TOOK PLACE IN BOREHOLE No. 12 AT DEPTH 35'-0" - 40'-0". MATERIAL ROSE APPROX. 3'-6" IN CASING OVERNIGHT AT 35'-0" AND IT CAME UP 1'-0" IN CASING DURING PENETRATION TEST AT 40'-0".
 - BOREHOLE No. 11 WAS BACKFILLED UP TO GROUND LEVEL WITH LOOSE CLEAN GRAVEL (3/4"). BOTTOM OF SOUNDING PIPE WAS SET AT -4'-5" O.D.
 - BOREHOLE No. 12 WAS BACKFILLED THUS:-
-52'-0" O.D. TO -13'-0" O.D. CLEAN GRAVEL.
-13'-0" O.D. TO +2'-0" O.D. DENSE BLUE CLAY WELL RAMMED.
+2'-0" O.D. TO GROUND LEVEL, LOOSE CLEAN GRAVEL.
 - THE BOTTOM OF THE SOUNDING PIPE WAS SET AT +2'-0" O.D. TUBING TO THE BOTTOM OF WHICH WAS FITTED A 2'-0" LENGTH OF PERFORATED STEEL PIPE, SEALED AT THE LOWER END.
 - (S) DENOTES TEST DONE WITH SOLID CONE
(H) DENOTES TEST DONE WITH HOLLOW SHOE.
• DENOTES DISTURBED SAMPLE.
Δ DENOTES WATER SAMPLE.

REPORT 1167 Box 5F

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| REVISIONS | DATE | BY | APPROVED |
| | | | |

SA. 2010-65

MARINA POWER STATION
LOGS OF BOREHOLES 11-15 INCL.
(COMPILED FROM RECORDS OF
MESSRS. SOIL MECHANICS LTD.)

62016

BOREHOLE No. 11. 64826 DIAMETER: 10' & 8"
 GROUND LEVEL: +17.43' O.D. DATE: 1-6-65 TO 4-6-65

BOREHOLE No. 12. 64827 DIAMETER: 10' & 8"
 GROUND LEVEL: +18.04' O.D. DATE: 8-6-65 TO 11-6-65

BOREHOLE No. 13. 64828 DIAMETER: 10' & 8"
 GROUND LEVEL: +18.1' O.D. DATE: 6-8-65 TO 17-8-65

BOREHOLE No. 14. 64829 DIAMETER: 10' & 8"
 GROUND LEVEL: +17.5' O.D. DATE: 18-8-65 TO 24-8-65

BOREHOLE No. 15. 64830 DIAMETER: 10' & 8"
 GROUND LEVEL: +19.0' O.D. DATE: 26-8-65 TO 1-9-65

BOREHOLE No. 16. 64831 DIAMETER: 10' & 8"
 GROUND LEVEL: +19.0' O.D. DATE: 26-8-65 TO 1-9-65

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF PENETRATION (FT) | NO. OF BLOWN |
|---|---------------|---------------|-------|-----------|---------------------------|---------------------------|--------------|
| LOOSE CLAYEY GRAVEL ETC. FILLING | +17.43 | | 0-0 | 5-0 | 3 (S) | | |
| FILLING MATERIAL CLAYEY GRAVEL AND FOUNDRY SLAG LOOSE | +18.4 | | 5-0 | 6-0 | 2 (S) | | |
| FINE DARK GRAY CONCRETE SILT WITH SOME CLAY FINE | +1.4 | | 16-0 | 8-0 | 0 (S) | | |
| COARSE AND MEDIUM GRAVEL UP TO 1 1/2" WITH SOME SAND AND VERY LITTLE SILT | +1.6 | | 19-0 | 5-0 | 8 (S) | | |
| FINE, MEDIUM AND COARSE RED GRAVEL, SOME SAND, COBBLES UP TO 4" | +2.9 | | 24-0 | 6-0 | 10 (S) | | |
| AS ABOVE | +12.6 | | 30-0 | 5-0 | 10 (S) | | |
| AS ABOVE BUT WITH MORE FINE RED SAND | +17.6 | | 38-0 | 5-0 | 3 (S) | | |
| AS ABOVE WITH LESS FINE RED SAND; BIGGER COBBLES | +22.6 | | 46-0 | 5-0 | 8 (S) | | |
| AS ABOVE WITH COBBLES UP TO 6" | +27.6 | | 45-0 | 10-0 | 33 (S) | | |
| AS ABOVE WITH INCREASED FINE SAND | +27.6 | | 55-0 | 10-0 | 16 (H) | | |
| AS ABOVE BUT MORE COBBLES UP TO 4" | +27.6 | | 65-0 | 5-0 | 73 (H) | | |
| | +52.6 | | 70-0 | 21-33M | 20 (H) | | |

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF PENETRATION (FT) | NO. OF BLOWN |
|--|---------------|---------------|-------|-----------|---------------------------|---------------------------|--------------|
| BROWN CLAY GRAVEL FILLING | +18.04 | | 0-0 | 5-0 | 10 (H) | | |
| BLACK FOUNDRY SAND | +19.0 | | 5-0 | 5-0 | 5 (H) | | |
| FINE DARK GRAY SILT WITH SOME VERY FINE SAND AND CLAY CONCRETE | +8.0 | | 10-0 | 5-0 | 3 (H) | | |
| AS ABOVE CHANGING TO MED. AND FINE GRAVEL WITH MORE SAND | +3.0 | | 15-0 | 7-6 | 6 (H) | | |
| 1" LAYER OF VEGETATION COMPRESSED LEAVES FEEN ETC. | +4.5 | | 18-0 | 2-0 | 2 (H) | | |
| FINE, MEDIUM & COARSE GRAVEL, SOME FINE RED SAND, COBBLES UP TO 2" | +7.0 | | 18-0 | 10-0 | 28 (H) | | |
| AS ABOVE WITH SOME MORE GRAVEL AND FINE RED SAND | +17.0 | | 38-0 | 5-0 | 34 (H) | | |
| AS ABOVE WITH FEWER, AND SMALLER, COBBLES UP TO 2" | +22.0 | | 40-0 | 6-0 | 41 (H) | | |
| AS ABOVE WITH LESS FINE SAND AND MORE COBBLES UP TO 6" | +30.0 | | 48-0 | 1-0 | 17 (H) | | |
| ONE BOULDER 10" x 8" (GASTONITE) | +31.0 | | 48-0 | 6-0 | 13 (H) | | |
| AS ABOVE WITH MORE COBBLES UP TO 4" | +40.0 | | 60-0 | 10-0 | 9 (H) | | |
| AS ABOVE BUT WITH COBBLES UP TO 6" | +52.0 | | 70-0 | 21-33M | 15 (H) | | |

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF PENETRATION (FT) | NO. OF BLOWN |
|---|---------------|---------------|-------|-----------|---------------------------|---------------------------|--------------|
| MADE GROUND PREDOMINATELY SAND AND SILT WITH SOME BRICK RUBBLE | +18.1 | | 0-0 | 13-0 | | | |
| GREY, SANDY SILT. GREY SILT AND FINE AND MEDIUM GRAVEL | +5.1 | | 13-0 | 2-0 | 4 (H) | | |
| AS ABOVE CHANGING TO MED. AND FINE GRAVEL WITH MORE SAND | +3.1 | | 15-0 | 3-0 | 6 (H) | | |
| GREY ORGANIC SILT-BECOMING SANDY WITH DEPTH | +0.1 | | 15-0 | 5-0 | 6 (H) | | |
| COARSE, MEDIUM AND FINE GRAVEL AND OCCASIONAL COBBLES | +5.4 | | 23-0 | 9-6 | 10 (H) | | |
| AS ABOVE CHANGING TO MEDIUM GRAVEL & COARSE SAND | +11.4 | | 29-0 | 14 (H) | | | |
| COBBLES AND COARSE MEDIUM AND FINE GRAVEL GRADING TO COBBLES WITH DEPTH | +16.4 | | 32-0 | 26 (S) | | | |
| MEDIUM GRAVEL WITH SOME FINE TO COARSE SAND | +22.4 | | 40-0 | 65 (S) | | | |
| MEDIUM GRAVEL WITH SOME COBBLES 1/2" | +24.5 | | 42-0 | 24 (S) | | | |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND | +27.5 | | 45-0 | 20 (S) | | | |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND & COBBLES 3/4" | +32.5 | | 50-0 | 16 (S) | | | |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND | +37.5 | | 55-0 | 20 (S) | | | |
| COMPACT FINE & COARSE SAND WITH MEDIUM GRAVEL | +42.5 | | 60-0 | 22 (S) | | | |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND & COBBLES 3/4" | +47.5 | | 65-0 | 21 (S) | | | |
| MEDIUM GRAVEL WITH COARSE SAND | +48.9 | | 66-0 | 30 (S) | | | |
| MEDIUM GRAVEL WITH COARSE SAND AND SOME COBBLES | +52.9 | | 70-0 | 28 (S) | | | |
| MEDIUM GRAVEL AND COARSE SAND WITH SOME 3/4" COBBLES | +58.9 | | 76-0 | 30 (S) | | | |
| COARSE, MEDIUM AND FINE GRAVEL, COARSE BROWN SAND AND COBBLES | +65.9 | | 82-0 | 29 (S) | | | |

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF PENETRATION (FT) | NO. OF BLOWN |
|---|---------------|---------------|-------|-----------|---------------------------|---------------------------|--------------|
| MADE UP GROUND; DARK SOIL AND SLAG WITH SOME STONES, SCRAP METAL, ASH, ETC. | +17.5 | | 0-0 | 9-0 | | | |
| AS ABOVE CHANGING TO GREY SILT | +8.5 | | 9-0 | 1-0 | 4 (H) | | |
| VERY SOFT GREY SILT WITH SOME TRACES OF SAND | +3.5 | | 10-0 | 7-0 | 4 (H) | | |
| SOFT GREY SANDY SILT | +0.5 | | 10-0 | 2-0 | 2 (H) | | |
| SILT AND SMALL GRAVEL, SOME FINE SAND | +4.5 | | 12-0 | 3-0 | 19 (H) | | |
| VERY SMALL GRAVEL WITH SOME FINE SAND | +6.5 | | 14-0 | 2-0 | 20 (S) | | |
| MEDIUM GRAVEL WITH SOME SILT | +7.5 | | 15-0 | 1-0 | 19 (S) | | |
| AS ABOVE CHANGING TO MEDIUM GRAVEL & SOME COARSE SAND | +11.5 | | 19-0 | 2-0 | 33 (S) | | |
| MEDIUM GRAVEL WITH SOME COBBLES 3/4" | +15.5 | | 23-0 | 4-0 | 29 (S) | | |
| MEDIUM AND SMALL GRAVEL WITH SOME COBBLES AND COARSE SAND | +17.5 | | 25-0 | 3-0 | 33 (S) | | |
| MEDIUM GRAVEL WITH SOME FINE TO COARSE SAND | +20.5 | | 28-0 | 2-0 | 30 (S) | | |
| MEDIUM GRAVEL WITH SOME COBBLES 1/2" | +22.5 | | 30-0 | 2-0 | 30 (S) | | |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND | +24.5 | | 32-0 | 1-0 | 22 (S) | | |
| COMPACT MED. GRAVEL & FINE SAND | +27.5 | | 35-0 | 5-0 | 24 (S) | | |
| COMPACT FINE & COARSE SAND WITH MEDIUM GRAVEL | +32.5 | | 40-0 | 3-0 | 22 (S) | | |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND & COBBLES 3/4" | +35.5 | | 43-0 | 2-0 | 22 (S) | | |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND | +37.5 | | 45-0 | 2-0 | 23 (S) | | |
| MEDIUM GRAVEL WITH 50% FINE BROWN SAND | +42.5 | | 50-0 | 2-0 | 23 (S) | | |
| ONE 8" SANDSTONE BOULDER | +42.5 | | 60-0 | 2-0 | 23 (S) | | |
| MEDIUM GRAVEL WITH COARSE SAND | +44.5 | | 62-0 | 2-0 | 25 (S) | | |
| MEDIUM GRAVEL WITH COARSE SAND | +46.5 | | 64-0 | 2-0 | 25 (S) | | |
| MEDIUM GRAVEL WITH COARSE SAND AND SOME COBBLES | +48.5 | | 66-0 | 4-0 | 27 (S) | | |
| MEDIUM GRAVEL AND COARSE SAND WITH SOME 3/4" COBBLES | +52.5 | | 70-0 | 2-0 | 26 (S) | | |
| MEDIUM GRAVEL AND COARSE SAND | +54.5 | | 72-0 | 1-0 | 23 (S) | | |
| COMPACT MEDIUM GRAVEL | +54.5 | | 72-0 | 6-0 | 24 (S) | | |
| VERY SMALL GRAVEL, COMPACT MEDIUM GRAVEL WITH SOME SMALL GRAVEL | +55.5 | | 73-0 | 5-0 | 31 (S) | | |
| VERY SMALL COMPACT GRAVEL | +57.5 | | 75-0 | 4-0 | 27 (S) | | |
| COMPACT MEDIUM GRAVEL AND SOME COARSE SAND | +77.5 | | 95-0 | 8-0 | 29 (S) | | |

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF PENETRATION (FT) | NO. OF BLOWN |
|--|---------------|---------------|-------|-----------|---------------------------|---------------------------|--------------|
| TARMAC AND CONCRETE | +19.0 | | 0-0 | 1-0 | | | |
| MADE UP GROUND CONSISTING OF DARK SOIL, SOME STONES AND SAND, SCRAP METAL ETC. | +18.0 | | 0-0 | 5-0 | | | |
| MADE UP GROUND CONSISTING OF FOUNDRY SLAG, STONES, SCRAP METAL, ETC. | +15.0 | | 5-0 | 8-0 | | | |
| VERY SOFT GREY SILT WITH SOME SHELLS | +15.0 | | 15-0 | 1-0 | 4 (H) | | |
| VERY SOFT GREY SANDY SILT | +2.0 | | 21-0 | 2-0 | 15 (H) | | |
| VERY SMALL GRAVEL, VERY SILTY | +4.0 | | 23-0 | 2-0 | 19 (H) | | |
| SMALL GRAVEL | +6.0 | | 25-0 | 1-0 | 16 (H) | | |
| VERY SMALL GRAVEL WITH SOME SILT | +8.0 | | 27-0 | 0-6 | 14 (H) | | |
| GREY SILT | +12.0 | | 31-0 | 2-0 | 24 (S) | | |
| GRAVEL 1/2" TO 3/4" SOME COARSE SAND | +14.0 | | 33-0 | 2-0 | 24 (S) | | |
| MEDIUM GRAVEL AND SOME COARSE SAND | +20.0 | | 39-0 | 2-0 | 51 (S) | | |
| COMPACT MEDIUM GRAVEL WITH 1/2" COBBLES | +22.0 | | 41-0 | 2-0 | 26 (S) | | |
| MEDIUM GRAVEL WITH SOME COBBLES | +24.0 | | 43-0 | 1-6 | 30 (S) | | |
| COMPACT MED. GRAVEL & FINE SAND | +26.0 | | 45-0 | 5-6 | 26 (S) | | |
| MEDIUM GRAVEL WITH SOME COBBLES | +31.0 | | 50-0 | 2-0 | 28 (S) | | |
| MEDIUM GRAVEL | +33.0 | | 52-0 | 3-6 | 28 (S) | | |
| MEDIUM GRAVEL AND COARSE SAND | +35.0 | | 54-0 | 0-6 | 30 (S) | | |
| SMALL GRAVEL AND COARSE SAND | +37.0 | | 56-0 | 2-0 | 30 (S) | | |
| COMPACT MEDIUM GRAVEL | +43.0 | | 62-0 | 2-0 | 27 (S) | | |
| AS ABOVE WITH 1/2" COBBLES | +45.0 | | 64-0 | 1-0 | 32 (S) | | |
| COBBLES TO VERY SMALL GRAVEL | +46.0 | | 65-0 | 3-0 | 33 (S) | | |
| VERY SMALL COMPACT GRAVEL | +48.0 | | 67-0 | 8-0 | 28 (S) | | |
| MEDIUM GRAVEL | +50.0 | | 69-0 | 2-0 | 27 (S) | | |
| VERY COMPACT SMALL GRAVEL WITH SOME COARSE SAND | +52.0 | | 71-0 | 4-6 | 39 (S) | | |
| MEDIUM GRAVEL AND COARSE SAND | +54.0 | | 73-0 | 1-8 | 28 (S) | | |
| AS ABOVE, ONE LARGE COBBLE | +56.0 | | 75-0 | 2-0 | 28 (S) | | |
| COMPACT MEDIUM GRAVEL WITH SOME COARSE SAND | +58.0 | | 77-0 | 5-0 | 28 (S) | | |
| MEDIUM GRAVEL WITH COARSE SAND, VERY COMPACT | +70.0 | | 89-0 | 2-0 | 28 (S) | | |

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF PENETRATION (FT) | NO. OF BLOWN |
|-------------|---------------|---------------|-------|-----------|---------------------------|---------------------------|--------------|
| | | | | | | | |

- NOTES:-
- FIGURES SHOWN IN THE COLUMN ENTITLED 'STANDARD PENETRATION TESTS' INDICATE NUMBER OF BLOWS/FOOT OF PENETRATION, USING A 140LBS WEIGHT DROPPING THROUGH 2'-6" TO DRIVE THE STANDARD HOLLOW CUTTING SHOE, 2" O.D., 1 1/4" I.D. IN SOME CASES, THE SOLID CONE WAS USED, DIMENSIONS SIMILAR TO ABOVE, BUT POINTED
 - 'BOILING UP' OF FINE GRAVEL AND SAND INSIDE THE CASING TOOK PLACE IN BOREHOLE No. 12 AT DEPTH 35'-0" - 40'-0". MATERIAL ROSE APPROX. 3'-6" IN CASING OVERNIGHT AT 35'-0" AND IT CAME UP 1'-0" IN CASING DURING PENETRATION TEST AT 40'-0".
 - BOREHOLE No. 11 WAS BACKFILLED UP TO GROUND LEVEL WITH LOOSE CLEAN GRAVEL (3/4"). BOTTOM OF SOUNDING PIPE WAS SET AT -4'-5" O.D.
 - BOREHOLE No. 12 WAS BACKFILLED THUS:-
 -52'-0" O.D. TO -13'-0" O.D. CLEAN GRAVEL
 -13'-0" O.D. TO +2'-0" O.D. DENSE BLUE CLAY WELL RAMMED
 +2'-0" O.D. TO GROUND LEVEL, LOOSE CLEAN GRAVEL
 - THE BOTTOM OF THE SOUNDING PIPE WAS SET AT +2'-0" O.D. TUBING TO THE BOTTOM OF WHICH WAS FITTED A 2'-0" LENGTH OF PERFORATED STEEL PIPE, SEALED AT THE LOWER END
 - (S) DENOTES TEST DONE WITH SOLID CONE
 (H) DENOTES TEST DONE WITH HOLLOW SHOE
 Δ DENOTES DISTURBED SAMPLE
 Δ DENOTES WATER SAMPLE

REPORT 1167 Box 51

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| REVISIONS | DATE | BY |
| | | |

SA. 2010-65

MARINA POWER STATION
 LOGS OF BOREHOLES 11-15 INCL.
 (COMPILED FROM RECORDS OF
 MESSRS SOIL MECHANICS LTD.)

62016

64816

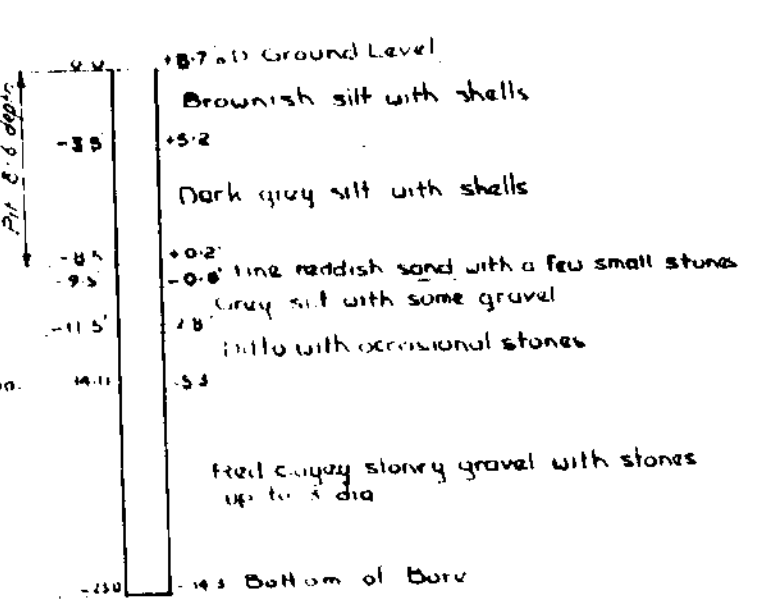
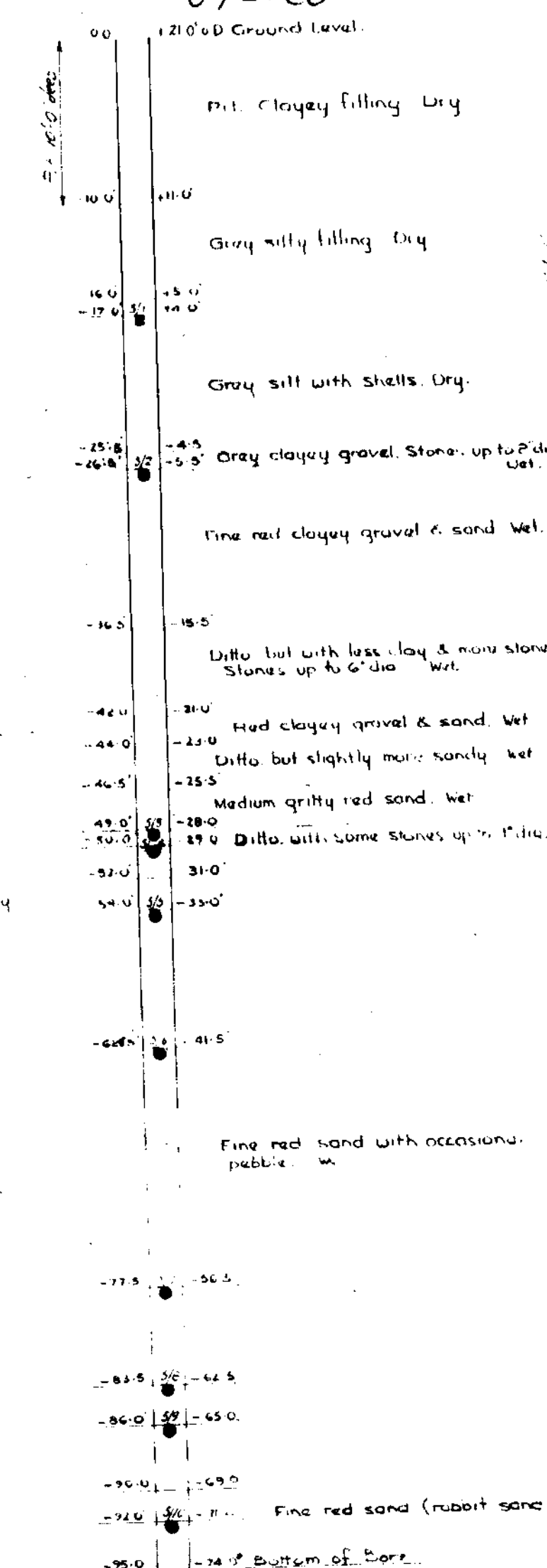
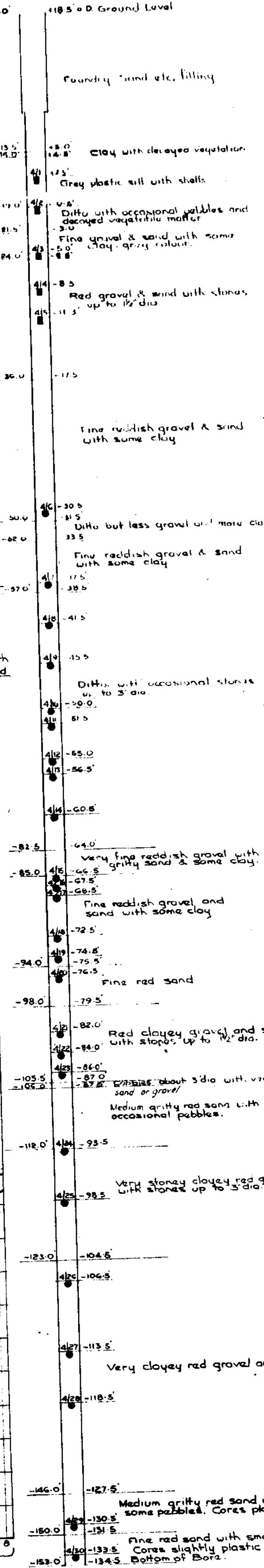
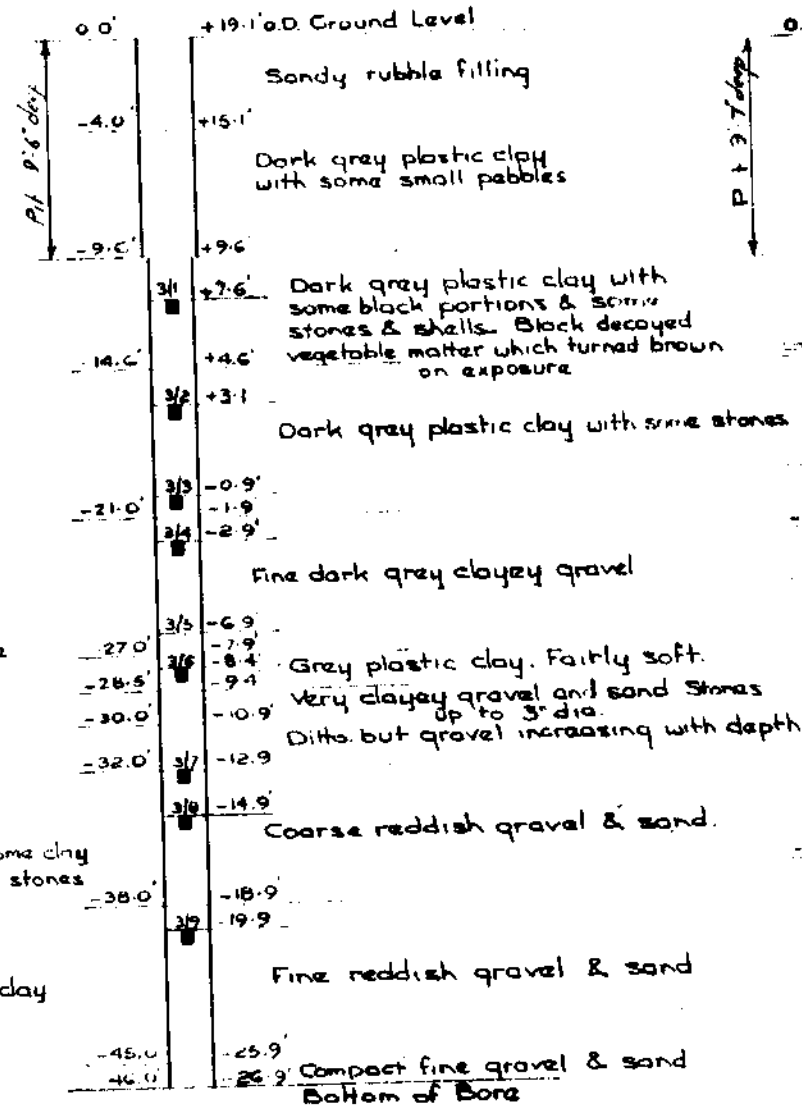
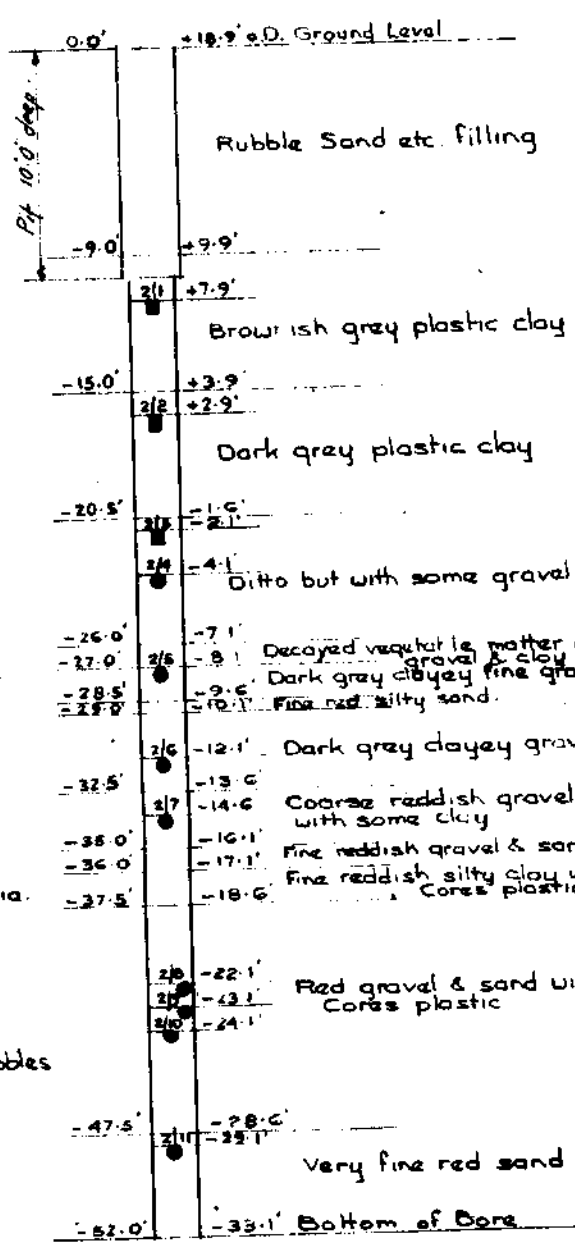
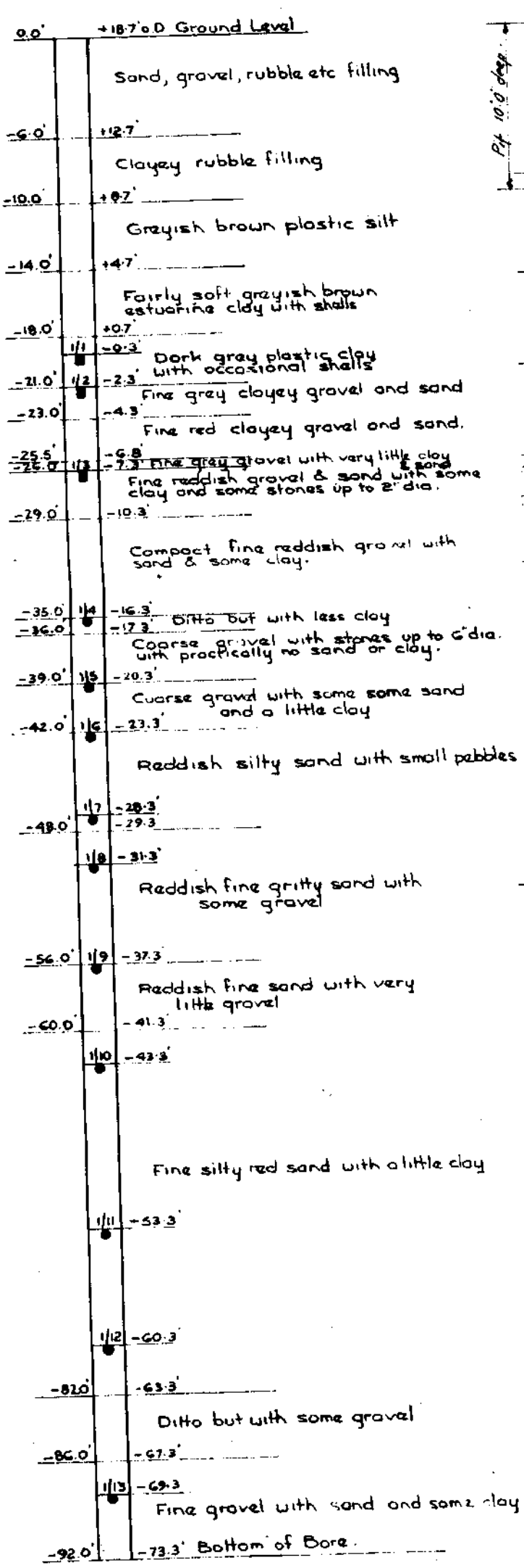
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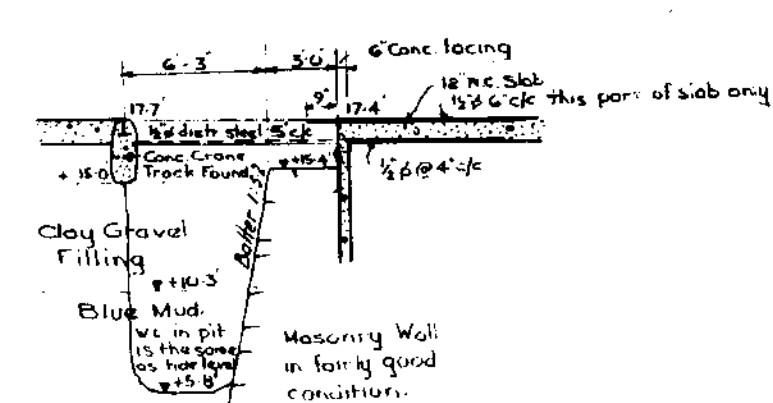
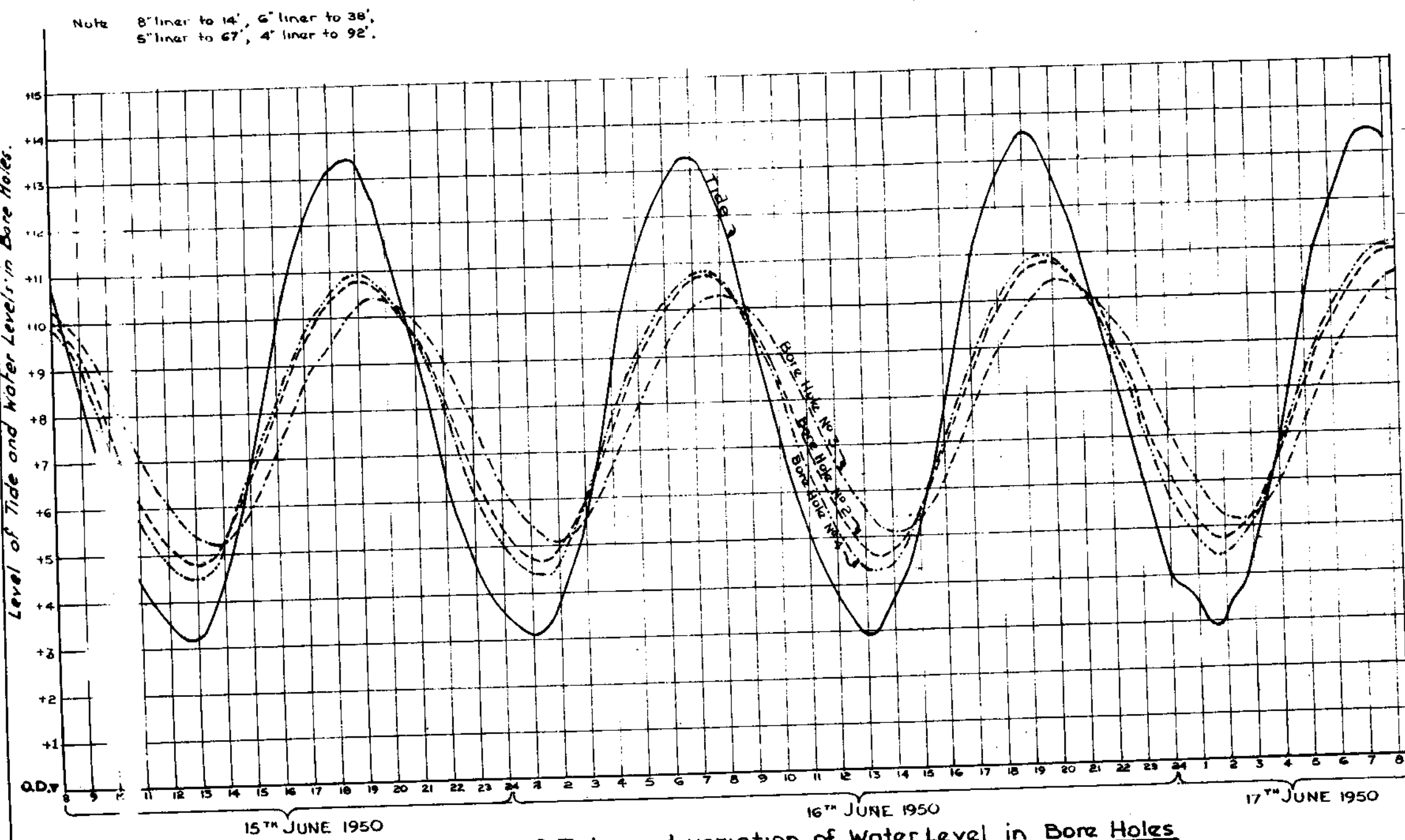
64821



Notes on liners
Pit 10' depth 8" liners to 15' 6" liners to 36'
5" liners to 60'
Boxed samples stored at site. Samples taken at 11' 0", 16' 0", 21' 0", 27' 0", 31' 0", 33' 0", 41' 0", 42' 0", 43' 0", 44' 0".
Sounding Well
The hole was backfilled with clay up to depth 40' 0". A 2" G.B. pipe with its lowest 10 perforated and covered with fine gauze was placed from depth 40' to above ground surface. The perforated portion was surrounded with screened sand and the remainder with clay to ground level. The water level in the pipe varies with the tide.

Notes on liners
Pit 9' G depth 8" liner to 12' 6" liner to 36'
No liner 36' to 46'.
Boxed samples stored at site. Samples taken at 11' 0", 16' 0", 20' 0", 22' 0", 25' 0", 27' 0", 32' 0", 34' 0", 39' 0".
Sounding Well
The hole was backfilled with clay up to depth 20' and filled with a pipe perforated, covered with gauze and surrounded by sand between 20' & 10' and the remainder of the hole filled with clay to surface level.

Notes on liners
Pit 10' depth 8" liner to 15' 6" liner to 40'
5" liner to 64' 7"
Bore Hole dry to depth of 25' 6". Water arose to tide level after that and then varied with the tide.



Note 2 - Pit 9' 7" depth 8" liner to 14' 6" liner to 49' 5" liner to 100' 4" liner to 147' 9". A 2" G.B. pipe is being installed in the hole with perforated section 49' to 39' approx.

REPORT 1167 Box 58

Note Materials denoted above are as described on site.

Disturbed Sample ●
Undisturbed Sample ■

REVISIONS
(A) Chart of W.L. added 7.4.51

LOGS OF BORE HOLES IN THE VICINITY OF THE CORK STEAM STATION
LOGS OF TRIAL PITS 1 & 2
Chart showing variation of W.L. in Bore Holes
1/100
4811 A

BOREHOLE No. 11 **64826** DIAMETER: 10' & 8"
 GROUND LEVEL: +17.43' O.D. DATE: 1-6-65 TO 4-6-65

BOREHOLE No. 12 **64827** DIAMETER: 10' & 8"
 GROUND LEVEL: +18.04' O.D. DATE: 8-6-65 TO 11-6-65

BOREHOLE No. 13 **64828** DIAMETER: 10' & 8"
 GROUND LEVEL: +18.1' O.D. DATE: 6-8-65 TO 17-8-65

BOREHOLE No. 14 **64829** DIAMETER: 10' & 8"
 GROUND LEVEL: +17.5' O.D. DATE: 18-8-65 TO 24-8-65

BOREHOLE No. 15 **64830** DIAMETER: 10' & 8"
 GROUND LEVEL: +19.0' O.D. DATE: 26-8-65 TO 1-9-66

BOREHOLE No. 16 **64831** DIAMETER: 10' & 8"
 GROUND LEVEL: +19.0' O.D. DATE: 26-8-65 TO 1-9-66

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF PENETRATION (FT) | NO. OF BLOWN | TEST |
|---|---------------|---------------|--------|-----------|---------------------------|---------------------------|--------------|------|
| LOOSE CLAYEY GRAVEL ETC. FILLING | +17.43 | | 0-0 | 5'-0" | | | 3 | (S) |
| FILLING MATERIAL CLAYEY GRAVEL AND FOUNDRY SLAG LOOSE | +18.4 | | 5-0 | 6'-0" | | | 2 | (S) |
| FINE DARK GRAY CONCRETE SILT WITH SOME CLAY FINE | +1.4 | | 16'-0" | 8'-0" | | | 0 | (S) |
| COARSE AND MEDIUM GRAVEL UP TO 1 1/2" WITH SOME SAND AND VERY LITTLE SILT | +1.6 | | 19-0 | 5'-0" | | | 8 | (S) |
| FINE MEDIUM AND COARSE RED GRAVEL; SOME SAND; COBBLES UP TO 4" | +2.9 | | 24-0 | 6'-0" | | | 10 | (S) |
| AS ABOVE | +12.6 | | 30-0 | 5'-0" | | | 10 | (S) |
| AS ABOVE BUT WITH MORE FINE RED SAND | +17.6 | | 38-0 | 5'-0" | | | 3 | (S) |
| AS ABOVE WITH LESS FINE RED SAND; BIGGER COBBLES | +22.6 | | 46-0 | 5'-0" | | | 8 | (S) |
| AS ABOVE WITH COBBLES UP TO 6" | +27.6 | | 45-0 | 10'-0" | | | 33 | (S) |
| AS ABOVE WITH INCREASED FINE SAND | +27.6 | | 55-0 | 10'-0" | | | 22 | (H) |
| AS ABOVE BUT MORE COBBLES UP TO 4" | +27.6 | | 65-0 | 5'-0" | | | 73 | (H) |
| | +52.6 | | 70-0 | 21'-33" | | | 20 | (H) |

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF PENETRATION (FT) | NO. OF BLOWN | TEST |
|---|---------------|---------------|-------|-----------|---------------------------|---------------------------|--------------|------|
| BROWN CLAY GRAVEL FILLING | +18.04 | | 0-0 | 5'-0" | | | 10 | (H) |
| BLACK FOUNDRY SAND | +19.0 | | 5-0 | 5'-0" | | | 5 | (H) |
| FINE DARK GRAY SILT WITH SOME VERY FINE SAND AND CLAY CONCRETE | +8.0 | | 10-0 | 5'-0" | | | 3 | (H) |
| AS ABOVE CHANGING TO MED. AND FINE GRAVEL WITH MORE SAND | +13.0 | | 15-0 | 7'-6" | | | 6 | (H) |
| 1" LAYER OF VEGETATION COMPRESSED LEAVES FERN ETC. | +14.5 | | 18-0 | 2'-0" | | | 2 | (H) |
| FINE MEDIUM AND COARSE GRAVEL; SOME FINE RED SAND; COBBLES UP TO 2" | +17.0 | | 22-0 | 10'-0" | | | 28 | (H) |
| AS ABOVE WITH SOME MORE GRAVEL AND FINE RED SAND | +17.0 | | 38-0 | 5'-0" | | | 34 | (H) |
| AS ABOVE WITH FEWER AND SMALLER COBBLES UP TO 2" | +22.0 | | 40-0 | 6'-0" | | | 41 | (H) |
| AS ABOVE WITH FEWER FINE AND MORE COBBLES UP TO 6" | +30.0 | | 48-0 | 1'-0" | | | 17 | (H) |
| ONE BOULDER 10" x 8" (GASTONITE) | +31.0 | | 48-0 | 6'-0" | | | 13 | (H) |
| FINE MED. E. COARSE GRAVEL AND SOME FINE RED SAND BUT FEWER COBBLES | +37.0 | | 58-0 | 5'-0" | | | 16 | (H) |
| AS ABOVE WITH MORE COBBLES UP TO 4" | +42.0 | | 60-0 | 10'-0" | | | 9 | (H) |
| AS ABOVE BUT WITH COBBLES UP TO 6" | +52.0 | | 70-0 | 21'-33" | | | 15 | (H) |

| DESCRIPTION | REDUCED LEVEL | LEGEND SAMPLE | DEPTH | THICKNESS | STANDARD PENETRATION TEST | DEPTH OF PENETRATION (FT) | NO. OF BLOWN | TEST |
|---|---------------|---------------|-------|-----------|---------------------------|---------------------------|--------------|------|
| MADE GROUND PREDOMINATELY SAND AND SILT WITH SOME BRICK RUBBLE | +18.1 | | 0-0 | 13'-0" | | | 4 | (H) |
| GREY SANDY SILT | +13.1 | | 13-0 | 2'-0" | | | 6 | (H) |
| GREY SILT AND FINE AND MEDIUM GRAVEL | +10.1 | | 15-0 | 3'-0" | | | 6 | (H) |
| GREY ORGANIC SILT-BECOMING SANDY WITH DEPTH | +5.1 | | 23-0 | 5'-0" | | | 10 | (H) |
| COARSE, MEDIUM AND FINE GRAVEL AND OCCASIONAL COBBLES | +5.4 | | 23-0 | 9'-0" | | | 18 | (H) |
| COBBLES AND COARSE MEDIUM AND FINE GRAVEL GRADING TO COBBLES WITH DEPTH | +16.4 | | 32-0 | 8'-0" | | | 26 | (S) |
| MEDIUM GRAVEL WITH SOME FINE TO COARSE SAND | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
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| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
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| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
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| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
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| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
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| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
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| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
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| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
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| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
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| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| MEDIUM GRAVEL WITH FINE TO COARSE SAND AND SOME COBBLES 3"-4" | +22.4 | | 40-0 | 20 | (S) | | 20 | (S) |
| COMPACT FINE AND COARSE SAND WITH MEDIUM GRAVEL | +22.4 | | 40-0 | 2 | | | | |

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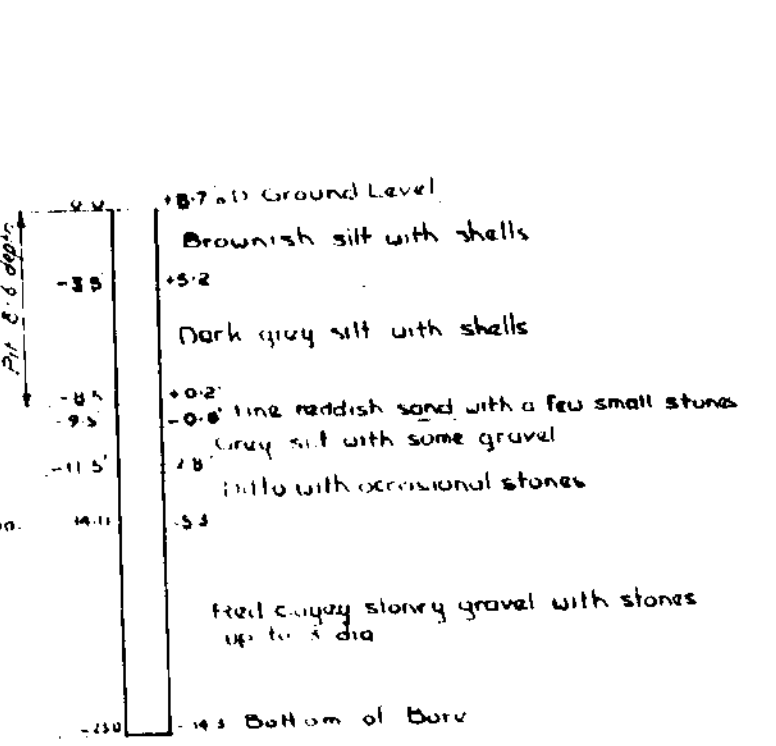
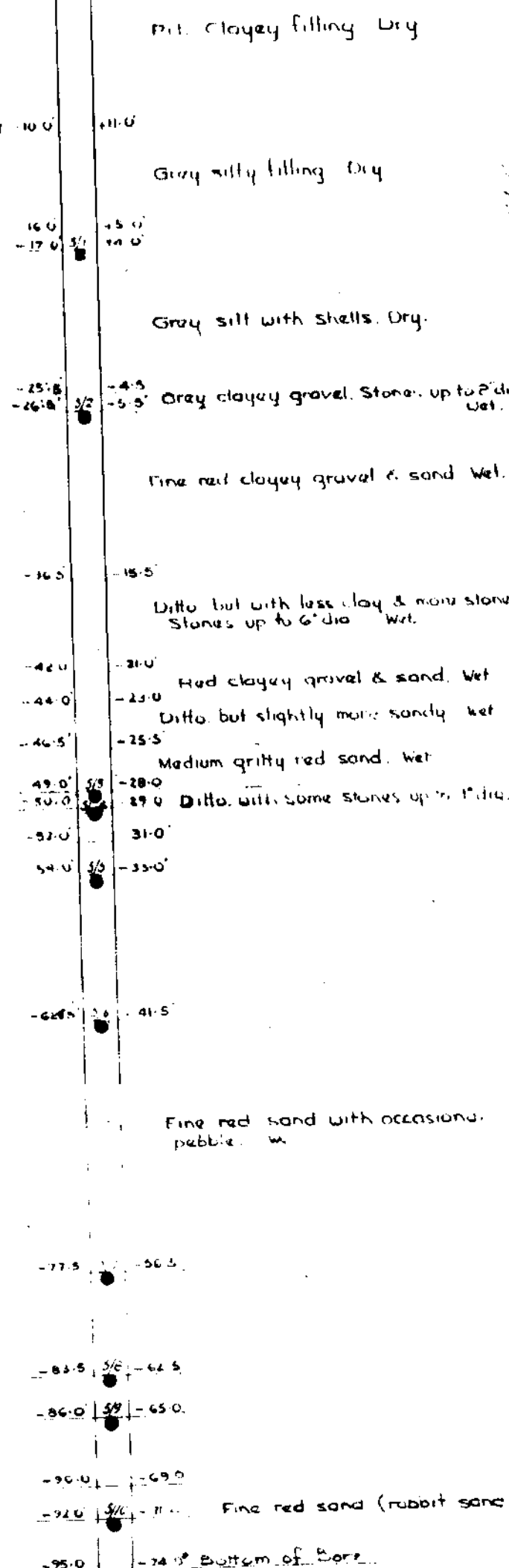
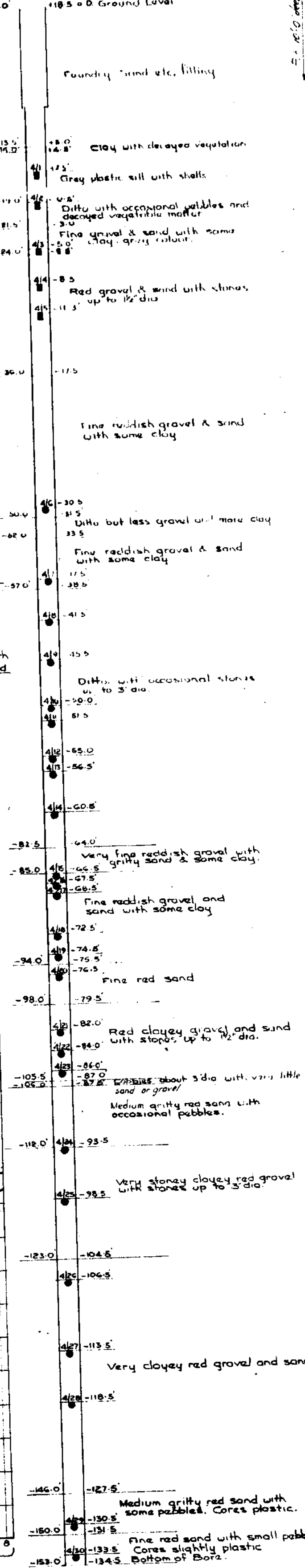
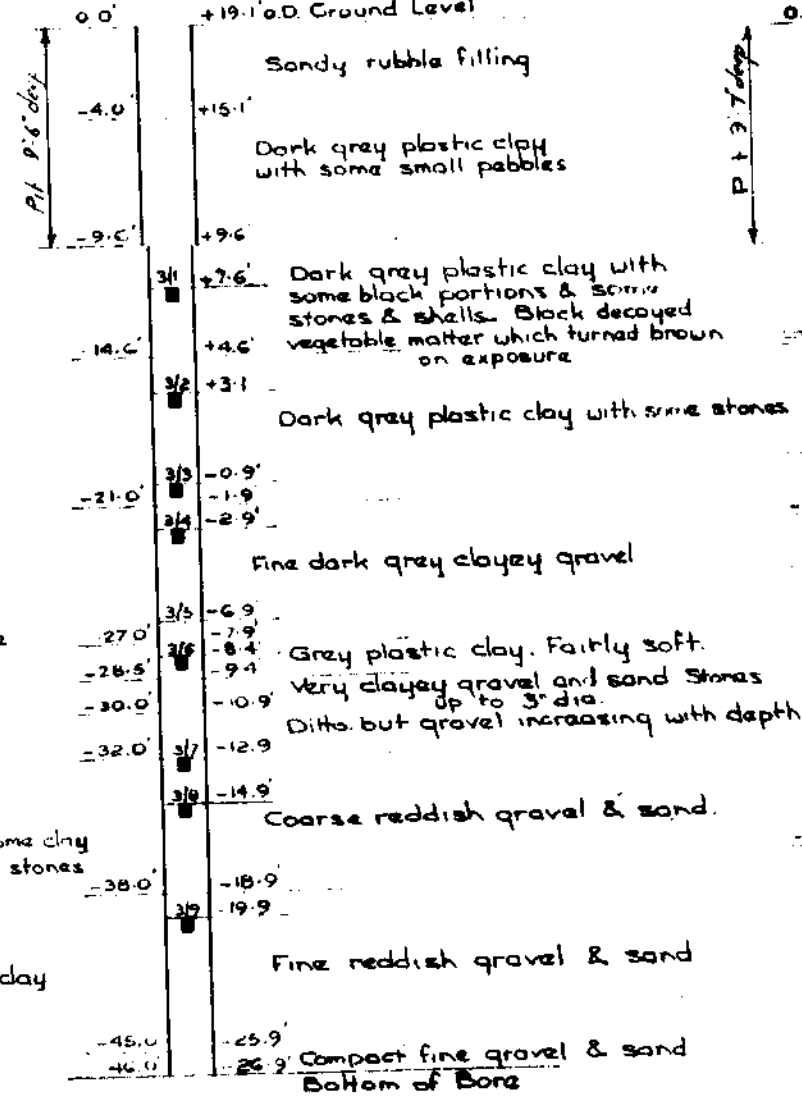
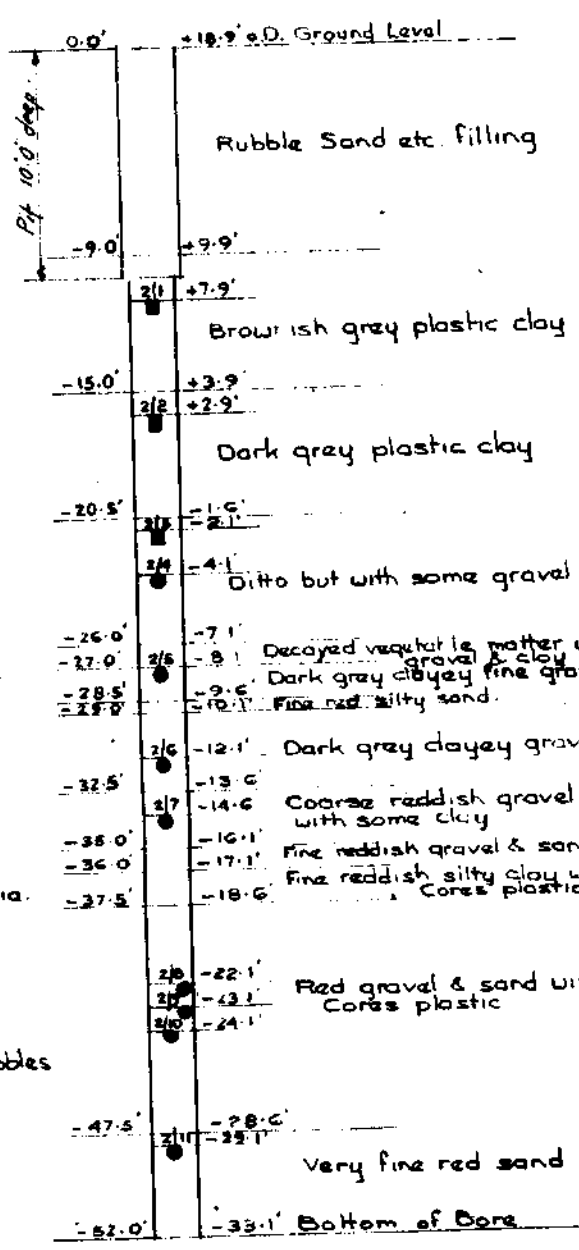
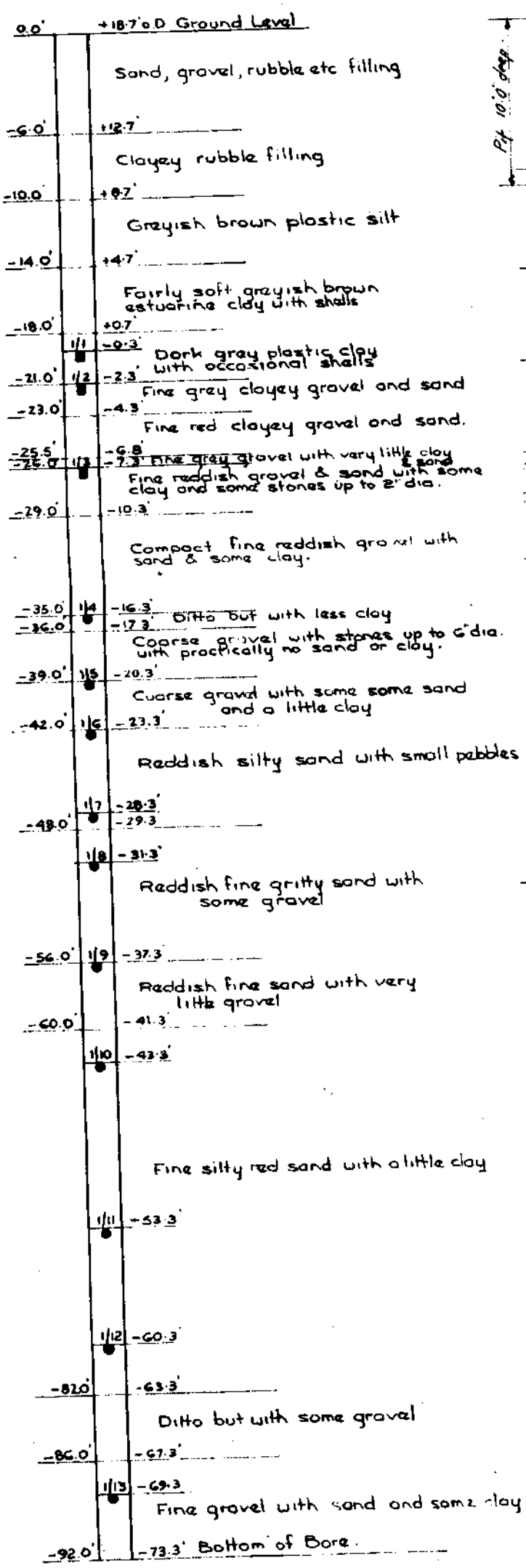
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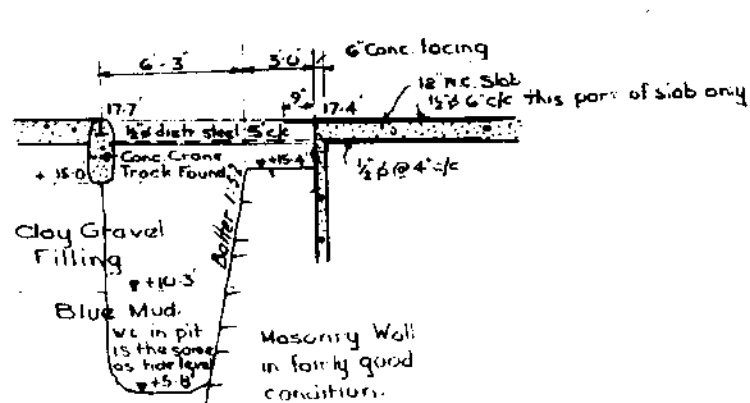
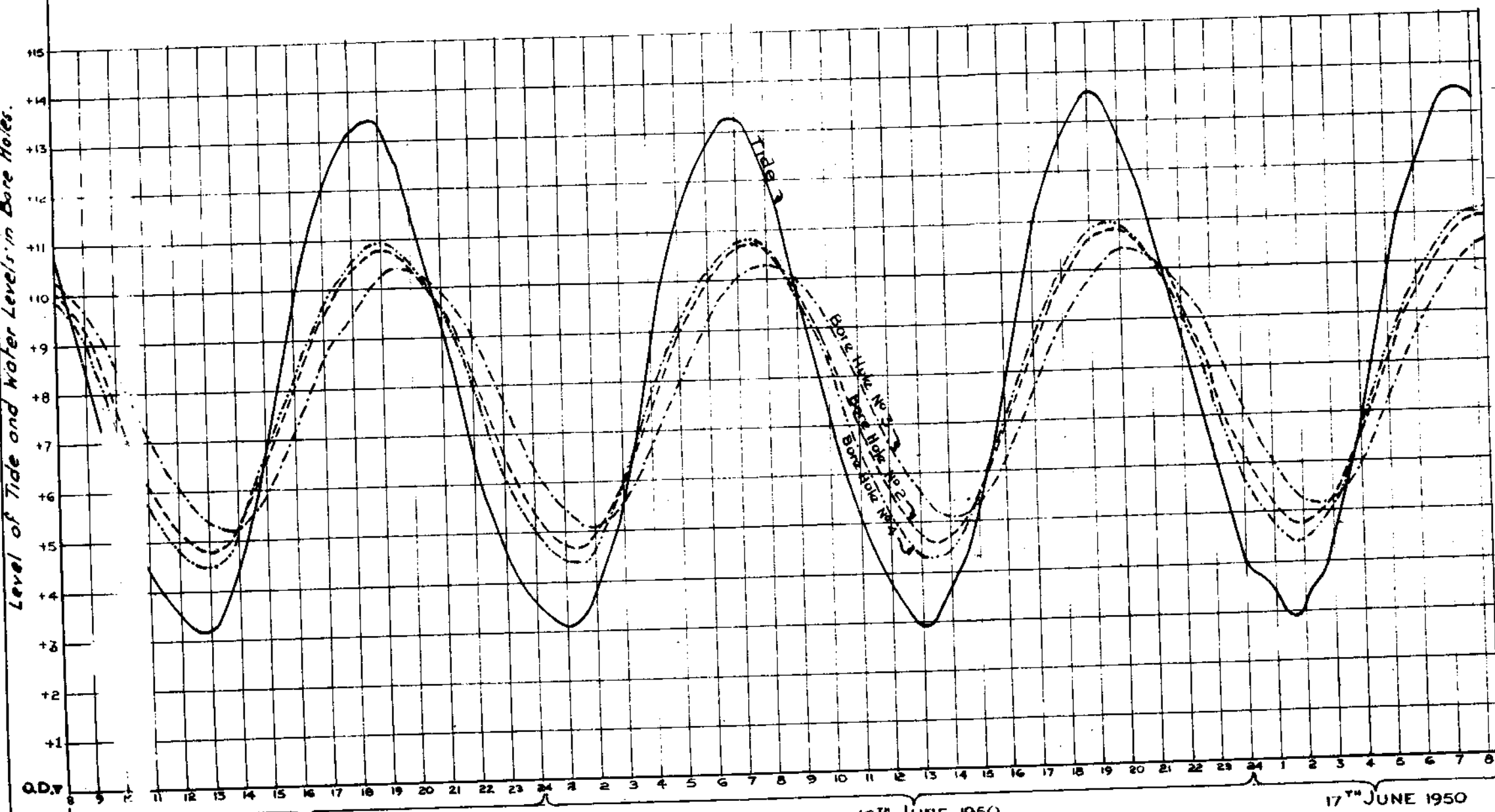


Notes on liners
Pit 10' depth 8" liners to 15' 6" liners to 36'
5" liners to 60'
Boxed samples stored at site. Samples taken at 11' 0" 16' 0" 21' 0" 27' 0" 31' 0" 33' 0" 41' 0" 42' 0" 43' 0" 44' 0"
Sounding Well
The hole was backfilled with clay up to depth 40' 0"
A 2" G.B. pipe with its lowest 10 perforated and covered with fine gauze was placed from depth 40' to above ground surface. The perforated portion was surrounded with screened sand and the remainder with clay to ground level. The water level in the pipe varies with the tide

Notes on liners
Pit 9' 6" depth 8" liner to 12' 6" liner to 36'
No liner 36' to 46'
Boxed samples stored at site. Samples taken at 11' 0" 16' 0" 20' 0" 22' 0" 25' 0" 27' 0" 32' 0" 34' 0" 39' 0"
Sounding Well
The hole was backfilled with clay up to depth 20' and filled with a pipe perforated, covered with gauze and surrounded by sand between 20' 0" and the remainder of the hole filled with clay to surface level

Notes on liners
Pit 10' 0" depth 8" liner to 15' 6" 6" liner to 40'
5" liner to 64' 7"
Bore Hole dry to depth of 25' 6". Water arose to tide level after that and then varied with the tide.

Note 8" liner to 14', 6" liner to 36', 5" liner to 67', 4" liner to 92'.



Note 2 - Pit 9' 7" depth 8" liner to 14' 6" liner to 49' 5" liner to 100' 4" liner to 147' 9"
A 2" G.B. pipe is being installed in the hole with perforated section 49' to 39' approx.

REPORT 1167 Box 58

Note Materials denoted above are as described on site.

Disturbed Sample
Undisturbed Sample

REVISIONS
(A) Chart of W.L. added 7.4.51

LOGS OF BORE HOLES 1 TO 6
LOGS OF TRIAL PITS 1 & 2
Chart showing variation of W.L. in Bore Holes

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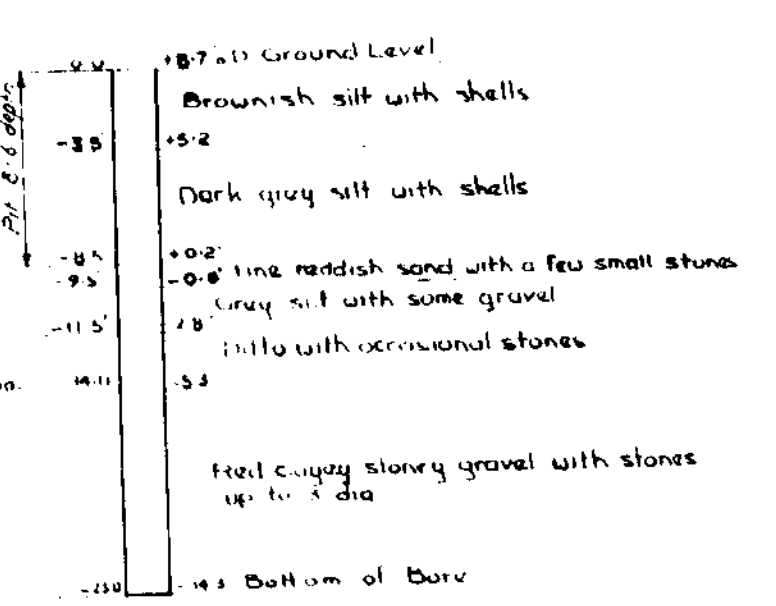
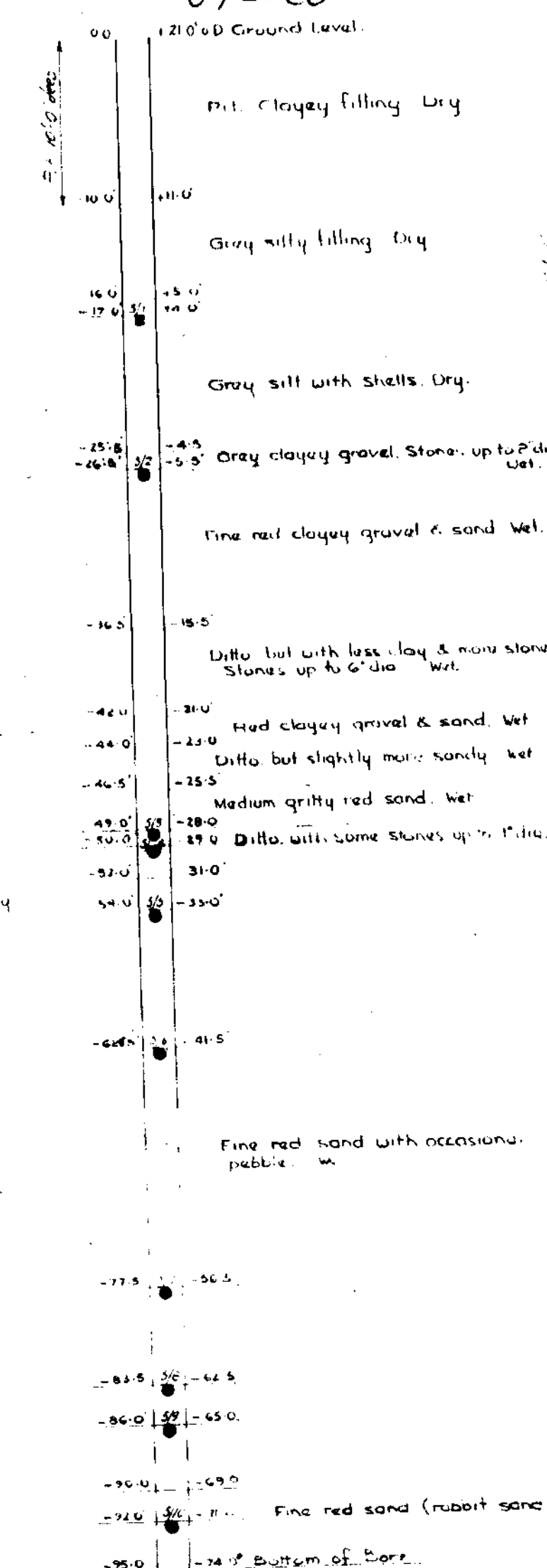
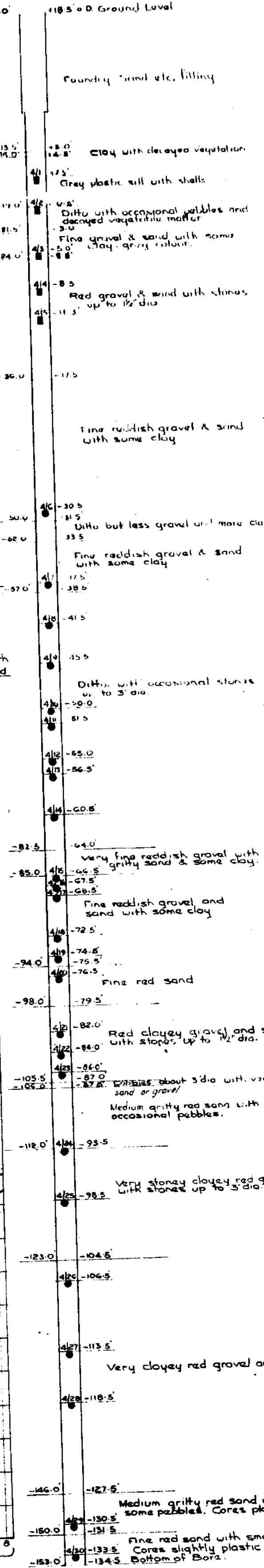
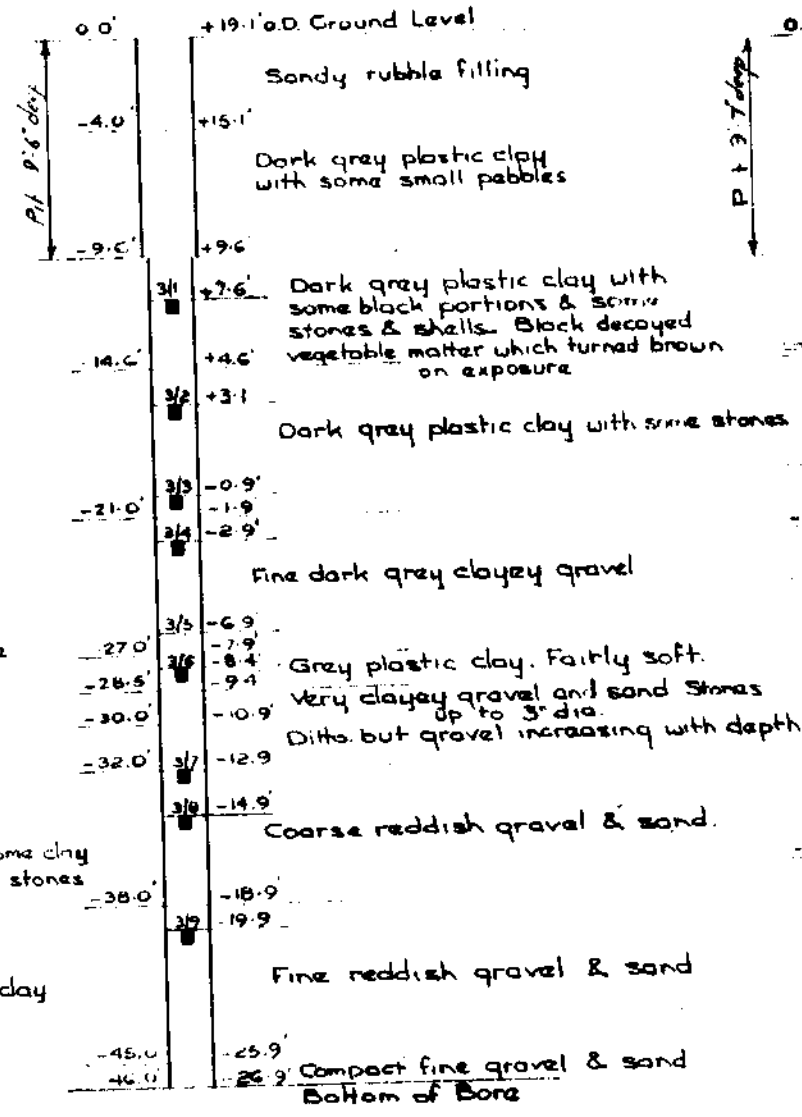
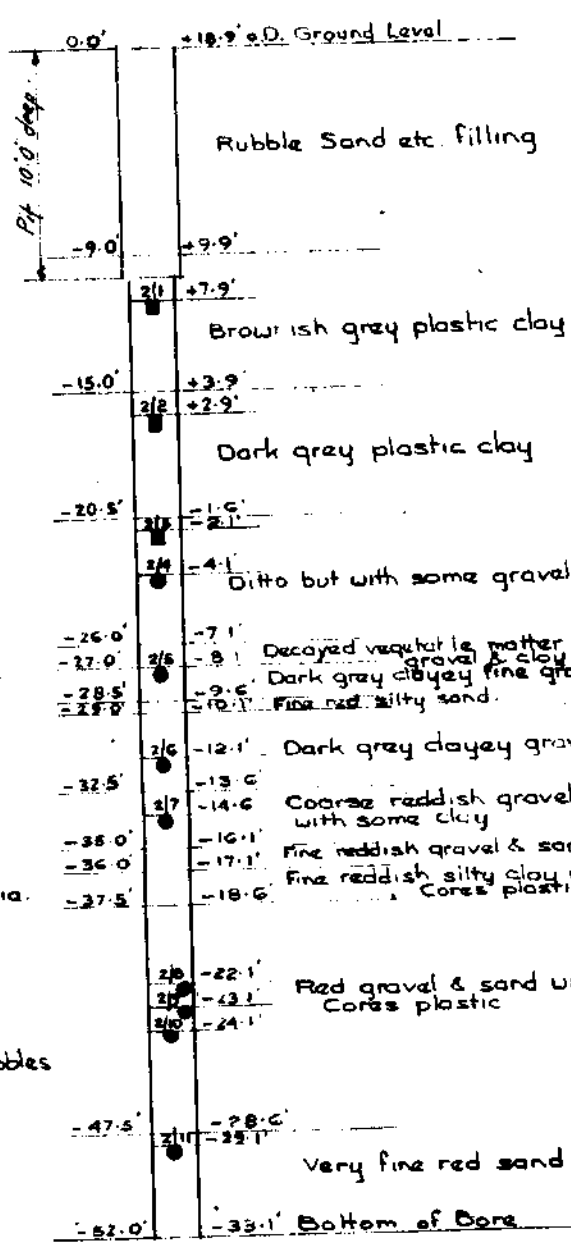
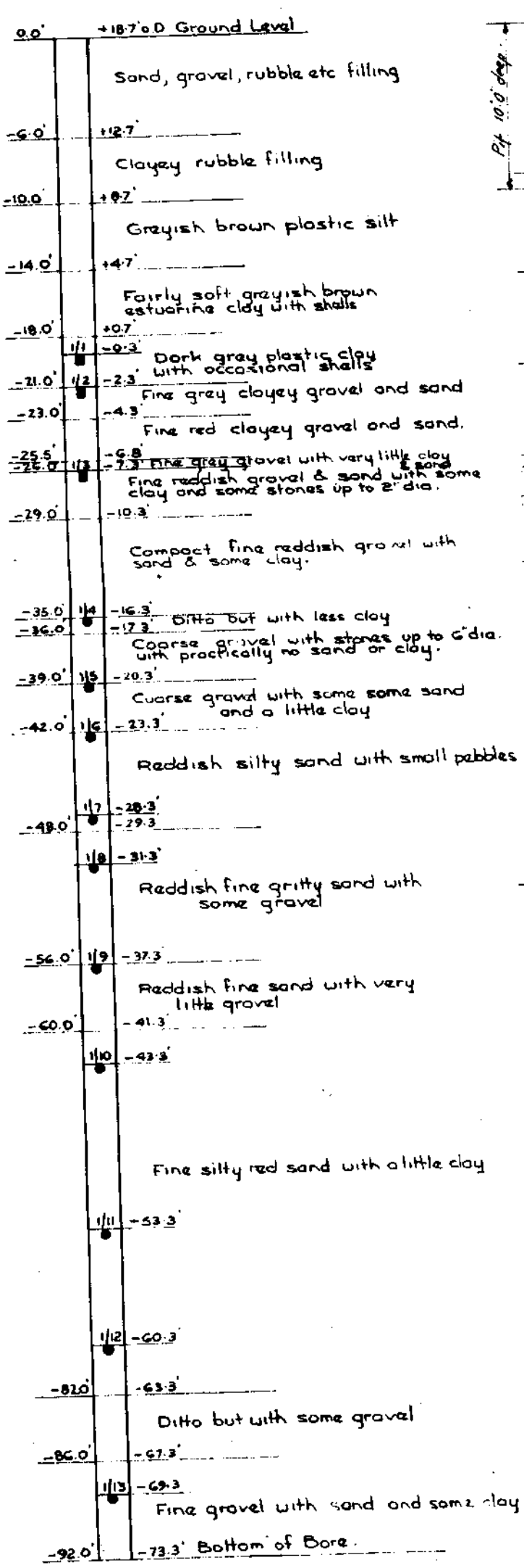
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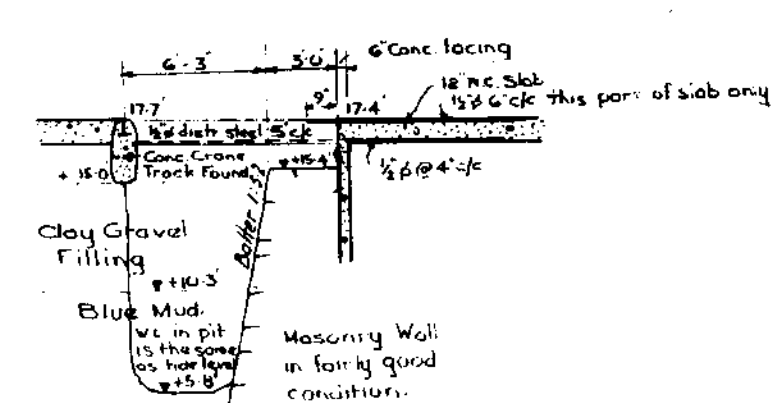
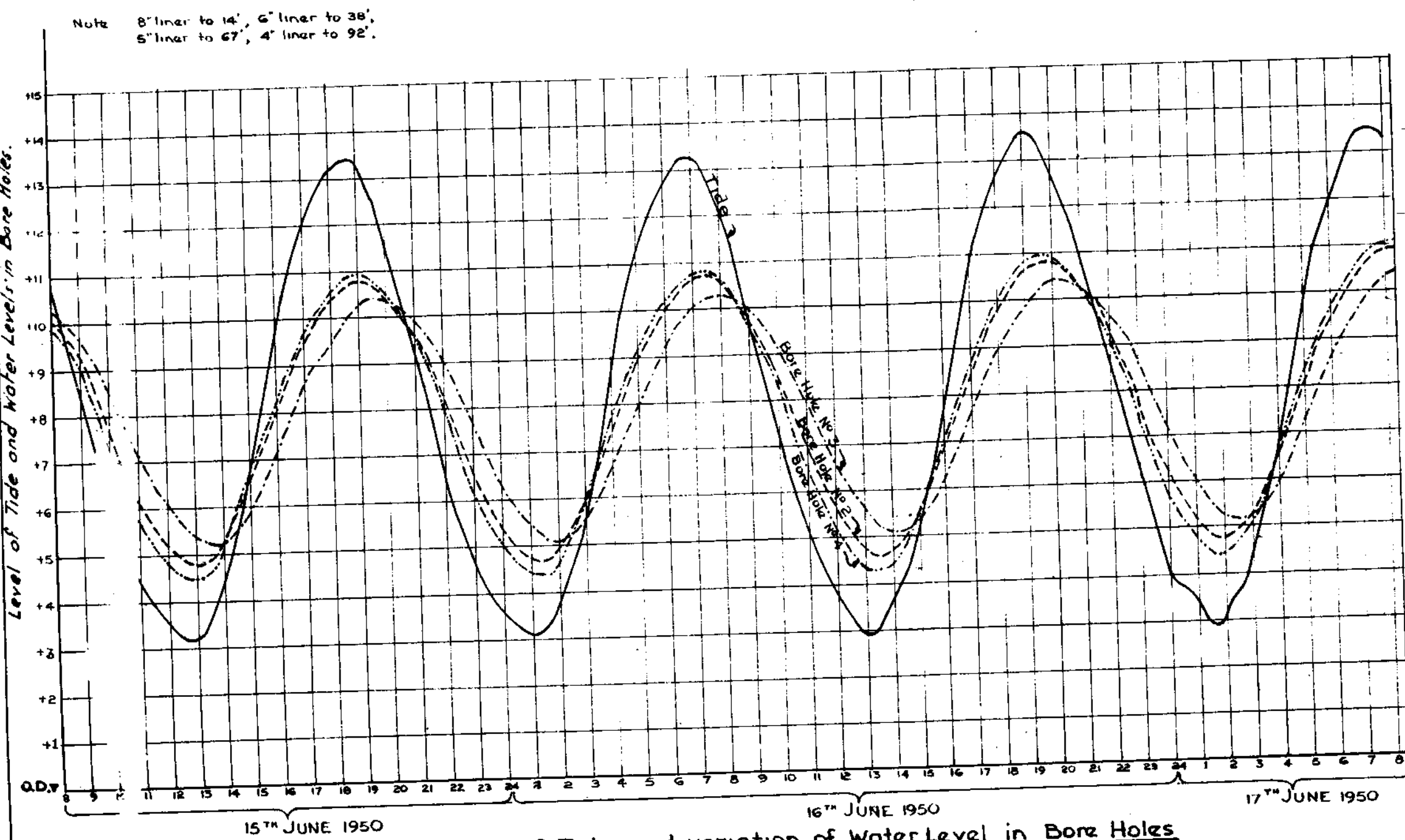
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Notes on liners
Pit 10' depth 8" liners to 15' 6" liners to 36'
5" liners to 60'
Boxed samples stored at site. Samples taken at 11' 0", 16' 0", 21' 0", 27' 0", 31' 0", 33' 0", 41' 0", 42' 0", 43' 0", 44' 0".
Sounding Well
The hole was backfilled with clay up to depth 40' 0". A 2" G.B. pipe with its lowest 10 perforated and covered with fine gauze was placed from depth 40' to above ground surface. The perforated portion was surrounded with screened sand and the remainder with clay to ground level. The water level in the pipe varies with the tide.

Notes on liners
Pit 9' 6" depth 8" liner to 12' 6" liner to 36'
No liner 36' to 46'.
Boxed samples stored at site. Samples taken at 11' 0", 16' 0", 20' 0", 22' 0", 25' 0", 27' 0", 32' 0", 34' 0", 39' 0".
Sounding Well
The hole was backfilled with clay up to depth 20' and filled with a pipe perforated, covered with gauze and surrounded by sand between 20' & 10' and the remainder of the hole filled with clay to surface level.

Notes on liners
Pit 10' 0" depth 8" liner to 15' 6", 6" liner to 40' 5" liner to 64' 7"
Bore Hole dry to depth of 25' 6". Water arose to tide level after that and then varied with the tide.



Note
No 2 - Pit 9' 7" depth 8" liner to 14' 6" liner to 49' 5" liner to 100' 4" liner to 147' 9"
A 2" G.B. pipe is being installed in the hole with perforated section 49' to 39' approx.

REPORT 1167 Box 58

Note
Materials denoted above are as described on site.

Disturbed Sample
Undisturbed Sample

REVISIONS
(A) Chart of W.L. added 7.4.51

LOGS OF BORE HOLES IN THE
CORK STEAM STATION
Logs of Bore Holes 1 to 6
Logs of Trial Pits 1 & 2
Chart showing variation of W.L. in Bore Holes

1/100

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64816

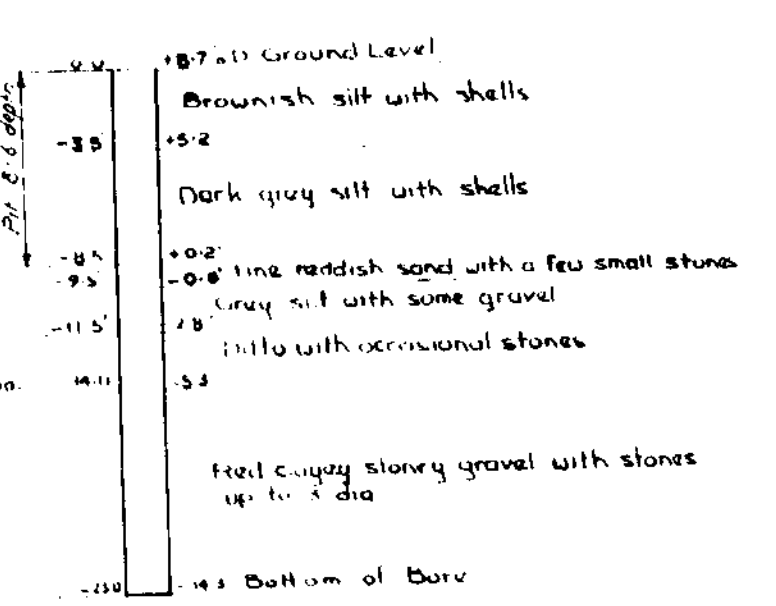
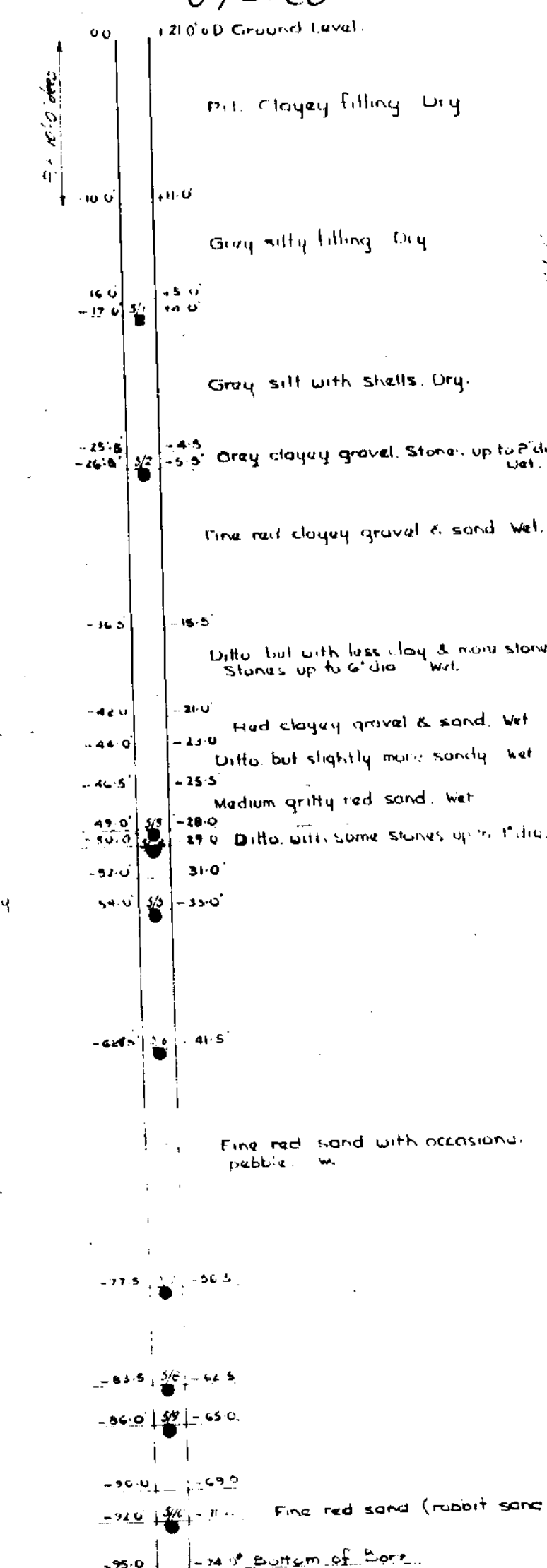
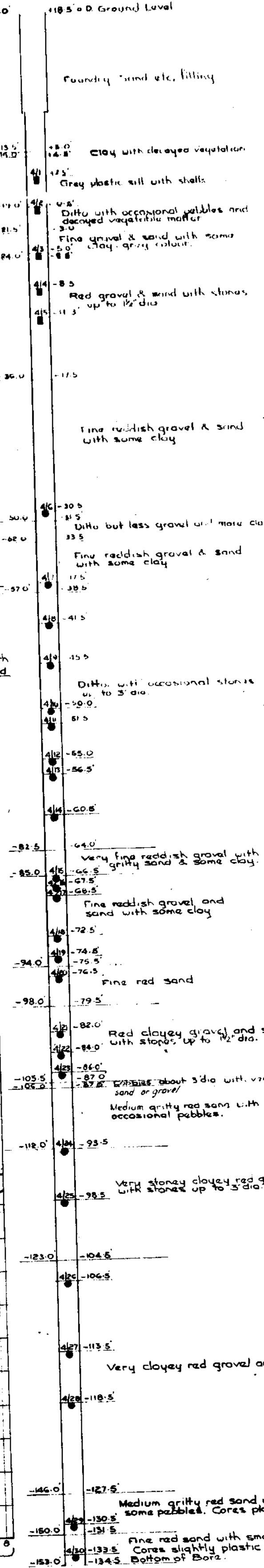
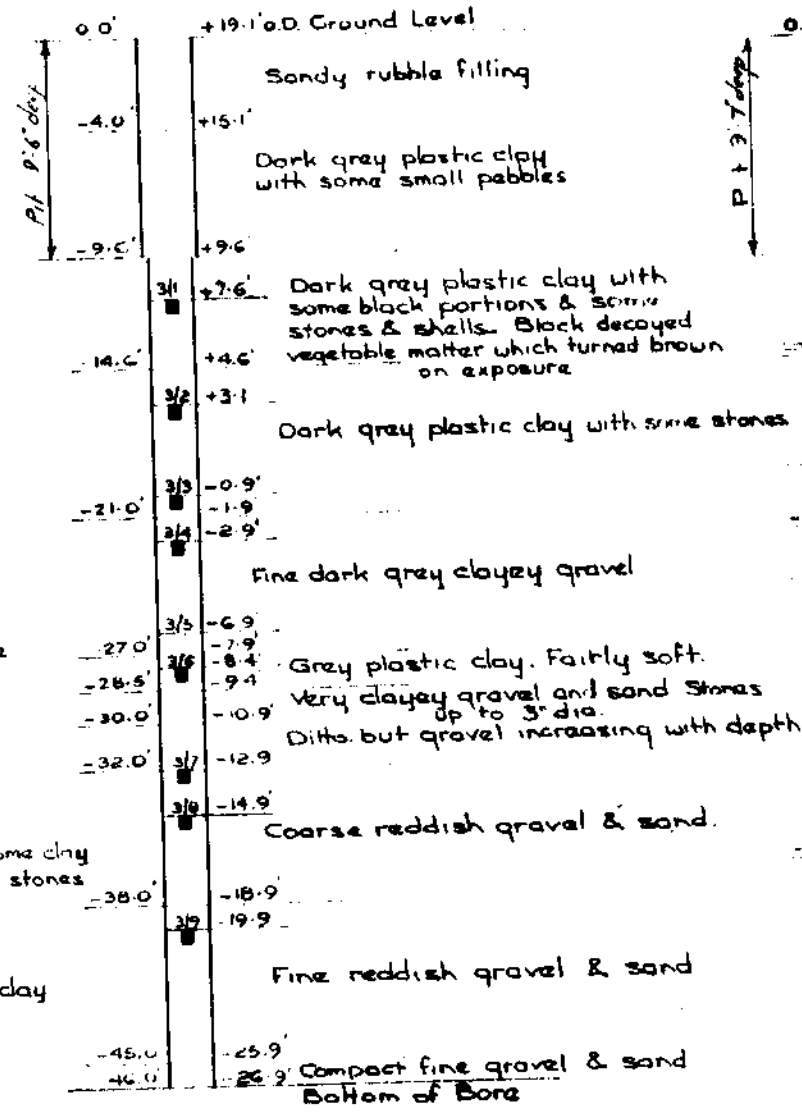
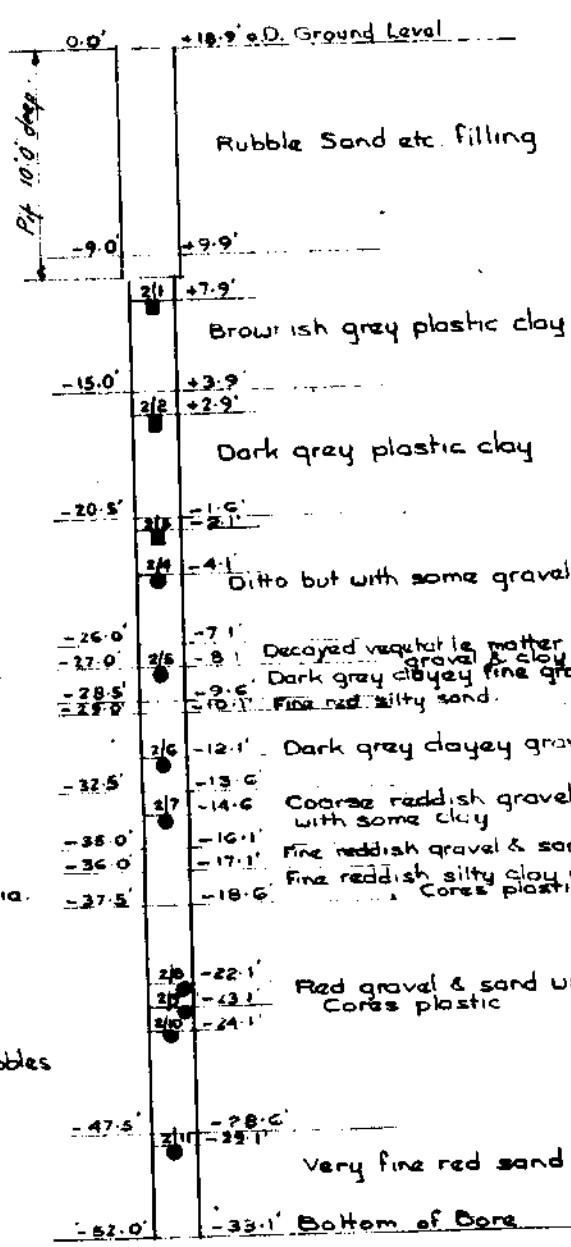
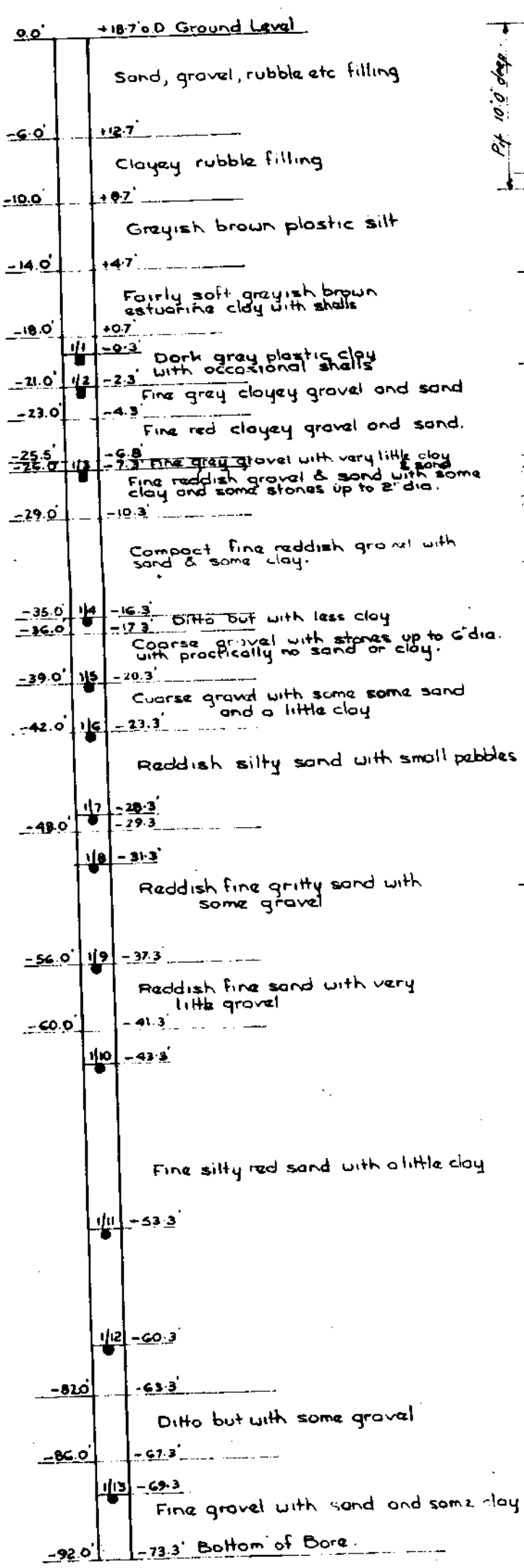
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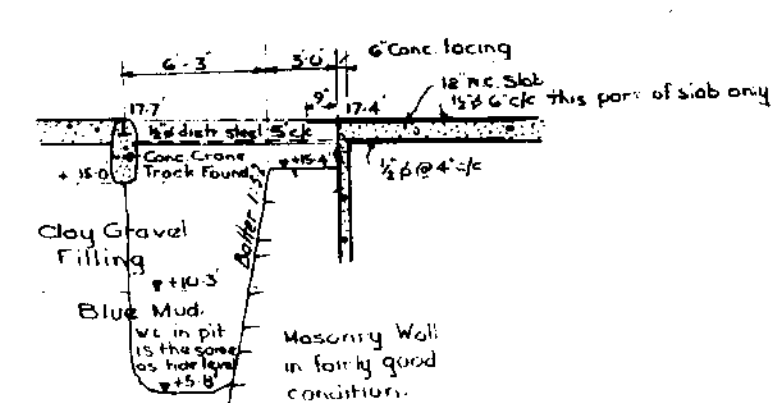
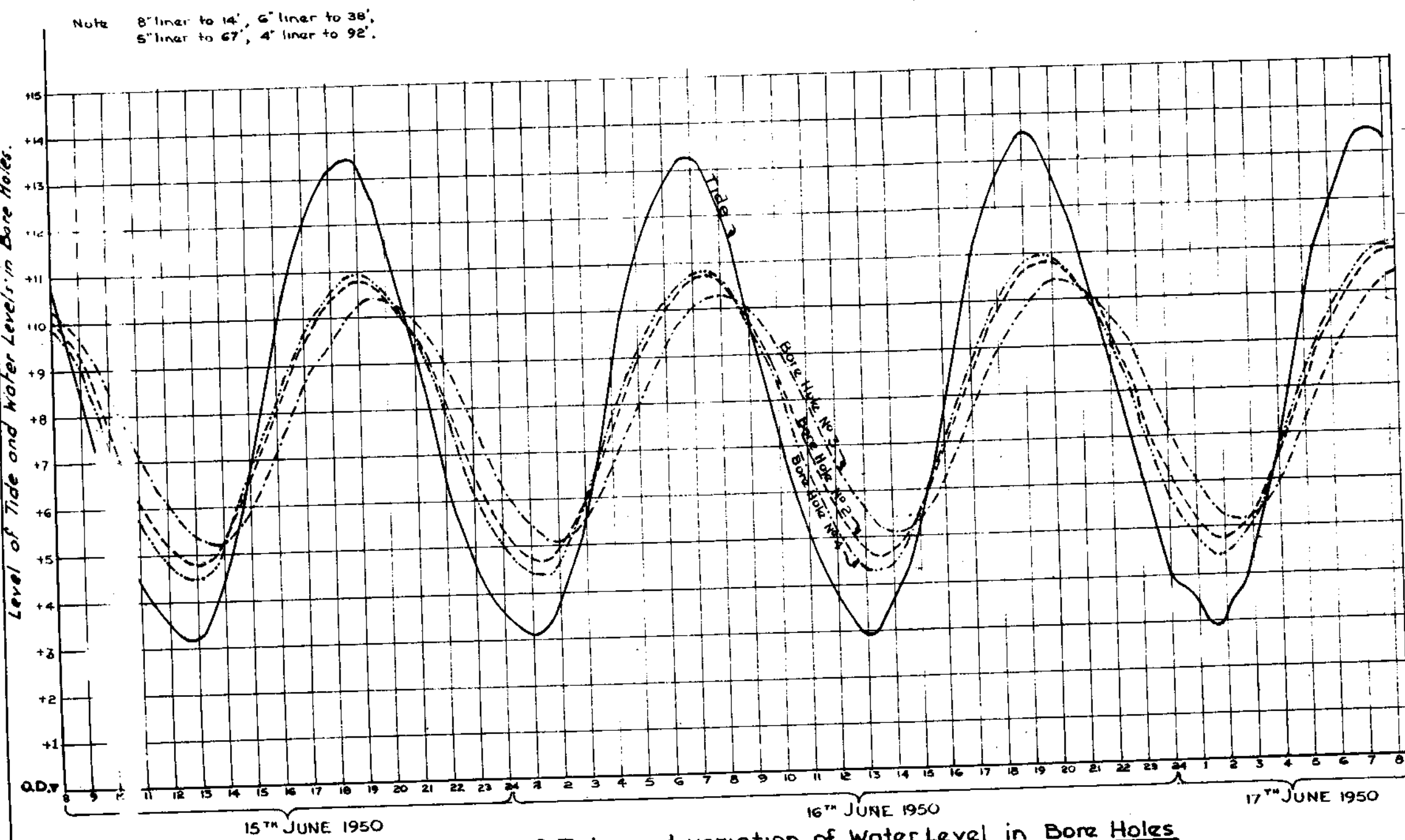
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Notes on liners
Pit 10' depth 8" liners to 15' 6" liners to 36'
5" liners to 60'
Boxed samples stored at site. Samples taken at 11' 0", 16' 0", 21' 0", 27' 0", 31' 0", 33' 0", 41' 0", 42' 0", 43' 0", 44' 0".
Sounding Well
The hole was backfilled with clay up to depth 40' 0". A 2" G.B. pipe with its lowest 10 perforated and covered with fine gauze was placed from depth 40' to above ground surface. The perforated portion was surrounded with screened sand and the remainder with clay to ground level. The water level in the pipe varies with the tide.

Notes on liners
Pit 9' 6" depth 8" liner to 12' 6" liner to 36'
No liner 36' to 46'.
Boxed samples stored at site. Samples taken at 11' 0", 16' 0", 20' 0", 22' 0", 25' 0", 27' 0", 32' 0", 34' 0", 39' 0".
Sounding Well
The hole was backfilled with clay up to depth 20' and filled with a pipe perforated, covered with gauze and surrounded by sand between 20' & 10' and the remainder of the hole filled with clay to surface level.

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Bore Hole dry to depth of 25' 6". Water arose to tide level after that and then varied with the tide.



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REPORT 1167 Box 58

Note Materials denoted above are as described on site.

Disturbed Sample
Undisturbed Sample

REVISIONS
(A) Chart of W.L.s added 7.4.51

LOGS OF BORE HOLES IN THE
CORK STEAM STATION
Logs of Bore Holes 1 to 6
Logs of Trial Pits 1 & 2
Chart showing variation of W.L.s in Bore Holes
1/100
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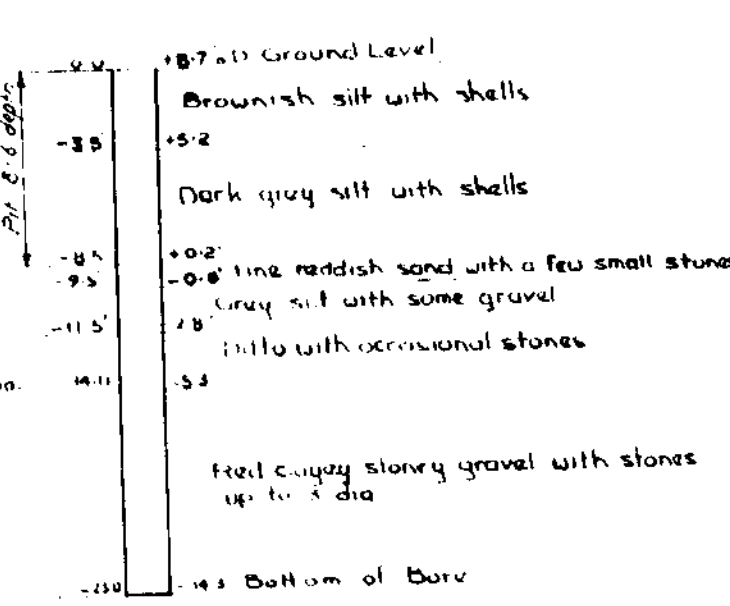
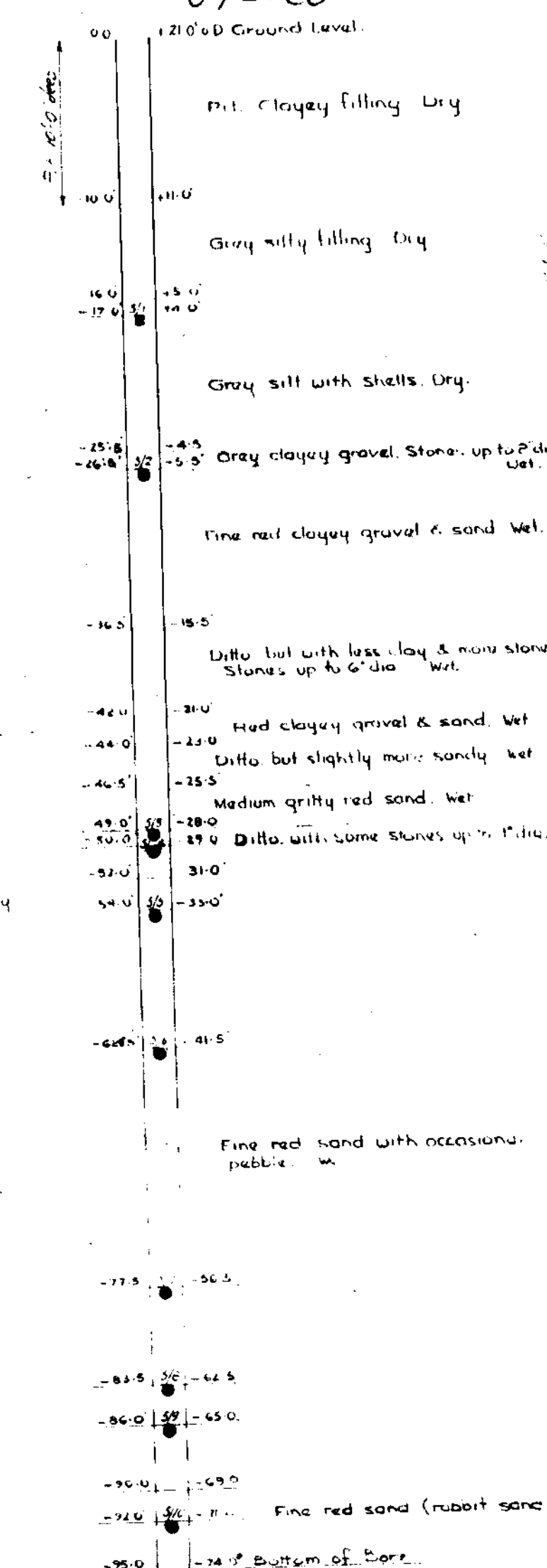
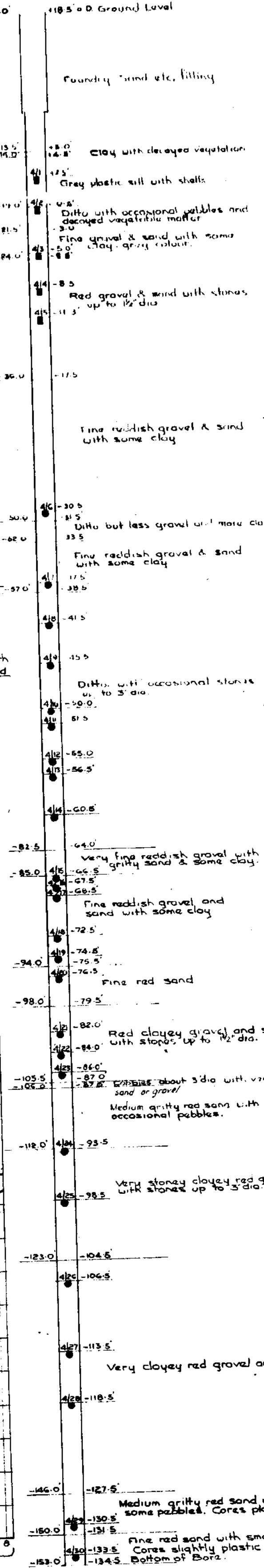
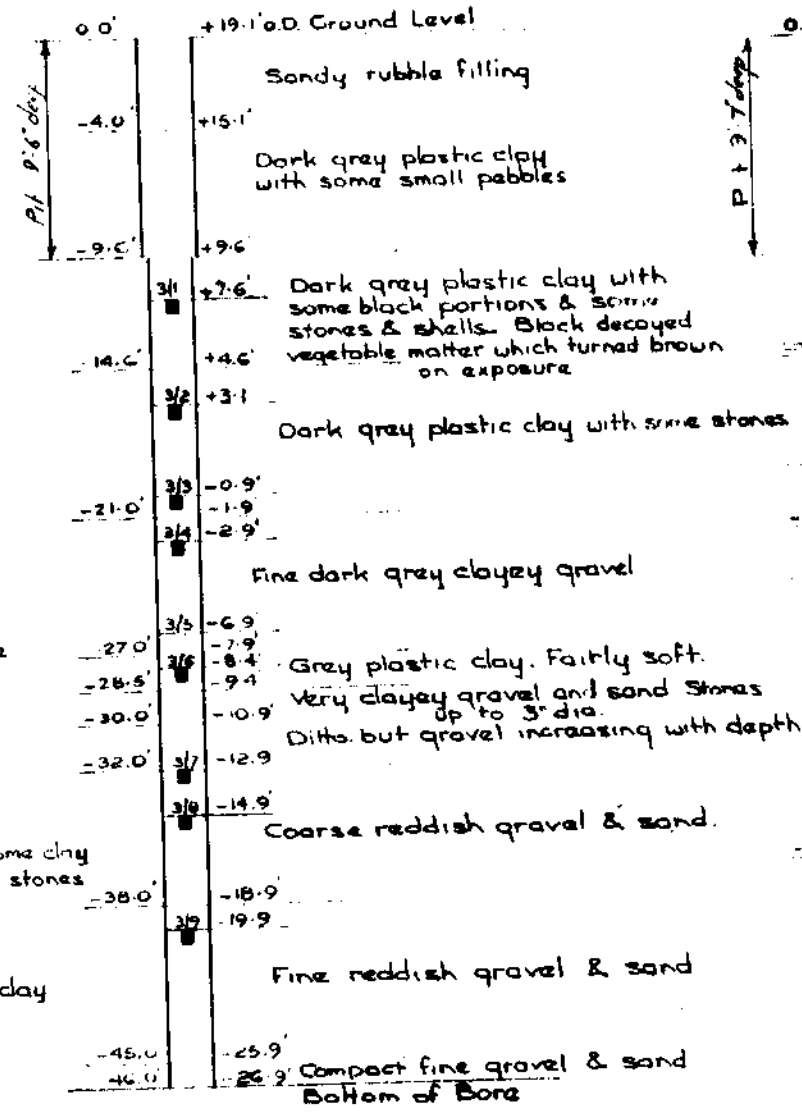
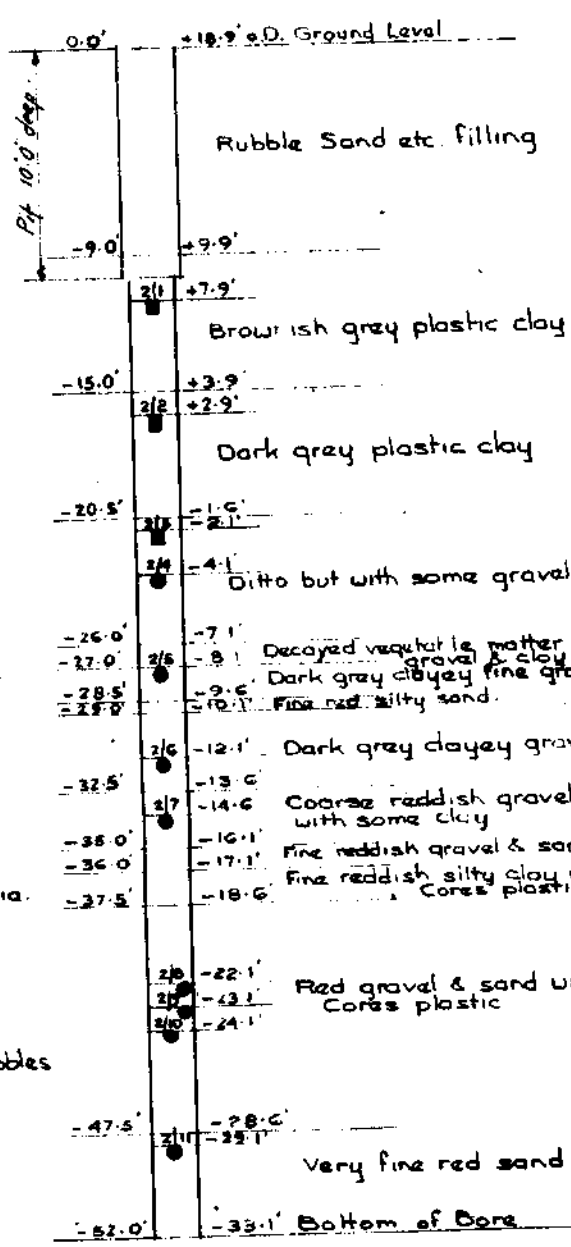
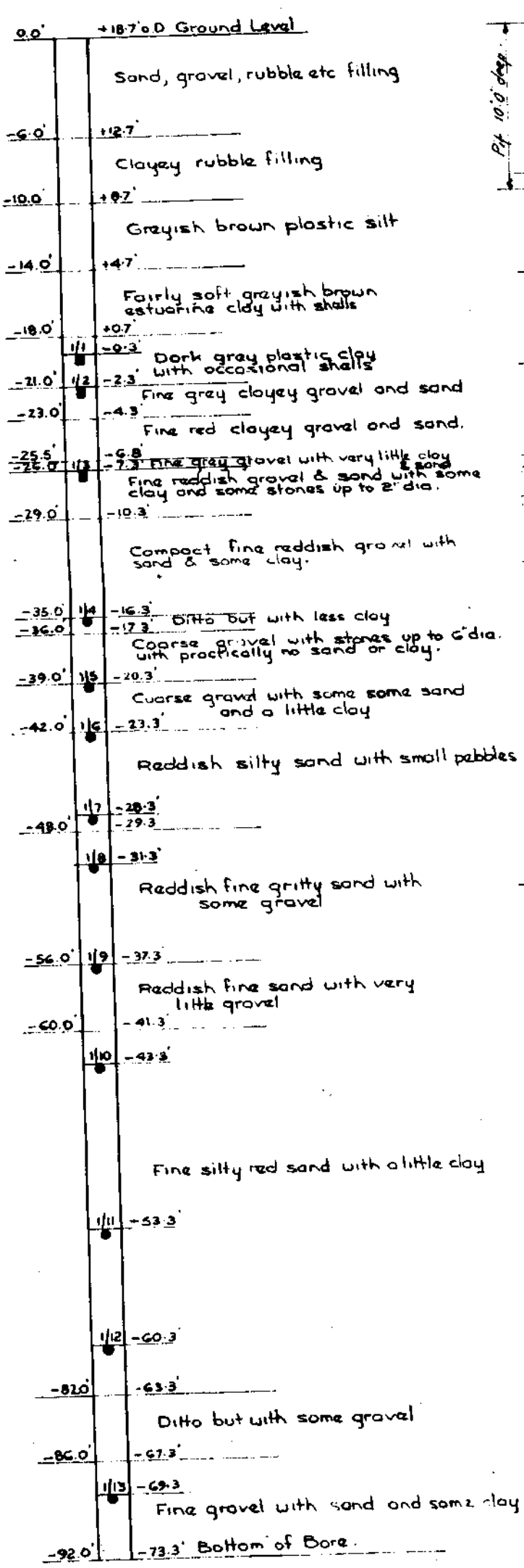
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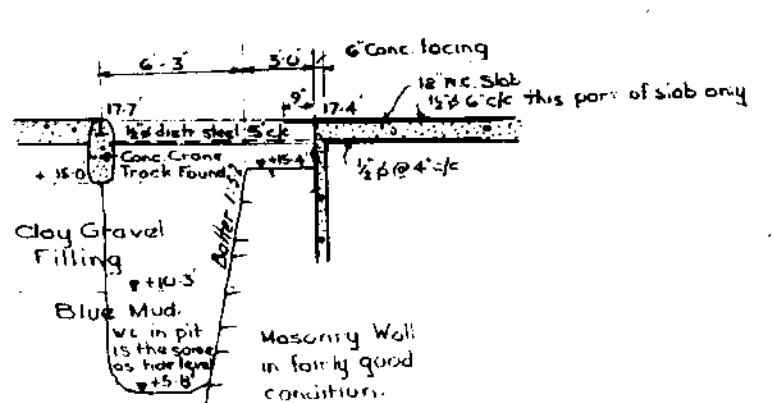
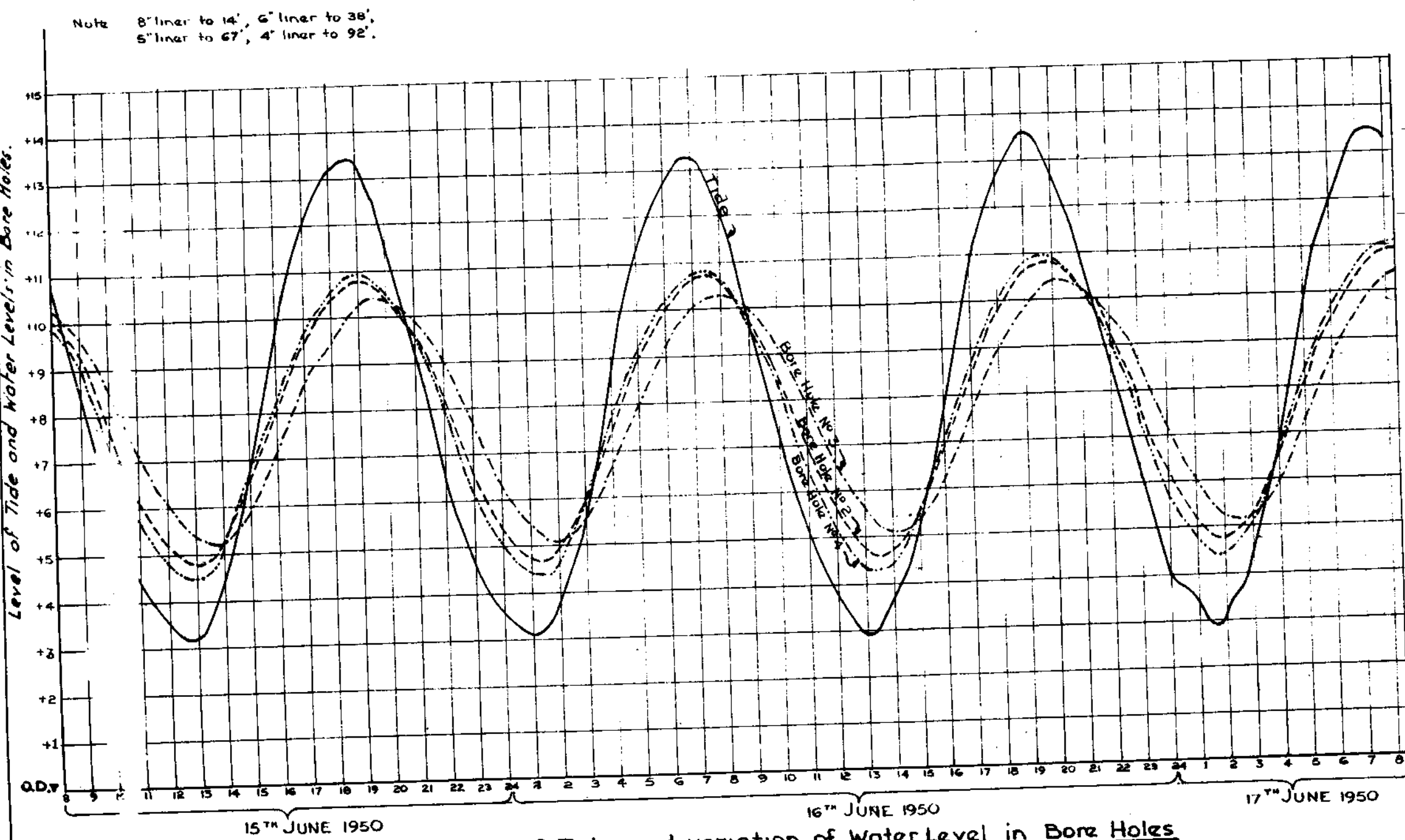
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Notes on liners
Pit 10' depth 8" liners to 15' 6" liners to 36'
5" liners to 60'
Boxed samples stored at site. Samples taken at 11' 0", 16' 0", 21' 0", 27' 0", 31' 0", 33' 0", 41' 0", 42' 0", 43' 0", 44' 0".
Sounding Well
The hole was backfilled with clay up to depth 40' 0". A 2" G.B. pipe with its lowest 10 perforated and covered with fine gauze was placed from depth 40' to above ground surface. The perforated portion was surrounded with screened sand and the remainder with clay to ground level. The water level in the pipe varies with the tide.

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Note
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A 2" G.B. pipe is being installed in the hole with perforated section 49' to 39' approx.

Note
Materials denoted above are as described on site.

Disturbed Sample ●
Undisturbed Sample ■

REVISIONS
(A) Chart of W.L. added 7.4.51

P. Herby

RESEARCH SOCIETY LTD
10, GRAFTON STREET, DUBLIN

CORK STEAM STATION

Logs of Bore Holes 1 to 6

Logs of Trial Pits 1 & 2

Chart showing variation of W.L. in Bore Holes

1/100

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Overview Map for GSI Report 1167: ESB Marino Power Station
ESB Marina Power Station, Cork Harbour, Co. Cork
Points Observed: 25



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GSI REPORT 1167

ESB Marino Power Station

ESB Marina Power Station, Cork Harbour, Co. Cork

Borehole List:

| Borehole | Name | Depth | DTB | ODMALIN | Easting | Northing | Description |
|----------|------|--------|-----|---------|---------|----------|------------------------------------|
| 64816 | 1 | 28.042 | | 2.99 | 169351 | 72111 | Cable Percussion (Shell and Auger) |
| 64817 | 2 | 15.85 | | 3 | 169362 | 72046 | Cable Percussion (Shell and Auger) |
| 64818 | 3 | 14.021 | | 3.08 | 169326 | 72064 | Cable Percussion (Shell and Auger) |
| 64819 | 4 | 46.634 | | 2.9 | 169390 | 72092 | Cable Percussion (Shell and Auger) |
| 64820 | 5 | 28.956 | | 3.69 | 169479 | 72179 | Cable Percussion (Shell and Auger) |
| 64821 | 6 | 7.01 | | -.06 | 169414 | 72007 | Cable Percussion (Shell and Auger) |
| 64822 | 7 | 30.48 | | 3.08 | 169395 | 72037 | Cable Percussion (Shell and Auger) |
| 64823 | 8 | 30.48 | | 3.08 | 169375 | 72017 | Cable Percussion (Shell and Auger) |
| 64824 | 9 | 28.55 | | 3.08 | 169347 | 72005 | Cable Percussion (Shell and Auger) |
| 64825 | 10 | 30.48 | | 3.08 | 169332 | 72031 | Cable Percussion (Shell and Auger) |
| 64826 | 11 | 21.336 | | 2.57 | 169419 | 72078 | Cable Percussion (Shell and Auger) |
| 64827 | 12 | 21.336 | | 2.78 | 169403 | 72107 | Cable Percussion (Shell and Auger) |
| 64828 | 13 | 24.994 | | 2.8 | 169409 | 72104 | Cable Percussion (Shell and Auger) |
| 64829 | 14 | 24.079 | | 2.6 | 169413 | 72070 | Cable Percussion (Shell and Auger) |
| 64830 | 15 | 28.956 | | 3.08 | 169401 | 72082 | Cable Percussion (Shell and Auger) |
| 97270 | 1 | 30.8 | | 1.52 | | | Cable Percussion (Shell and Auger) |
| 97271 | 2 | 30.5 | | 1.48 | | | Cable Percussion (Shell and Auger) |
| 97272 | 3 | 26 | | 1.37 | | | Cable Percussion (Shell and Auger) |
| 97273 | 4 | 27 | | 1.57 | | | Cable Percussion (Shell and Auger) |
| 97274 | 5 | 27.3 | | 1.27 | | | Cable Percussion (Shell and Auger) |
| 97275 | 6 | 27 | | 1.26 | | | Cable Percussion (Shell and Auger) |
| 97276 | 7 | 27 | | 1.62 | | | Cable Percussion (Shell and Auger) |
| 97277 | 8 | 29 | | 1.63 | | | Cable Percussion (Shell and Auger) |
| 97278 | 9 | 30 | | 1.8 | | | Cable Percussion (Shell and Auger) |
| 97279 | 10 | 30 | | 2.03 | | | Cable Percussion (Shell and Auger) |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64816 (Company Name: 1)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|----------|------------|----------------|-----------------------|-----------------------|
| 6481601 | 0 | 1.83 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 6481602 | 1.83 | 3.05 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 6481603 | 3.05 | 4.27 | | Grey Brown | Clayey | Silt | Silt |
| 6481604 | 4.27 | 5.49 | Soft | Grey Brown | Clayey | Clay | Clay |
| 6481605 | 5.49 | 6.4 | | Dark Grey | Clayey | Clay | Clay |
| 6481606 | 6.4 | 7.01 | | Grey | Fine | Clay, Sand And Gravel | Clay, Sand And Gravel |
| 6481607 | 7.01 | 7.75 | | Red | Fine | Clay, Sand And Gravel | Clay, Sand And Gravel |
| 6481608 | 7.75 | 7.92 | | Grey | Fine | Clay And Gravel | Clay And Gravel |
| 6481609 | 7.92 | 8.84 | | Red Brown | Fine | Clay, Sand And Gravel | Clay, Sand And Gravel |
| 6481610 | 8.84 | 10.67 | Compact | Red Brown | Fine | Gravel And Clay | Gravel And Clay |
| 6481611 | 10.67 | 10.97 | Compact | Red | Fine | Gravel And Clay | Gravel And Clay |
| 6481612 | 10.97 | 11.89 | Coarse | | Gravelly | Gravel And Clay | Gravel And Clay |
| 6481613 | 11.89 | 12.8 | Coarse | | Gravelly Sandy | Gravel And Clay | Gravel And Clay |
| 6481614 | 12.8 | 14.63 | | Red Brown | Silty Sandy | Silt | Silt |
| 6481615 | 14.63 | 17.07 | | Red Brown | Fine | Gravel And Clay | Gravel And Clay |
| 6481616 | 17.07 | 24.99 | | | Fine Silty | Sand And Clay | Sand And Clay |
| 6481617 | 24.99 | 28.04 | | | Fine | Gravel And Clay | Gravel And Clay |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64817 (Company Name: 2)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|----------|------------|-----------------|-----------------------|-----------------------|
| 6481701 | 0 | 3.05 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 6481702 | 3.05 | 4.57 | | Brown Grey | Clayey | Clay | Clay |
| 6481703 | 4.57 | 7.92 | | Dark Grey | Clayey Gravelly | Clay | Clay |
| 6481704 | 7.92 | 8.23 | | | Clayey | Gravel And Clay | Gravel And Clay |
| 6481705 | 8.23 | 8.66 | | Dark Grey | Fine | Clay And Gravel | Clay And Gravel |
| 6481706 | 8.66 | 8.84 | | Red | Fine | Silt And Clay | Silt And Clay |
| 6481707 | 8.84 | 9.88 | | Dark Grey | Clayey | Gravel | Gravel |
| 6481708 | 9.88 | 10.67 | Coarse | Red Brown | Clayey | Clay, Sand And Gravel | Clay, Sand And Gravel |
| 6481709 | 10.67 | 10.97 | | Red | Fine | Clay, Sand And Gravel | Clay, Sand And Gravel |
| 6481710 | 10.97 | 11.4 | | Red Brown | Fine Silty | Clay And Gravel | Clay And Gravel |
| 6481711 | 11.4 | 14.45 | | Red | Clayey | Clay, Sand And Gravel | Clay, Sand And Gravel |
| 6481712 | 14.45 | 15.85 | | Red | Very Fine | Sand | Sand |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64818 (Company Name: 3)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|----------|--------------------|-------------|-----------------|-----------------|
| 6481801 | 0 | 2.9 | | Dark Grey | Clayey | Clay And Gravel | Clay And Gravel |
| 6481802 | 2.9 | 4.42 | Friable | Dark Grey Black | Clayey | Clay | Clay |
| 6481803 | 4.42 | 6.4 | Friable | Dark Grey | Clayey | Sand And Clay | Sand And Clay |
| 6481804 | 6.4 | 8.23 | | Dark Grey | Fine | Clay And Gravel | Clay And Gravel |
| 6481805 | 8.23 | 8.66 | Friable | Grey | Clayey | Clay | Clay |
| 6481806 | 8.66 | 9.75 | | | Very Clayey | Sand And Gravel | Sand And Gravel |
| 6481807 | 9.75 | 11.58 | Coarse | Red Brown | Clayey | Sand And Gravel | Sand And Gravel |
| 6481808 | 11.58 | 13.72 | | Red Brown | Fine | Sand And Gravel | Sand And Gravel |
| 6481809 | 13.72 | 14.02 | Compact | | Fine | Sand And Gravel | Sand And Gravel |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64819 (Company Name: 4)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|----------|-----------|-------------|-----------------------|-----------------------|
| 6481901 | 0 | 4.09 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 6481902 | 4.09 | 4.27 | | | Clayey | Clay | Clay |
| 6481903 | 4.27 | 6.53 | Friable | Grey | Clayey | Silt | Silt |
| 6481904 | 6.53 | 7.32 | | Grey | Fine | Clay, Sand And Gravel | Clay, Sand And Gravel |
| 6481905 | 7.32 | 10.97 | | Red | Clayey | Sand And Gravel | Sand And Gravel |
| 6481906 | 10.97 | 15.24 | | Red Brown | Fine | Clay, Sand And Gravel | Clay, Sand And Gravel |
| 6481907 | 15.85 | 25.12 | | Red | Fine | Clay, Sand And Gravel | Clay, Sand And Gravel |
| 6481908 | 25.12 | 25.91 | | Red Brown | Very Fine | Clay, Sand And Gravel | Clay, Sand And Gravel |
| 6481909 | 25.91 | 28.65 | | Red Brown | Fine | Clay, Sand And Gravel | Clay, Sand And Gravel |
| 6481910 | 28.65 | 29.87 | | Red | Fine | Sand | Sand |
| 6481911 | 29.87 | 32.13 | | Red | Clayey | Sand And Gravel | Sand And Gravel |
| 6481912 | 32.13 | 34.14 | | Red | Medium | Sand And Gravel | Sand And Gravel |
| 6481913 | 34.14 | 37.49 | | Red | Very Stony | Gravel And Clay | Gravel And Clay |
| 6481914 | 37.49 | 44.5 | | Red | Very Clayey | Sand And Gravel | Sand And Gravel |
| 6481915 | 44.5 | 45.72 | | Red | Medium | Gravel | Gravel |
| 6481916 | 45.72 | 46.63 | | Red | Fine | Sand | Sand |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64820 (Company Name: 5)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|------------|--------|-----------|--------------------|--------------------|
| 6482001 | 0 | 3.05 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 6482002 | 3.05 | 4.88 | | Grey | Silty | Fill - Made Ground | Fill - Made Ground |
| 6482003 | 4.88 | 7.75 | | Grey | Silty | Silt | Silt |
| 6482004 | 7.75 | 8.05 | | Grey | Clayey | Gravel | Gravel |
| 6482005 | 8.05 | 12.8 | Dense fine | Red | Clayey | Sand And Gravel | Sand And Gravel |
| 6482006 | 12.8 | 13.41 | | Red | Clayey | Sand And Gravel | Sand And Gravel |
| 6482007 | 13.41 | 14.94 | | Red | Medium | Sand | Sand |
| 6482008 | 14.94 | 28.96 | | Red | Fine | Sand And Gravel | Sand And Gravel |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64821 (Company Name: 6)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|------|------|----------|-----------|--------------|-----------------|-----------------|
| 6482101 | 0 | 1.04 | | Brown | Silty | Silt | Silt |
| 6482102 | 1.04 | 2.57 | | Dark Grey | Clayey | Silt | Silt |
| 6482103 | 2.57 | 2.87 | | Red Brown | Fine | Sand And Gravel | Sand And Gravel |
| 6482104 | 2.87 | 3.48 | | Grey | Clayey | Gravel And Silt | Gravel And Silt |
| 6482105 | 3.48 | 7.01 | | Red | Stony Clayey | Gravel | Gravel |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64822 (Company Name: 7)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|------|-------|----------|-------------|-------------|--------------------|--------------------|
| 6482201 | 0 | 4.57 | | Light Brown | Fine Sandy | Fill - Made Ground | Fill - Made Ground |
| 6482202 | 4.57 | 9.75 | Soft | Dark Grey | Sandy Silty | Silt | Silt |
| 6482203 | 9.75 | 30.48 | Dense | Red Brown | Silty | Gravel | Gravel |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64823 (Company Name: 8)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|------|-------|-----------------|------------|--------------------|--------------------|--------------------|
| 6482301 | 0 | 3.66 | | Dark Brown | Sandy Gravelly | Fill - Made Ground | Fill - Made Ground |
| 6482302 | 3.66 | 9.6 | Very Soft | Grey | Clayey Silty Sandy | Gravel | Gravel |
| 6482303 | 9.6 | 30.48 | Medium Dense | Red Brown | Fine to Coarse | Gravel And Cobbles | Gravel And Cobbles |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64824 (Company Name: 9)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|-----------------|------------|--------------------|--------------------|--------------------|
| 6482401 | 0 | 3.81 | | Dark Brown | Sandy Clayey | Fill - Made Ground | Fill - Made Ground |
| 6482402 | 3.81 | 12.19 | Soft | Dark Grey | Clayey Silty Sandy | Gravel And Cobbles | Gravel And Cobbles |
| 6482403 | 12.19 | 28.55 | Medium Dense | Red Brown | Fine to Coarse | Gravel And Cobbles | Gravel And Cobbles |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64825 (Company Name: 10)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|-----------------|------------|----------------------|--------------------|--------------------|
| 6482501 | 0 | 2.9 | Soft | Dark Brown | Sandy Gravelly Silty | Fill - Made Ground | Fill - Made Ground |
| 6482502 | 2.9 | 10.82 | Soft | Dark Grey | Silty Sandy Gravelly | Clay | Clay |
| 6482503 | 10.82 | 30.48 | Medium Dense | Red Brown | Fine to Coarse | Sand And Gravel | Sand And Gravel |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64826 (Company Name: 11)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|------|-------|----------|-----------|-----------------|---------------------------|---------------------------|
| 6482601 | 0 | 1.52 | Loose | | Clayey Gravelly | Fill - Made Ground | Fill - Made Ground |
| 6482602 | 1.52 | 4.88 | Loose | | Clayey Gravelly | Fill - Made Ground | Fill - Made Ground |
| 6482603 | 4.88 | 5.79 | | Dark Grey | Clayey Silty | Clay | Clay |
| 6482604 | 5.79 | 21.34 | | Red Brown | Fine to Coarse | Sand, Gravel And Boulders | Sand, Gravel And Boulders |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64827 (Company Name: 12)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|------|-------|----------|-----------|-------------------------|------------------|------------------|
| 6482701 | 0 | 1.52 | | Brown | Clayey Gravelly | Clay And Gravel | Clay And Gravel |
| 6482702 | 1.52 | 3.05 | | Black | Clayey | Sand | Sand |
| 6482703 | 3.05 | 4.57 | | Dark Grey | Fine Silty | Silt And Clay | Silt And Clay |
| 6482704 | 4.57 | 21.34 | | Red | Fine to Coarse Sandy | Sand And Cobbles | Sand And Cobbles |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64828 (Company Name: 13)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|----------|--------|----------------|---------------------------|---------------------------|
| 6482801 | 0 | 3.96 | | | Silty Sandy | Fill - Made Ground | Fill - Made Ground |
| 6482802 | 3.96 | 4.57 | | Grey | Sandy Silty | Silt And Clay | Silt And Clay |
| 6482803 | 4.57 | 5.49 | | Grey | Fine to Medium | Gravel And Silt | Gravel And Silt |
| 6482804 | 5.49 | 7.01 | | Grey | Organic | Silt And Clay | Silt And Clay |
| 6482805 | 7.01 | 9.91 | | | Fine to Coarse | Sand, Gravel And Boulders | Sand, Gravel And Boulders |
| 6482806 | 9.91 | 12.34 | | | Fine to Coarse | Gravel And Cobbles | Gravel And Cobbles |
| 6482807 | 12.34 | 20.12 | | | Fine to Coarse | Sand, Gravel And Boulders | Sand, Gravel And Boulders |
| 6482808 | 20.12 | 23.32 | Coarse | | | Gravel And Cobbles | Gravel And Cobbles |
| 6482809 | 23.32 | 24.99 | | Brown | Fine to Coarse | Sand And Cobbles | Sand And Cobbles |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64829 (Company Name: 14)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|-----------|------------|------------------|---------------------------|---------------------------|
| 6482901 | 0 | 2.74 | | Dark Brown | Clayey | Fill - Made Ground | Fill - Made Ground |
| 6482902 | 2.74 | 5.18 | Very Soft | Grey | Silty Sandy | Silt | Silt |
| 6482903 | 5.18 | 5.79 | Soft | Grey | Sandy Silty | Silt | Silt |
| 6482904 | 5.79 | 6.71 | | | Fine Sandy | Gravel And Silt | Gravel And Silt |
| 6482905 | 6.71 | 7.32 | | | Small | Sand And Gravel | Sand And Gravel |
| 6482906 | 7.32 | 8.84 | | | Medium | Sand And Gravel | Sand And Gravel |
| 6482907 | 8.84 | 10.06 | | | Medium | Gravel And Cobbles | Gravel And Cobbles |
| 6482908 | 10.06 | 10.67 | | | Medium | Sand, Gravel And Boulders | Sand, Gravel And Boulders |
| 6482909 | 10.67 | 11.58 | | | Medium | Sand, Gravel And Boulders | Sand, Gravel And Boulders |
| 6482910 | 11.58 | 12.19 | Coarse | | Medium Gravelly | Sand And Gravel | Sand And Gravel |
| 6482911 | 12.19 | 12.8 | Compact | | Medium | Sand And Gravel | Sand And Gravel |
| 6482912 | 12.8 | 15.24 | Compact | | Fine to Coarse | Sand And Gravel | Sand And Gravel |
| 6482913 | 15.24 | 16.15 | | | Medium Gravelly | Sand And Cobbles | Sand And Cobbles |
| 6482914 | 16.15 | 18.9 | | | Medium to Coarse | Sand And Gravel | Sand And Gravel |
| 6482915 | 18.9 | 19.51 | | | Medium Gravelly | Gravel And Cobbles | Gravel And Cobbles |
| 6482916 | 19.51 | 20.12 | | | Medium Gravelly | Sand And Gravel | Sand And Gravel |
| 6482917 | 20.12 | 21.34 | | | Medium Gravelly | Sand, Gravel And Boulders | Sand, Gravel And Boulders |
| 6482918 | 21.34 | 24.08 | Compact | | Medium | Gravel | Gravel |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 64830 (Company Name: 15)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|--------------|------------|------------------|------------------------------|------------------------------|
| 6483001 | 0 | .3 | | | | Fill - Made Ground | Fill - Made Ground |
| 6483002 | .3 | 1.83 | | Dark Brown | Clayey | Fill - Made Ground | Fill - Made Ground |
| 6483003 | 1.83 | 4.27 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 6483004 | 4.27 | 4.57 | Very Soft | Grey | Clayey | Silt | Silt |
| 6483005 | 4.57 | 6.4 | Very Soft | Grey | Silty Sandy | Silt | Silt |
| 6483006 | 6.4 | 7.01 | | | Clayey | Gravel And Silt | Gravel And Silt |
| 6483007 | 7.01 | 11.89 | | | Medium | Sand And Gravel | Sand And Gravel |
| 6483008 | 11.89 | 12.5 | Compact | | Medium | Gravel And Cobbles | Gravel And Cobbles |
| 6483009 | 12.5 | 13.11 | | | Medium | Gravel And Cobbles | Gravel And Cobbles |
| 6483010 | 13.11 | 15.24 | Compact | | Medium | Gravel And Cobbles | Gravel And Cobbles |
| 6483011 | 15.24 | 15.85 | | | Medium | Gravel | Gravel |
| 6483012 | 15.85 | 16.92 | | | Medium to Coarse | Sand And Gravel | Sand And Gravel |
| 6483013 | 16.92 | 17.68 | Coarse | | Small | Sand And Gravel | Sand And Gravel |
| 6483014 | 17.68 | 18.9 | Very Compact | | Medium | Gravel | Gravel |
| 6483015 | 18.9 | 19.51 | Very Compact | | Medium | Gravel, Cobbles And Boulders | Gravel, Cobbles And Boulders |
| 6483016 | 19.51 | 20.42 | Compact | | Small | Gravel | Gravel |
| 6483017 | 20.42 | 22.86 | Compact | | Small | Gravel | Gravel |
| 6483018 | 22.86 | 23.47 | | | Medium | Gravel | Gravel |
| 6483019 | 23.47 | 24.84 | Very Compact | | Small | Sand And Gravel | Sand And Gravel |
| 6483020 | 24.84 | 28.96 | Very Compact | | Medium Gravelly | Sand And Gravel | Sand And Gravel |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 97270 (Company Name: 1)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|------|------|----------|--------|--------------------------|------------------------------|------------------------------|
| 9727001 | 0 | .15 | | | | Fill - Made Ground | Fill - Made Ground |
| 9727002 | .15 | 2.8 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 9727003 | 2.8 | 4.9 | Soft | Grey | Silty | Clay | Clay |
| 9727004 | 4.9 | 5.05 | Soft | Grey | Organic | Silt | Silt |
| 9727005 | 5.05 | 5.2 | Coarse | | Very Clayey | Gravel | Gravel |
| 9727006 | 5.2 | 5.8 | Soft | Grey | Clayey | Silt | Silt |
| 9727007 | 5.8 | 7.1 | Loose | | Slightly Sandy Clayey | Gravel | Gravel |
| 9727008 | 7.1 | 8.9 | Soft | Black | Organic | Clay | Clay |
| 9727009 | 8.9 | 11 | Compact | | Coarse | Gravel | Gravel |
| 9727010 | 11 | 16.9 | Compact | | Medium | Sand And Gravel | Sand And Gravel |
| 9727011 | 16.9 | 20.5 | | | Medium to Coarse | Sand, Gravel And Boulders | Sand, Gravel And Boulders |
| 9727012 | 20.5 | 30.8 | Compact | | Coarse | Sand, Gravel And Boulders | Sand, Gravel And Boulders |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 97271 (Company Name: 2)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|------|------|----------|----------------|-----------------|---------------------------|---------------------------|
| 9727101 | 0 | .15 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 9727102 | .15 | 2.3 | | | Clayey Gravelly | Fill - Made Ground | Fill - Made Ground |
| 9727103 | 2.3 | 3.7 | Soft | Brown and Grey | Clayey | Silt | Silt |
| 9727104 | 3.7 | 4.15 | Soft | Grey | Sandy | Silt | Silt |
| 9727105 | 4.15 | 4.3 | Soft | Grey | Silty | Clay | Clay |
| 9727106 | 4.3 | 5.55 | Loose | | Sandy | Gravel And Silt | Gravel And Silt |
| 9727107 | 5.55 | 6.1 | Soft | Grey | Organic | Silt And Clay | Silt And Clay |
| 9727108 | 6.1 | 7.7 | Compact | | Sandy | Gravel | Gravel |
| 9727109 | 7.7 | 10.9 | Compact | | Coarse | Gravel And Cobbles | Gravel And Cobbles |
| 9727110 | 10.9 | 16.3 | Coarse | | Clayey | Sand And Gravel | Sand And Gravel |
| 9727111 | 16.3 | 30.5 | Compact | | Coarse | Sand, Gravel And Boulders | Sand, Gravel And Boulders |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 97272 (Company Name: 3)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|------|------|----------|-----------|------------------|------------------------------|------------------------------|
| 9727201 | 0 | .15 | | | | Fill - Made Ground | Fill - Made Ground |
| 9727202 | .15 | 2 | | | | Fill - Made Ground | Fill - Made Ground |
| 9727203 | 2 | 2.7 | Soft | Grey | Stony | Silt | Silt |
| 9727204 | 2.7 | 4 | | Dark Grey | Organic | Silt | Silt |
| 9727205 | 4 | 5.7 | Loose | | Medium to Coarse | Gravel | Gravel |
| 9727206 | 5.7 | 6 | Soft | Dark Grey | Organic gravelly | Clay | Clay |
| 9727207 | 6 | 6.5 | | | Fine to Medium | Sand And Gravel | Sand And Gravel |
| 9727208 | 6.5 | 7.1 | | Grey | Clayey | Silt | Silt |
| 9727209 | 7.1 | 14 | Compact | | Medium to Coarse | Sand, Gravel And Boulders | Sand, Gravel And Boulders |
| 9727210 | 14 | 18.3 | Stiff | Grey | | Clay | Clay |
| 9727211 | 18.3 | 18.8 | Stiff | Grey | Shelly | Clay | Clay |
| 9727212 | 18.8 | 26 | Compact | | Medium to Coarse | Gravel, Cobbles And Boulders | Gravel, Cobbles And Boulders |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 97273 (Company Name: 4)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|----------|-----------|------------------|------------------------------|------------------------------|
| 9727301 | 0 | .15 | | | | Fill - Made Ground | Fill - Made Ground |
| 9727302 | .15 | 2 | | | | Fill - Made Ground | Fill - Made Ground |
| 9727303 | 2 | 3.5 | Soft | Grey | Clayey | Silt | Silt |
| 9727304 | 3.5 | 5 | Loose | | Clayey | Sand And Gravel | Sand And Gravel |
| 9727305 | 5 | 5.8 | Soft | Grey | Clayey | Silt | Silt |
| 9727306 | 5.8 | 6.2 | | | Medium to Coarse | Sand And Gravel | Sand And Gravel |
| 9727307 | 6.2 | 7.15 | Soft | | Gravelly | Silt | Silt |
| 9727308 | 7.15 | 8 | | Dark Grey | Silty Stony | Clay | Clay |
| 9727309 | 8 | 10.35 | Compact | | Medium to Coarse | Sand, Gravel And Boulders | Sand, Gravel And Boulders |
| 9727310 | 10.35 | 15.7 | | | Fine to Medium | Sand | Sand |
| 9727311 | 15.7 | 27 | Compact | | Coarse Sandy | Gravel, Cobbles And Boulders | Gravel, Cobbles And Boulders |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 97274 (Company Name: 5)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|------|------|----------|------------|--------------------------|---------------------------------|---------------------------------|
| 9727401 | 0 | .15 | | | | Fill - Made Ground | Fill - Made Ground |
| 9727402 | .15 | 2 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 9727403 | 2 | 4 | | Grey | Organic | Silt | Silt |
| 9727404 | 4 | 4.6 | | Dark Grey | Very Silty | Gravel | Gravel |
| 9727405 | 4.6 | 6 | | | Medium to Coarse | Sand And Gravel | Sand And Gravel |
| 9727406 | 6 | 6.5 | Soft | Grey | Clayey | Silt | Silt |
| 9727407 | 6.5 | 13.7 | Coarse | | Sandy Gravelly | Gravel, Cobbles And Boulders | Gravel, Cobbles And Boulders |
| 9727408 | 13.7 | 17.5 | Stiff | Grey Green | Silty Clayey | Silt And Clay | Silt And Clay |
| 9727409 | 17.5 | 27.3 | Compact | | Coarse Sandy Gravelly | Sand And Gravel | Sand And Gravel |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 97275 (Company Name: 6)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|------|------|-----------------|------------|--------------------------|---------------------------------|---------------------------------|
| 9727501 | 0 | .15 | | | | Fill - Made Ground | Fill - Made Ground |
| 9727502 | .15 | 2 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 9727503 | 2 | 3.15 | Soft | Grey Brown | Clayey | Silt | Silt |
| 9727504 | 3.15 | 4 | Soft | Grey | Very Sandy | Silt | Silt |
| 9727505 | 4 | 4.9 | Loose | | Coarse Sandy | Gravel | Gravel |
| 9727506 | 4.9 | 5.5 | Soft | Grey | Clayey | Silt | Silt |
| 9727507 | 5.5 | 6.5 | Compact | | Fine Gravelly | Sand And Gravel | Sand And Gravel |
| 9727508 | 6.5 | 8 | Soft | Grey | Organic | Silt | Silt |
| 9727509 | 8 | 12 | Compact | | Coarse Sandy Gravelly | Gravel | Gravel |
| 9727510 | 12 | 13.3 | Compact | | Very Coarse | Gravel, Cobbles And Boulders | Gravel, Cobbles And Boulders |
| 9727511 | 13.3 | 15 | Very Stiff | Brown | Very Stony | Clay, Cobbles And Boulders | Clay, Cobbles And Boulders |
| 9727512 | 15 | 15.6 | | | Very Coarse Gravelly | Gravel And Cobbles | Gravel And Cobbles |
| 9727513 | 15.6 | 27 | Very Compact | | Coarse Sandy | Gravel, Cobbles And Boulders | Gravel, Cobbles And Boulders |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 97276 (Company Name: 7)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|------------|-------------|----------------------|------------------------------|------------------------------|
| 9727601 | 0 | .15 | | | | Fill - Made Ground | Fill - Made Ground |
| 9727602 | .15 | 2.6 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 9727603 | 2.6 | 4.65 | Very Soft | Grey Brown | Organic | Silt And Clay | Silt And Clay |
| 9727604 | 4.65 | 5.3 | Loose | | Coarse Sandy Silty | Silt | Silt |
| 9727605 | 5.3 | 6 | | Grey | Gravelly | Silt | Silt |
| 9727606 | 6 | 7 | Loose | | Fine to Coarse | Sand And Gravel | Sand And Gravel |
| 9727607 | 7 | 7.8 | | Grey | Slightly Sandy Silty | Silt | Silt |
| 9727608 | 7.8 | 10.2 | Compact | | Coarse | Gravel And Cobbles | Gravel And Cobbles |
| 9727609 | 10.2 | 11 | Coarse | | Sandy | Gravel | Gravel |
| 9727610 | 11 | 14.65 | Compact | | Very Coarse | Gravel And Cobbles | Gravel And Cobbles |
| 9727611 | 14.65 | 16.4 | Stiff | Grey | Clayey | Clay | Clay |
| 9727612 | 16.4 | 17.3 | Stiff | Grey | Silty Clayey | Clay | Clay |
| 9727613 | 17.3 | 18.8 | Very Stiff | Light Brown | Silty, Very Stony | Clay, Cobbles And Boulders | Clay, Cobbles And Boulders |
| 9727614 | 18.8 | 27 | Compact | | Very Coarse Sandy | Gravel, Cobbles And Boulders | Gravel, Cobbles And Boulders |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 97277 (Company Name: 8)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|----------|------------|-------------------|------------------------------|------------------------------|
| 9727701 | 0 | .15 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 9727702 | .15 | 2 | | | | Fill - Made Ground | Fill - Made Ground |
| 9727703 | 2 | 4.3 | Soft | Grey | Clayey | Silt | Silt |
| 9727704 | 4.3 | 5.8 | Loose | | Coarse Silty | Sand And Gravel | Sand And Gravel |
| 9727705 | 5.8 | 6.75 | Loose | | Fine Silty | Sand And Gravel | Sand And Gravel |
| 9727706 | 6.75 | 7.4 | | Grey | Organic | Gravel And Silt | Gravel And Silt |
| 9727707 | 7.4 | 14 | Compact | | Very Coarse Sandy | Gravel, Cobbles And Boulders | Gravel, Cobbles And Boulders |
| 9727708 | 14 | 18.7 | Stiff | Grey Green | Clayey Silty | Clay And Silt | Clay And Silt |
| 9727709 | 18.7 | 19.05 | | | | Fill - Made Ground | Fill - Made Ground |
| 9727710 | 19.05 | 19.7 | Stiff | Grey | Silty Clayey | Clay | Clay |
| 9727711 | 19.7 | 21.6 | Stiff | Brown | Silty Clayey | Silt And Clay | Silt And Clay |
| 9727712 | 21.6 | 23.7 | Stiff | Green | Very Silty | Clay | Clay |
| 9727713 | 23.7 | 29 | Compact | | Very Coarse Sandy | Gravel, Cobbles And Boulders | Gravel, Cobbles And Boulders |

GSi REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 97278 (Company Name: 9)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|--------------|-------------|------------------|------------------------------|------------------------------|
| 9727801 | 0 | .15 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 9727802 | .15 | 2.8 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 9727803 | 2.8 | 3.45 | Soft | Grey | Very Silty | Clay | Clay |
| 9727804 | 3.45 | 4.9 | Soft | Grey | Silty Stony | Silt And Stones | Silt And Stones |
| 9727805 | 4.9 | 5.3 | Firm | Grey | Clayey | Silt | Silt |
| 9727806 | 5.3 | 7.45 | Loose | | Medium to Coarse | Sand And Gravel | Sand And Gravel |
| 9727807 | 7.45 | 8.3 | Firm | Grey | Clayey | Silt | Silt |
| 9727808 | 8.3 | 10.8 | Compact | | Coarse Sandy | Gravel And Cobbles | Gravel And Cobbles |
| 9727809 | 10.8 | 12.8 | Compact | | Coarse Gravelly | Gravel, Cobbles And Boulders | Gravel, Cobbles And Boulders |
| 9727810 | 12.8 | 14.15 | Very Stiff | Light Brown | Sandy Clayey | Clay, Cobbles And Boulders | Clay, Cobbles And Boulders |
| 9727811 | 14.15 | 14.6 | | Grey | Silty | Gravel And Boulders | Gravel And Boulders |
| 9727812 | 14.6 | 17 | Compact | | Medium to Coarse | Sand, Gravel And Boulders | Sand, Gravel And Boulders |
| 9727813 | 17 | 30 | Very Compact | | Medium to Coarse | Sand, Gravel And Boulders | Sand, Gravel And Boulders |

GSI REPORT 1167

ESB Marino Power Station

LAYERS FOR BOREHOLE 97279 (Company Name: 10)

| LAYER | TOP | BASE | STRENGTH | COLOUR | MINORLITH | MAJORLITH | INTERPRETATION |
|---------|-------|-------|----------|--------|-----------------------|--------------------|--------------------|
| 9727901 | 0 | .15 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 9727902 | .15 | 2.7 | | | Clayey | Fill - Made Ground | Fill - Made Ground |
| 9727903 | 2.7 | 4.35 | Soft | Grey | Silty | Silt | Silt |
| 9727904 | 4.35 | 6 | Loose | Grey | Very Sandy | Silt | Silt |
| 9727905 | 6 | 6.5 | Loose | | Medium to Coarse | Gravel | Gravel |
| 9727906 | 6.5 | 8.1 | Loose | | Very Sandy Silty | Gravel | Gravel |
| 9727907 | 8.1 | 11.25 | Compact | | Fine to Coarse | Gravel | Gravel |
| 9727908 | 11.25 | 15.6 | Compact | | Very Coarse Sandy | Gravel And Cobbles | Gravel And Cobbles |
| 9727909 | 15.6 | 16 | Compact | | Coarse Gravelly | Sand And Gravel | Sand And Gravel |
| 9727910 | 16 | 30 | Compact | | Coarse Sandy Gravelly | Gravel And Cobbles | Gravel And Cobbles |

Summary of Geotechnical boreholes from Marina Generating Station Report (1974)

| ID | Depth (mBGL) | Geology |
|----------------|--------------|--|
| Borehole no. 1 | 0 – 3.05 | Rubble sand MADE GROUND |
| | 3.05 – 6.4 | Dark grey soft greyish estuarine CLAY and SILT with shells |
| | 6.4 – 28.04 | Clayey reddish SAND & GRAVEL |
| Borehole no. 2 | 0 – 3.05 | Clayey sand gravel rubble MADE GROUND |
| | 3.05 - 7.92 | Dark grey plastic greyish estuarine CLAY and SILT |
| | 7.92 – 15.85 | Clayey reddish GRAVEL and SAND |
| Borehole no. 3 | 0 – 4.42 | Dark grey gravelly CLAY |
| | 4.42 – 14.02 | Reddish brown sand and GRAVEL |
| Borehole no. 4 | 0 – 4.09 | Foundry sand (clinker?) and rubble MADE GROUND |
| | 4.09 – 6.53 | Grey plastic CLAY with decayed vegetation and shells |
| | 6.53 – 46.63 | Reddish brown clayey fine SAND and GRAVEL |
| Borehole no. 5 | 0 – 4.88 | Grey clayey silty MADE GROUND |
| | 4.88 – 7.75 | Grey estuarine SILT with shells |
| | 7.75 – 28.96 | Red clayey fine SAND and GRAVEL |
| Borehole no. 6 | 0 – 2.57 | Brownish SILT with shells |
| | 2.57 – 7.01 | Fine reddish SAND with GRAVEL |
| Borehole no. 7 | 0 – 4.57 | MADE GROUND comprising gravelly clinker with light brown sand and metal pieces |
| | 4.57 – 9.75 | Soft grey sandy and |

| | | |
|-----------------|---------------|---|
| | | gravelly SILT alluvium |
| | 9.75 – 30.48 | Reddish-brown silty sand and coarse GRAVEL with cobbles |
| Borehole no. 8 | 0 – 3.66 | Dark brown sandy and gravelly MADE GROUND with black slag clinker |
| | 3.66 – 9.6 | Soft grey sandy and gravelly SILT alluvium with some shells |
| | 9.6 – 30.48 | Reddish-brown clayey sand and coarse GRAVEL with cobbles |
| Borehole no. 9 | 0 – 3.81 | Dark brown sandy and gravelly MADE GROUND with black slag clinker and brick pieces |
| | 3.81 – 12.19 | Soft grey sandy and gravelly SILT alluvium with some cobble basal layers |
| | 12.19 – 28.55 | Reddish-brown clayey sand and coarse GRAVEL with cobbles |
| Borehole no. 10 | 0 – 2.9 | Topsoil rootlets with soft dark brown gravelly MADE GROUND. Brick pieces and slag waste |
| | 2.9 – 10.82 | Soft grey sandy and gravelly SILT alluvium with some shells and vegetable matter |
| | 10.82 – 30.48 | Reddish-brown clayey sand and coarse GRAVEL with cobbles |
| Borehole no. 11 | 0 – 4.88 | Dark brown sandy and gravelly MADE GROUND with clinker ash deposits |
| | 4.88 – 5.79 | Soft grey sandy and gravelly CLAY alluvium with some shells |
| | 5.79 – 21.34 | Reddish-brown clayey sand and coarse GRAVEL with cobbles |
| Borehole no. 12 | 0 – 4.57 | Dark brown sandy and gravelly MADE GROUND |

| | | |
|-----------------|--------------|--|
| | | with clinker ash deposits |
| | 4.57 – 21.34 | Fine, medium and coarse reddish brown SAND with GRAVEL and cobbles |
| Borehole no. 13 | 0 – 3.96 | Dark brown sandy and gravelly MADE GROUND with some brick rubble |
| | 3.96 – 7.01 | Soft grey sandy and gravelly SILT |
| | 7.01 – 24.99 | Reddish-brown clayey sand and coarse GRAVEL with cobbles |
| Borehole no. 14 | 0 – 2.74 | Dark brown sandy and gravelly MADE GROUND with clinker slag and metal pieces |
| | 2.74 – 5.79 | Soft grey sandy and gravelly SILT |
| | 5.79 – 24.08 | Reddish-brown clayey sand and coarse GRAVEL with cobbles |
| Borehole no. 15 | 0 – 4.27 | Dark gravelly sandy MADE GROUND with scrap metal and clinker ash/slag |
| | 4.27 – 6.4 | Soft grey sandy and gravelly SILT |
| | 6.4 – 28.96 | Reddish-brown clayey sand and coarse GRAVEL with cobbles |



APPENDIX G

IRISH WATER RISK ASSESSMENT CORRESPONDENCE



From: [REDACTED]
Sent: Wednesday 19 February 2020 12:34
To: [REDACTED] (ESB Networks)
Cc: HQDWcompliance ; [REDACTED] ; [REDACTED]
Subject: RE: ESB enquiry regarding risk to water supply from cable fluid leaks

Dear [REDACTED]

Further to your query (within the attached email), we have examined the locations within your interactive map and cross referenced against the results from our regulatory monitoring programme for **Total Polyaromatic Hydrocarbons** (Total PAHs) and **Benzene**, from 2014 to date. Without knowing the exact chemical composition of the oil used to fill ESB cables, these are the closest parameters we can find from our monitoring programme that would be representative of potential oil contamination.

For the relevant supplies within the Greater Dublin Area, we have recorded zero exceedances of the parametric value (i.e. legally allowable limit) for Total PAHs (which is 0.1µg/L) and Benzene (which is 1µg/L) within this period. The same is true for the Cork City area.

A summary of these results are collated in the following table

| Location Assessed | Number of Samples tested for PAH | Number of exceedances for PAH | Number of Detections* for PAH | Number of Samples tested for Benzene | Number of exceedances for Benzene | Number of Detections* for Benzene |
|---------------------|----------------------------------|-------------------------------|--------------------------------------|--------------------------------------|-----------------------------------|-----------------------------------|
| Greater Dublin Area | 981 | 0 | 15 (Range detected 0.01-0.04µg/L) | 980 | 0 | 2 (Range detected 0.1-0.4µg/L) |
| Cork City | 61 | 0 | 1 (Result: 0.02µg/L) | 61 | 0 | 0 |

* **Detections** – where the result was above the limit of detection for the test in question, i.e. the test returned an actual concentration of the analyte

These results (which are from samples taken at the customer tap) would not indicate that leaks from oil filled cables have contaminated the drinking water supply for these areas, or at least to an extent where any contamination arising has resulted in a breach of the parametric value for PAHs and Benzene.

Notwithstanding what these results indicate, oil contamination in drinking water is a **serious public health matter**, and every effort should be made to ensure the likelihood of oil leaks from ESB cables coming into contact with water pipes is minimised to the **lowest possible extent**. Whilst our water mains are pressurised, should pressure levels drop for any reason (nearby burst for example),



contaminated groundwater could potentially infiltrate into our mains. Benzene in particular could also pose a risk to our PVC and Polyethylene pipes.

I trust this analysis and commentary is sufficient for your risk assessment.

Regards,

[Redacted]

*Drinking Water Compliance Lead
Environmental Regulation*

Uisce Éireann

Teach Colvill, 24-26 Sráid Thalbóid, Balie Átha Cliath 1

Irish Water

Colvill House, 24-26 Talbot Street, Dublin 1, Ireland

[Redacted]

Pesticide awareness – the protective foil of a pesticide container can contain enough product to cause a pesticide exceedance along a 30km stretch of a stream!