agricultural grassland (GA1) and some linear treelines (WL2) to the west and south. The habitats surveyed within the wider St. Anne's Park comprised of man-made open water features in the Model Garden, Duck Pond, and City Farm (not visible on the map) (FL8) and drainage ditches (FW4) – one of which drains into a tributary of the Naniken River within a copse of mixed broadleaf woodland (WD1), and the other drains the lands from Mount Prospect Avenue, north to the Red Stables and eastwards through the lower park to the south lagoon at North Bull Island (Fig. 2).

Fig. 1 Boundary map of the proposed "Foxlands" development site at St. Anne's Park, Raheny, Dublin 5 exhibiting the extensive amenity grasslands that dominate the site. The yellow bar shows the division of the "main section" from the "access corridor section" for the purposes of this report.

Fig. 2. A map indicating surveyed wetland areas with potential suitability for amphibians and the location of the proposed "Foxlands" development (outlined in red).

2.2 DESKTOP STUDY

A comprehensive search of all relevant and publicly accessible databases (NBDC, iNaturalist, etc.), grey literature, and other sources was conducted prior to the onset of surveys. Search criteria was limited to a 2km from the proposed development site and restricted to the last 10 years. This limitation is based on realistic dispersal capabilities of the species being surveyed and the availability of dispersal corridors in this area. The ponds and other key features present

on the site are compared to historical maps available through the OSI Geohive to determine if they have any historical significance.

2.3 FIELD SURVEYS

Standard survey methods appropriate for detecting amphibians e.g., visual encounter searches via torch lighting and dip netting, were employed (Griffiths et al. 1996; NRA guidelines (2009); Sewell et al. 2013). Submerged funnel traps were not deployed during these surveys as (i) the water bodies were sufficiently shallow and/or clear to permit conclusive visual encounter surveys combined with dip net sampling; and (ii) the surveys were undertaken at a suboptimal time for detection of adult newts and their larvae, or frog tadpoles, particularly in waterbodies that contain multiple species of fish that are known to prey on native amphibians, their eggs, and larvae. Any natural or artificial refugia present near the waterbodies were inspected (e.g., wood stumps). Visual encounter surveys and dip netting surveys were conducted at each pond except from the ditch north of Belgrove Park. An incident whereby foul water/sewerage had entered the ditch via an inlet from the western side of the park rendering dip netting an unhygienic endeavour. All visual encounter surveys were conducted during periods of suitable weather (warm, calm, and humid without mist/very light rain). All sightings of a focal species or other deemed relevant, were recorded on a Garmin 60CSx GPS unit or suitably equipped smart phone. Given the timing of the surveys, common frog spawn counts and breeding effort estimation were not possible. However, in this case, the proposed development has no areas of standing water nor other wetland habitats. Therefore, any estimation of frog spawn counts would be conducted at the nearest possible waterbody outside of the proposed development footprint. In this case that would be the Model Garden ponds, some 700m meters away from the eastern boundary of the proposed development, and the last known breeding site for common frogs in the park in 2016 (R Gandola/HSI, pers obs.)

3. RESULTS

3.1 SURVEY AREAS

The proposed development site does not have any habitat suitable for either native amphibian species that could potentially inhabit the area apart from some potential foraging habitat within

the linear treelines or some copse of mixed woodland. The Model Garden has two ponds, of which, the western most is the last known site of common frog reproduction within the park. Both ponds offer suitable habitat for both the common frog, and to a lesser extent, the smooth newt. The City Farm ponds are small but are likely to offer suitable habitat for breeding common frogs as they can be unfussy with the wetlands in which they spawn where other options are limited. The Duck Pond is thought to have been installed at some point between 1897 and 1913 as it appears on the Historic 25inch OSi map for the area. The Duck Pond offers some habitat for native amphibians and is the last known site of breeding smooth newts in the park (1960's). However, this pond does contain multiple fish species and has been stocked in the recent past, making it less than ideal for amphibians. The ditch to the north of Belgrove Park is a typical over-shaded woodland ditch. While it retains water, is it is also subject to foul water inputs and therefore of very limited use for native amphibians who like open, shallow, warm water. The ditch that drains the area from Mount Prospect Avenue to the south lagoon may offer suitable breeding habitat for the common frog near to its entry point into the park at certain times of year. However, this ditch tends to be regularly overgrown and was dry during the survey visits.

3.2 DESKTOP STUDY

A total of three (n = 3) historical records were discovered within a 2km radius of the proposed development. Records from west of the Sybill Hill Road were not deemed to be important to this assessment as the road is likely to pose a significant barrier to dispersal as is the housing estate habitat which would need to be navigated in order to reach the park. A single record from North Bull Island was not retained as the causeway road and the Howth Road between the island and the Parklands are likely to be major barriers to outwards dispersal from the island. It is likely that common frogs occupy more gardens in close vicinity to the park than is currently known.

3.3 FIELD SURVEYS

Surveying took place on two occasions during periods of warm and humid, calm weather on **8th July 2022 and 10th July 2022**. On both occasions surveys began at 21:30. Supplementary surveys were conducted during daylight hours on **16th July** and **17th July 2022**, respectively as access to the Model Gardens was not possible at night.

Model Garden

Although ample suitable habitat exists for both species in the ponds and immediate area, neither species of amphibian were detected through dip. The pond life here is dominated by water slaters (*Asellus aquaticus*), Leeches (*Eropdella sp.*), pond skaters (*Gerris lacustris*), lesser water boatmen (*Corixa sp.*) and Mayfly (Ephemeroptera: *Cloeon sp.*). These ponds have undergone restoration works in recent years, are likely to still be maturing, and are likely to return to their former levels of biodiversity richness over time.

Duck Pond

Neither species of native amphibian were detected using the duck pond or were encountered in a number of suitable terrestrial habitats in the immediate vicinity of the pond. Other wildlife encountered using the pond was an adult hawker dragonfly (*Aeshna sp.*), seen "hawking" over the pond surface on 8/7/22. Twenty Swifts (*Apus apus*) were counted foraging above the pond. Breeding mallards (*Anas platyrhynchos*), moorhen (*Gallinula chloropus*), coots (*Fulica atra*), Little grebe (*Tachybaptus ruficollis*) and brown rats (*Rattus norvegicus*) were also seen active in the pond. Approximately 20 little egrets (*Egretta garzetta*) were also counted coming into roost in the heronry near to the duck pond.

Torching resulted in the detection of no fewer than 14 individuals of the critically endangered European eel (*Anguilla anguilla*) of multiple size and age classes (e.g., elvers, yellow eels, and silver eels; see Appendix 1) on the 08/07/2022 and 19 individuals on 13/07/2022. Two individuals of the three-spined stickleback (*Gasterosteus aculeatus*) were also captured by netting with many more individuals seen by torchlight.

An unidentified damselfly nymph (Odonata) and *Cloeon sp.* of Mayfly were also detected in the pond edge among some floating algae, as were Ramshorn snails (Planorbidae), pond snails (*Lymnaea sp.*), leeches (*Eropdella sp.)* and water slaters (*Ascellus aquaticus*) were amongst

the most common species obtained by dip netting. Four bat species were detected foraging over the pond using a Magenta Bat 5 heterodyne detector. The species were identified as Common pipistrelle (*P. pipistrellus*), Soprano pipistrelle (*P. pygameus*), Leisler's bat (*Nyctalus leisleri*), and Daubenton's bat (*Myotis daubentonii*).

The Eurasian otter (*Lutra lutra*) has also been seen foraging in this pond (pers obvs. June 2020). At least one other bat species has also previously been detected foraging over this pond during the summer months (pers obvs); Brown long-eared bat (*Plecotus auritus*),

City Farm

Volunteer staff at the City Farm indicated that frog spawn had been introduced to the City Farm ponds by another volunteer from an unknown source location. This spawn had been allowed to develop naturally and the froglets had been allowed to emerge and disperse into the adjoining allotment area and wider park. This may result in recolonization of the park by this species

4. IMPACT ASSESSMENT

4.1 POTENTIAL DETRIMENTAL IMPACTS

Destruction and Disturbance of breeding & foraging habitats

The development of "Foxlands" is highly unlikely to have any detrimental impact on common frogs or newts as there are no suitable breeding habitats available to them within the footprint of the proposed development. The majority of potential foraging areas form the boundaries the site and therefore impact is likely to be minimal. However, no observations of any amphibian using these linear habitats have been recorded to date suggesting that the habitat is of poor suitability for amphibians.

Accidental mortality & population decline

It is unlikely that any clearance works will pose a risk of killing or injuring frogs and newts as they do not occupy the proposed development site. Even so, care must be taken that works do

not create more favourable features for amphibians in the process of clearance or construction e.g., flooded excavations etc.

4.2 MITIGATION MEASURES FOR AMPHIBIANS

Prior to the initiation of works, an appropriate exclusion barrier(s) should be installed around the boundary line to exclude any amphibians that may be cryptically using the area. This may be combined with other beneficial and necessary mitigation works (e.g., the installation of a silt trap fence line to protect the Naniken River etc.). Caution should be taken at all times to mitigate the chances of a negative interaction with amphibians that may unexpectedly be encountered on site.

Irrespective of whether both, one, or neither amphibian species are resident near or on the proposed site, the proposed landscape masterplan has included nature friendly SuDs to deal with surface water and pluvial flooding events in the form of rain gardens and a subterranean attenuation tank (see Appendix 2). On-site attenuation of surface run-off will not only assist in alleviating pressure on the local surface water drainage network and overflows to the Naniken River, but they will also conform to best practice of incorporating functioning SuDs features of high amenity value into the landscape, that will also be of benefit to local wildlife populations. In parts of the development where surface level gully pot type drains are required, then recessed kerbs and "amphibian ladders" should be installed as another wildlife friendly measure. These additional features provide all wildlife an opportunity to avoid or escape falling into the surface water drainage system.

5. RECOMMENDATIONS

- Retention of a suitably qualified and licenced Ecological Clerk of Works during the construction phase
- Employ the precautionary principle for cryptic wildlife when undertaking clearance and construction works
- Installation of exclusion barriers and/or temporary landscaping to divert amphibians/other wildlife away from the works and protect the Naniken River
- Initiate works in the middle of the site and work outwards with controlled clearance of areas i.e., sequentially rather than all at once.

6. CONCLUSION

The proposed "Foxlands" development is unlikely to have any direct impacts on common frogs or smooth newts as they are not known to occur on the site. However, an appropriate containment and surface water drainage and management plan is of utmost importance as any spillage/pollution/contamination event into the Naniken River could have a catastrophic effect on the Duck Pond and the wildlife which use it for foraging, some of which are either critically endangered (European eels) or protected under the EU Habitats Directive (Annex IV) e.g., bat species and Eurasian otter).

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APPENDIX 1

A1.1 Video still of critically endangered European eels of multiple size classes and ages dip netted from the Duck Pond at St. Anne's Park, Raheny, Dublin 5.

Appendix 2

A2.1 The proposed landscape masterplan map for "Foxlands".

Appendix H Naniken Freshwater Survey Report

Enviroguide CONSULTING

FRESHWATER ECOLOGY SURVEY OF THE NANIKEN STREAM

FOR

A MIXED USE DEVELOPMENT

AT

LANDS EAST OF ST PAUL'S COLLEGE, SYBIL HILL ROAD, RAHENY, DUBLIN 5

ON BEHALF OF

RAHENY 3 LIMITED PARTNERSHIP

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DOCUMENT CONTROL SHEET

Client	Raheny 3 Limited Partnership
Project Title	Mixed use Development at lands east of St Paul's College, Sybil Hill Road, Raheny, Dublin 5.
Document Title	Freshwater Ecology Survey Report

Rev.	Status	Author(s)	Reviewed by	Approved by	Issue Date
00	Draft	Dr Siobhán Atkinson *Senior Ecologist*	Liam Gaffney *Senior Ecologist*	-	-
01	Final	Dr Siobhán Atkinson *Senior Ecologist*	Liam Gaffney *Senior Ecologist*	Jim Dowdall *Director*	19/08/2022

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1 INTRODUCTION

1.1 Background

Enviroguide Consulting was commissioned by Raheny 3 Limited Partnership to undertake a biological assessment of the Naniken Stream in the vicinity of the Proposed Development (Foxlands) at St. Paul's College, Sybil Hill, Raheny, Dublin 5. The assessment comprised a physical habitat walk over survey of the length of the Naniken stream from where it enters St. Anne's Park to where it outflows into Dublin Bay. A macro-invertebrate sample was collected and assessed to determine the biological water quality (Q Rating) of the stream. This report details the findings of the assessment.

1.2 Evidence of Technical Competence and Experience

Synergy Environmental Ltd., T/A Enviroguide Consulting, is wholly Irish Owned multi-disciplinary consultancy specialising in the areas of the Environment, Waste Management and Planning. All of Enviroguide's consultants carry scientific or engineering qualifications and have a wealth of experience working within the Environmental Consultancy sectors, having undergone extensive training and continued professional development.

Enviroguide Consulting as a company remains fully briefed in European and Irish environmental policy and legislation. Enviroguide employees are highly qualified in their field. Professional memberships include the Chartered Institution of Wastes Management (CIWM), the Irish Environmental Law Association and Chartered Institute of Ecology and Environmental Management (CIEEM).

Dr Siobhán Atkinson is a Senior Ecologist at Enviroguide Consulting and is responsible for carrying out freshwater surveys. Siobhán has a B.Sc. (Hons) in Environmental Biology and a Ph.D. in Freshwater Biology from University College Dublin, and extensive experience in Geographic Information Systems (GIS), desktop research, literature review and reporting, as well as practical field and laboratory experience including environmental DNA analysis, freshwater macroinvertebrate sampling, and identification, physical river habitat surveys, fish sampling and processing and terrestrial habitat surveying.

Siobhán has prepared Ecological Impact Assessments (EcIA), Stage I and Stage II Appropriate Assessment Reports, Habitat Surveys and Invasive Species Surveys and input and reviewed Ecological and Environmental assessments for several EIA Reports. Siobhán is the first author of several publications relating to barriers to riverine connectivity in Ireland.

2 METHODOLOGY

2.1 Desk Study

A desktop study was carried out to collate and review available information, datasets and documentation sources pertaining to the River Naniken. The desktop study relied on the following sources:

- Information on species records and distributions, obtained from the National Biodiversity Data Centre (NBDC) at www.maps.biodiversityireland.ie ;
- Information on waterbodies, catchment areas and hydrological connections obtained from the Environmental Protection Agency (EPA) at www.gis.epa.ie ;
- Information on bedrock, groundwater, aquifers and their statuses, obtained from Geological Survey Ireland (GSI) at www.gsi.ie ;
- Satellite imagery and mapping obtained from various sources and dates including Google, Digital Globe, Bing and Ordnance Survey Ireland;
- Dublin City Otter Survey (Macklin et al., 2019).

2.2 Field Survey

2.1.1 Walkover Survey

A walkover survey of the length of the Naniken stream from where it enters St. Annes Park to where it outflows into Dublin Bay was undertaken on the 24th September 2021. The aim of the walkover survey was to undertake a general physical habitat assessment of the river channel and riverbanks and fisheries habitat assessment, taking into account the following features:

- Channel morphology and flow types,
- Substrate
- Barriers to connectivity
- Bank structure and stability
- Bank and bank top vegetation
- Adjacent land use

2.1.2 Biomonitoring

A biological water quality assessment of the Naniken was undertaken using benthic macroinvertebrates as bioindicators. Benthic macroinvertebrates are an excellent tool for water quality assessment as they exhibit differential responses to physical and chemical changes in their environment. Macroinvertebrate community diversity declines in the presence of pollution, and sensitive species are progressively replaced by more tolerant forms as pollution increases. As such, macroinvertebrates provide a realistic record of prevailing water quality conditions.

The Quality Rating (Q) System (Toner et al, 2005) is the standard biotic index which is used by the Irish EPA and was used to assess biological water quality at each site. The EPA Q-value classification is on a five-point scale, Q1- Q5, with intermediate scores obtainable, e.g. Q3-4. Q1 represents the poorest water quality whereas Q5 represents pristine/unpolluted water. Q-values are based on the proportions of five 'Indicator Groups' of macroinvertebrates, with different pollution tolerances: Group A, the sensitive forms, Group B, the less sensitive forms, Group C, the tolerant forms, Group D, the very tolerant forms and Group E, the most tolerant forms (Toner et al., 2005). The scheme mainly reflects the effects of organic pollution (i.e. deoxygenation and eutrophication).

Q-values are related to four Water Quality Classes (Unpolluted, Slightly Polluted, Moderately Polluted and Seriously Polluted) and to Water Framework Directive (WFD) water status as outlined in Table 1.

TABLE 1. THE Q-VALUE AND CORRESPONDING WFD STATUS AND POLLUTION GRADIENT.

Q-value Score	WFD Status	Pollution Gradient	Quality Class
Q5	High	Unpolluted	Class A
Q4-5	High	Unpolluted	Class A
Q4	Good	Unpolluted	Class A
Q3-4	Moderate	Slightly polluted	Class B
Q3	Poor	Moderately polluted	Class C
Q2-3	Poor	Moderately polluted	Class C
Q2	Bad	Seriously polluted	Class D
Q1-2	Bad	Seriously polluted	Class D
Q1	Bad	Seriously polluted	Class D

Class A waters are those in which problems relating to existing or potential beneficial uses are unlikely to arise and they are, therefore, regarded as being in a 'satisfactory' condition. Classes B, C and D are to a lesser or greater extent 'unsatisfactory' in this regard. For example, the main characteristic of Classes B and C waters is eutrophication which may interfere with the amenity, abstraction or fisheries potential. In Class D waters excessive organic loading leads to deoxygenation and may produce 'sewage fungus' growths, and as a consequence most beneficial uses are severely curtailed or eliminated (Toner et al., 2005).

The sampling method adopted was that applied by the Irish EPA in the national river monitoring programme (Feeley et al., 2020). The ideal timeframe for carrying out biomonitoring is between June to September when flows are likely to be relatively low and water temperatures highest. Surveys during this period are likely to coincide with the worst conditions to be expected in those reaches affected by waste inputs. River macroinvertebrates were collected on the 24th of September 2021 for this assessment. The sampling site location is indicated in Figure 1.

Using an FBA (Freshwater Biological Association) pond net (1mm mesh), a semi-quantitative, 2-minute kick-sample was collected from the riverbed. The sample was collected from faster flowing riffle/run habitat. A further one-minute stone-wash was undertaken (Feeley et al., 2020). To minimize disturbance, sampling was carried out in a downstream to upstream direction. Bankside habitat assessments, visual estimates of the percentage of flow and substrate types and the percentage of riparian shading was carried out. A once-off measurement of pH and conductivity was undertaken using a probe.

Live macroinvertebrate samples were sorted on the riverbank on a white tray using a head torch. Taxa were preserved in 70% Industrial Methylated Spirits (IMS) and identified by microscope. An EPA Q-value classification was assigned to each sample by recording the taxa present at a suitable taxonomic resolution and their categorical relative abundance.

FIGURE 1. LOCATION OF NANIKEN RIVER, DUCK POND AND BIOMONITORING SAMPLING SITE.

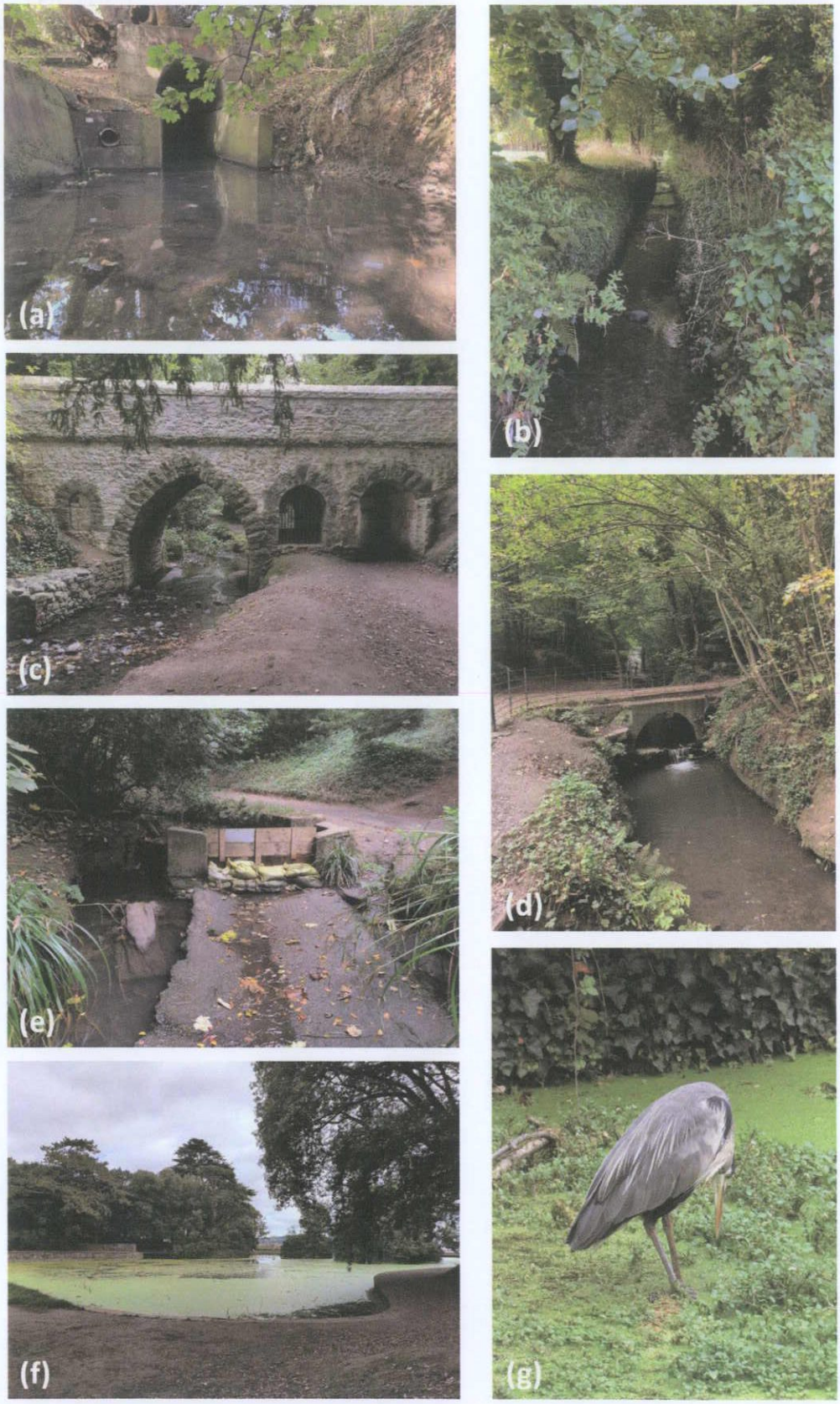

PLATE 1. PHOTOGRAPHS OF THE NANIKEN RIVER SHOWING (A) THE RIVER AT HOWTH ROAD CULVERT, (B) CHANNELISED AND STRAIGHTENED SECTION OF THE RIVER, (C) BANK EROSION, (D) PERCHED CULVERT (E) MODIFIED RIVER CHANNEL AT THE DUCK POND INLET (F) THE DUCK POND AND (G) HERON FEEDING ON THE DUCK POND.

3 RESULTS

3.1 Desk Study

The Naniken River is a small river located on the north side of Dublin city within St. Anne's Park, Raheny. It enters St. Anne's Park from a culvert on the R105 (Howth Road) and flows eastwards for approximately 1.7 km through the park before discharging into Raheny Strand and Dublin Bay.

The river is located within the terrestrial buffer zone of Dublin Bay Biosphere. There are no EPA monitoring stations on this river (EPA, 2021). The river is underlain by limestone till and is situated on a locally important aquifer (Ll) (GSI, 2021). Groundwater vulnerability in the area is *Low* (GSI, 2021).

Relevant records of relevant freshwater fauna from the National Biodiversity Data Centre tetrad associated with the river are shown in Table 2. Common Frog, dragonflies, invasive reptiles (Red-eared Terrapin and Yellow-bellied Slider) and waterfowl[1] were recorded.

TABLE 2. NATIONAL BIODIVERSITY DATA CENTRE RECORDS FOR FRESHWATER SPECIES.

Taxon	Date of Last Record	Title of Dataset	Designation
Common Frog (*Rana temporaria*)	24/02/2018	Amphibians and reptiles of Ireland	Protected Species: EU Habitats Directive Annex V Protected Species: Wildlife Acts
Common Hawker (*Aeshna juncea*)	18/09/2019	Dragonfly Ireland 2019 to 2024	
Migrant Hawker (*Aeshna mixta*)	17/08/2019	Dragonfly Ireland 2019 to 2024	
Red-eared Terrapin (*Trachemys scripta*)	08/06/2013	Local BioBlitz Challenge 2013	Invasive Species EU Regulation No. 1143/2014
Yellow-bellied Slider (*Trachemys scripta scripta*)	25/02/2012	National Invasive Species Database	
Common Moorhen (*Gallinula chloropus*)	08/06/2013	Local BioBlitz Challenge 2013	
Eurasian Teal (*Anas crecca*)	31/12/2011	Bird Atlas 2007 - 2011	Wildlife Acts EU Birds Directive Annex II
Mallard (*Anas platyrhynchos*)	08/06/2013	Local BioBlitz Challenge 2013	Wildlife Acts EU Birds Directive Annex II & Annex III
Northern Shoveler (*Anas clypeata*)	07/03/2018	Birds of Ireland	Wildlife Acts EU Birds Directive Annex II & Annex III
Eurasian Wigeon (*Anas penelope*)	31/12/2011	Bird Atlas 2007 - 2011	Wildlife Acts EU Birds Directive Annex II & Annex III
Eurasian Spoonbill (*Platalea leucorodia*)	13/03/2013	Rare birds of Ireland	
Great Cormorant (*Phalacrocorax carbo*)	08/06/2013	Local BioBlitz Challenge 2013	Wildlife Acts
Grey Heron (*Ardea cinerea*)	08/06/2013	Local BioBlitz Challenge 2013	

[1] Only those considered to potentially utilise the Naniken River and Duck Pond are shown.

Little Egret (*Egretta garzetta*)	08/06/2013	Local BioBlitz Challenge 2013	Wildlife Acts EU Birds Directive Annex I
Herring Gull (*Larus argentatus*)	31/12/2011	Bird Atlas 2007 - 2011	Wildlife Acts
Lesser Black-backed Gull (*Larus fuscus*)	31/12/2011	Bird Atlas 2007 - 2011	Wildlife Acts
Common Gull (*Larus canus*)	08/06/2013	Local BioBlitz Challenge 2013	Wildlife Acts
Black-headed Gull (*Larus ridibundus*)	31/12/2011	Bird Atlas 2007 - 2011	Wildlife Acts

3.2 Physical Habitat

The Naniken exhibits signs of poor hydromorphological condition. The stream has been channelised and straightened in the past, and numerous weirs, bridges and perched culverts fragment the river throughout its length (Plate 1). Bank erosion was evident throughout the river and is likely exacerbated by human access to the riverbanks. The riverbanks are very steep in places (2-3m high), and this, coupled with trees along the banks, has resulted in heavy shading throughout the river. The channel substrate was scoured in places (in particular downstream of perched culverts and weirs) on the day of survey, whereas the channel was heavily silted in the slower flowing sections. It appears historic modifications to the river channel have limited its ability to function naturally (e.g. it has limited potential to respond to changes in sediment supply and hydrology). The channel substrate is typically comprised of cobbles, gravel, sand and silt, and is embedded in places. The dominant flow types comprised of riffle, run and glide habitat which was quite shallow. The water was turbid on the day of survey.

The mouth of the river has been rerouted and modified to facilitate water inputs into the Duck Pond. A sluice gate directs river water into the pond, and river water which does not enter the pond follows an artificial concrete channel which ultimately outfalls into Dublin Bay via one-way sluice flaps. Excess pond water is returned to the Naniken via a culvert outlet just upstream of James Larkin Road.

As noted by Macklin et al. (2019), within and west of the Pitch and Putt Course, the river flows primarily through linear blocks of mature, semi-natural broadleaf woodland (WD1) in a parkland and amenity grassland (GA2) landscape. The river flows through more extensive broadleaved woodland habitat (WD1) east of the Pitch and Putt Course. Tree species recorded along the river included Ash *Fraxinus excelsior*, Lime *Tilia* sp., Willow *Salix* spp., Sycamore *Acer pseudoplatanus*, Horse Chestnut *Aesculus hippocastanum*, Hawthorn *Crataegus monogyna*, Cherry *Prunus* sp., Elder *Sambucus nigra*, Alder *Alnus glutinosa*, beech *Fagus sylvatica* and yew *Taxus baccata*.

Unsurprisingly, the hydromorphological status of the Naniken (based on the River Habitat Assessment Technique - RHAT) was assessed as being "bad" and "poor" by Macklin et al. (2019).

The Duck Pond is an artificial pond (FL8). It was heavily silted on the day of survey, with patches of emergent vegetation noted along the margins of the pond and islands within it. An

extensive duckweed *Lemna* sp. 'carpet' covered large areas of the pond, and filamentous algae was noted within it (Figure 2).

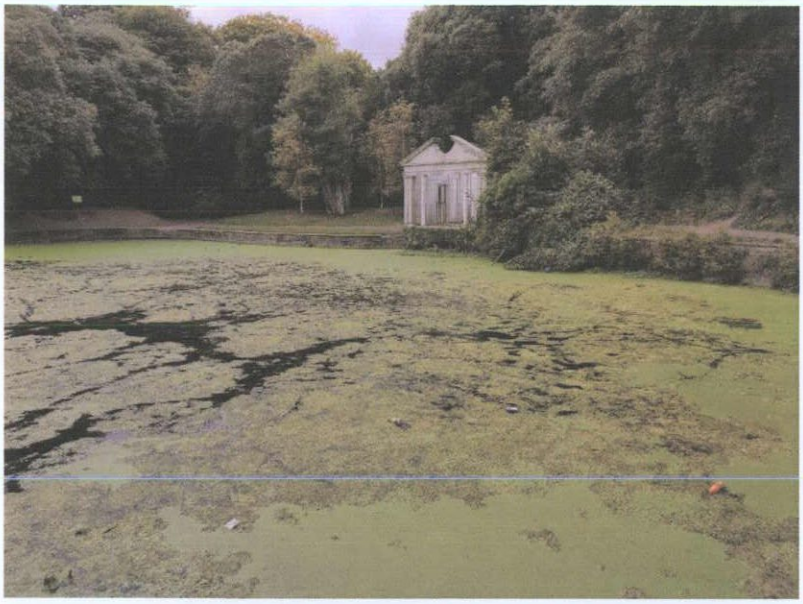

FIGURE 2. DUCKWEED 'CARPET' WITHIN THE DUCK POND.

3.3 Biomonitoring

The Naniken River was assigned a Q-value of 3, corresponding with a WFD status of "poor" and a pollution gradient of "moderately polluted". The biomonitoring sample was collected from riffle/glide habitat. Substrate at the sampling site was comprised of 40% sand, 20% cobble, 20% gravel and 20% silt. The sampling site was heavily shaded due to the mature woodland on both sides of the river.

Conductivity and pH were indicative of the soil and geology in the area with slightly high pH (7.6) and high conductivity (555 µS/cm).

TABLE 3. BENTHIC INVERTEBRATE SPECIES RECORDED AT THE NANIKEN, AND CORRESPONDING Q-VALUE.

Taxon	Q-Class	Abundance
Ephemeroptera		
Baetis rhodani/atlanticus	C	56
Crustacea		
Gammarus dubeni	C	46
Asellus aquaticus	D	49
Gastropoda		
Potamopyrgus antipodarum	C	6
Sphaeriidae	D	16
Oligochaeta		
Lumbriculidae	n/a	4
Platyhelminthes	C	3
Diptera		

Taxon	Q-Class	Abundance
Chironomidae indet	C	3
Ceratopogoniidae	n/a	1
Simulidae	C	2
Total Abundance		186
Richness		10
Frequency of Occurrence Class C Taxa		64%
Frequency of Occurrence Class D Taxa		36%
Q-Value		3

3.4 Fisheries Potential

3.1.1 Salmonids

Given the poor physical condition, heavily modified and fragmented nature, and moderately polluted status of the Naniken river, it is not considered to have salmonid (Brown trout *Salmo trutta* and Salmon *S. salar*) potential.

3.1.2 European Eel

The Naniken River could support European Eel *Anguilla anguilla*, however the one-way sluice flaps at the river outlet, as well as the many barriers within the river, would likely impact their distribution and abundance. European Eel are tolerant of moderately polluted water, however, the current biological status of the Naniken river is not conducive to a healthy eel population. It is noted that eel have been recorded within the Duck Pond. However, given the apparent high level of eutrophication in this pond (evidenced by high algal and macrophyte growth), it is unlikely that a healthy eel population could be sustained in it.

3.1.3 Other Fish Species

The Naniken River is likely to support more pollution tolerant fish species such as 3-Spined Stickleback *Gasterosteus aculeatus* and Minnow *Phoxinus phoxinus*.

3.5 Terrestrial Fauna

No Otter signs were recorded within or adjacent to the stream during the walk over survey carried out. This finding is in-keeping with the Dublin City Otter survey, which also did not detect any Otter signs along the Naniken (Macklin et al., 2019). An active mammal burrow was recorded on the river bank within the upper reaches of the Naniken river in St. Annes Park. Given the absence of Otter signs along the river, and the size and shape of the burrow, it is likely that it is a Fox *Vulpes vulpes* den Figure 3.

FIGURE 3. MAMMAL BURROW ON THE BANKS OF THE NANIKEN IN ST. ANNES PARK.

4 Discussion & Conclusions

The physical habitat assessment and macroinvertebrate biomonitoring indicates that the Naniken River is currently impacted. This is most likely due to historic modifications to the river channel, human related disturbance and surrounding urban land use.

The river is unlikely to support salmonid fish populations but may support the critically endangered European Eel and other fish species such as Minnow and 3-spined Stickleback. As noted previously, European Eel have been recorded within the Duck Pond. Although affected by eutrophication, this pond also provides an important habitat for a range of freshwater fauna including invertebrates, amphibians and waterfowl – many of which are protected by national and international legislation. This river also functions as an important ecological corridor.

Mitigation measures will be required to ensure no pollutants are discharged into the Naniken river (and consequently the Duck Pond) during the Construction Phase of the Proposed Development. Sustainable Urban Drainage Systems (SuDS) should be incorporated into the project design to ensure all surface water from the Site during the Operational Phase is appropriately treated and attenuated prior to discharge from the Site.

Provided SuDS are incorporated into the Project design, and standard best practice mitigation measures are implemented throughout the Construction Phase of the Proposed Development as per relevant guidelines (e.g. Inland Fisheries Ireland guidance document '*Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*'), no negative impacts on the Naniken River and Duck Pond should arise as a result of the Proposed Development.

5 References

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Enviroguide CONSULTING

Appendix I Site Investigation Report

GROUND INVESTIGATIONS IRELAND

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GROUND INVESTIGATIONS IRELAND LTD

DEVELOPMENT AT ST PAULS RAHENY

GROUND INVESTIGATION REPORT

DOCUMENT CONTROL SHEET

Engineer	OCSC
Project Title	St Paul's Raheny
Project No	5228-07-15
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
B	Final	C Finnerty	F McNamara	F McNamara	Dublin	30th October 2015

St Paul's Raheny –Ground Investigation Report

Appendices

1.0 Preamble

On the instructions of OCSC Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., between September and October 2015 at the site at St Paul's College in Raheny in North Dublin.

2.0 Overview

2.1 Background

It is proposed to construct a residential development with associated access roads and car parking at the proposed site and develop some playing pitches. The site is currently in use as playing fields for St Paul's College. The proposed development consists of a mix of residential buildings with multi-storey over basement proposed over a portion of the site with the remaining area containing two/three storey residential dwellings.

2.2 Purpose and Scope

The purpose of the site investigation was to investigate subsurface soil conditions by means of cable percussion boreholes. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 10 No. Cable Percussion boreholes to a maximum depth of 8.0m BGL
- Standpipe installations and groundwater monitoring
- Laboratory testing
- Report with recommendations

3.0 Subsurface Exploration

3.1 General

During the ground investigation a programme of cable percussion boring was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during drilling.

3.2 Cable Percussion Boreholes

Ten Cable Percussion Boreholes were drilled using a Dando 2000 drilling rig with regular insitu testing and sampling undertaken to facilitate the production of geotechnical logs and laboratory testing.

The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a Shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the Shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the Cable Percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason thin lenses of granular material may not be noticed.

Disturbed samples were taken from the boring tools at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata.

Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 60° cone.

The Standard Penetration Test number referred to as the 'N' value is the number of blows required to drive the tube 300mm, after an initial penetration of 150mm. The number gives a guide to the consistency of the soil and can also be used to estimate the relative strength/density at the depth of the test and also to estimate the bearing capacity and compressibility of the soil.

The Cable Percussion borehole logs are provided in Appendix 2 of this Report.

The above notes outline the procedures used in this site investigation and are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:1999 + A2:2010.

3.3 Laboratory Testing

Samples were selected from the boreholes for a range of geotechnical classification testing to provide information for the proposed design. The environmental testing, including Waste Acceptance Criteria (WAC) was carried out by OCSC and is discussed under the cover of a separate report.

The results of the geotechnical laboratory testing are included in Appendix 3 of this Report.

4.0 Ground Conditions

4.1 Ground Conditions

The ground conditions encountered during the investigation are summarised below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were consistent across the site and are generally consisted of;

- Made Ground
- Cohesive Deposits

Made Ground Deposits: Made Ground deposits were encountered beneath the ground surface or Topsoil and were present to a depths of between 0.8 and 1.5m BGL in the boreholes. These deposits were described generally consisted of *brown/grey sandy gravelly CLAY.*

Cohesive Deposits: Stiff brown cohesive deposits were present below the Made Ground deposits in the boreholes and were typically described as brown *sandy gravelly CLAY with occasional cobbles.* This stratum was present to a depth of up to 2.3m BGL and was underlain by a *stiff to very stiff black slightly sandy gravelly CLAY with occasional cobbles and boulders* to a maximum depth of 8.0m BGL.

4.2 Groundwater

The groundwater strikes were generally not encountered during the investigation in the cohesive deposits. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the time of year, tidal influence, rainfall, nearby construction and other factors. For this reason standpipes were installed in BH1, BH2, BH3, BH6 and BH9 to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 6 of this Report.

5.0 Recommendations and Conclusions

5.1 General

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided on the proposed building, excavations and loading and assumptions have been made based on discussions on site and the nature of the development.

5.2 Foundations

An allowable bearing capacity of 150kN/m^2 is recommended for the stiff brown cohesive deposits below the made ground depths of 0.80 – 1.50m BGL. An allowable bearing capacity of 300kN/m^2 is recommended for deeper foundations based on the stiff black cohesive deposits in the vicinity of the proposed basement.

5.3 Excavations

Excavations in the areas where deeper Made Ground deposits were encountered may require to be appropriately battered or the sides supported due to the variable strength of these deposits. Reference should be made to the OCSC environmental report and the testing completed to inform the disposal of any material to be excavated.

5.4 External Pavement

The proposed access roads and car parking are proposed to be founded on the firm to stiff cohesive deposits or on compacted imported fill material depending on the final level of the proposed roads. CBR testing should be undertaken prior to or at the time of construction to verify the design assumptions and the proposed pavement make up. An average value of 2.0% would be recommended for outline design on the firm to stiff cohesive deposits with

pavement options presented for less than 2%, 5.0% and 10.0% where verified during the construction phase.

The recommendations provided in this report should be verified in the design of the proposed buildings, using the full details of the loading conditions and taking into consideration the allowable tolerable settlements/movements that the building can accommodate. The founding strata should be inspected and verified by a suitably qualified engineer prior to construction of the building foundations.

Appendix 1: Site Location Plan


BH1
BH2
BH3
BH10
BH4
BH7
BH5
BH6
BH8
BH9

Appendix 2: Cable Percussion Borehole Records

Project Name: St. Paul's Raheny

Hole ID: BH1

Client: New Generation

Consultant: OCSC

Location: Raheny

Start date: 28/09/2015 End date: 29/09/2015

Type of drilling: CP Hole diameter: 200 mm

Co-ordinates: 720366.38 737591.04

Elevation: 24.852

Project no. 5228-07-15

Drilled by: F McArdle

Logged by: James Dunn

Strata Description	Legend	Depth	Level (mOD)	Samples / tests: Type	Depth	Result	Water Depth	Date
TOPSOIL		0.10	24.75					
MADE GROUND comprising brown sandy gravelly Clay FILL				SPT-C B+T	0.50 0.50	N=21		
Stiff brown sandy gravelly CLAY with occassional cobbles		1.00	23.85	SPT-C B+T	1.00 1.00	N=15		
		2		SPT-C B+T	2.00 2.00	N=20		
Stiff black sandy gravelly CLAY with occassional cobbles and boulders		2.30	22.55	SPT-C	2.50	N=29		
		3		SPT-C B+T	3.00 3.00	N=41		
		4		SPT-C B+T	4.00 4.00	50/300mm		
		5		SPT-C B+T	5.10 5.10	N=40	5.00	
Obstruction: Presumed Boulder		5.50	19.35					
End of Borehole at 5.60 m		5.60	19.25				5.60	29/09/2015
		6						
		7						
		8						
		9						

Remarks:

hiselling from 3.6m to 3.8m BGL for 30 mins, from 4.7m to 4.8m BGL for 60 mins
om 4.8m to 5.1m BGL for 35mins and from 5.5m to 5.6m BGL for 30mins
0mm standpipe with flush cover installed. Slotted with gravel response zone from 1.0m to 5.6m BGL
nd sealed from 0.0m to 1.0m BGL

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

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Project Name: St. Paul's Raheny

Hole ID: BH2

Client: New Generation
Consultant: OCSC
Location: Raheny
Start date: 30/09/2015 End date: 01/10/2015
Type of drilling: CP Hole diameter: 200 mm

Co-ordinates: 720501.93, 737565.25
Elevation: 22.489
Project no. 5228-07-15
Drilled by: F McArdle
Logged by: James Dunn

Strata Description	Legend	Depth	Level (mOD)	Samples / tests: Type	Depth	Result	Water Depth	Date
TOPSOIL		0.20	22.29					
MADE GROUND comprising brown sandy gravelly Clay FILL				SPT-C B+T	0.50 0.50	N=33		
Stiff brown sandy gravelly CLAY with occassional cobbles		0.80	21.69					
		1		SPT-C B+T	1.00 1.00	N=22		
		2		SPT-C B+T	2.00 2.00	N=36		
Stiff black sandy gravelly CLAY with occassional cobbles ` rare boulders		2.20	20.29					
		3		SPT-C B+T	3.00 3.00	N=41		
		4		SPT-C B+T	4.00 4.00	N=43		
		5		SPT-C B+T	5.00 5.00	N=39		
		6		SPT-C B+T	6.00 6.00	50/300mm		
		7		SPT-C B+T	7.00 7.00	N=47		
End of Borehole at 8.00 m		8.00	14.49	SPT-C B+T	8.00 8.00	N=46		
		9						

Remarks:
50mm standpipe with flush cover installed. Slotted with gravel response zone from 2.0m to 5.0m BGL and sealed from 0.0m to 2.0m BGL

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

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Project Name: St. Paul's Raheny

Hole ID: BH3

Client: New Generation
Consultant: OCSC
Location: Raheny
Start date: 30/09/2015 End date: 01/10/2015
Type of drilling: CP Hole diameter: 200 mm

Co-ordinates: 720600.88, 737513.70
Elevation: 21.943
Project no. 5228-07-15
Drilled by: F McArdle
Logged by: James Dunn

Strata Description	Legend	Depth	Level (mOD)	Samples / tests: Type	Depth	Result	Water Depth	Date
TOPSOIL		0.10	21.84					
MADE GROUND comprising brown/grey sandy gravelly Clay FILL				SPT-C B+T	0.50 0.50	N=23		
		1		SPT-C B+T	1.00 1.00	N=29		
Stiff brown sandy gravelly CLAY with occassional cobbles		1.50	20.44	SPT-C	1.50	N=18		
Stiff black sandy gravelly CLAY with occassional cobbles and rare boulders		2.00	19.94	SPT-C B+T	2.00 2.00	N=46		
		3		SPT-C B+T	3.00 3.00	N=37		
		4		SPT-C B+T	4.00 4.00	N=37		
		5		SPT-C B+T	5.00 5.00	N=42		
Stiff grey sandy slightly gravelly CLAY		6.00	15.94	SPT-C B+T	6.00 6.00	50/300mm		
		7		SPT-C B+T	7.00 7.00	50/300mm		
							▼ 7.80 ▽ 8.00	02/10/2015
End of Borehole at 8.00 m		8.00	13.94	B+T	8.00			
		9						

Remarks:
0mm standpipe with flush cover installed. Slotted with gravel response zone from 2.0m to 5.0m BGL and sealed from 0.0m to 2.0m BGL

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

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Project Name: St. Paul's Raheny

Hole ID: BH4

Client: New Generation
Consultant: OCSC
Location: Raheny
Start date: 29/09/2015 End date: 30/09/2015
Type of drilling: CP Hole diameter: 200 mm

Co-ordinates: 720484.56
737484.02
Elevation: 23.349
Project no. 5228-07-15
Drilled by: F McArdle
Logged by: James Dunn

Strata Description	Legend	Depth	Level (mOD)	Samples / tests: Type	Depth	Result	Water Depth	Date
TOPSOIL		0.10	23.25					
MADE GROUND comprising brown/grey sandy gravelly Clay FILL with cobbles				SPT-C B+T	0.50 0.50	N=23		
		1		SPT-C B+T	1.00 1.00	N=17		
Stiff brown sandy gravelly CLAY with occassional cobbles		1.40	21.95					
		2		SPT-C B+T	2.00 2.00	N=33		
Stiff black sandy gravelly CLAY with occassional cobbles rare boulders		2.20	21.15					
		3		SPT-C B+T	3.00 3.00	N=38		
		4		SPT-C B+T	4.00 4.00	N=38		
		5		SPT-C B+T	5.00 5.00	N=43		
		6		SPT-C B+T	6.00 6.00	N=45		
		7		SPT-C B+T	7.00 7.00	N=45		
End of Borehole at 8.00 m		8.00	15.35	SPT-C B+T	8.00 8.00	N=48		
		9						

Remarks:
Chiselling from 4.7m to 4.9m BGL for 30mins
Borehole backfilled on completion

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

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Project Name: St. Paul's Raheny

Hole ID: BH5

Client: New Generation

Consultant: OCSC

Location: Raheny

Start date: 02/10/2015 End date: 05/10/2015

Type of drilling: CP Hole diameter: 200 mm

Co-ordinates: 720591.52, 737402.83

Elevation: 22.407

Project no. 5228-07-15

Drilled by: F McArdle

Logged by: James Dunn

Strata Description	Legend	Depth	Level (mOD)	Samples / tests: Type	Depth	Result	Water Depth	Date
TOPSOIL		0.20	22.21					
MADE GROUND comprising brown/grey sandy gravelly Clay FILL with cobbles				SPT-C B+T	0.50 0.50	N=20		
		1		SPT-C B+T	1.00 1.00	N=21		
Stiff grey/brown sandy gravelly CLAY with occassional cobbles		1.30	21.11					
		2		SPT-C B+T	2.00 2.00	N=24		
Stiff black sandy gravelly CLAY with occassional cobbles and rare boulders		2.20	20.21					
				SPT-C	2.50	N=46		
		3		SPT-C B+T	3.00 3.00	N=43		
		4		SPT-C B+T	4.00 4.00	N=49		
		5		SPT-C B+T	5.00 5.00	N=38		
		6		SPT-C B+T	6.00 6.00	N=37		
		7		SPT-C B+T	7.00 7.00	N=45		
End of Borehole at 8.00 m		8.00	14.41	SPT-C B+T	8.00 8.00	N=40		
		9						

Remarks:

Borehole backfilled on completion

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

GROUND INVESTIGATIONS IRELAND

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Project Name: St. Paul's Raheny

Hole ID: BH6

Client:	New Generation	Co-ordinates:	720466.04 737407.03
Consultant:	OCSC	Elevation:	23.223
Location:	Raheny	Project no.	5228-07-15
Start date:	08/10/2015	Drilled by:	F McArdle
End date:	08/10/2015	Logged by:	James Dunn
Type of drilling:	CP	Hole diameter:	200 mm

Strata Description

Depth	Level (mOD)	Strata Description	Samples / tests Type	Depth	Result	Water Depth	Date
0.10	23.12	TOPSOIL					
		MADE GROUND comprising brown sandy gravelly Clay FILL with cobbles	SPT-C B+T	0.50 0.50	N=21		
1			SPT-C B+T	1.00 1.00	N=17		
1.30	21.92	Stiff brown sandy gravelly CLAY with occassional cobbles	SPT-C B	1.50 1.50	N=21		
2			SPT-C B+T	2.00 2.00	N=32		
2.30	20.92	Stiff black sandy gravelly CLAY with occassional cobbles boulders	SPT-C	2.50	N=33		
3			SPT-C B+T	3.00 3.00	N=35		
4			SPT-C B+T	4.00 4.00	N=40		
5			SPT-C B+T	5.00 5.00	N=39		
6			SPT-C B+T	6.00 6.00	N=42		
7			SPT-C B+T	7.00 7.00	N=45		
7.80	15.42	Obstruction: Presumbed Boulder					
7.90	15.32	End of Borehole at 7.90 m					
8							
9							

Remarks:

Chiselling from 7.8m to 7.9m BGL for 60mins
50mm standpipe with flush cover installed. Slotted with gravel response zone from 2.0m to 5.6m BGL and sealed from 0.0m to 2.0m BGL

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

GROUND INVESTIGATIONS IRELAND

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Project Name: St. Paul's Raheny

Hole ID: BH7

Client: New Generation
Consultant: OCSC
Location: Raheny
Start date: 09/10/2015 End date: 09/10/2015
Type of drilling: CP Hole diameter: 200 mm

Co-ordinates: 720347.86, 737449.43
Elevation: 23.972
Project no. 5228-07-15
Drilled by: F McArdle
Logged by: James Dunn

Strata Description	Legend	Depth	Level (mOD)	Samples / tests: Type	Depth	Result	Water Depth	Date
TOPSOIL		0.20	23.77					
MADE GROUND comprising brown/grey sandy gravelly Clay FILL with cobbles				SPT-C B+T	0.50 0.50	N=20		
Stiff brown sandy gravelly CLAY with occassional cobbles		0.90	23.07	SPT-C B+T	1.00 1.00	N=17		
				SPT-C B+T	2.00 2.00	N=30		
Stiff black sandy gravelly CLAY with occassional cobbles and rare boulders		2.20	21.77					
				SPT-C B+T	3.00 3.00	N=36		
				SPT-C B+T	4.00 4.00	N=38		
				SPT-C B+T	5.00 5.00	N=37		
				SPT-C B+T	6.00 6.00	N=41		
				SPT-C B+T	7.00 7.00	50/180mm		
				SPT-C B+T	8.00 8.00	N=45		
End of Borehole at 8.50 m		8.50	15.47					

Remarks:
Chiselling from 7.4m to 7.6m BGL for 30mins
Borehole backfilled on completion

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

GROUND INVESTIGATIONS IRELAND
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Project Name: St. Paul's Raheny

Hole ID: BH8

Client: New Generation
Consultant: OCSC
Location: Raheny
Start date: 06/10/2015 End date: 06/10/2015
Type of drilling: CP Hole diameter: 200 mm

Co-ordinates: 720443.89, 737307.54
Elevation: 22.279
Project no. 5228-07-15
Drilled by: F McArdle
Logged by: James Dunn

Strata Description	Legend	Depth	Level (mOD)	Samples / tests: Type	Depth	Result	Water Depth	Date
TOPSOIL		0.20	22.08					
MADE GROUND comprising brown/grey sandy gravelly Clay FILL with cobbles and fragments of plastic				SPT-C B+T	0.50 0.50	N=25		
		1		SPT-C B+T	1.00 1.00	N=20		
Stiff grey brown sandy gravelly CLAY with occassional cobbles		1.20	21.08					
		2		SPT-C B+T	2.00 2.00	N=18		
				SPT-C	2.50	N=23		
Stiff black sandy gravelly CLAY with occassional cobbles and rare boulders		3.00	19.28	SPT-C B+T	3.00 3.00	N=28		
		4		SPT-C B+T	4.00 4.00	N=37		
		5		SPT-C B+T	5.00 5.00	N=38		
		6		SPT-C B+T	6.00 6.00	N=38		
		7		SPT-C B+T	7.00 7.00	N=45		
End of Borehole at 8.00 m		8.00	14.28	SPT-C B+T	8.00 8.00	50/300mm		
		9						

Remarks:
Borehole backfilled on completion

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

GROUND INVESTIGATIONS IRELAND
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Project Name: St. Paul's Raheny

Hole ID: BH9

Client: New Generation

Consultant: OCSC

Location: Raheny

Start date: 05/10/2015 End date: 06/10/2015

Type of drilling: CP Hole diameter: 200 mm

Co-ordinates: 720588.42, 737295.98

Elevation: 21.421

Project no. 5228-07-15

Drilled by: F McArdle

Logged by: James Dunn

Strata Description	Legend	Depth	Level (mOD)	Samples / tests: Type	Depth	Result	Water Depth	Date
TOPSOIL		0.10	21.32					
MADE GROUND comprising brown/grey sandy gravelly Clay FILL with cobbles				SPT-C B+T	0.50 0.50	N=19		
Stiff brown sandy gravelly CLAY with occassional cobbles		1.00	20.42	SPT-C B+T	1.00 1.00	N=18		
		2		SPT-C B+T	2.00 2.00	N=15		
Firm to stiff black slightly silty gravelly CLAY with occassional cobbles		2.20	19.22	SPT-C B	2.50 2.50	N=14		
Stiff black sandy gravelly CLAY with occassional cobbles and rare boulders		3.00	18.42	SPT-C B+T	3.00 3.00	N=28		
		4		SPT-C B+T	4.00 4.00	N=37		
		5		SPT-C B+T	5.00 5.00	N=41		
		6		SPT-C B+T	6.00 6.00	N=37		
		7		SPT-C B+T	7.00 7.00	N=38		
End of Borehole at 8.00 m		8.00	13.42	SPT-C B+T	8.00 8.00	N=38		
		9						

Remarks:

0mm standpipe with flush cover installed. Slotted with gravel response zone from 2.0m to 5.0m BGL nd sealed from 0.0m to 2.0m BGL

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

GROUND INVESTIGATIONS IRELAND

www.gii.ie

Project Name: St. Paul's Raheny

Hole ID: BH10

Client: New Generation
Consultant: OCSC
Location: Raheny
Start date: 07/10/2015 End date: 07/10/2015
Type of drilling: CP Hole diameter: 200 mm

Co-ordinates: 720389.97, 737509.16
Elevation: 24.554
Project no. 5228-07-15
Drilled by: F McArdle
Logged by: James Dunn

Strata Description	Legend	Depth	Level (mOD)	Samples / tests: Type	Depth	Result	Water Depth	Date
TOPSOIL		0.10	24.45					
MADE GROUND comprising brown/grey sandy gravelly Clay FILL with cobbles				SPT-C B+T	0.50 0.50	N=14		
		1		SPT-C B+T	1.00 1.00	N=12		
Stiff brown sandy gravelly CLAY with occassional cobbles		1.50	23.05	SPT-C B	1.50 1.50	N=18		
		2		SPT-C B+T	2.00 2.00	N=29		
Stiff black sandy gravelly CLAY with occassional cobbles rare boulders and gravell lenses from 8.0m to 8.1m BGL		2.30	22.25	SPT-C B	2.50 2.50	N=17		
		3		SPT-C B+T	3.00 3.00	N=30		
		4		SPT-C B+T	4.00 4.00	N=37		
		5		SPT-C B+T	5.00 5.00	N=40		
		6		SPT-C B+T	6.00 6.00	N=39		
		7		SPT-C B+T	7.00 7.00	N=43		
							▼ 7.70	
		8		SPT-C B+T	8.00 8.00	50/180mm	▽ 8.00	07/10/2015
Obstruction: Presumed Boulder		8.10	16.45					
End of Borehole at 8.20 m		8.20	16.35					
		9						

Remarks:
Chiselling from 8.1m to 8.2m BGL for 30mins
Borehole backfilled on completion

KEY

B	Bulk disturbed sample.
D	Small disturbed sample
U	Undisturbed sample
SPT-S	Standard Penetration Test, split spoon.
SPT-C	Standard Penetration Test, solid cone.
▽	Groundwater strike
▼	Water level 20mins after strike.

GROUND INVESTIGATIONS IRELAND
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Appendix 3: Laboratory Testing

National Materials Testing Laboratory Ltd.

SUMMARY OF TEST RESULTS

			Particle			Index Properties		Bulk	Cell	Undrained Triaxial Tests		Shear Strength	
BH/TP	Depth	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Cu	Mode of
No	m	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	Failure
BH5	2.50	12.3		59.8	30	15	15						
BH5	5.60	11.0		58.7	28	15	13						
BH5	8.00	8.6		57.5	28	14	14						
BH7	1.00	14.5		64.2	31	17	14						
BH7	4.00	13.3		57.3	28	15	13						
BH9	0.50	22.9		48.9	55	30	25						
BH9	1.00	14.5		58.8	34	18	16						
BH9	2.00	13.3		62.3	30	16	14						

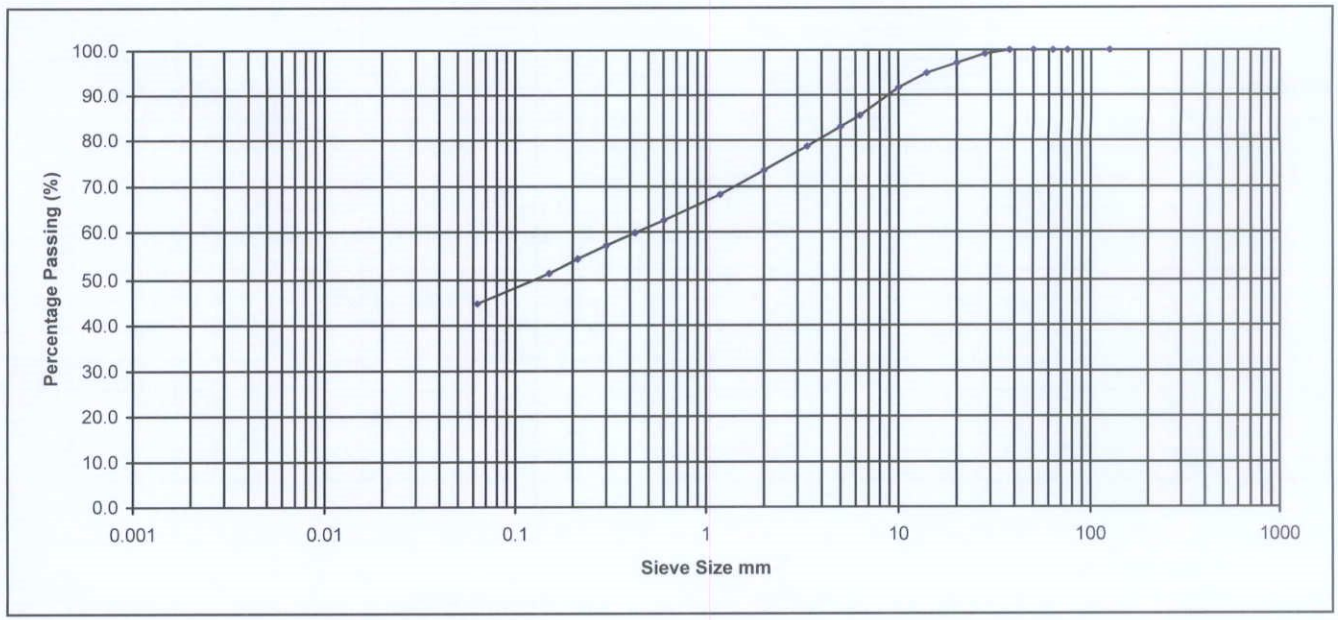
NMTL	Notes :	Job ref No.	NMTL 1489	Table
	1. All BS tests carried out using preferred (definitive) method unless otherwise stated.	Location	St Paul's Rahney	

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	99.1
20.000	97.1
14.000	94.9
10.000	91.6
6.300	85.4
5.000	82.9
3.350	78.5
2.000	73.4
1.180	68.3
0.600	62.5
0.425	59.8
0.300	57.2
0.212	54.4
0.150	51.4
0.063	44.8



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
0.0		44.8			28.6			26.6		0.0	0.0

Sample Description: Dark grey slightly gravelly slightly sandy SILT/CLAY.

Project: St Paul's Rahney

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	22/10/2015

Project No.	NMTL 1489
BH/TP No.	BH5
Sample No.	B
Depth	2.50m

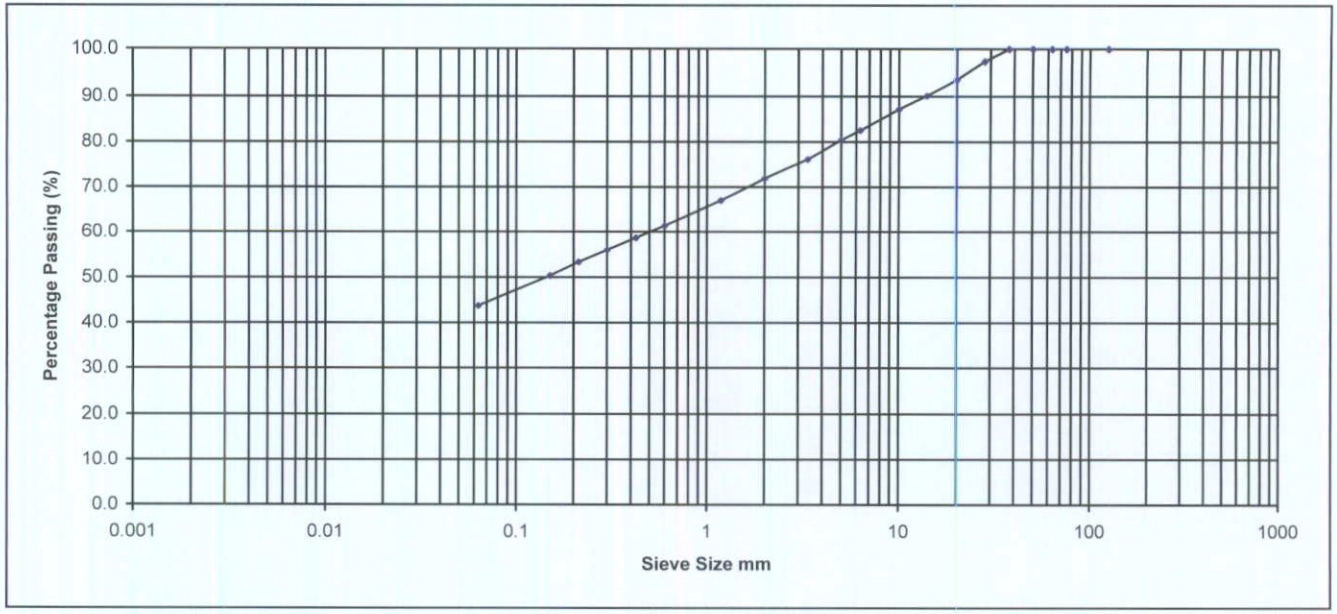
NM TL Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	97.5
20.000	93.7
14.000	90.1
10.000	87.2
6.300	82.5
5.000	80.4
3.350	76.1
2.000	71.8
1.180	67.0
0.600	61.3
0.425	58.7
0.300	56.1
0.212	53.3
0.150	50.3
0.063	43.7



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
0.0		43.7			28.2			28.2		0.0	0.0

Sample Description: Dark grey slightly gravelly slightly sandy SILT/CLAY.

Project: St Paul's Rahney

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	22/10/2015

Project No.	NMTL 1489
BH/TP No.	BH5
Sample No.	B
Depth	5.60m

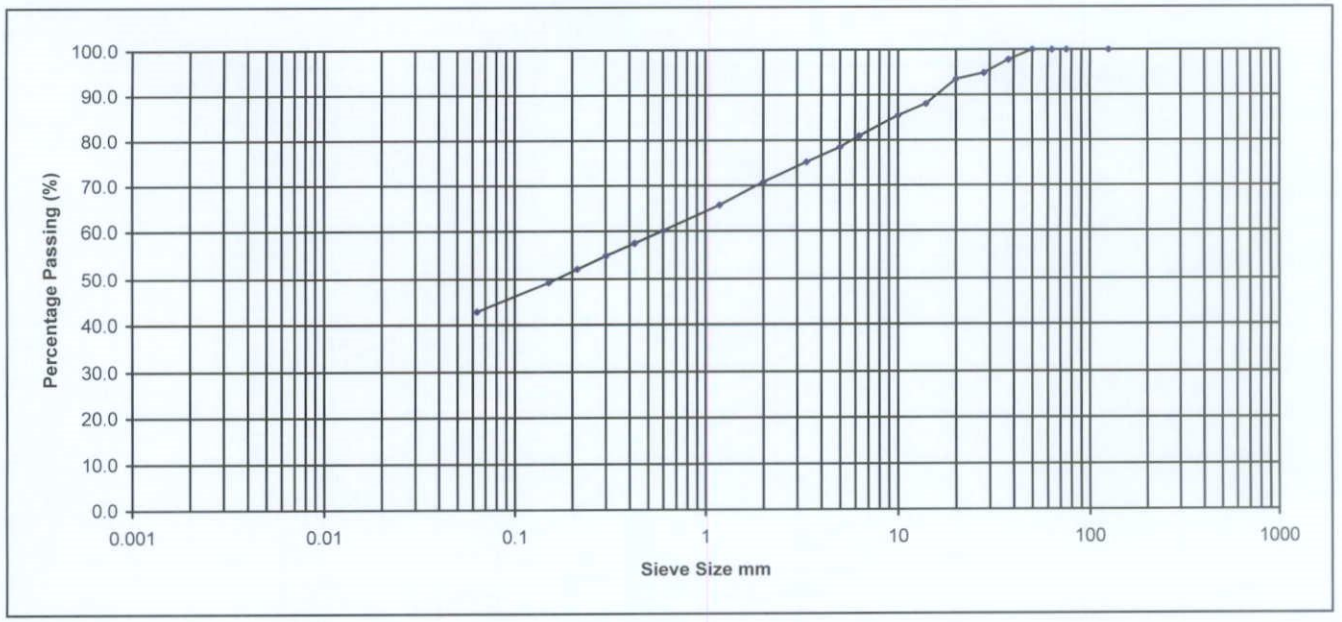
NM TL Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	97.8
28.000	94.9
20.000	93.5
14.000	88.1
10.000	85.5
6.300	80.9
5.000	78.4
3.350	75.1
2.000	70.7
1.180	65.7
0.600	60.1
0.425	57.5
0.300	54.9
0.212	52.2
0.150	49.2
0.063	42.8



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
0.0		42.8			28.0			29.3		0.0	0.0

Sample Description: Dark grey slightly gravelly slightly sandy SILT/CLAY.

Project: St Paul's Rahney

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	22/10/2015

Project No.	NMTL 1489
BH/TP No.	BH5
Sample No.	B
Depth	8.00m

NM TL Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	98.8
20.000	95.5
14.000	95.0
10.000	91.7
6.300	87.2
5.000	85.1
3.350	81.2
2.000	76.8
1.180	72.1
0.600	66.7
0.425	64.2
0.300	61.6
0.212	59.0
0.150	56.2
0.063	50.1

Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt			Sand			Gravel				
0.0	50.1			26.7			23.2			0.0	0.0

Sample Description: Dark grey slightly gravelly slightly sandy SILT/CLAY.

Project: St Paul's Rahney

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	22/10/2015

Project No.	NMTL 1489
BH/TP No.	BH7
Sample No.	B
Depth	1.00m

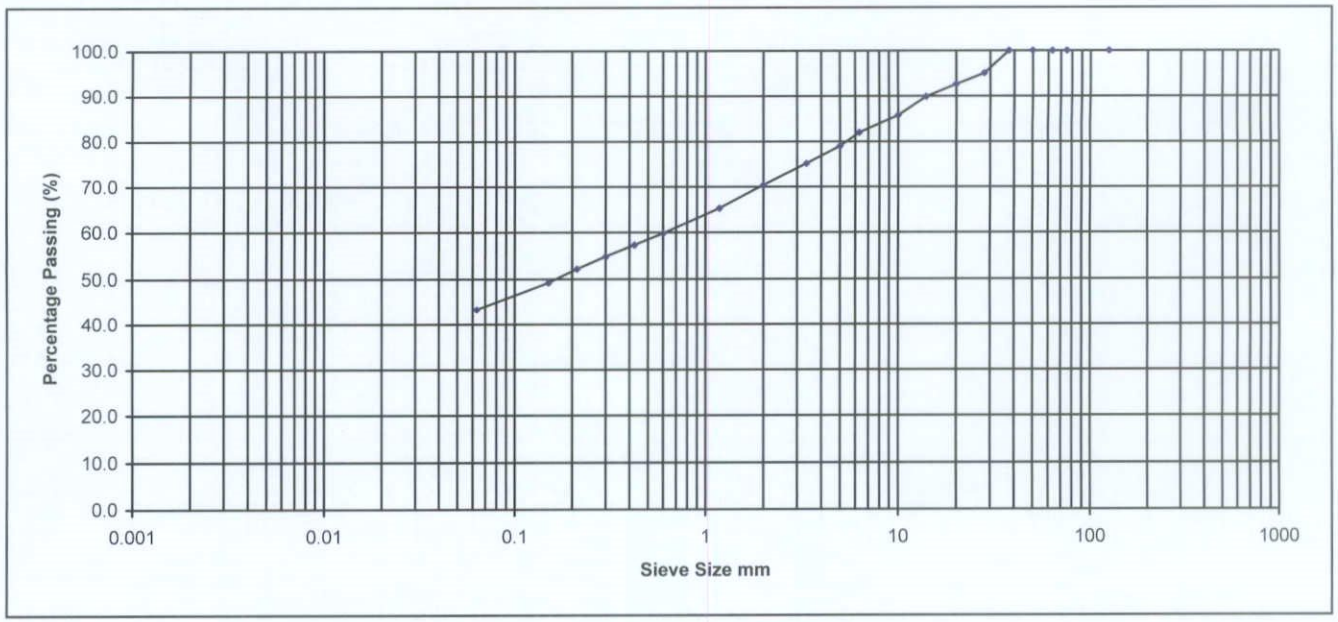
NM TL Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	95.1
20.000	92.7
14.000	89.9
10.000	85.8
6.300	82.0
5.000	78.9
3.350	75.1
2.000	70.4
1.180	65.3
0.600	59.8
0.425	57.3
0.300	54.8
0.212	52.2
0.150	49.2
0.063	43.3



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
0.0		43.3			27.1			29.6		0.0	0.0

Sample Description: Dark grey slightly sandy slightly gravelly SILT/CLAY.

Project: St Paul's Rahney

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	22/10/2015

Project No.	NMTL 1489
BH/TP No.	BH7
Sample No.	B
Depth	4.00m

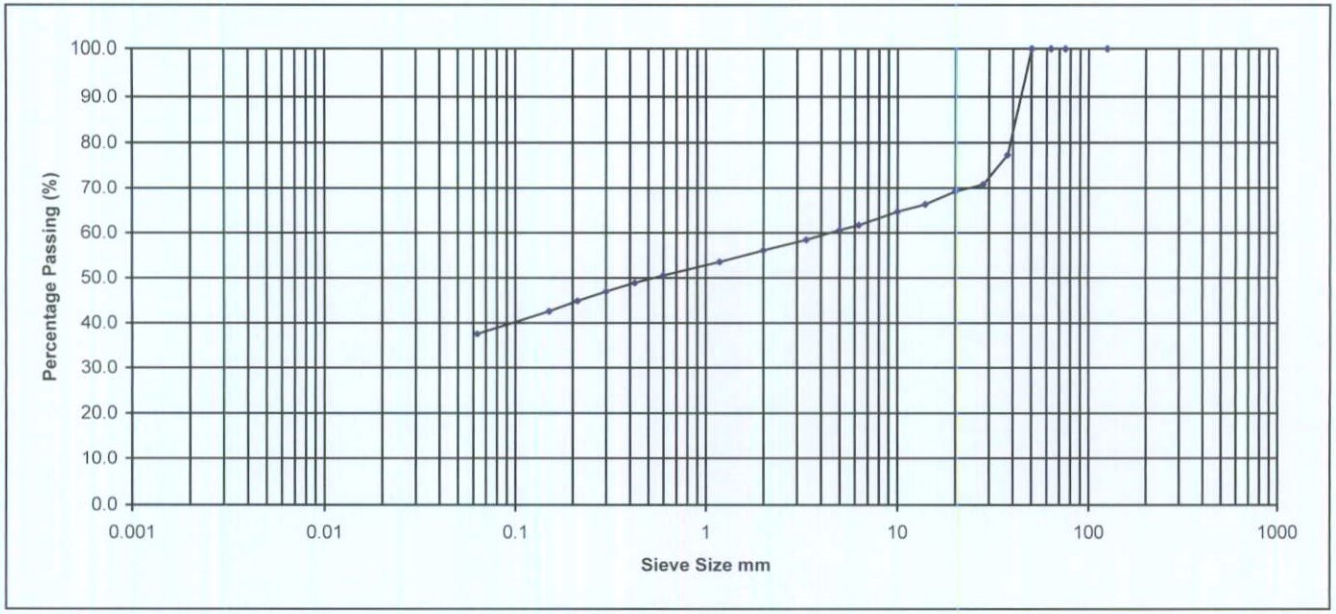
NM TL Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	77.3
28.000	70.8
20.000	69.2
14.000	66.3
10.000	64.7
6.300	61.7
5.000	60.6
3.350	58.4
2.000	56.1
1.180	53.5
0.600	50.5
0.425	48.9
0.300	46.9
0.212	44.9
0.150	42.5
0.063	37.6



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
0.0		37.6			18.5			43.9		0.0	0.0

Sample Description: Brown slightly sandy gravelly SILT/CLAY.

Project: St Paul's Rahney

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	22/10/2015

Project No.	NMTL 1489
BH/TP No.	BH9
Sample No.	B
Depth	0.50m

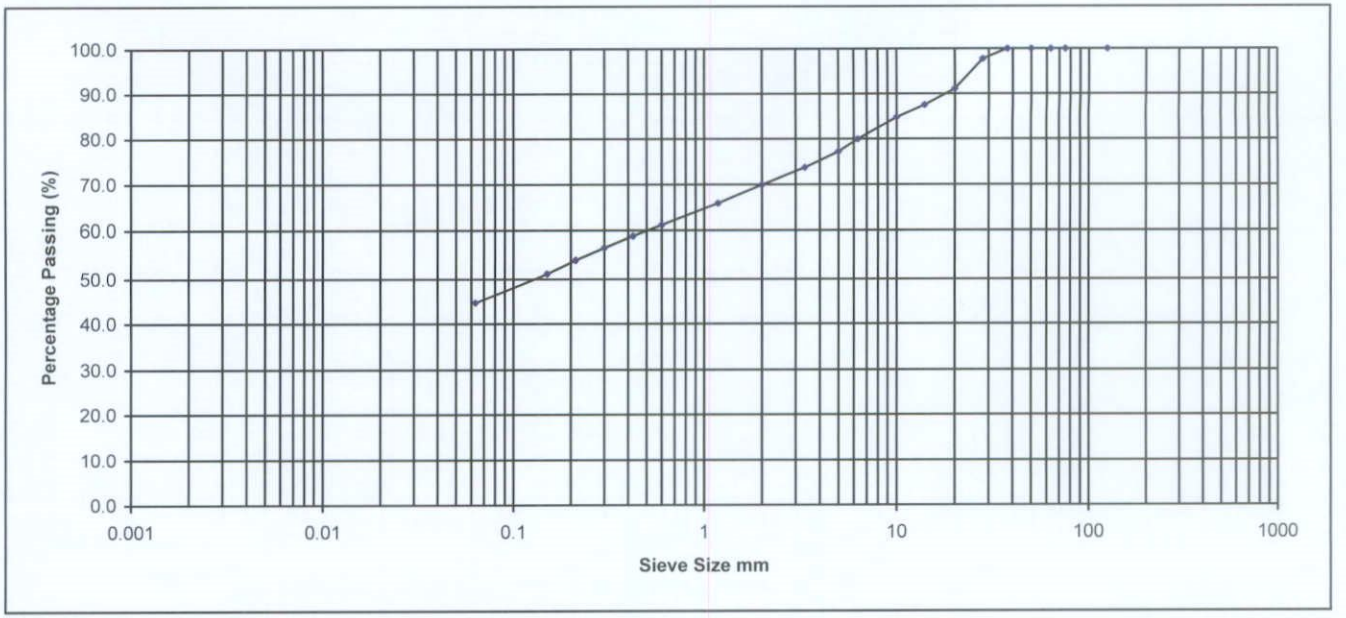
NM TL Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	97.8
20.000	91.1
14.000	87.5
10.000	84.7
6.300	79.9
5.000	77.1
3.350	73.7
2.000	69.9
1.180	65.9
0.600	61.1
0.425	58.8
0.300	56.5
0.212	54.0
0.150	51.1
0.063	44.7



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
0.0		44.7			25.2			30.1		0.0	0.0

Sample Description: Brown slightly sandy slightly gravelly SILT/CLAY.

Project: St Paul's Rahney

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	23/10/2015

Project No.	NMTL 1489
BH/TP No.	BH9
Sample No.	B
Depth	1.00m

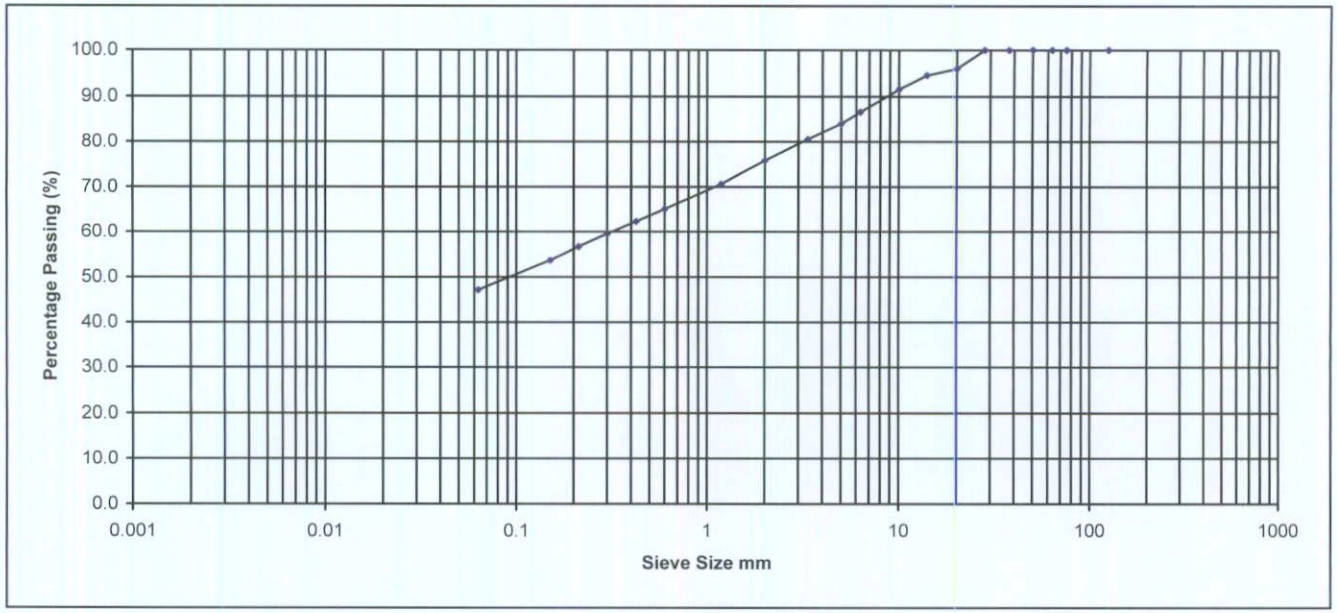
NMTL Ltd

NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	100.0
20.000	96.0
14.000	94.5
10.000	91.6
6.300	86.6
5.000	84.0
3.350	80.5
2.000	75.8
1.180	70.6
0.600	65.0
0.425	62.3
0.300	59.6
0.212	56.7
0.150	53.7
0.063	47.1



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
0.0		47.1			28.7			24.2		0.0	0.0

Sample Description: Brown/dark brown slightly gravelly slightly sandy SILT/CLAY.

Project: St Paul's Rahney

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	23/10/2015

Project No.	NMTL 1489
BH/TP No.	BH9
Sample No.	B
Depth	2.00m

NM TL Ltd

Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA, UK

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

O'Connor Sutton Cronin & Assoc. Ltd
9 Prussia Street
Dublin 7
Ireland

4225

Attention :	Cian O'Hora
Date :	14th October, 2015
Your reference :	
Our reference :	Test Report 15/14318 Batch 1
Location :	St Pauls
Date samples received :	6th October, 2015
Status :	Final report
Issue :	1

Eleven samples were received for analysis on 6th October, 2015 of which eleven were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Where Waste Acceptance Criteria Suite (EC Decision of 19 December 2002 (2003/33/EC)) has been requested, all analyses have been performed using the relevant EN methods where they exist.

Compiled By:

Bruce Leslie
Project Co-ordinator

Client Name: O'Connor Sutton Cronin & Assoc. Ltd
Reference:
Location: St Pauls
Contact: Cian O'Hora
JE Job No.: 15/14318

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1	2	3	4	5	6	7	8	9	10	LOD/LOR	Units	Method No.
Sample ID	BH1	BH1	BH2	BH2	BH2	BH2	BH3	BH4	BH4	BH4			
Depth	0.00-1.00	1.00-2.00	0.50	1.00	2.00	3.00	0.50	0.00-1.00	1.00-2.00	2.00-3.00			
COC No / misc													
Containers	T	T	T	T	T	T	T	T	T	T			
Sample Date	28/09/2015	28/09/2015	30/09/2015	30/09/2015	30/09/2015	30/09/2015	01/10/2015	03/10/2015	03/10/2015	03/10/2015			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015			
Antimony	<1	4	3	4	2	2	-	3	2	2	<1	mg/kg	TM30/PM15
Arsenic #	6.9	13.0	20.0	13.2	10.9	8.6	-	16.1	10.0	10.6	<0.5	mg/kg	TM30/PM15
Barium #	135	72	132	69	131	107	-	124	102	100	<1	mg/kg	TM30/PM15
Cadmium #	1.5	1.3	2.2	2.7	3.2	1.5	-	2.7	1.7	1.7	<0.1	mg/kg	TM30/PM15
Chromium #	28.0	33.2	60.6	31.4	34.0	34.0	-	58.0	30.0	28.4	<0.5	mg/kg	TM30/PM15
Copper #	20	25	33	22	27	22	-	36	23	24	<1	mg/kg	TM30/PM15
Lead #	15	19	48	18	18	22	-	59	19	19	<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum #	2.6	6.1	4.9	7.7	4.5	2.9	-	3.7	3.7	4.1	<0.1	mg/kg	TM30/PM15
Nickel #	22.0	39.5	49.7	36.2	47.6	35.2	-	49.6	37.3	35.1	<0.7	mg/kg	TM30/PM15
Selenium #	<1	6	2	1	3	3	-	2	2	1	<1	mg/kg	TM30/PM15
Zinc #	49	62	109	67	91	63	-	101	75	70	<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03	0.05	<0.03	<0.03	0.04	0.16	0.06	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	0.02	<0.02	<0.02	0.03	0.07	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	99	106	95	101	99	102	106	103	95	101	<0	%	TM4/PM8
Mineral Oil >C8-C10	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	mg/kg	TM5/PM16
Mineral Oil >C10-C12	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM16
Mineral Oil >C12-C16	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM16
Mineral Oil >C16-C21	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM16
Mineral Oil >C21-C40	<10	87	<10	<10	<10	132	<10	<10	<10	<10	<10	mg/kg	TM5/PM16
Mineral Oil >C8-C40	<45	87	<45	<45	<45	132	<45	<45	<45	<45	<45	mg/kg	TM5/PM16

Please see attached notes for all abbreviations and acronyms

Client Name: O'Connor Sutton Cronin & Assoc. Ltd
Reference:
Location: St Pauls
Contact: Cian O'Hora
JE Job No.: 15/14318

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1	2	3	4	5	6	7	8	9	10	LOD/LOR	Units	Method No.
Sample ID	BH1	BH1	BH2	BH2	BH2	BH2	BH3	BH4	BH4	BH4			
Depth	0.00-1.00	1.00-2.00	0.50	1.00	2.00	3.00	0.50	0.00-1.00	1.00-2.00	2.00-3.00			
COC No / misc													
Containers	T	T	T	T	T	T	T	T	T	T			
Sample Date	28/09/2015	28/09/2015	30/09/2015	30/09/2015	30/09/2015	30/09/2015	01/10/2015	03/10/2015	03/10/2015	03/10/2015			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015			
TPH CWG													
Aliphatics													
>C5-C6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C6-C8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM16
>C12-C16 #	<4	<4	<4	<4	<4	<4	-	<4	<4	<4	<4	mg/kg	TM5/PM16
>C16-C21 #	<7	<7	<7	<7	<7	<7	-	<7	<7	<7	<7	mg/kg	TM5/PM16
>C21-C35 #	<7	87	<7	<7	8	132	-	<7	<7	<7	<7	mg/kg	TM5/PM16
>C35-C40 #	<7	<7	<7	<7	<7	<7	-	<7	<7	<7	<7	mg/kg	TM5/PM16
Total aliphatics C5-40	<26	87	<26	<26	<26	132	-	<26	<26	<26	<26	mg/kg	TM5/TM36/PM12/PM16
>C6-C10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10	<10	17	-	<10	<10	<10	<10	mg/kg	TM5/PM16
>C25-C35	<10	76	<10	<10	<10	115	-	<10	<10	<10	<10	mg/kg	TM5/PM16
Aromatics													
>C5-EC7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC7-EC8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC8-EC10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC12	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM16
>EC12-EC16	<4	<4	<4	<4	<4	<4	-	<4	<4	<4	<4	mg/kg	TM5/PM16
>EC16-EC21	<7	<7	<7	<7	<7	<7	-	<7	<7	<7	<7	mg/kg	TM5/PM16
>EC21-EC35	<7	32	<7	<7	<7	55	-	<7	<7	<7	<7	mg/kg	TM5/PM16
>EC35-EC40	<7	<7	<7	<7	<7	<7	-	<7	<7	<7	<7	mg/kg	TM5/PM16
Total aromatics C5-40	<26	32	<26	<26	<26	55	-	<26	<26	<26	<26	mg/kg	TM5/TM36/PM12/PM16
Total aliphatics and aromatics(C5-40)	<52	119	<52	<52	<52	187	-	<52	<52	<52	<52	mg/kg	TM5/TM36/PM12/PM16
>EC6-EC10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10	<10	<10	<10	<10	-	<10	<10	<10	<10	mg/kg	TM5/PM16
>EC25-EC35	<10	32	<10	<10	<10	53	-	<10	<10	<10	<10	mg/kg	TM5/PM16
MTBE	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM31/PM12
Benzene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM31/PM12
Toluene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM31/PM12
Ethylbenzene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM31/PM12
m/p-Xylene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM31/PM12
o-Xylene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM31/PM12
PCB 28 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
Total 7 PCBs #	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	ug/kg	TM17/PM8

Please see attached notes for all abbreviations and acronyms

PLAN NO: LRD6002/22-S3 REC:06/09/2022

Client Name: O'Connor Sutton Cronin & Assoc. Ltd
Reference:
Location: St Pauls
Contact: Cian O'Hora
JE Job No.: 15/14318

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.	1	2	3	4	5	6	7	8	9	10	LOD/LOR	Units	Method No.
Sample ID	BH1	BH1	BH2	BH2	BH2	BH2	BH3	BH4	BH4	BH4			
Depth	0.00-1.00	1.00-2.00	0.50	1.00	2.00	3.00	0.50	0.00-1.00	1.00-2.00	2.00-3.00			
COC No / misc													
Containers	T	T	T	T	T	T	T	T	T	T			
Sample Date	28/09/2015	28/09/2015	30/09/2015	30/09/2015	30/09/2015	30/09/2015	01/10/2015	03/10/2015	03/10/2015	03/10/2015			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015	06/10/2015			
Natural Moisture Content	9.7	8.9	17.7	12.5	10.6	8.2	13.4	22.3	10.7	10.9	<0.1	%	PM4/PM0
% Dry Matter 105°C	85.9	86.9	85.4	89.6	88.8	89.6	85.5	79.7	88.9	87.7	<0.1	%	NONE/PM4
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	-	<0.3	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0516	-	<0.0015	-	-	-	0.0027	0.0224	-	-	<0.0015	g/l	TM38/PM20
Chromium III	28.0	33.2	60.6	31.4	34.0	34.0	-	58.0	30.0	28.4	<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.50	1.03	1.20	0.44	0.53	0.53	2.27	2.02	0.34	0.38	<0.02	%	TM21/PM24
pH #	8.65	-	8.50	-	-	-	8.36	8.56	-	-	<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1051	0.1036	0.1056	0.1003	0.1011	0.1003	0.105	0.1133	0.1007	0.1022		kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		kg	NONE/PM17

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