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APPENDIX 6-C GROUND INVESTIGATION
REPORT FOR BAY OF NIGG HARBOUR
DEVELOPMENT





 **SOIL ENGINEERING**



REPORT QUALITY ASSURANCE SHEET

Title:

GROUND INVESTIGATION REPORT

FOR

BAY OF NIGG HARBOUR DEVELOPMENT

ABERDEEN

VOLUME ONE

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GROUND INVESTIGATION REPORT: BAY OF NIGG HARBOUR DEVELOPMENT, ABERDEEN

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EXECUTIVE SUMMARY

This summary contains an over view of the key findings and conclusions of this report. It is emphasised however that no reliance should be placed on any part of this summary without referring to the relevant sections of the report. These sections within the main body of the report, together with linking laboratory data and plans etc., may contain information which puts into context findings which are highlighted within this summary.

Soil Engineering Geoservices Limited were instructed by Arch Henderson LLP (The Engineer) acting for and on behalf of Aberdeen Harbour Board (The Employer), to provide a geotechnical assessment for the proposed new Bay of Nigg Harbour Development at Aberdeen. This assessment in the form of a ground investigation report (GIR) was to be based on the ground investigation also carried out by Soil Engineering between June and November 2013, together with previous borehole information provided by the British Geological Survey.

It is proposed to develop Nigg Bay as a new harbour facility with the construction of new breakwaters, quays and a navigation channel and harbour area. The construction of the navigation channel and harbour area will involve dredging of parts of Nigg Bay to reduce its level to approximately -9.0m chart datum with the approach channel at -10.5m chart datum.

Nigg Bay is located at the eastern end of St Fittick's Road, some 6km to the south-east of Aberdeen city centre (centred on approximate National Grid reference NJ 970 046). The site is irregular in shape and comprises the over water and inter tidal area of Nigg Bay between the headlands occupied by Balnagask Golf Course to the north and Loirston Country Park to the south.

Geological maps show that the land adjacent to the site is underlain by superficial Pleistocene deposits comprising glacial meltwater deposits (sand and gravels with lenses of silt and clay) and glacial till (clay, sandy clay or sand with a significant gravel, cobble and boulder content). At greater depth, the adjacent land is shown to be underlain by metasedimentary rocks (psammites, semipelites and subsidiary pelites) of the Aberdeen Formation of the Dalradian supergroup of Precambrian age.

In the vicinity of the proposed new harbour development only local and limited thicknesses of made ground was encountered beneath the south western corner of the site. A significant and variable thickness of superficial deposits were encountered beneath the site typically comprising medium dense or dense marine granular deposits overlying typically very stiff and hard glacial till strata and very dense glacial granular strata with thicknesses of superficial deposits between not encountered and 38.00m recorded in the exploratory holes. The superficial deposits appear to infill an east west trending valley feature incised into the underlying weak, medium strong and strong Dalradian rock strata.

The ground conditions encountered beneath the site appear to be generally favourable for the development. The exploratory holes indicate that the areas where breakwaters are to be constructed are underlain by medium dense, dense and very dense marine granular materials, very stiff and hard glacial till and granitic gneiss rock strata. In the area of the new quay, a similar sequence of superficial strata was encountered with variable thicknesses and type of superficial deposits and rockhead levels encountered. Based on the current borehole information dredging of the new harbour basin and approach channel will excavate marine granular deposits and the underlying glacial till and granular glacial deposits.

The concrete design classification for the site is calculated as DS-1 with an ACEC class AC-1.

1.0 INTRODUCTION

In June 2013 Soil Engineering Geoservices Limited were instructed by Arch Henderson LLP (The Engineer) acting for and on behalf of Aberdeen Harbour Board (The Employer), to carry out a ground investigation for the Bay of Nigg Harbour Development. The investigation comprised the formation of cable percussive boreholes selectively extended by rotary drilling together with trial pitting, grab sampling, in situ testing and a geophysical magnetometer survey. Most of the work was to be undertaken overwater or within the intertidal area of the bay.

This ground investigation report (GIR) comprises the results of the fieldwork and laboratory testing together with an interpretation of the geoenvironmental conditions at the site. The fieldwork was carried out between 5th June and 2nd November 2013.

2.0 PURPOSE, SCOPE AND REPORT FORMAT

2.1 Purpose

The purpose of this investigation was to determine the subsurface ground, and groundwater conditions at the site. An interpretative geoenvironmental (GIR) report was also required in order that appropriate material parameters for the design of the proposed structures could be ascertained.

2.2 Scope of Work

The brief for this Ground Investigation Report comprised the following items:

1. To form exploratory holes on site.
2. To install gas and ground water monitoring instruments.
3. To monitor on site installations.
4. To undertake laboratory tests scheduled by the Engineer on samples recovered from exploratory holes.
5. Review and provide a written appraisal of readily available published geotechnical information and geotechnical and historical information provided by the Engineer
6. Provide a written appraisal of the ground and water conditions
7. Provide analysis and interpretation of factual data for the classification and derivation of design parameters for each stratum encountered
8. Provide geotechnical engineering assessment

The sources of information used in the compilation of this report are detailed in the list of references on page 39.

2.3 Limitations

This report has been prepared using the site investigation data and / or desk study / historical information referenced in the report text. Soil Engineering has prepared the report in accordance with the specification and scope of works for this project, which was designed by Arch Henderson LLP together with the relevant European and British Standards.

It should be noted that the investigation data on which this report is based is only indicative of the actual ground, groundwater and ground gas conditions that exist at the locations of the exploratory holes and may not be representative of the conditions that exist on the site as a whole.

Soil Engineering accept no liability for any adverse geotechnical or environmental impacts on the proposed

development, that result from ground not investigated as part of this project. Similarly, Soil Engineering is not liable for any adverse effects that arise as a result of conditions that exist on land adjacent to the subject site.

2.4 Report Format

This report is presented in the following format:

- Description of fieldwork
- Summary of Desk Study Information
- Geotechnical Appraisal, Interpretation and Engineering Assessment
- Exploratory hole logs
- Laboratory test results
- Data Plots and Sections
- Maps and plans

2.5 Key Sources of Information

- Arch Henderson, Drawing No 121106-01
- BGS 1:50,000 scale geological map for the area, Sheet 77-Scotland, Solid (1982) and Drift (1980) editions for Aberdeen.
- BGS Memoir for the 1:50 000 Sheet 77-Scotland (1986) entitled Geology of the country around Aberdeen.
- British Geological Survey Borehole Data Pack, Ref BH_119433_1, dated 28 October 2013

3.0 DESK STUDY INFORMATION

3.1 Scope of Study

A formal comprehensive desk study was not requested or supplied by the Engineer for this investigation. Information from the British Geological Survey on the site geology and historical borehole records for the area was provided by the Engineer and is appended to this report.

The following sections provide general details of site location, site description and site geology as ascertained from published maps and memoirs.

3.2 Site Location and Description

The site is located at the eastern end of St Fittick's Road, some 6km to the south-east of Aberdeen city centre (centred on approximate National Grid reference NJ 970 046). The site is irregular in shape and comprises the over water and inter tidal area of Nigg Bay between the headlands occupied by Balnagask Golf Course to the north and Loirston country park to the south. The site is bounded by the two aforementioned headlands/golf courses to the north and south, by rough ground, pasture land and the Nigg Bay Waste Water treatment plant to the west and by the North Sea to the east. A road (Coast Road and Greyhope Road) approximately bounds the northern, western and south-eastern edges of the site. The site is currently unoccupied and comprises Nigg Bay, an area of tidal open seawater, as well as the bounding intertidal areas comprising open sand, roughly vegetated areas as well as exposed rock headland.

The site is located in a predominantly semi-rural coastal area to the south east of Aberdeen with the mouth of the River Dee and Aberdeen harbour located approximately 1km to the north of the site to the north of the bounding northern headland.

The site has a complex relief with elevated headland areas to the north and south, a lower lying area to the east and the bay topography generally sloping towards the centre of the bay and out to sea.

The location of the site is indicated on Figure 1 in Section C of this report.

3.3 Site History

No information on the history of the site was provided by the Engineer.

3.4 Geology

The 1:50,000 scale Geological Survey map for the area, sheet 77-(Scotland) for Aberdeen, Solid (1982) and Drift (1980) editions, shows the land adjacent to the site to be underlain by Pleistocene deposits comprising glacial meltwater deposits (sand and gravels with lenses of silt and clay) and glacial till (clay, sandy clay or sand with a significant gravel, cobble and boulder content). The map also records a glacial melt water channel as entering the bay from the south. At greater depth, the adjacent land is shown to be underlain by metasedimentary rocks (psammites, semipelites and subsidiary pelites) of the Aberdeen Formation of the Dalradian supergroup of Precambrian age. Subsidiary discordant sheets of amphibolite and hornblende schist are also recorded. The map records outcrops of Dalradian rock strata underlying the Pleistocene deposits on the headlands to the north and south of the site. The map also records foliation and banding within the Dalradian strata as dipping to the north-west and north-east with dips between 45° and 90° recorded. The nearest faulting is recorded as the north-east south-west trending Dee Fault which is recorded approximately 1.5km to the north west of the centre of the site.

Further information on the superficial deposits is contained within the geological maps and information in the British Geological Survey Borehole Data Pack, Ref BH_119433_1, dated 28 October 2013 (presented in the appendix to this report). This records a variable sequence of glacial sand and gravel deposits overlying glacial till on both headlands to the north and south of Nigg Bay. Alluvium is recorded infilling the shallow valley behind the bay and a sequence of marine beach deposits is recorded lining the shore of the bay.

Information from the BGS geological memoir for the area (BGS Memoir for the 1:50 000 Sheet 77-Scotland (1986) entitled Geology of the country around Aberdeen) indicates that the bay area is underlain by silts, sands and gravels classified by the BGS as marine beach deposits of Quaternary age. The memoir also records raised beach deposits in the Aberdeen area sometimes with associated deposits of peat. Nigg Bay is recorded by the memoir as being underlain by an infilled former glacial melt out channel and possible former course of the River Dee. The memoir records that boreholes drilled within the bay indicate anomalous drift depths associated with a buried channel and glacial deposits underlying more recent marine beach deposits. The buried channel is recorded as being infilled with glacial (largely till) deposits with a thickness of 30m noted from boreholes. Geophysical surveys mentioned in the memoir indicate that the channel may extend at least 1km out to sea and the publication speculates that the channel may be a subglacial or pre Devensian feature. The glacial tills in the Aberdeen area are noted by the memoir to be variable with at least three till units noted. The memoir suggests lodgement, melt-out and flow till origins for individual till units with the melt-out and flow till units typically being more granular in nature and with all types of till containing coarse granular materials.

The memoirs record significant weathering of rock to depths of up to 20m in the Aberdeen area with the psammites being less prone to weathering than other types of rock however the weathering is noted to be variable and difficult to predict. This deep weathering is thought to be associated with relatively warm interglacial periods that occurred during the last glaciation and preceding this, during the Tertiary period. The Dalradian rocks are interpreted as sedimentary rocks altered by low grade metamorphism and the amphibolite and hornblende schist is thought to represent metamorphosed basic igneous intrusions.

3.5 Hydrology and Hydrogeology

No information on the Hydrology and Hydrogeology of the site was provided by the Engineer.

3.6 Previous Investigations

The Engineer has supplied details of a geophysical and bathymetric survey carried out on the site in 2012 by Caledonian Geotech Ltd. This investigation comprised sub-bottom profile, bathymetry and side scan sonar surveys. For further information, reference should be made to the full report, which is listed on page 39 of this report. This investigation produced an isopach map of rockhead depths in Nigg Bay area and opposite the adjacent headlands based on the results of the sonar survey. Although quite variable, the general pattern indicated is for rockhead depths to gradually increase out to sea opposite the headland areas (depths between 14.0m and 26.0m below chart datum are indicated approximately 500m out from the headlands). In the central part of the bay, a roughly east-west trending channel with a width of approximately 200m to 300m is indicated. In the area of Nigg Bay rockhead depths are indicated to increase away from the headlands towards the centre of the channel however, the channel appears to have relatively steep sides in some areas and local plateau areas indicated to either side of this. Although the base of the channel is indicated to be relatively level, an uneven and undulating local topography is indicated. The channel is also indicated to gradually increase in depth out to sea (with rock head depths increasing from 14.0m to in excess of 40.0m below chart datum indicated).

The Engineer supplied a British Geological Survey (BGS) Borehole Data Pack, Ref BH_119433_1, dated 28 October 2013 containing a description of the geology of the area and also database records for twelve exploratory holes undertaken within Nigg Bay and the surrounding vicinity principally for the Aberdeen Sea Outfall. The boreholes were mainly drilled in the bay area, along the southern headland (Greg Ness) and out to sea from this. A summary of the strata and ground water encountered in these records together with key in situ testing results are summarised in the following tables. For further detailed information, reference should be made to Section 7.2 and to the full report, which is listed on page 39 of this report.

TABLE 1: SUMMARY OF STRATA TYPES RECORDED IN THE BRITISH GEOLOGICAL SURVEY BOREHOLE DATA PACK REF. BH_119433_1

Borehole No	Made Ground (mbgl)	Sand and Sand and Gravel, Local Cobbles (mbgl)	Glacial Till (Variably Sandy Variably Gravelly Clay) (mbgl)	Glacial Silt (mbgl)	Sand, Gravel Cobbles and Boulders (mbgl)	Weathered Granite and Gneiss (mbgl)	Less Weathered Granite and Gneiss (mbgl)
NJ90SESE7119 1A	NE	GL-15.20P	NE	NE	15.20-20.0+	-	-
NJ90SESE7807 8	NE	GL-3.43 4.42-5.33	NE 5.33-35.97	3.43-4.42 NE	35.97-40.54	40.54-54.56	54.56-66.29+
NJ90SESE7807 21	GL - 5.50	5.50 - 6.50	6.50 - 11.00+	-	-	-	-
NJ90SESE7119 1	NE	NE	NE	NE	GL-6.50+	-	-
NJ90SESE7807 22	GL-3.63	NE	NE	NE	NE	3.62-5.70+	-
NJ90SESE7807 7	NE	GL-2.44	NE	2.44-25.25	25.25-29.26+	-	-
NJ90SESE7807 26	NE	NE	NE	NE	GL-20.50	NE	20.50-29.50+
NJ90SESE7807 27		GL-0.60	0.60-18.50	NE	NE	18.50-19.00	19.00-29.50+
NJ90SESE7807 10	NE	NE	NE	NE	NE	GL-1.22	1.22-64.24+
NJ90SESE7807 11	NE	GL-3.05	NE	NE	3.05-4.12	4.12-8.48+	-
NJ90SESE7113 16	NE	GL-6.50	6.50-9.50	NE	9.5 -11.00	NE	11.00-33.50+
NJ90SESE7113 17	NE	GL-6.30	NE	NE	NE	6.30-9.50	9.50-34.50+

Notes: + Denotes base of strata not encountered
NE Not encountered
P Strata contains peat bands

Table 1 indicates that seven main material types were identified during the various investigations. The table also indicates the variability of the superficial materials encountered around the edge of Nigg Bay and especially along the northern edge of the Greg Ness headland where they principally comprise variable granular and cohesive glacial deposits. On the tip of the headland itself, rock was encountered at shallow depth with superficial deposits thickening to the east of this towards Nigg Bay. Two boreholes within these investigations proved granite and gneiss bedrock to depths in excess of 60.00m.

Limited ground water data was obtained during the various investigations contained in the BGS report. These are summarised in Table 2.

TABLE 2: SUMMARY OF GROUNDWATER OBSERVATIONS FROM THE BRITISH GEOLOGICAL SURVEY BOREHOLE DATA PACK REF. BH_119433_1

Borehole No	Strike Depth (m)	Standing Level (m)	Strata	Notes
NJ90SESE7119 1A	5.00	4.00	Sand & Gravel	
NJ90SESE7807 8	-	-	-	Not Recorded
NJ90SESE7807 21	Dry	-	-	Borehole Dry
NJ90SESE7119 1	Dry	-	-	Borehole Dry
NJ90SESE7807 22	Dry	-	-	Borehole Dry
NJ90SESE7807 7	-	-	-	Not Recorded
NJ90SESE7807 26	Dry	-	-	Borehole Dry
NJ90SESE7807 27	Dry	-	-	Borehole Dry
NJ90SESE7807 10	-	-	-	Not Recorded
NJ90SESE7807 11	-	-	-	Not Recorded
NJ90SESE7113 16	-	-	-	Not Recorded
NJ90SESE7113 17	-	-	-	Not Recorded

TABLE 3: SUMMARY OF IN SITU TEST RESULTS FROM THE BRITISH GEOLOGICAL SURVEY BOREHOLE DATA PACK REF. BH_119433_1

In situ test type	Made Ground	Sand and Sand and Gravel, Local Cobbles	Glacial Till (Variably Sandy Variably Gravelly Clay)	Glacial Silt	Sand, Gravel Cobbles and Boulders	Weathered Granite and Gneiss	Less Weathered Granite and Gneiss
SPT 'N' value (blows)	-	8 - 97	54 - 89	-	46 - 79	-	-
Note: SPT trip hammer efficiency unknown							

Limited in situ testing was undertaken during the various investigations contained in the BGS report. This is summarised in Table 3 and comprised standard penetration testing.

4.0 FIELDWORK

4.1 Scope of Fieldwork

The scope of the fieldwork was specified by the Engineer and was undertaken in general accordance with Eurocode 7 Part 2 (BS EN 1997-2: 2007) and where there is no conflict also with BS 5930: 1999 + A2: 2010. Soil and rock logging has been undertaken in accordance with the relevant European Standards, listed in the references for this report. Soil Engineering had responsibility for setting out and surveying all exploratory holes while the Engineer had responsibility for determining the in situ testing and sampling regime. Cable percussion boreholes selectively extended by rotary drilling were formed together with mechanically excavated trial pits, seabed and magnetometer surveys and grab sampling. The exploratory hole locations are shown on the site plan presented in Section C of this report.

4.2 Magnetometer Survey

A detailed marine magnetometer survey was undertaken by Coastline Surveys Limited in June 2013. The results of the survey show thirty-three targets with magnetic signature significantly above background levels.

For further information, reference should be made to the full survey report, included as an appendix to this report.

4.3 Inspection Pits

In order to reduce the risk of damaging buried services, the location of exploratory hole L01 was scanned using a cable avoidance tool (CAT). As a further precaution, an inspection pit was hand excavated to a depth of 1.20m, followed by a further scan of the base of the pit with the CAT. Inspection pits were not excavated for the remaining boreholes, as they were formed overwater from a jack-up platform.

4.4 Cable Percussion Boreholes

A total of forty-nine over-water boreholes and a single land based borehole were formed to depths between 0.10m and 10.40m using conventional light cable percussion techniques together with 200mm and 150mm diameter temporary steel casings. The boreholes were all formed in order to obtain samples for laboratory testing and to provide geotechnical information for foundation design.

In granular materials, cohesive materials and rock Standard Penetration Tests were carried out using either a split spoon sampler or a solid 60° cone. The results of these tests are given as a Standard Penetration "N" value or as a blow count for a given penetration at the appropriate position on the borehole logs, where the use of either the sampler or cone is also recorded.

Representative disturbed samples of all materials encountered were obtained and these were placed in sealed containers for transport to the laboratory.

Where appropriate / required, environmental samples were obtained for chemical testing.

The samples recovered from the boreholes were described by an Engineering Geologist, in accordance with the terminology presented in Appendix 1 of this report. A detailed description of all strata encountered, groundwater conditions and the position and type of samples taken are included on the borehole logs presented in Section A of this report.

4.5 Rotary Drilling

In order to obtain information on the solid geology beneath the site and/or where the stiffness of the cohesive material and presence of coarse granular material prevented the progression of the cable percussion drilling, boreholes were extended using rotary drilling techniques. These boreholes were extended to depths between 4.00m and 40.00m, using a combination of SWF, Geobore S or T6116 core barrels together with a protective semi rigid plastic liner and a Polycrystalline Diamond (PCD) or Diamond Impregnated (Impreg) core bit with water flush to produce cores of 107, 102 or 89mm nominal diameter respectively.

Details of the strata encountered are given on the borehole logs along with the Engineering Geologist's assessment of Total Core Recovery (TCR), Solid Core Recovery (SCR), and Rock Quality Designation (RQD) each expressed as a percentage of the individual core runs. Where applicable a fracture spacing (l_f) has also

been determined and this information is given on the logs.

The symbols and abbreviations used on the rotary borehole logs are explained on the exploratory hole log legend and notation sheet presented in Section A of this report.

The core samples recovered were photographed and described by an Engineering Geologist in accordance with the terminology presented in Appendix 1 of this report. Where suitable, sub-samples of the cored superficial deposits were taken. These sub-samples were sealed in wax to prevent moisture loss and transported to the Leeds laboratory of Soil Engineering for geotechnical testing. The borehole logs are presented in Section A of this report and photographic records are presented in Section D of this report.

4.6 Grab Sampling

In order to establish contamination levels for proposed dredged material, twenty-six grab samples were undertaken using a Van Veen grab sampler.

The recovered samples were described by an Engineering Geologist and the descriptions of the samples recovered are shown on the relevant logs presented in Section A of this report.

4.7 Trial Pits

Eighteen trial pits designated TP01 to TP18 inclusive were excavated using a 20 tonne tracked excavator to depths between 1.70m and 4.40m. The pits were located around the inter-tidal foreshore of the site to provide a reasonable indication of the presence of any made ground and in particular to assess the mass soil fabric of the near surface natural deposits.

The trial pits were not shored and were logged from the surface by an Engineering Geologist. The Engineering Geologist provided a detailed description of the ground conditions encountered in each pit and also obtained disturbed soil samples at regular intervals for geotechnical analysis. The strata encountered in the trial pits are described on the trial pit logs presented in Section A of this report and the location of each of the trial pits is indicated on the site plan presented in Section C of this report. Trial pit photographs are included in Section D of this report.

5.0 LABORATORY TESTING

5.1 Scope of Testing

All geotechnical (soils) and chemical (contamination) testing was scheduled by the Engineer. The scope of the testing was required to enable comments regarding the dredgability of overburden and rock and the suitability of soil and rock for construction of quay walls and breakwaters to be made and for potential site contamination levels to be established.

5.2 Geotechnical Soils Testing

The programme of laboratory testing was carried out in accordance with BS 1377. The testing was carried out at the Leeds laboratory of Soil Engineering, a UKAS accredited testing laboratory No 1265.

Results are given on the summary sheets with individual test plots presented in Section B of this report.

In addition, chemical (sulfate and pH) testing was undertaken by SAL, a UKAS accredited testing laboratory No. 1549. Testing was undertaken in order to assess concrete requirements from BRE Special Digest No 1. Samples were prepared in general accordance with BS 1377, although final analysis of total sulfate was

performed using ICP and aqueous extract using Ion Chromatography.

5.3 Geotechnical Rock Testing

In order to provide an indication of the strength of the rock encountered, point load testing and unconfined compressive strength testing was undertaken on selected core samples. These tests were performed in accordance with the specifications indicated on the individual test plots.

Results are presented in Section B of this report.

5.4 Environmental Testing

A programme of environmental testing was scheduled on the samples recovered utilising the Van Veen grab sampler. Testing was carried out by SAL, a UKAS accredited testing laboratory No. 1549.

Testing was carried out in accordance with the methods identified in the test reports.

The results of the environmental testing are presented in Section B of this report.

6.0 SUMMARY OF RESULTS OF THE INVESTIGATION

6.1 Scope of Commentary

The results of this investigation appear to conflict to some extent with the published geology summarised in Section 3.3 of this report but generally agreed with the findings of the previous investigations carried out on this site and referenced in Section 3.4 of this report. Although the superficial deposits were as predicted by the published geological information, the solid geology differed to some extent for the published records. The following sections are only intended to provide a summary of the ground conditions encountered during this investigation whilst the logs presented in Section A of this report give detailed descriptions of all the strata observed.

6.2 Made Ground

Made ground typically between 0.60m and 3.70m in thickness was only encountered in trial pits TP08 and TP10 to TP15 inclusive in the south western corner of the bay. The made ground was generally seen to comprise a granular mix of coarse and very coarse materials comprising a variable mix of sand and gravel, cobble and boulder sized fragments of metamorphic rock, igneous rock, concrete, tarmac, brick, plastic pipe, packaging and metal. Other materials were also identified including wood fragments, cast iron pipe pieces and polystyrene.

6.3 Superficial Deposits

Underlying any made ground, topsoil or at ground/seabed level, a variable sequence of sand, sand and gravel, cobbles, boulders, and variably sandy variably gravelly clay with cobbles and boulders was encountered. The sequence typically comprised an upper principally granular formation of marine deposits comprising a variable mix of sand, gravel, cobbles and boulders underlain by glacial deposits comprising variably sandy variably gravelly clay with cobbles and boulders with interbedded granular materials comprising sand, gravel, cobbles and boulders.

Two distinct units were noted within the upper marine granular formation with both being discontinuous and not encountered in all exploratory holes. Typically, the uppermost unit comprised a fine to coarse sand with varying fine gravel, silt and cobble content. This unit was encountered in the majority of the boreholes to depths between 0.20m and 10.10m below bed level and typically increased in thickness towards the mouth of Nigg Bay. This unit was locally underlain by a unit of very coarse material typically comprising cobbles and boulders of mixed igneous and metamorphic lithologies with a sand and gravel matrix. It was noted that the coarse granular deposit was more prevalent in the intertidal and foreshore areas especially in the north western quadrant of the bay to the south of the Girdle Ness headland while towards the centre of the bay the unit thins and in this area sometimes comprises isolated cobbles and boulders.

Underlying the upper marine granular formation glacial deposits comprising till with subsidiary granular materials and/or bedrock was encountered. The glacial deposits, where present, were seen to principally comprise units of glacial till generally consisting of brown or greyish brown, stiff, very stiff and hard clay with varying sand, gravel, cobble and boulder content. Localised variation in the clay included a reddish brown clay layer within this stratum. The glacial till strata also contained variable granular units comprising sand and gravel often with a significant cobble and boulder content. The glacial deposits were noted to be very variable in thickness with thicknesses in excess of 25.00m noted along a roughly east-west trending axis running through the centre of the bay.

6.4 Dalradian Rock Strata

The depth to rockhead was very variable across the site. Rock was encountered at ground/bed level or at

shallow depth adjacent to the headlands but depths to rockhead in excess of 30.00m were recorded in exploratory holes drilled along a roughly east-west trending axis running through the centre of the bay. The topography of the buried valley as illustrated by varying rockhead levels in boreholes appears to be quite complex with plateau areas and areas of steeply sloping ground indicated (e.g. between boreholes A31 and A34).

Twenty-eight boreholes were extended into rock in order to assess the solid geology. These boreholes encountered a banded granitic gneiss, comprising of interbanded units of micaceous schist, gneiss and coarse grained granitic materials frequently in thin to thickly banded units. The granitic gneiss was proved to a maximum depth of 40.00m in borehole A05. The rock appeared to be variably weathered and typically appeared to be slightly or moderately weathered but also contained weaker moderately and highly weathered strata. The distribution of the weathered material between boreholes appeared to follow no set pattern and was very variable.

A summary of the ground conditions encountered during this investigation is presented as Tables 4, 5, 6 and 7.

Additional information on the ground conditions is available from the British Geological Survey Borehole Data Pack and a summary of this information is given in Table 1.

TABLE 4: SUMMARY OF STRATA TYPES ENCOUNTERED IN BOREHOLES FROM THE SOIL ENGINEERING 2013 INVESTIGATION - C AND D SERIES BOREHOLES

Borehole No	Made Ground (mbgl)	Marine Deposits (Sand and Sand and Gravel) (mbgl)	Marine Deposits (Sand, Gravel, Cobbles and Boulders) (mbgl)	Glacial Till (Variably Sandy Variably Gravelly Clay with Cobbles and Boulders)	Glacial Sand, Gravel Cobbles and Boulders (mbgl)	Weathered Gneiss (Granite, Gneiss and Schist) (mbgl)	Less Weathered Gneiss (Granite, Gneiss and Schist) (mbgl)
C79	NE	GL-0.90	NE	NE	NE	6.13-8.00+	0.90-6.13
C81	NE	GL - 2.50	2.50-4.40	4.40-8.00+	-	-	-
C83	NE	GL-2.30	2.30-2.50	2.50-10.10+	-	-	-
C84	NE	GL-1.00	1.00-1.40	1.40-7.40+	-	-	-
C87	NE	GL-1.10	1.10-1.20	1.20-8.50+	-	-	-
C88	NE	GL-1.00	1.00-1.20	1.20-8.25+	-	-	-
C96	NE	GL-4.50	NE	NE	NE	4.50-7.30+	-
D98	NE	GL-2.00	NE	NE	NE	NE	2.00-4.10+
D99	NE	GL-4.10	NE	4.10-7.10+	-	-	-
D100	NE	GL-3.10	NE	NE	NE	NE	3.10-4.00+
D101	NE	GL-4.80	NE	4.80-8.80+	-	-	-
D102	NE	GL-3.00+	-	-	-	-	-
D104	NE	GL-7.95	7.95-8.25	8.25-11.60+	-	-	-

Notes: + Denotes base of stratum not encountered
NE Not encountered

TABLE 5: SUMMARY OF STRATA TYPES ENCOUNTERED IN BOREHOLES FROM THE SOIL ENGINEERING 2013 INVESTIGATION - A, B, GS AND L SERIES BOREHOLES

Borehole No	Made Ground (mbgl)	Marine Deposits (Sand and Gravel) (mbgl)	Marine Deposits (Sand, Gravel, Cobbles and Boulders) (mbgl)	Glacial Till (Variably Sandy Variably Gravelly Clay with Cobbles and Boulders) (mbgl)	Glacial Sand, Gravel Cobbles and Boulders (mbgl)	Weathered Gneiss (Granite, Gneiss and Schist) (mbgl)	Less Weathered Gneiss (Granite, Gneiss and Schist) (mbgl)
A05	NE	GL-1.80	NE	1.80-14.50 19.40 - 38.00	14.50-19.40	38.00-40.00+	-
A08	NE	GL - 1.60	NE	1.60-32.40 35.60-36.00+	32.40 - 35.60	-	-
A11	NE	GL-1.20	NE	1.20-14.60 17.10-27.50	14.60-17.10 27.50-28.20	NE	28.20-32.80+
A19	NE	NE	NE	GL-1.40	1.40-4.50	NE	4.50-9.80+
A26	NE	NE	GL-2.80?	2.80-3.20	NE	3.20-6.34	6.34-8.10+
A29	NE	GL-2.30	2.30-2.65?	2.65-22.50	NE	NE	22.50-28.00+
A31	NE	GL-1.35	1.35-1.80	1.80-26.00	NE	NE	26.00-34.00+
A34	NE	GL-2.30	NE	2.30-10.35	NE	NE	10.35-15.30+
A36	NE	NE	GL-4.65	NE	NE	NE	4.65-9.70+
A39	NE	NE	GL-1.50	NE	NE	2.83-12.60+	1.50-2.83
A42	NE	NE	GL-2.20	2.20-2.50?	NE	NE	2.50-12.50+
A47	NE	NE	NE	NE	NE	NE	GL-10.10+
A51	NE	GL-2.10	2.10-5.20	NE	NE	NE	5.20-10.20+
A54	NE	GL-4.65	NE	4.65-11.25	11.25-11.65	NE	11.65-16.50
A57	NE	GL-5.60	NE	5.60-27.00	NE	27.00-28.50	28.50-32.00+
A59	NE	GL-4.10	4.10-4.60	4.60-29.50	29.50-31.00+	-	-
A63	NE	GL-6.00	NE	6.00-18.80 25.00-25.50+	18.80-25.00	-	-
B61	NE	GL-4.50	4.50-5.00	5.00-31.30	NE	NE	31.30-36.80+
GS011	NE	NE	GL-2.40	2.40-19.00+	-	-	-
L01	NE	GL-3.50	3.50-6.80	13.00-20.30	6.80-13.00	NE	20.30-25.55+

Notes: + Denotes base of stratum not encountered
NE Not encountered

TABLE 6: SUMMARY OF STRATA TYPES ENCOUNTERED IN BOREHOLES FROM THE SOIL ENGINEERING 2013 INVESTIGATION - E SERIES BOREHOLES

Borehole No	Made Ground (mbgl)	Marine Deposits (Sand and Gravel) (mbgl)	Marine Deposits (Sand, Gravel, Cobbles and Boulders) (mbgl)	Glacial Till (Variably Sandy Variably Gravelly Clay with Cobbles and Boulders) (mbgl)	Glacial Sand, Gravel Cobbles and Boulders (mbgl)	Weathered Gneiss (Granite, Gneiss and Schist) (mbgl)	Less Weathered Gneiss (Granite, Gneiss and Schist) (mbgl)
Northern	Breakwater						
E65	NE	GL-7.50	NE	7.50-10.60+	-	-	-
E66	NE	GL - 10.10	10.10-10.70	10.70-14.25+	-	-	-
E69	NE	GL-6.90	6.90-7.30	7.30-10.60+	-	-	-
E71	NE	GL-9.50	NE	9.50-13.30+	-	-	-
E72	NE	GL-6.15	6.15-6.66	6.66-6.90?	NE	6.90-9.60+	-
E74	NE	NE	GL-3.50	NE	NE	NE	3.50-6.10+
E75	NE	GL-3.60	NE	NE	NE	3.60-6.90+	NE
Southern	Breakwater						
E105	NE	GL-6.00+	-	-	-	-	-
E106	NE	GL-6.00+	-	-	-	-	-
E107	NE	GL-2.95 4.95-6.00+	2.95-4.50	-	-	-	-
E108	NE	GL-3.65	NE	NE	NE	NE	3.65-6.65+
E109	NE	GL-5.80	-	-	-	5.80-5.90?+	-
E110	NE	GL-2.15	NE	NE	NE	NE	2.15-5.85+
E111	NE	GL-3.30	NE	NE	NE	3.30-4.00	4.00-6.00+
E112	NE	GL-2.70	NE	NE	NE	NE	2.70-6.05+
E115	NE	GL-1.50	NE	NE	NE	1.70-4.35+	4.35-5.70+
E116	NE	GL-1.00	NE	NE	NE	NE	1.00-4.50+

Notes: + Denotes base of stratum not encountered
NE Not encountered

TABLE 7: SUMMARY OF STRATA TYPES ENCOUNTERED IN BOREHOLES FROM THE SOIL ENGINEERING 2013 INVESTIGATION - TRIAL PITS

Borehole No	Made Ground (mbgl)	Marine Deposits (Sand and Sand and Gravel with Clay Interbeds) (mbgl)	Marine Deposits (Sand, Gravel, Cobbles and Boulders) (mbgl)	Glacial Till (Variably Sandy Variably Gravelly Clay with Cobbles and Boulders) (mbgl)	Glacial Sand, Gravel Cobbles and Boulders (mbgl)	Weathered Gneiss (Granite, Gneiss and Schist) (mbgl)	Less Weathered Gneiss (Granite, Gneiss and Schist) (mbgl)
TP01	NE	GL-0.85	NE	NE	NE	0.85-1.70+	-
TP02	NE	GL-0.40	NE	0.40-1.00	NE	1.00-2.10+	-
TP03	NE	GL-0.55	NE	0.55-2.40	NE	2.40-2.70+	-
TP04	NE	GL-0.50	NE	0.50-3.30+	-	-	-
TP05	NE	GL-1.30	NE	1.30-3.20+	-	-	-
TP06	NE	GL-3.00+	-	-	-	-	-
TP07	NE	GL-2.00+	-	-	-	-	-
TP08	GL-2.50	2.50-3.80+	-	-	-	-	-
TP09	NE	NE	GL-2.40	2.40-3.80+	-	-	-
TP10	GL-2.40	2.40-3.20	NE	3.20-4.40+	-	-	-
TP11	GL-2.30	NE	NE	2.30-3.10+	-	-	-
TP12	GL-3.70+	-	-	-	-	-	-
TP13	GL-2.50	NE	NE	2.50-3.50+	-	-	-
TP14	GL-3.50+	-	-	-	-	-	-
TP15	GL-0.60	0.60-2.90+	-	-	-	-	-
TP16	NE	GL-2.50	NE	NE	NE	NE	2.50-2.80+
TP17	NE	GL-4.40+	-	-	-	-	-
TP18	NE	GL-2.00+	-	-	-	-	-

Notes: + Denotes base of stratum not encountered
NE Not encountered

The information obtained from all the investigations undertaken on the site has been summarised in a simplified form in Table 8. This table provides the main stratum types together with their depth ranges and a general description of the material composition.

6.5 Groundwater

During the investigation, minor ground water inflows were recorded in most of the exploratory holes formed on land at depths in the range 0.00m to 3.10m below ground level. The majority of the inflows were recorded within the made ground and granular superficial deposits but inflows were also recorded within the clay and rock strata. The majority of these inflows were recorded as seepages or minor inflows.

TABLE 8: SUMMARY OF GROUND CONDITIONS FROM SOIL ENGINEERING 2013 INVESTIGATION

Stratum	Depth to top (mbgl)	Depth to base (mbgl)	Typical Description
Made ground (generally absent)	GL	0.60 - >3.70	A granular mix of coarse and very coarse materials comprising a mix of sand and gravel, cobble and boulder sized fragments of metamorphic rock, igneous rock, concrete, tarmac, brick, plastic pipe, packaging and metal
Marine Sands and Sand & Gravel Deposits (locally absent)	GL - 2.50	0.40 - 10.10	Typically medium dense and dense fine to coarse sand with varying fine gravel, silt and cobble content
Marine Very Coarse Deposits (locally absent)	GL - 10.10	1.80 - 10.70	Cobbles and boulders of mixed igneous and metamorphic lithologies with a sand and gravel matrix
Glacial Till (locally absent)	0.40 - 13.00	1.00 - 38.00	Firm and stiff brown or greyish brown clay with varying sand, gravel, cobble and boulder content
Glacial Granular Deposits (locally absent)	1.40 - 32.40	4.50 - 35.60	Dense and very dense sand and gravel often with a significant cobble and boulder content
Weathered Gneiss (locally absent)	0.85 - 38.00	1.70 - >40.00	Extremely weak, very weak and weak often fractured banded granitic gneiss, comprising of interbanded units of micaceous schist, gneiss and coarse grained granitic materials
Less Weathered Gneiss	GL - 31.30	>40.00	Weak medium strong and strong banded granitic gneiss, comprising of interbanded units of micaceous schist, gneiss and coarse grained granitic materials

6.6 Summary

The strata encountered in the various exploratory holes formed on or adjacent to this site are summarised in tables 1, 4, 5, 6 and 7. Table 8 describes the general sequence of strata encountered on the site. These tables illustrate the variability of the sequence across the site.

An inspection of the exploratory holes and the strata they encountered in relation to their location on the site generally confirms the findings of the geophysics bathometric survey and previous geological information in relation to the location of the infilled buried valley beneath Nigg Bay. The investigation confirmed the geological information that the buried valley is, to the depths investigated, infilled principally with glaciogenic materials (glacial till and granular deposits). These are overlain by a predominantly granular sequence of marine deposits that generally appear to thicken towards the mouth of the bay.

7.0 GEOTECHNICAL PARAMETRIC ASSESSMENT

7.1 General Comment

The data obtained during both the current investigation has been used in the parametric assessment and material geotechnical parameters are given in the following sections.

It should be noted that the geotechnical parameters detailed in Section 7 are based on a general assessment of the data. The values stated should be reviewed by the designer and specific characteristic values determined in order to make them applicable to the individual design requirements.

7.2 Soil Classification

7.2.1 Moisture Content and Atterberg Limits

Moisture content testing and Atterberg Limits testing was undertaken on the glacial till deposits.

The natural moisture content test results obtained from these deposits are summarised in Table 9 below.

TABLE 9: SUMMARY OF MOISTURE CONTENT TEST RESULTS FROM SOIL ENGINEERING 2013 INVESTIGATION

Strata	No of Tests	Minimum Moisture Content %	Maximum Moisture Content %	Average Moisture Content %
Marine Deposits	3	9.4	25	19.5
Glacial Till	70	3.6	32	9.7

A plot of moisture content against depth is presented in Figure 1 in Section E of this report. The plot illustrates the relatively low and consistent moisture content of the glacial till which shows little variation with depth apart from slightly elevated values near its top.

Three Atterberg Limits tests were performed on potentially cohesive samples taken from the marine deposits. Both of the test results indicate that the material tested is non-plastic.

The results of the Atterberg Limits testing on marine deposits are shown in Table 10.

TABLE 10: SUMMARY OF MOISTURE CONTENT AND ATTERBERG LIMIT TEST RESULTS FOR MARINE DEPOSITS FROM SOIL ENGINEERING 2013 INVESTIGATION

Parameter	No of Tests	Minimum	Maximum	Average
Natural mc %	3	9.4	25	19.5
Plastic Limit %	3	NP	21	NP
Liquid Limit %	3	22	36	28
Plasticity Index %	3	NP	15	NP

Note: NP Non Plastic

Twenty-nine Atterberg Limits tests were performed on samples taken from the glacial till. The majority of the test results indicate that the material tested is clay, with only one sample classifying as non-plastic. The plasticity of the samples is relatively consistent with the classification on the A line plot which is shown as Figure 2 in Section E, indicating that the material is of low plasticity (86% of the till samples tested) but with a few samples of intermediate and high plasticity also determined and with most of the test results

plotting close to the T Line. The relative consistency of the material is also illustrated by a plot of Plasticity Index against depth detailed in Figure 3 in Section E of this report.

The results of the Atterberg Limits testing on Marine Alluvium are shown in Table 11.

TABLE 11: SUMMARY OF MOISTURE CONTENT AND ATTERBERG LIMIT TEST RESULTS FOR GLACIAL TILL FROM SOIL ENGINEERING 2013 INVESTIGATION

Parameter	No of Tests	Minimum	Maximum	Average
Natural mc %	70	3.6	32	9.7
Plastic Limit %	29	13	21	17
Liquid Limit %	29	22	52	31
Plasticity Index %	29	7	31	14

Based on these results a moderately conservative value of 15% has been adopted for the Plasticity Index in glacial till.

7.2.2 Particle size Distribution

Eighty seven particle size distribution tests were carried out on selected samples from the marine deposits, thirty eight tests were undertaken on the glacial till and six tests were undertaken on made ground and the results are presented in Figures 4, 5, and 6 in Section E of this report. The samples from the glacial till deposits generally classify as being slightly gravelly sandy clays with a variable content of very coarse material with seven samples classifying as slightly sandy slightly gravelly clays, three samples classifying as slightly sandy gravelly clays and one sample classifying as slightly sandy clay all with a variable content of very coarse material. The fines content of this material indicates that it is on the borderline of cohesive and granular.

The earthworks classification of the glacial till has been assessed in accordance with the Highway Agency Specification Series 600. The particle size distribution curves for the tests undertaken on the glacial till are plotted in Figure 6 in Section E of this report, with the material class envelopes for Class 2C - Stony Cohesive Fill shown as a black solid line. Results indicate that the samples of the glacial till generally fall within the Class 2C envelope.

Eighty-seven particle size distribution tests were carried out on selected samples from the marine deposits and the results are presented in Figure 5 in Section E of this report. The majority of samples classify as a slightly silty or silty variably gravelly sand with only four samples classifying as very clayey variably gravelly sand and eight samples classifying as variably clayey variably sandy gravel or sand and gravel. It is noted that some of these strata had a significant content of very coarse material and the very coarse marine deposits noted in Section 6 were generally not tested because of the difficulty of sampling this stratum.

The earthworks classification of the marine deposits has been assessed in accordance with the Highway Agency Specification Series 600. The particle size distribution curves for the tests undertaken on the marine deposits are plotted in Figure 5 in Section E of this report, with the material class envelopes for Class 1 - General Granular Fill shown as a black solid line. Results indicate that the samples of the sand marine deposits tested generally fall within the Class 1 envelope and may also be suitable as Class 6 for fill to structures.

Six particle size distribution tests were carried out on selected samples from the made ground deposits and the results are presented in Figure 4 in Section E of this report. The plot demonstrates the generally granular nature of this material with the majority of samples classify as a slightly silty or silty sandy or very sandy gravel with a low to medium content of very coarse material.

7.3 Earthworks Classification

Laboratory determinations of California bearing Ratio (CBR) tests were carried out on two samples of remoulded material from beds of clay encountered within the marine sand deposits. The tests were performed on samples from depths between 1.00m and 1.50m below existing ground level obtained on land while trial pitting. Results of these tests are shown in Table 12.

TABLE 12: SUMMARY OF LABORATORY DETERMINED CBR TEST RESULTS FOR CLAY UNITS WITHIN THE MARINE SAND DEPOSITS FROM SOIL ENGINEERING 2013 INVESTIGATION

Strata	Number of Tests	Average Natural MC%	CBR % Min value	CBR% Max Value	CBR % Average
Clay beds within Marine Sand Deposits	4	15	0.31	0.65	0.48

These results indicate that based on the results of laboratory testing a conservative value of 1% is recommended for the marine sand deposits encountered on land. Although a higher California Bearing Ratio value could reasonably be anticipated for the granular materials within this unit, the lower bound 1% value is proposed because of the weak clay units within this stratum.

7.4 Shear Strength Parameters

7.4.1 Triaxial Tests

A total of thirty-eight total stress undrained triaxial tests were performed on the glacial till encountered within the exploratory holes. Single stage tests were performed and these yielded value of undrained shear strength (Cu). A summary of the test results obtained for the three material types is given in Table 13.

TABLE 13: SUMMARY OF UNDRAINED SHEAR STRENGTH VALUES FROM SOIL ENGINEERING 2013 INVESTIGATION

Material Type	No of Tests	Minimum Shear Strength Cu kPa	Maximum Shear Strength Cu kPa	Average Shear Strength Cu kPa
Glacial Till	38	58	488	291

All of the test results are shown on Figure 7 in Section E of this report in which they are plotted against depth. The trend within the glacial till shows little variation with depth and the results show considerable variability. From the triaxial test data, a moderately conservative undrained shear strength of 260kPa is considered appropriate to the glacial till. In terms of Eurocode EC7, the parameters detailed above are for moderately conservative large volume assessments of strength. Other strength assessments for instance for local failure conditions are also detailed on Figure 7.

7.4.2 Standard Penetration Test

Standard Penetration Tests (SPT) were carried out in all of the boreholes and window sampler holes. The undrained shear strength of the cohesive materials tested has been estimated using the relationship developed by Stroud, where:

$$C_u = f_1 \times \text{SPT N}_{60} \text{ value}$$

The value of f_1 is dependent on the Plasticity Index (Ip). By using the moderately conservative Plasticity Index of 15% for the glacial till a moderately conservative value of $f_1 = 5.0$ has been derived.

Results from one hundred and ninety eight SPT N60 values in the glacial till are plotted against depth in Figure 8 in Section E of this report and suggest that the majority of the material is typically in the very high and extremely high strength category with shear strengths varying from 175kPa to in excess of 750kPa. As with the triaxial testing the results show little trend with depth and a considerable variation in values. Based on these results a moderately conservative assessment of undrained shear strength of 350kPa has been derived.

In terms of Eurocode EC7, the parameters detailed above are for moderately conservative large volume assessments of strength. Other strength assessments, for instance, for local failure are also detailed in Figure 8.

7.4.2 Effective Stress Shear Strength Parameters

A total of three consolidated undrained triaxial compression test with pore water pressure measurement was performed on the glacial till materials encountered within the exploratory holes. Multistage tests were performed and these yielded value of effective cohesion c' and effective angle of shearing resistance ϕ' . A summary of the test results obtained for the glacial till deposits is given in table 14.

TABLE 14: SUMMARY OF EFFECTIVE STRESS SHEAR STRENGTH VALUES FOR CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION EFFECTIVE STRESS TESTS ON GLACIAL TILL SAMPLES FROM SOIL ENGINEERING 2013 INVESTIGATION

Material Type and Parameter	No of Tests	Minimum	Maximum	Average *
Glacial Till				
Effective cohesion c' (kPa)	3	17	19	18
Effective angle of shearing resistance ϕ' (°)	3	29.5	35.5	32.7
Note:				

7.5 Granular Strata Density Classification

7.5.1 Shear Box Tests

A total of six small shear box tests were performed on the granular materials encountered within the exploratory holes with all six tests performed on the marine sand deposits. Multistage small shear box tests were performed to record peak shear strength parameters and these yielded value of peak cohesion c' and peak angle of shearing resistance ϕ' . On three tests, residual values were also determined. A summary of the test results obtained for the creek deposits is given in table 15.

TABLE 15: SUMMARY OF SHEAR STRENGTH VALUES FOR SMALL SHEAR BOX TESTING ON SAMPLES OF MARINE SAND DEPOSITS FROM SOIL ENGINEERING 2013 INVESTIGATION

Material Type and Parameter	No of Tests	Minimum	Maximum	Average
Marine Sand Deposits				
Peak cohesion c_p' (kPa)	6	0.3	10	5.9
Peak angle of shearing resistance ϕ_p' (°)	6	35.5	42	39.5
Residual cohesion c_r' (kPa)	3	1.0	4.9	2.6
Residual angle of shearing resistance ϕ_r' (°)	3	34	38	35.5

7.5.2 Standard Penetration Testing

The results of one hundred and seventy two Standard Penetration Tests normalised to 60% trip hammer energy ratio (N60) undertaken within the marine deposits ranged from N60 = 3 to N60 = 129 (upper value extrapolated) with these values generally falling in the medium dense, dense and very dense categories. The results are plotted against depth in Figure 9 in Section E of this report and based on these results a moderately conservative design line of N60 = 24 at 0.50m depth increasing to N60 = 90 at 9.50m depth has been adopted for these data. The SPT N60 values for the marine deposits are plotted against vertical effective stress in Figure 10 in Section E of this report together with curves generated by Mitchell for angles of internal friction. The results detailed on this plot should be treated with caution because of the relatively low values of effective stress encountered however based on these results an effective angle of shearing resistance of 42° is assessed for the marine sand deposits from this testing.

The results of nine Standard Penetration Tests normalised to 60% trip hammer energy ratio (N60) undertaken within the granular glacial deposits ranged from N60 = 43 to N60 = 117 (upper value extrapolated) with these values falling in the dense and very dense categories. The results are plotted against depth in Figure 11 in Section E of this report and based on these results a conservative local design value of N60 = 50 has been adopted for these data because of the low number of test results. Based on these results an effective angle of shearing resistance of 45° is assessed for these deposits.

In terms of Eurocode EC7, the parameters detailed above are for moderately conservative large volume assessments of relative density. Other strength assessments, for instance, for local failure are also detailed on Figure 9.

7.6 Consolidation Parameters

No odometer or Row cell (consolidation) tests were performed on samples because the coarse granular material encountered within the glacial till prevented compliant testing. Five consolidation test results obtained from effective stress testing during consolidation yielded an m_{vi} value in the range 0.04 m²/MN to 0.09 m²/MN with an average of 0.07 m²/MN over an appropriate stress range.

The modulus of volume compressibility m_v of the cohesive materials tested has been estimated from SPT data using the relationship developed by Stroud, where:

$$m_v = 1 / f_2 \times \text{SPT N60 value}$$

The value of f_2 is dependent on the Plasticity Index (Ip). By using the moderately conservative Plasticity Index of 15% for the glacial till a moderately conservative value of $f_1 = 0.5$ has been derived. The results of SPT testing detailed in Figure 8 in Section E of this report indicates that compressibility values do not vary

much with depth.

For the glacial till a moderately conservative design value of $m_v = 0.04 \text{ m}^2/\text{MN}$ has been adopted for design. A summary of adopted design values is given in Table 16.

TABLE 16: ASSUMED VALUES OF VOLUME COMPRESSIBILITY (m_v) BASED ON IN SITU AND LABORATORY INDEX TESTING FOR THE SOIL ENGINEERING 2013 INVESTIGATION

Material Type	m_v (MN/m ²)	Assumptions
Glacial Till	0.04	m_v calculated for load increment $p_o + 100\text{kPa}$

7.7 Soil Unit Weight

7.7.1 Particle Density of Granular Materials

In order to confirm assessments of soil unit weight in granular materials particle density testing was undertaken on eleven samples of the granular marine deposits.

The particle density test results obtained from these deposits are summarised in Table 17 below.

TABLE 17: SUMMARY OF PARTICLE DENSITY TEST RESULTS FROM SOIL ENGINEERING 2013 INVESTIGATION

Strata	No of Tests	Minimum Particle Density (Sg)	Maximum Particle Density (Sg)	Average Particle Density (Sg)
Marine Deposits	12	2.61	2.68	2.67

The results are relatively consistent and show little variance indicating a relatively consistent mineralogy of the sand in the marine deposits.

7.7.2 Bulk Density

Bulk density testing was undertaken on forty-three samples from the Glacial Till. In all cases the test values were derived as part of triaxial and odometer testing. Table 18 summarises the results of bulk density testing and values of laboratory determined bulk density are plotted against depth for all samples tested in Figure 12 in Section E of this report. Figure 12 demonstrates the high and relatively consistent bulk density of the glacial till which appears to vary little but shows a slight decrease in density over the depth interval assessed.

TABLE 18: SUMMARY OF LABORATORY DETERMINED BULK DENSITY VALUES FROM SOIL ENGINEERING 2013 INVESTIGATION

Material Type	Number of Tests	Minimum γ (Mg/m ³)	Maximum γ (Mg/m ³)	Average γ (Mg/m ³)
Glacial Till	48	1.96	2.40	2.28

All of the laboratory results have also been correlated with published values in the literature and values of unit weight for design are summarised in Table 19.

TABLE 19: SUMMARY OF DERIVED SOIL UNIT WEIGHT PARAMETERS

Material Type	γ (kN/m ³)	Assumptions	Source
Made Ground	16	Unsaturated rock fill	CIRIA C580:2003
Marine Sand Deposits	21.5	Saturated medium dense and dense medium sand	CIRIA C580:2003 & Laboratory Testing
Marine Sand, Gravel Cobble and Boulder Deposits	20	Saturated loose gravel	CIRIA C580:2003
Glacial Till	22	Very Stiff and Hard Clay	CIRIA C580:2003 & Laboratory Testing
Granular Glacial Deposits	21	Saturated dense gravel	CIRIA C580:2003

7.8 Rock Classification

7.8.1 Moisture Content

Moisture content testing was undertaken on the granitic gneiss strata.

The natural moisture content test results obtained from these strata are summarised in Table 20 below.

TABLE 20: SUMMARY OF ROCK MOISTURE CONTENT TEST RESULTS FROM SOIL ENGINEERING 2013 INVESTIGATION

Strata	No of Tests	Minimum Moisture Content %	Maximum Moisture Content %	Average Moisture Content %
Granitic Gneiss	48	0.1	2.9	0.48

A plot of rock moisture content against depth is presented in Figure 13 in Section E of this report. The plot illustrates the relatively low and consistent moisture content of the granitic gneiss strata which shows little variation with depth but is quite variable.

7.8.2 Point Load Tests

Point Load testing was performed on a number of rock core samples of both the weathered and less weathered granitic gneiss. One hundred and ninety four tests were performed on weathered granitic gneiss and seven hundred and thirty four on the less weathered granitic gneiss. The results of these tests are shown in Table 21. Plots of point load I_{s50} verses depth and elevation for the samples tested are presented in Figure 14 and Figure 15 respectively. Values in both plots show little variation with depth/elevation but a considerable variation in values indicating there is little topographic variation in rock strength but a large variation in the strength properties of the rock mass.

TABLE 21: SUMMARY OF POINT LOAD Is50 TEST RESULTS

Material Type	No of Tests	Minimum (MN/m ²)	Maximum (MN/m ²)	Average (MN/m ²)
Weathered Granitic Gneiss	194	0.0	16.6	2.1
Less Weathered Gneiss	734	0.0	22.4	3.9

7.8.3 Unconfined Compressive Strength Tests

Unconfined Compressive Strength (UCS) testing was undertaken on three samples of weathered granitic gneiss and twenty-two tests were performed on samples of less weathered granitic gneiss. These tests yielded results as presented in Table 22. Plots of UCS verses depth and elevation for the samples tested are presented in Figure 16 and Figure 17 respectively. As with point load test data UCS values in both plots show little variation with depth/elevation but a considerable variation in values indicating there is little topographic variation in rock strength but a large variation in the strength properties of the rock mass.

TABLE 22: SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH (UCS) TEST RESULTS

Material Type	No of Tests	Minimum (MN/m ²)	Maximum (MN/m ²)	Average (MN/m ²)
Weathered Granitic Gneiss	3	8.46	16.5	11.7
Less Weathered Gneiss	22	35.1	111	68.6

7.9 Sulfate and Related Test Results

TABLE 23: RESULTS OF CHEMICAL TESTS FOR CONCRETE DESIGN FROM SOIL ENGINEERING 2013 INVESTIGATION

Material Type	Water Soluble SO ₄ (mg/l)	pH	Nitrate (mg/kg)	Cl (mg/kg)	Mg (mg/l)	BRE Design Class	ACEC Class
Made Ground	60	8.5	10	93	5300	DS-1	AC-1
Marine Sand Deposits	480	8.3	-	4100	77000	DS-1	AC-1
Glacial Till	255	8.2	-	2950	43500	DS-1	AC-1s

The tests outlined in BRE Special Digest 1 for determining appropriate concrete class for use on this site were performed on a total of seventeen soil samples. Water soluble Sulfate, pH, Nitrate, Chloride and Magnesium testing was undertaken on two samples from the made ground, six samples from the marine sand deposits and nine samples from the glacial till. The characteristic values for these tests for the three material types and groundwater are shown in Table 23. The table also details the aggressive chemical environment for concrete (ACEC) classification for undisturbed ground.

7.10 Summary of Geotechnical Parameters

A summary of the geotechnical parameters discussed in the preceding sections is given in Table 24 below. If any additional information on ground conditions is obtained before design is undertaken, these values should be reassessed.

TABLE 24: SUMMARY OF GEOTECHNICAL PARAMETERS FROM SOIL ENGINEERING 2013 INVESTIGATION

Parameter	Stratum type						
	Made Ground	Marine Sand Deposits	Marine Sand, Gravel, Cobble and Boulder Deposits	Glacial Till	Glacial Sand, Gravel, Cobble and Boulder Deposits	Weathered Gneiss	Less Weathered Gneiss
SPT 'N60' Value	-	2 - >65	>65	35 - >65	43 - >65	>65	>65
Moisture Content %	-	24 - 25	-	3.6 - 32	-	0.1 - 2.9	
PI %	-	-	NP	15	-	-	-
PSD range	Figure 4	Figure 5	-	Figure 6	-	-	-
Saturated Unit Weight (kN/m ³)	16	21.5	20	22	21	-	-
California Bearing Ratio %	-	1	-	-	-	-	-
Undrained Shear Strength (kPa)	-	-	-	300	-	-	-
Odometer mv value (MN/m ²)	-	-	-	0.04	-	-	-
Effective Angle of Shearing Resistance ϕ'°	-	40	35	33	45	-	-
Effective Cohesion c' (kPa)	-	0	-	0	0	-	-
Critical State Angle of Shearing Resistance ϕ'_{crit}	-	32	-	30	36	-	-
Point Load Is50 (MPa)	-	-	-	-	-	0 - 16.6	0 - 22.4
Unconfined Compressive Strength (MPa)	-	-	-	-	-	8.5 - 16.5	35.1 - 111
Concrete Class (disturbed)	DS - 1	DS - 1	-	DS - 1	-	-	-

8.0 GEOTECHNICAL ENGINEERING ASSESSMENT

8.1 Proposals

It is understood that the site investigated is to be developed as a new port with a general layout as shown on Arch Henderson drawing No. 121106 - 01 Rev. D dated 31/01/1 and cross section drawings DKR4708/300/D002 and DKR4708/300/D003 dated 12/10/2012. The proposed development will include the construction of new breakwaters, quays and a navigation channel and harbour area. The construction of the navigation channel and harbour area will involve dredging of parts of Nigg Bay to reduce its level.

Two breakwaters constructed of quarried rock materials are to be constructed to enclose the bay. The northern breakwater is indicated to run roughly north - south and extend from the end of Girdle Ness headland with a crest level of 11.5m (chart datum) indicated. Breakwater heights from seabed of approximately 17.0m to 18.0m are indicated with the width of the crest indicated at 14.7m and the breakwater flanks indicated at an inclination of 1.33 horizontal to 1 vertical. The southern breakwater is indicated to run roughly south west - north east and extend from the end of the Greg Ness headland with a crest level of 12.3m (chart datum) indicated. For this breakwater, heights from seabed of approximately 21.8m to 24.8m are indicated with the width of the crest indicated at between 14.4m and 16.5m and the breakwater flanks indicated at an inclination of 1.33 horizontal to 1 vertical.

The approach channel running between the breakwaters is indicated to have a level of -10.5m chart datum and this links into the roughly circular main harbour basin behind the breakwaters with a base level of -9.0m indicated.

For the quay and harbour side a concrete deck supported by precast concrete beam units with a level of +6.5m chart datum is indicated. The drawing also indicates steel tubular piles are proposed to support the deck.

8.2 Site Conditions

A description of the site location, its condition, and general environs has already been given in section 3.2 of this report. It is considered however that the following factors noted during the site works or taken from the desk study report prepared by the Engineer and in a site check type report prepared by and supplied by the Employer may be of engineering and environmental significance with regard to the proposed development.

A walkover survey carried out by the site engineering geologist noted that the site comprised a wide bay area between two rock headlands. Rock comprising fractured granitic gneiss was noted on both headlands and on the northern headland, some evidence of superficial deposits overlying this can also be seen in the cliff section. Rock was seen at the end of the southern headland and a distinct contact between granitic gneiss and glacial superficial deposits can be seen in the south western corner of the bay. To the west of this contact, a large section of glacial superficial deposits can be seen in the cliff face that appear to extend all the way to beach level. The western end of the bay comprised a sloping sand, gravel and cobble beach backed by the coastal road and open grassland. At the southern end of the beach, a level area backing onto the cliff behind is evident with some evidence of bituminous surfacing exposed at its top and blocks of concrete and brick and other man made materials noted in exposed and eroded materials.

Historical exploratory hole data noted in Section 3.6 of this report confirm the rapid thickening of superficial deposits behind the Greg Ness headland to the north west of the soil rock contact noted in the preceding paragraph in the south western corner of the bay. It is also noted that the borehole from the historical information drilled in Nigg Bay (borehole NJ90SESE7807 7) recorded a considerable thickness of glacial silt overlying bedrock and this information is at variance with all the data from this current

investigation.

8.3 Summary of Subsurface Conditions

The ground conditions encountered in the exploratory holes have been described in section 6.0 of this report. Within this section, however the general stratigraphy encountered during the investigation is reviewed, the engineering significance of individual strata is discussed and design information is summarised. Any particular problem areas are also highlighted.

A variable and in places thick sequence of superficial deposits infilling a buried valley and overlying metamorphic rock strata was encountered by the investigation. Cross sections of borehole data presented as Figures 18 to 26 inclusive in Section E of this report demonstrate the buried valley topography of the soil rock contact. A reasonably well defined sequence of predominantly granular marine deposits overlying typically cohesive glacial deposits that infill a buried valley incised into the underlying granitic gneiss bedrock is indicated by the current boreholes. The strata encountered in these exploratory holes are also summarised in Tables 4, 5, 6 and 7 in Section 6 of the report.

The made ground encountered was very limited in extent and was only encountered in trial pits dug in the south western corner of the bay with thicknesses between 2.60m and in excess of 3.70m recorded. The made ground appears to be largely inert comprising predominantly granular materials with a variable mix of sand and gravel, cobble and boulder sized fragments of metamorphic rock, igneous rock, concrete, tarmac, brick, plastic pipe, packaging and metal observed.

Two distinct units were noted within the upper marine granular formation with both being discontinuous and not encountered in all exploratory holes drilled around the bay. Typically, the uppermost unit comprised a fine to coarse sand with varying fine gravel, silt and cobble content and this locally overlies a variable sequence of very coarse material comprising a mix of sand, gravel, cobbles and boulders.

The marine sand deposits were encountered in most boreholes drilled in the bay but were variable in thickness. This stratum typically exceeded 4.00m in the mouth of the bay (beneath the ends of both breakwaters) and decreased in thickness towards the beach and headlands as illustrated by cross sections B-B, C-C and G-G. The strata comprised units of generally well sorted fine to coarse sand with varying fine gravel, silt and cobble content. In situ test and laboratory test data associated with the marine sand deposits are summarised and discussed in Section 7 while Figures 5, 9 and 10 presented in Section E of this report provide summary plots of in situ and laboratory test data for the stratum. Based on this information a moderately conservative design SPT "N60" value of $N_{60} = 24$ at 0.50m depth increasing to $N_{60} = 90$ at 9.50m is assessed for design where large volumes of this material are affected. Based on SPT results and the results of shear box testing an effective angle of shearing resistance of 40° and a critical state angle of shearing resistance of 32° is assessed with effective cohesion of 0kPa in both cases.

The very coarse marine deposits were mainly encountered in boreholes drilled in the northern and north western parts of the bay to the south of the Girdle Ness Headland. This stratum was very variable in thickness as illustrated by sections B-B, C-C, E-E and F-F. The stratum was principally granular typically comprising cobbles and boulders of mixed igneous and metamorphic lithologies with a sand and gravel matrix. In situ SPT testing in this stratum was largely ineffective as tests refused on cobble and boulder obstructions and similarly sampling of this material proved difficult. Consequently, a conservative effective angle of shearing resistance of 35° is proposed for this material.

In all of the boreholes and trial pits that fully penetrated the marine deposits these strata were underlain by glacial till, glacial granular deposits and/or rock. The glacial till and glacial granular strata varied considerably in thickness as illustrated by sections B-B, C-C, and D-D and these sections illustrate that the buried valley feature has been principally infilled with glacial deposits. The glacial till lithology comprised

the predominant material for these deposits with the granular materials generally interlensed with the glacial till. The top of the glacial deposits where present was recorded at depths between 0.40m and 13.00m below ground level and the strata was proved to depths of up to 38.00m below ground level in the exploratory holes and probes undertaken.

The glacial till material comprised very stiff and hard brown or greyish brown clay with varying sand, gravel, cobble and boulder content. Figure 6 illustrates the variable fines content of this material and in some cases the material analysed appears to be borderline cohesive/granular. This is also illustrated by Figure 2 which shows the till to be of generally low plasticity. In situ test and laboratory test data associated with the glacial till are summarised and discussed in Section 7 while Figures 3 to 3 inclusive, 6, to 8 inclusive and 12 presented in Section E of this report provide summary plots of in situ and laboratory test data for the stratum. Based on this information, a moderately conservative design undrained shear strength of 300 kPa is assessed with undrained shear strength appearing to vary little with depth. A preliminary design compressibility of $mv = 0.04 \text{ MN/m}^2$ is also assessed for the glacial till with little variation with depth indicated from in situ testing. The above values are assessed for structural design and should not be applied to an assessment of the excavatability of this stratum. To evaluate this all of the data presented in Figures 6 to 8 inclusive should be assessed.

The granular glacial material comprised variable granular units of sand and gravel often with a significant cobble and boulder content. In situ test and laboratory test data associated with the glacial granular deposits are summarised and discussed in Section 7 while Figures 6 and 11 presented in Section E of this report provide summary plots of in situ and laboratory test data for the stratum. Based on this information a moderately conservative design value of $N_{60} = 50$ has been adopted for these data because of the low number of test results. Based on these results an effective angle of shearing resistance of 45° is assessed for these deposits is assessed for design where large volumes of this material are affected and a critical state angle of shearing resistance of 36° is assessed with effective cohesion of 0kPa in both cases.

In all boreholes that fully penetrated the made ground and superficial deposits rock comprising granitic gneiss was encountered. As previously noted rockhead depths were very variable and pick out an east - west trending valley running beneath Nigg Bay. This is illustrated by cross sections A-A to G-G inclusive presented in Section E of this report. The lithology of the banded granitic gneiss varied on a relatively small scale with this material comprising of interbanded units of micaceous schist, gneiss and coarse grained granitic materials frequently in thin to thickly banded units. The rock appeared to be variably weathered and typically appeared to be slightly or moderately weathered but also contained weaker moderately and highly weathered strata. The distribution of the weathered material between boreholes appeared to follow no set pattern and was very variable. In situ test and laboratory test data associated with the granitic gneiss are summarised and discussed in Section 7 while Figures 13 to 17 inclusive presented in Section E of this report provide summary plots of in situ and laboratory test data for the stratum. These plots indicate a considerable variation in unconfined compressive strength and point load test results with values showing little trend with depth or elevation indicating strength variations within the rock mass are on a local rather than a site wide scale.

During laboratory testing point load testing was undertaken on a few of the same samples selected for UCS testing in order to establish a site correlation between the two strength parameters and the results of this testing is detailed in Figure 18. Based on this testing a site correlation of $UCS = 10.7 \text{ Is}_{50} \text{ MPa}$ was derived. Based on this correlation the results of point load testing were converted to equivalent unconfined compressive strength values and a composite plot of laboratory UCS and derived point load UCS against depth is presented in Figure 19. When analysing point load test data for this plot only sets of 10 tests have been included and the average value excluding the two highest and lowest Is_{50} values has been calculated. For the less weathered granitic gneiss strata based on this information a moderately conservative design rock strength value of $UCS = 30 \text{ MPa}$ has been assessed for structural design where large volumes of this material are affected and a local strength value of 6MPa has also been derived. The results detailed in

Tables 21 and 22 indicate that the weathered rock material has lower strength and moderately conservative design rock strength value of UCS = 6 MPa has been assessed for structural design where large volumes of the weathered gneiss material are affected and a local strength value of 1MPa is assessed for this material. The above values are assessed for structural design and should not be applied to an assessment of the excavatability of rock strata. To evaluate this all of the data presented in Figures 13 to 19 inclusive should be assessed.

With regard to groundwater most of the site was below sea level or within the intertidal zone. The limited exploratory holes undertaken on land indicate that in these parts of the site the groundwater table beneath the site appears to be encountered at shallow depth within the rock strata or superficial deposits with strikes recorded between 0.00m to 3.10m below ground level during the formation of the exploratory holes.

8.4 Development of Site

As noted in section 8.3 above, the boreholes show that there is only local and limited thicknesses of made ground present beneath the south western corner of the site. The remaining ground conditions encountered beneath the site are generally favourable for the development with typically medium dense or dense marine granular deposits encountered overlying typically very stiff and hard glacial till strata and very dense glacial granular strata and at greater depth typically weak, medium strong and strong Dalradian rock strata

The proposed development of the site will need to take into account the nature, thickness and variability of the superficial deposits and the variability of rockhead levels and rock strata beneath the site.

The main structures with significant associated loads are indicated to be:

- North and South Breakwaters
- Harbour access channel and harbour area
- Quay area comprising reinforced concrete deck supported by tubular steel piles

The remaining proposals which could include car parking areas, access roads and storage areas are unlikely to have significant loads associated with them.

For the purposes of assessing foundation levels, it has been assumed that the majority of the site will remain at existing levels.

8.5 Foundations

8.5.1 Summary

Piled foundations have been indicated to support part of the quay area in the northern side of the bay (cross section drawings DKR4708/300/D002 and DKR4708/300/D003). Any foundation solution will however have to take account of the site geology and the nature of the development and the site location adjacent to the North Sea.

Spread foundations are likely to be suitable for lightly loaded structures constructed on land on the site. For those more heavily loaded structures which require settlement to be maintained at minimal levels, and for structures constructed over water piled foundations would be suitable for use on the site.

8.5.2 Spread Foundations

Shallow spread foundations could be used to support parts of the quay structure where this abuts the

Girdle Ness headland and beach area.

Based on the results of the in situ and laboratory testing it is considered that a net allowable bearing pressure of 185kPa may be placed the marine sand strata at a depth of 1.00m by a conventional spread strip foundation of least width 0.6 to 1.0 metre at the location of borehole L01. For pad foundations, a net allowable bearing pressure of 175 kPa may be placed on the same material at the same depths by a conventional pad foundation of dimensions 2.0m by 2.0m. A minimum adequacy factor in excess of 3.0 was assessed for this foundation configuration and consequently the GEO limit state requirement is satisfied. The quoted net allowable bearing pressure is for settlement not exceeding 25mm. Shallow spread foundations should be founded on the marine sand strata and because of the low shrinkage potential of this strata a minimum founding depth of 0.80m should be adopted. Care should be exercised to confirm the density of the founding granular strata on the shore area as any windblown sand deposits are likely to be less compact and have lower bearing pressures.

Higher allowable bearing pressures would be available on the granitic gneiss rock strata. Based on the results of the in situ and laboratory testing it is considered that a net allowable bearing pressure of 2.5MPa may be placed the less weathered granitic gneiss strata with a fracture spacing greater than 100mm by a conventional spread strip foundation of least width 0.6 to 1.0 metre. For pad foundations, the same net allowable bearing pressure may be placed on the same material by a conventional pad foundation of dimensions 2.0m by 2.0m. For the weathered granitic gneiss strata, a lower net allowable bearing pressure of 0.5MPa is assessed for the same strip and pad foundation dimensions and rock fracture spacing detailed above. The quoted net allowable bearing pressure is for settlement not exceeding 25mm.

Prior to blinding, the base of foundation excavations should be carefully examined for pockets of organic, soft or loose material. If encountered, these should be removed and replaced with compacted lean mix concrete. Over excavation and compacted back filling must be avoided.

8.5.3 Piled Foundations

If it is considered that some or all of the proposed structures need to be supported on foundations that will guarantee very limited settlement, or for foundations to be constructed over water, a piled foundation solution could be adopted. The suspended reinforced concrete deck for the quay could be supported on closed or open-ended steel tubular driven piles as proposed by the Engineer provided that ground vibration and noise can be tolerated during construction. The advice of specialist piling contractors should be sought on the suitability and load carrying capacity of their proprietary systems for use at the site. Cross sections C-C, D-DE-E, F-F, H-H and I-I indicate very variable rockhead depths over the area of the proposed quay. Whereas sections E-E and F-F indicate that rockhead is typically less than 5.00m along the northern edge of the bay, rockhead depths increase rapidly towards the centre of the bay and this will impact on the installation of piles in these areas. The presence of cobble and boulder obstructions within the very coarse granular marine deposits (for example as detailed on cross section F-F) and glacial till and granular deposits will present difficulties for driven piles in these materials and suitable protection or other measures may be required to ease passage through this material.

Piles will need to be extended to sufficient depth within the glacial till or less weathered granitic gneiss and based on the borehole information this could mean that piles between 6.0m to in excess of 30.0m length would be required to support a suspended concrete deck at the level indicated (+6.5m chart datum). The exploratory hole logs, the data presented in Tables 1 to 25 inclusive together with Figures 1 to 28 inclusive should be made available to piling contractors.

It is recommended that limited pile load tests should be carried out to verify design loads although it is acknowledged that this testing may be restricted by the cost of these tests. When reviewing the pile load test programme the design economies associated with the Eurocode UK National Annex should be

considered. It is also recommended that if piles are considered to be necessary for this scheme, piling contractors are consulted about the most suitable type of pile for use on the site.

8.6 Access Channel and Harbour Excavations

As part of the harbour development parts of the bay are to be dredged and the ground level lowered to construct a harbour basin and approach channel. The approach channel running between the breakwaters is indicated to have a level of -10.5m chart datum and this links into the roughly circular main harbour basin behind the breakwaters with a base level of -9.0m indicated.

The dredge levels detailed on drawing 121106-AB-01 are indicated on cross sections B-B, C-C, G-G and H-H. These sections indicate that excavations will principally be undertaken within the marine sand deposits, the coarse granular marine deposits and the underlying glacial till. Although the levels detailed on the drawing are limited excavation levels do not appear to intersect the extrapolated rockhead levels drawn on the cross sections. It is noted however that rockhead levels in this type of buried valley feature are often very variable and this is to some extent confirmed by the geophysical survey and consequently excavations intersecting the underlying rock strata cannot be discounted based on the current distribution of exploratory holes.

Dredging excavations within the marine sand deposits and coarse granular marine deposits should be readily achievable with marine dredging plant although the dredging plant should be capable of handling the very coarse (cobble and boulder) materials noted in the very coarse marine strata. The underlying glacial till materials will prove more difficult to excavate because of the high undrained shear strength of this material. A review of the data for the glacial till presented in Figures 7 and 8 indicates an inferior local undrained shear strength value of 175kPa and a superior local strength value of around 750kPa and the dredging plant employed on this project should be capable of readily excavating till materials within this strength range. It is also noted that the glacial till stratum contains very coarse (cobble and boulder) materials that could also cause excavation difficulties.

8.7 Breakwater Construction

Cross sections A-A, B-B and I-I indicate that both breakwaters will be constructed on ground that is variable both in terms of thickness and lithology. Depth to rockhead varies considerably beneath both breakwaters with this being especially so beneath the northern breakwater. The thickness of the individual strata beneath the breakwaters also varies considerably as indicated by the above cross sections. The above cross sections all indicate that the base of both breakwaters will mainly be founded on the marine sand deposits but locally (e.g. cross section B-B) the breakwater bases may found on the very coarse granular marine deposits.

For the northern breakwater, the topographic survey information indicates that for much of its length the base will be founded at approximately -8.00m chart datum with the height of the crest indicated at 11.5m chart datum. Based on these values and assuming a saturated bulk density of 20 kN/m³ for the rock fill forming the bund and a sea level of 0.00m chart datum total settlements in the centre of the breakwater at its northern end (at the location of BHE74) are assessed to be in the range 25mm to 70mm while at the southern end of the northern breakwater (at the location of BHB61) total settlements are assessed to be in the range 160mm to 400mm.

For the southern breakwater, assessments of settlement at its north eastern end are difficult because the depth of rockhead has not been determined. The breakwater will stress the ground to a considerable depth because of its width (the depth at which the stress increase due to loading is equal to 20% effective stress is estimated to be approximately 70m) and consequentially information in ground conditions to rockhead would be required in this area for a full assessment. The topographic survey information indicates that for

much of its length the base of the southern breakwater will be founded at approximately -13.00m chart datum with the height of the crest indicated at 12.3m chart datum. Based on these values and assuming a saturated bulk density of 20 kN/m^3 for the rock fill forming the bund and a sea level of 0.00m chart datum total settlements in the centre of the breakwater at its southern end (at the location of BHE112) are assessed to be in the range 35mm to 100mm while at the northern end of the southern breakwater (at the location of BHE106) total settlements are assessed to be in the range 65mm to in excess of 150mm.

In the above assessment, it is estimated that between 50% and 90% of settlement will occur during construction depending on its location along the breakwater.

8.8 Sulfate and pH Aggressivity

A total of seventeen soil samples were analysed for water soluble sulfate content, chloride content, water soluble magnesium content and pH levels. Selected soil samples were also analysed for nitrate content. The results of the analyses are given on the summary sheets in Section C. The results of the soil analysis indicate that a characteristic value for water soluble sulfate levels of 420 mg/l exist in the ground and that pH levels lie in the range pH = 7.9 to pH = 9.0. Chloride content values are in the range 81 to 3000 mg/kg and nitrate content values are in the range 5 to 10mg/kg.

Referring to Table C1 in BRE Special Digest 1 the recorded sulfate, pH and other test results would require the use of Design Sulfate Class DS-1 concrete and an ACEC class of AC-1 on this site. This is in agreement with the characteristic values and material classification for the various individual strata as detailed in Table 23. All other recommendations given in the Digest should be followed when designing concrete mixes for use on this site.

8.9 Mining

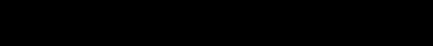
This report has been prepared on the basis that the site is stable with regard to mining activities. No evidence of economically viable minerals or mining was encountered within the depth zone penetrated by the exploratory holes formed as part of this investigation.

9.0 CONCLUSIONS AND RECOMMENDATIONS

The information available for the site has been gathered from a historical ground investigation and from the current ground investigation. Together with the desk study information, these investigations have provided sufficient and suitable data from which design parameters have been derived.

Although sufficient information has been obtained to allow a preliminary assessment of the project additional exploratory hole information would be required for final design. This would include additional exploratory holes on land to facilitate the development of structures associated with the harbour and additional boreholes within the bay to fill in parts of the site where exploratory hole coverage is poor. In addition, an assessment of the stability of the high slope of superficial deposits observed in the south western corner of the site should be considered if its failure will impact on the new facility.

For and on behalf of
Soil Engineering Geoservices Ltd


Principal Engineering Geologist

P. Rodgers
Reports Manager

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Where any documents referenced above are subject to any amendment, then the latest version incorporating such amendment shall be deemed to apply, unless specifically stated otherwise.



SUPPORTING FACTUAL DATA

SECTION A

Exploratory Hole Records and Field Data

EXPLORATORY HOLE LOG LEGEND AND NOTATION SHEET

SECTION A: EXPLORATORY HOLE LOG LEGENDS

CODE	DESCRIPTION	LEGEND	CODE	DESCRIPTION	LEGEND
101	Topsoil		806	Coal	
102	Made Ground		807	Breccia	
104	Concrete		808	Conglomerate	
201	Clay		809	Fine Grained Igneous	
301	Silt		810	Medium Grained Igneous	
401	Sand		811	Coarse Grained Igneous	
501	Gravel		812	Fine Grained Metamorphic	
601	Peat		813	Coarse / Medium Grained Metamorphic	
701	Cobbles		EVT	Evaporite	
730	Boulders		MWS	Mine Workings	
801	Mudstone		904	Grout	
802	Siltstone		905	Arisings	
803	Sandstone		BLK	Zone of No Recovery	
804	Limestone		WTR	Water	
805	Chalk				

Note: Most soils types comprise a mixture of particle sizes. These soil types are represented graphically on the exploratory hole logs by combining the legends shown on this sheet.

SECTION A: EXPLORATORY HOLE LOG LEGENDS

SAMPLING NOTATION

U	Undisturbed U100 or U38 sample (size given on log)
UT	Thin wall open drive tube sampler (size given on log)
P	Piston Sample
BLK	Block Sample
M	Mazier Sample
TW	Thin Walled Sample
L	Liner Sample obtained from windowless sampler
D	Small Disturbed Sample
B	Bulk Disturbed Sample
LB	Large Bulk Disturbed Sample
C	Core Sample
ES	Environmental Soil Sample
EW	Environmental Water Sample
W	Water Sample
UF	No Recovery in U Sample
UTF	No Recovery in UT Sample
PF	No Recovery in P Sample
TWF	No Recovery in TW Sample

IN SITU TEST NOTATION

SPT	Standard Penetration Test with a Split Spoon
SPT(C)	Standard Penetration Test with a Cone
C	Cone Penetration Test
NP	No Penetration for SPT or SPT(C)
V	Vane Test
HV	Hand Vane
HP	Hand Penetrometer
CBR	California Bearing Ratio Test
K	Permeability Test (test type not differentiated)
Pr	Pressuremeter Test

OTHER NOTATION

TCR	Total Core Recovery
SCR	Solid Core Recovery
RQD	Rock Quality Designation
FI	Fracture Index
If	Fracture Spacing
NI	Non Intact
NA	Data Not Applicable
NR	Data Not Recorded

GRAPHICS USED



Standing water level
Joining bar indicates level risen
Waterstrike level



SUPPORTING FACTUAL DATA

SECTION A

Exploratory Hole Records and Field Data

CABLE PERCUSSION AND ROTARY DRILLING RECORDS

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A05
Engineer	Arch Henderson LLP		Header
Employer	Aberdeen Harbour Board		

Ground Level	-0.53m CD	Coordinates	396688.10 E, 804636.30 N National Grid
Date Started	23/09/2013	Date Completed	29/09/2013
		Inclination	Vertical

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00	1.40	CP	23/09/2013	23/09/2013	IC	DT			Dando 3000		
1.40	1.80	RO	23/09/2013	23/09/2013	WW	DT			Deltabase 520		
1.80	8.50	RC	23/09/2013	24/09/2013	WW	DT	T6116	Impreg	Deltabase 520		
8.50	14.00	RC	24/09/2013	24/09/2013	TT	DT		Impreg	Deltabase 520		
14.00	14.50	RC	24/09/2013	24/09/2013	TT	DT	T6116	Impreg	Deltabase 520		
14.50	19.40	RO	26/09/2013	26/09/2013	WW	WW			Deltabase 520		
19.40	30.10	RC	26/09/2013	27/09/2013	WW/MM	DT	SWF	Impreg	Deltabase 520		
30.10	38.00	RO	28/09/2013	28/09/2013	WW	WW			Deltabase 520		
38.00	40.00	RC	28/09/2013	29/09/2013	WW/MM	DT	T6116	Impreg	Deltabase 520		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow
23/09/2013	2300	1.40	1.20	-1.10	End of CP/Start of Rotary							
24/09/2013	0700	8.50	1.80	-3.80	End of Shift/Start of Shift							
24/09/2013	1900	14.50	9.10	-3.60	End of Shift							
26/09/2013	0700	14.50	9.10	-2.90	Start of Shift							
26/09/2013	1800	20.10	19.30	-5.70	End of Shift							
27/09/2013	0700	20.10	19.30	-3.00	Start of Shift							
27/09/2013	1900	25.60	19.30	-3.40	End of Shift/Start of Shift							
28/09/2013	0700	30.10	19.40	-2.90	End of Shift/Start of Shift							
28/09/2013	1900	39.00	19.40	-3.70	End of Shift/Start of Shift							
29/09/2013	0700	40.00	19.40	-1.34	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
0.80	1.40	2100	0200	Chiselling	0.50	SPT(C)	50/15mm (25/75,50/15)	AR362	75	N/A	-2.00
					1.40	SPT(C)	50/0mm (25/0,50/0)	AR362	75	1.20	-1.10
					2.80	SPT(C)	50/80mm (6,11,25,25/5)	AR362	75	1.80	-1.10
					4.30	SPT(C)	50/85mm (9,17,25,25/10)	AR362	75	1.80	-2.10
					5.80	SPT(C)	50/125mm (6,12,18,32/50)	AR362	75	1.80	-3.00
					7.30	SPT(C)	50/10mm (25/25,50/10)	AR362	75	1.80	-3.80
					8.50	SPT(C)	50/160mm (10,14,21,21,8/10)	AR362	75	1.80	-2.30
					10.00	SPT(C)	N=70 (7,13,13,17,19,21)	AR362	75	9.10	-1.40
					11.50	SPT(C)	50/5mm (25/10,50/5)	AR362	75	9.10	-2.30
					13.00	SPT(C)	50/10mm (25/0,50/10)	AR362	75	9.10	-2.70
					14.50	SPT(C)	50/75mm (18,25,38,12/0)	AR362	75	9.10	-3.10
					20.10	SPT(C)	50/80mm (9,11,25,25/5)	AR362	75	19.30	-3.00
					22.00	SPT(C)	50/0mm (25/0,50/0)	AR362	75	19.30	NR
					24.00	SPT(C)	50/160mm (6,8,17,23,10/10)	AR362	75	19.30	NR
					26.20	SPT(C)	50/175mm (5,9,11,18,21/25)	AR362	75	19.40	-3.40
					27.70	SPT(C)	50/95mm (7,18/70,41,9/20)	AR362	75	19.40	-2.10
					29.20	SPT(C)	50/180mm (4,10,18,19,13/30)	AR362	75	19.40	-2.00
					32.00	SPT(C)	50/0mm (25/0,50/0)	AR362	75	19.40	NR
					35.00	SPT(C)	50/85mm (11,14,21,29/10)	AR362	75	19.40	NR

ROTARY FLUSH DETAILS					SPT DETAILS						
From depth	To depth	Flush type	Flush return %	Flush colour	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
1.80	8.50	Water	100	Milky							
8.50	9.00	Water	0	-							
9.00	39.00	Water	100	Brown							
39.00	40.00	Water	90	Brown							

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %
200	1.40	200	1.20					
150	19.40	150	19.40					
145	38.00							
116	40.00							

INSTALLATION DETAILS				PIPE CONSTRUCTION				
Distance from G.L.	ID	Type	Response zone Top Base	ID	Pipe Top Base	Dia. of pipe	Type of pipe	

BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	38.00	Arisings					
38.00	40.00	Grout					

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A05
Engineer	Arch Henderson LLP		Sheet 1 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-0.53m CD	Coordinates	396688.10 E, 804636.30 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
Dense brown silty gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Driller notes large cobbles and boulders. from 0.80m to 1.80m driller notes boulders		0.00 - 1.80	-2.33	B001	1.40-1.80							SPT(C)50/15mm 0.50 0.59 SPT(C)50/0mm 1.40 1.40
Stiff very high strength brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and granite. Cobbles are angular to subrounded of granite and gneiss. from 7.20m to 7.30m assumed zone of no recovery from 8.90m to 9.00m assumed zone of no recovery		1.80	-2.33	1.80	2.80	89	100	NA	NA			SPT(C)50/80mm 2.80 3.03
		2.80	4.30	89	100	NA	NA			SPT(C)50/85mm 4.30 4.54		
		4.30	5.80	89	100	NA	NA			SPT(C)50/125mm 5.80 6.08		
		5.80	7.30	89	93	NA	NA			SPT(C)50/10mm 7.30 7.34		
		7.30	8.50	89	100	NA	NA			SPT(C)50/160mm 8.50 8.81		
		8.50	9.00	107	80	NA	NA					
		9.00	10.00	107	85	NA	NA					

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A05
Engineer	Arch Henderson LLP		Sheet 2 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-0.53m CD	Coordinates	396688.10 E, 804636.30 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Remaining Detail : 9.85m - 10.00m : from 9.85m to 10.00m assumed zone of no recovery from 10.40m to 10.53m strong grey boulder of granite		10.70	-11.23	10.00	11.50	107	47	NA	NA	SPT(C)70 10.00 10.45	
Assumed zone of no recovery. Stiff greyish brown boulder CLAY with large cobbles and granite boulders. (Driller's description)		11.50	-12.03							SPT(C)50/5mm 11.50 11.52	
Firm to stiff brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. Cobbles are angular to subrounded of granite and gneiss. from 11.95m to 12.10m angular coarse gravel sized fragments of granite and schist		12.10	-12.63	11.50	13.00	107	40	NA	NA		
Assumed zone of no recovery. Stiff brown boulder CLAY with small bands of large gravels and granite boulders. (Driller's description)		13.00	-13.53							SPT(C)50/10mm 13.00 13.01	
Firm to stiff brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite and gneiss.		13.40	-13.93	13.00	14.00	107	40	NA	NA		
Assumed zone of no recovery. Stiff brown boulder CLAY with small bands of large gravels and granite boulders. (Driller's description)		14.00	-14.53	14.00	14.50	89	40	NA	NA		
Stiff brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite and gneiss. from 14.20m to 14.50m assumed zone of no recovery		14.50	-15.03							SPT(C)50/75mm 14.50 14.73	
No recovery. SAND. (Driller's description) from 14.50m to 14.90m driller notes boulders of granite											
Stiff brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded		19.40	-19.93	19.40	20.10	107	100	NA	NA	NA	

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A05
Engineer	Arch Henderson LLP		Sheet 3 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-0.53m CD	Coordinates	396688.10 E, 804636.30 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite and gneiss. from 21.80m to 22.00m assumed zone of core loss		20.10	-24.18	20.10	20.80	107	100	NA	NA	SPT(C)50/80mm 20.10 20.33	
				20.80	22.00	107	83	NA	NA		
				22.00	23.00	107	100	NA	NA	SPT(C)50/0mm 22.00 22.00	
				23.00	24.00	107	65	NA	NA		
Assumed zone of no recovery. Firm greyish brown very sandy boulder CLAY and large cobbles. (Driller's description)		23.65	-24.18								
Stiff brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. from 24.46m to 24.60m medium strong grey boulder of gneiss from 24.60m to 24.709m assumed zone of no recovery from 25.10m to 25.40m assumed zone of no recovery from 25.50m to 25.60m assumed zone of no recovery from 25.60m to 25.80m subangular to rounded coarse gravel and subangular cobbles of granite and gneiss from 26.00m to 26.20m assumed zone of no recovery from 26.46m to 26.55m medium strong grey boulder of granite from 26.70m to 26.95m assumed zone of no recovery		24.00	-24.53	24.00	24.70	107	86	NA	NA	SPT(C)50/160mm 24.00 24.31	
				24.70	25.40	107	57	NA	NA		
				25.40	25.60	107	50	NA	NA	SPT(C)50/175mm 26.20 26.53	
				25.60	26.20	107	67	NA	NA		
				26.20	26.95	107	67	NA	NA		
				26.95	27.70	107	33	NA	NA		
Assumed zone of no recovery. Very stiff very sandy boulder CLAY with cobbles, boulders and small sand bands. (Driller's description)		27.20	-27.73								
Stiff brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite, gneiss and schist. from 28.30m to 28.70m and 29.00m to 29.20m assumed zone of no recovery		27.70	-28.23	27.70	28.70	107	60	NA	NA	SPT(C)50/95mm 27.70 27.94	
				28.70	29.20	107	60	NA	NA		
				29.20	30.10	107	22	NA	NA	SPT(C)50/180mm 29.20 29.53	
No recovery. Stiff greyish brown very sandy boulder CLAY with large cobbles and boulders. (Driller's description)		29.40	-29.93								

NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Log Print Date And Time: 23/12/2013 10:23:18	
Form No. SIEXPHOLELOG	Issue/Revision No. 1.05 Issue Date 22/10/2012

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.	A05
Project No.	TA7148		Sheet 4 of 4	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	-0.53m CD	Coordinates	396688.10 E, 804636.30 N National Grid	
Hole Type	CP+RC	Inclination	Vertical	

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
No recovery. Stiff greyish brown very sandy boulder CLAY with large cobbles and boulders. (Driller's description)		32.00	-38.53							SPT(C)50/0mm 32.00	
				35.00	35.60	89	0	NA	NA	SPT(C)50/85mm 35.00 35.24	
Extremely weak dark grey locally stained dark reddish brown GNEISS. Recovered as non intact core (angular fine to coarse gravel sized fragments).		38.00	-38.53							NI	
				39.00	40.00	89	95	0	0		

Exploratory hole complete at 40.00 m.

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A08
Engineer	Arch Henderson LLP		Header
Employer	Aberdeen Harbour Board		

Ground Level	0.18m CD	Coordinates	396673.80 E, 804740.90 N National Grid
Date Started	19/09/2013	Date Completed	22/09/2013
		Inclination	Vertical

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00	1.20	CP	19/09/2013	19/09/2013	IC	DT			Dando 3000		
1.20	1.60	RO	19/09/2013	19/09/2013	WW	WW			Deltabase 520		
1.60	2.60	RC	19/09/2013	19/09/2013	MM	DT	SWF	Impreg	Deltabase 520		
2.60	9.60	RC	19/09/2013	20/09/2013	MM	DT	T6116	Impreg	Deltabase 520		
9.60	36.00	RC	20/09/2013	21/09/2013	TT/WW	DT	T6116	Impreg	Deltabase 520		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow
19/09/2013	1755	1.20	1.20	-2.60	End of CP/Start of RO							
19/09/2013	1800	1.60	-	NR	End of RO/Start of RC							
19/09/2013	1900	2.60	2.30	-1.75	End of Shift/Start of Shift							
20/09/2013	0700	9.60	5.50	-2.00	End of Shift/Start of Shift							
20/09/2013	1900	14.50	10.15	-4.00	End of Shift/Start of Shift							
21/09/2013	0700	22.80	17.40	-1.80	End of Shift/Start of Shift							
21/09/2013	1900	30.70	24.90	-2.30	End of Shift/Start of Shift							
22/09/2013	0700	36.00	34.00	-1.80	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
0.80	1.20	1600	0200	Chiselling	0.50	SPT(C)	50/50mm (25/0,50/50)	AR362	75	N/A	-3.00
					3.60	SPT(C)	50/25mm (25/10,50/25)	AR362	75	2.30	-2.60
					5.30	SPT(C)	50/95mm (4,7,8,42/20)	AR362	75	2.30	-2.20
					5.80	SPT(C)	50/220mm (5,10,12,13,25/70)	AR362	75	2.30	-2.50
					7.30	SPT(C)	N=48 (3,7,10,11,12,15)	AR362	75	2.30	-3.00
					8.80	SPT(C)	N=47 (4,8,9,12,12,14)	AR362	75	2.30	-2.70
					10.30	SPT(C)	N=59 (7,10,10,14,16,19)	AR362	75	9.60	-3.60
					11.50	SPT(C)	50/20mm (25/20,50/20)	AR362	75	9.60	-3.80
					13.00	SPT(C)	N=68 (11,13,13,17,19,19)	AR362	75	9.60	-4.40
					14.50	SPT(C)	N=69 (9,11,14,16,16,23)	AR362	75	9.60	-4.10
					16.10	SPT(C)	50/225mm (7,9,11,14,25)	AR362	75	10.15	-4.00
					17.95	SPT(C)	50/75mm (9,11,50)	AR362	75	17.40	-3.20
					19.75	SPT(C)	50/0mm (25/0,50/0)	AR362	75	17.40	NR
					21.25	SPT(C)	N=42 (4,6,11,9,10,12)	AR362	75	17.40	-2.40
					22.80	SPT(C)	50/0mm (25/0,50/0)	AR362	75	17.40	-1.80
					24.30	SPT(C)	50/10mm (25/5,50/10)	AR362	75	24.30	-1.80
					25.80	SPT(C)	50/0mm (25/10,50/0)	AR362	75	24.90	-2.90
					27.30	SPT(C)	50/0mm (25/10,50/0)	AR362	75	24.90	-3.60
					28.60	SPT(C)	50/10mm (25/20,50/10)	AR362	75	24.90	-2.50
					30.70	SPT(C)	50/15mm (25/8,50/15)	AR362	75	24.90	NR

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
1.60	4.30	Water	100	Brown
4.30	9.60	Water	0	-
9.60	10.30	Water	100	Brown
10.30	14.50	Water	100	Brown
14.70	17.40	Water/Air	100	Brown
17.40	17.95	Water/Air	80	Brown
17.95	21.25	Water/Air	100	Brown
21.25	22.00	Water/Air	80	Brown
22.00	22.80	Water/Air	0	-
22.80	30.70	Water/Air	100	Brown

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %
150	24.90	150	24.90					
120	34.00	120	36.00					
116	36.00							

INSTALLATION DETAILS				PIPE CONSTRUCTION				
Distance from G.L.	ID	Type	Response zone Top / Base	ID	Pipe Top / Base	Dia. of pipe	Type of pipe	

BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	36.00	Arisings					

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A08
Engineer	Arch Henderson LLP		Sheet 1 of 4
Employer	Aberdeen Harbour Board		

Ground Level	0.18m CD	Coordinates	396673.80 E, 804740.90 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
Brown slightly silty fine to coarse SAND. from 0.20m to 1.60m driller notes cluster of large cobbles and boulders				B001	0.50-0.80							
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. Cobbles are angular to subrounded of granite, gneiss and schist.		1.60	-1.42									
Assumed zone of no recovery. Firm brown boulder CLAY and some cobbles. (Driller's description)		2.18	-2.00	1.60	2.60	89	58	NA	NA			
Light grey gravelly COBBLES and BOULDERS with medium to coarse gravel sized pockets of sandy gravelly clay. (Driller notes boulder clay). from 2.80m to 3.00m granite boulder		2.60	-2.42									
Assumed zone of no recovery. Stiff brown boulder CLAY with cobbles and boulders of granite. (Driller's description)		3.00	-2.82	2.60	3.60	107	40	NA	NA			
Light grey gravelly COBBLES and BOULDERS with medium to coarse gravel sized pockets of sandy gravelly clay. (Driller notes boulder clay).		3.60	-3.42									
Assumed zone of no recovery. Stiff brown boulder CLAY with cobbles and frequent boulders of granite. (Driller's description)		3.75	-3.57	3.60	4.30	107	27	NA	NA	SPT(C)50/25mm 3.60 3.64		
Stiff very high strength brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. Cobbles are angular to subrounded of granite, gneiss and schist. from 5.20m to 5.30m assumed zone of no recovery		4.30	-4.12	4.30	5.30	89	90	NA	NA			
from 6.10m to 6.20m angular to subrounded coarse gravel of granite, gneiss and schist		5.30		5.30	5.80	89	100	NA	NA	SPT(C)50/95mm 5.30 5.55		
from 7.10m to 7.30m assumed zone of no recovery		5.80		5.80	7.30	89	87	NA	NA	SPT(C)50/220mm 5.80 6.17		
Assumed zone of no recovery. Stiff brown boulder CLAY with cobbles and frequent boulders of granite. (Driller's description)		7.30	-7.72	7.30	8.80	89	40	NA	NA	SPT(C)48 7.30 7.75		
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite, gneiss and schist. from 9.50m to 9.60m assumed zone of no recovery		8.80	-8.62	8.80	9.60	89	88	NA	NA	SPT(C)47 8.80 9.25		
		9.60		9.60	10.30	89	57	NA	NA			

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A08
Engineer	Arch Henderson LLP		Sheet 2 of 4
Employer	Aberdeen Harbour Board		

Ground Level	0.18m CD	Coordinates	396673.80 E, 804740.90 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite, gneiss and schist. from 10.00m to 10.30m assumed zone of no recovery												
Assumed zone of no recovery. Stiff to firm brown boulder CLAY with large granite boulders and small sand and gravel bands. (Driller's description)		11.07	-10.89	10.30	11.50	89	64	NA	NA	SPT(C)59 10.30	10.75	
Stiff to firm brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite, gneiss and schist. from 12.90m to 13.00m assumed zone of no recovery from 13.20m to 13.40m angular to subrounded coarse gravel and angular cobbles of granite, gneiss and schist		11.50	-11.32	11.50	13.00	89	43	NA	NA	SPT(C)50/20mm 11.50	11.54	
Assumed zone of no recovery. Stiff to firm brown boulder CLAY with large granite boulders and small sand and gravel bands. (Driller's description)		13.40	-13.22	13.00	14.50	89	27	NA	NA	SPT(C)68 13.00	13.45	
Rotary openhole drilling. BOULDERS. (Driller's description)		14.50	-14.32							SPT(C)69 14.50	14.95	
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite, gneiss and schist.		14.70	-14.52	14.50	16.10	89	100	NA	NA			
Assumed zone of no recovery. Firm to stiff greyish brown boulder CLAY and some cobbles. (Driller's description)		16.10	-15.92	16.10	17.40	89	0	NA	NA	SPT(C)50/225mm 16.10	16.48	
Stiff very high strength greyish brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite, gneiss and schist.		17.40	-17.22	17.40	17.95	89	100	NA	NA	SPT(C)50/75mm 17.95	18.18	
				17.95	19.75	89	100	NA	NA	NA		
										SPT(C)50/0mm 19.75	19.75	

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A08
Engineer	Arch Henderson LLP		Sheet 3 of 4
Employer	Aberdeen Harbour Board		

Ground Level	0.18m CD	Coordinates	396673.80 E, 804740.90 N National Grid
Hole Type	CP+RC	Inclination	Vertical


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Stiff very high strength greyish brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite, gneiss and schist.		19.75	-21.92	21.25	89	100	NA	NA		SPT(C)42 21.25 21.70	
				22.10	89	100	NA	NA			
Assumed zone of no recovery. Stiff greyish brown boulder CLAY and some cobbles. (Driller's description)		22.10	-21.92	22.80	89	0	NA	NA		SPT(C)50/0mm 22.80 22.80	
				23.40	89	0	NA	NA			
Light grey and brown gravelly COBBLES and BOULDERS with cobbkle sized pockets of sandy gravelly clay. (Driller notes boulder clay).		23.40	-23.22	23.80	89	44	NA	NA		SPT(C)50/10mm 24.30 24.32	
				23.80	89	44	NA	NA			
Assumed zone of no recovery. Boulder CLAY with large granite boulders throughout. (Driller's description)		23.80	-23.62	24.30	89	93	NA	NA		SPT(C)50/0mm 25.80 25.81	
				24.30	89	93	NA	NA			
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and gneiss. Cobbles are subangular to subrounded of granite and gneiss. from 24.30m to 24.36m strong grey boulder of granite from 25.70m to 25.80m assumed zone of no recovery		24.30	-24.12	25.80	89	50	NA	NA		SPT(C)50/0mm 27.30 27.31	
				26.60	89	0	NA	NA			
Assumed zone of no recovery. Boulder CLAY with large granite boulders. (Driller's description)		26.20	-26.02	27.30	89	46	NA	NA		SPT(C)50/10mm 28.60 28.63	
				27.30	89	46	NA	NA			
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite, gneiss and schist.		27.30	-27.12	27.90	89	80	NA	NA		SPT(C)50/0mm 28.60 28.63	
				27.90	89	80	NA	NA			
Assumed zone of no recovery. Boulder CLAY and large granite boulders. (Driller's description)		27.90	-27.72	28.60	89	80	NA	NA		SPT(C)50/10mm 28.60 28.63	
				28.60	89	80	NA	NA			
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite, gneiss and schist. from 28.70m to 28.89m medium strong grey boulder of granite from 29.36m to 29.50m strong grey boulder of granite		28.60	-28.42	29.60	89	80	NA	NA		SPT(C)50/10mm 28.60 28.63	
				29.60	89	80	NA	NA			
		29.60	-29.42								

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Ground Level 0.18m CD	Coordinates 396673.80 E, 804740.90 N National Grid	
Hole Type CP+RC	Inclination Vertical	

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Assumed zone of no recovery. Boulder CLAY with large granite boulders. (Driller's description)	[Pattern]	30.10	-29.92								
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite and gneiss.	[Pattern]	30.30	-30.12	30.10	30.70	89	0	NA	NA		
Assumed zone of no recovery. Boulder CLAY with large granite boulders. (Driller's description)	[Pattern]	30.70	-30.52								
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse grained igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite and gneiss.	[Pattern]	30.70	-30.52	30.70	32.35	89	100	NA	NA		
from 30.70m to 30.80m and 32.35m to 32.45m angular to subrounded cobbles of granite, schist and gneiss	[Pattern]	32.35	-32.17								
Rotary openhole drilling: Firm brown sandy boulder clay with some cobbles (drillers description)	[Pattern]	32.40	-32.22	B002	32.50-33.50						
Rotary openhole drilling: Brown slightly gravelly coarse SAND. Gravel is angular to rounded fine to medium of mixed igneous and metamorphic lithologies including granite, gneiss and schist. (driller notes sand and gravel).	[Pattern]			B003	33.50-34.00						
	[Pattern]			B004	35.00-35.50						
Rotary openhole drilling: boulder clay (drillers description)	[Pattern]	35.60	-35.42								
Exploratory hole complete at 36.00 m.	[Pattern]	36.00	-35.82								

NOTES: All depths in metres, all diameters in millimetres.
 See header sheet for details of boring, progress and water.
 For details of abbreviations, see key

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log		Hole ID.						
Project No. TA7148												A11						
Engineer Arch Henderson LLP												Header						
Employer Aberdeen Harbour Board																		
Ground Level -0.17m CD				Coordinates		396693.40 E, 804798.70 N National Grid												
Date Started 14/09/2013				Date Completed		18/09/2013		Inclination		Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00	0.70	CP	14/09/2013	14/09/2013	KL	DT			Dando 3000									
0.70	6.20	RC	14/09/2013	14/09/2013	MM	DT	SWF	Impreg	Deltabase 520									
6.20	6.50	RO	16/09/2013	16/09/2013	WW	DT		3/4 RP	Deltabase 520									
6.50	32.80	RC	16/09/2013	18/09/2013	WW	DT	T6116	Impreg	Deltabase 520									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow		
14/09/2013	2240	0.70	0.70	-3.50	End of CP/Start of Rotary													
15/09/2013	0600	6.20	4.70	-3.20	End of Shift													
16/09/2013	0700	6.20	4.70	-1.90	Start of Shift													
16/09/2013	1900	13.40	4.70	-2.80	End of Shift/Start of Shift													
17/09/2013	0700	17.10	11.45	-1.30	End of Shift/Start of Shift													
17/09/2013	1900	28.10	17.00	-1.10	End of Shift/Start of Shift													
18/09/2013	0700	29.80	28.62	-2.00	End of Shift/Start of Shift													
18/09/2013	1900	32.80	28.62	-1.00	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks		Depth	Type	Incremental blow count / penetration in mm			Hammer No.	Energy ratio %	Casing depth	Water depth
0.60	0.70			2040	0200	Chiselling				0.50	SPT	50/15mm (4,21,50/15)			AR362	75	N/A	-3.20
										0.70	SPT(C)	50/0mm (25/0,50/0)			AR362	75	N/A	-3.30
										2.00	SPT(C)	50/30mm (25/30,50/30)			AR362	75	2.00	-3.50
										3.50	SPT(C)	50/85mm (7,10,42,8/10)			AR362	75	2.00	-3.20
										5.00	SPT(C)	50/20mm (25/40,50/20)			AR362	75	2.00	-3.10
										6.50	SPT(C)	50/0mm (25/0,50/0)			AR362	75	4.70	-1.90
										8.20	SPT(C)	N=41 (6,6,9,10,11,11)			AR362	75	4.70	-2.90
										9.60	SPT(C)	N=32 (5,6,6,8,8,10)			AR362	75	4.70	-4.20
										11.10	SPT(C)	N=28 (4,6,5,6,8,9)			AR362	75	4.70	-3.70
										12.70	SPT(C)	N=29 (4,6,6,7,7,9)			AR362	75	4.70	-3.00
										14.10	SPT(C)	50/245mm (4,9,12,13,15,10/20)			AR362	75	5.70	-3.10
										15.60	SPT(C)	50/170mm (10,12,19,23,8/20)			AR362	75	14.10	-3.20
										17.10	SPT(C)	N=30 (4,6,7,7,9)			AR362	75	17.00	-1.30
										18.60	SPT(C)	N=37 (5,5,8,9,9,11)			AR362	75	17.00	-2.30
										19.60	SPT(C)	50/0mm (25/0,50/0)			AR362	75	17.00	-2.80
										20.10	SPT(C)	N=33 (4,4,6,8,9,10)			AR362	75	17.00	-3.40
										22.40	SPT(C)	N=41 (5,5,7,9,11,14)			AR362	75	17.00	-4.40
										23.60	SPT(C)	N=33 (4,6,6,7,9,11)			AR362	75	17.00	-3.20
										25.60	SPT(C)	N=32 (4,4,6,8,8,10)			AR362	75	17.00	-2.00
										26.00	SPT(C)	N=34 (5,6,6,9,9,10)			AR362	75	17.00	-1.70
										27.50	SPT(C)	50/0mm (25/0,50/0)			AR362	75	17.00	-1.40
ROTARY FLUSH DETAILS																		
From depth	To depth	Flush type		Flush return %	Flush colour													
0.70	6.20	Water		0	-													
6.20	11.10	Water		100	Brown													
11.10	17.10	Water		0	-													
17.10	27.40	Water		100	Brown													
27.40	29.80	Water		0	-													
29.80	32.80	Water		100	White													
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %										
200	0.70	200	0.70															
155	5.70	150	5.70															
125	28.62	120	28.62															
116	32.80																	
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00	28.20	Arisings																
28.20	32.80	Grout																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
Log Print Date And Time: 23/12/2013 10:24:11																		
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012												

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A11
Engineer	Arch Henderson LLP		Sheet 1 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-0.17m CD	Coordinates	396693.40 E, 804798.70 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Grey slightly silty slightly gravelly fine to coarse SAND. Gravel is fine.				D001 0.00 B002 0.00-0.50							
No recovery. Large boulder obstruction. (Driller's description)		0.60 0.70	-0.77 -0.87	D003 0.50						SPT50/15mm 0.50 0.60 SPT(C)50/0mm 0.70 0.70	
Medium dense to dense grey and brown gravelly subangular to rounded COBBLES and BOULDERS of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Recovered as angular to rounded coarse gravel and cobble sized fragments. (Driller notes boulder clay). from 0.80m to 1.20m with clay pockets		1.20	-1.37	0.70 2.00	107	38	NA	NA			
Assumed zone of no recovery. Stiff boulder CLAY with cobbles and boulders. (Driller's description)		2.00	-2.17							SPT(C)50/30mm 2.00 2.06	
Medium dense to dense grey and brown gravelly subangular to rounded COBBLES and BOULDERS of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Recovered as angular to rounded coarse gravel and cobble sized fragments. (Driller notes boulder clay).		2.35	-2.52	2.00 3.50	107	20	NA	NA			
Assumed zone of no recovery. Stiff boulder CLAY with cobbles and boulders. (Driller's description)		3.50	-3.67							SPT(C)50/85mm 3.50 3.74	
Medium dense to dense grey and brown gravelly subangular to rounded COBBLES and BOULDERS of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Recovered as angular to rounded coarse gravel and cobble sized fragments. (Driller notes boulder clay).		3.70	-3.87	3.50 5.00	107	13	NA	NA			
Assumed zone of no recovery. Stiff boulder CLAY with cobbles and boulders. (Driller's description)		5.00	-5.17							SPT(C)50/20mm 5.00 5.06	
Medium dense to dense grey and pink gravelly subangular to rounded COBBLES and BOULDERS of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Recovered as angular to rounded coarse gravel, cobble and boulder sized fragments. (Driller noted boulder clay). from 5.00m to 5.20m and 5.45m to 5.60m with medium to coarse gravel sized pockets of clay. from 5.10m to 5.33m strong grey boulder of granite from 5.47m to 5.60m strong grey boulder of gneiss		5.60	-5.77	5.00 6.20	107	50	NA	NA			
Assumed zone of no recovery. Stiff boulder CLAY with cobbles and boulders. (Driller's description)		6.20	-6.37								
Rotary openhole drilling: BOULDERS. (Driller's description)		6.50	-6.67	6.50 7.10	107	100	NA	NA		SPT(C)50/0mm 6.50 6.50	
Dense grey, brown and pink clayey angular to rounded coarse GRAVEL with medium cobble content. Cobbles are subangular to rounded of granite and gneiss. Gravel is of mixed igneous and metamorphic lithologies including granite, gneiss and schist.		7.10	-7.27	7.10 8.20	89	95	NA	NA			
Stiff extremely high strength reddish brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite and gneiss. from 8.15m to 8.20m assumed zone of no recovery		8.20		8.20 9.60	89	100	NA	NA		SPT(C)41 8.20 8.65	
										SPT(C)32 9.60 10.05	

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A11
Engineer	Arch Henderson LLP		Sheet 2 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-0.17m CD	Coordinates	396693.40 E, 804798.70 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Stiff extremely high strength reddish brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite and gneiss.		10.50	-10.67	9.60	11.10	89	100	NA	NA		
Stiff extremely high strength greyish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist.		11.10		11.10	12.70	89	100	NA	NA	SPT(C)28	11.10 - 11.55
Stiff brown slightly gravelly CLAY. Gravel is angular to rounded fine to medium of granite and gneiss.		12.40	-12.57							SPT(C)29	12.70 - 13.15
from 13.10m to 13.20m cobble of quartz from 13.20m to 13.40m assumed zone of no recovery		12.70		12.70	13.40	89	71	NA	NA		
from 13.60m to 13.70m cobble of granite		13.70	-13.87	13.40	14.10	89	57	NA	NA		
Assumed zone of no recovery. Stiff to firm greyish brown boulder CLAY. (Driller's description)		14.10	-14.27							SPT(C)50/245mm	14.10 - 14.50
Firm brown slightly gravelly CLAY. Gravel is angular to rounded fine to coarse of granite and schist. from 14.40m to 14.60m recovered as angular coarse gravel sized fragments		14.60	-14.77	14.10	15.60	89	33	NA	NA	NA	
Assumed zone of no recovery. Dense clay bound GRAVEL with cobbles and boulders. (Driller's description)		15.60	-15.77							SPT(C)50/170mm	15.60 - 15.92
Dense clayey angular to subrounded fine to coarse GRAVEL of mixed igneous and metamorphic lithologies including granite, gneiss and schist with low cobble content. Cobbles are subangular of granite and gneiss.		16.20	-16.37	15.60	17.10	89	60	NA	NA		
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to rounded of granite and gneiss.		16.50	-16.67								
Assumed zone of no recovery. Clay bound GRAVEL with cobbles and boulders. (Driller's description)		17.10	-17.27							SPT(C)30	17.10 - 17.55
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite and gneiss.		17.70	-17.87	17.10	18.60	89	40	NA	NA		
Assumed zone of no recovery. Firm greyish brown boulder CLAY with sandy bands. (Driller's description)		18.60	-18.77							SPT(C)37	18.60 - 19.05
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite, gneiss and schist. from 19.40m to 19.60m assumed zone of no recovery		18.60	-18.77	18.60	19.60	89	80	NA	NA		
		19.60		19.60	19.85	89	100	NA	NA	SPT(C)50/0mm	19.60 - 19.60

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A11
Engineer	Arch Henderson LLP		Sheet 3 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-0.17m CD	Coordinates	396693.40 E, 804798.70 N National Grid
Hole Type	CP+RC	Inclination	Vertical


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite, gneiss and schist. from 20.15m to 20.20m angular medium to coarse gravel of schist and granite		20.20	-20.37	19.85	21.10	89	28	NA	NA	SPT(C)33 20.10 20.55	
Assumed zone of no recovery. Firm greyish brown boulder CLAY with sandy bands. (Driller's description)		21.10	-21.27								
Stiff extremely high strength brown slightly sandy gravelly CLAY with medium cobble content. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. Cobbles are angular to subrounded of granite, gneiss and schist. from 22.40m to 22.60m assumed zone of no recovery				21.10	22.60	89	87	NA	NA	SPT(C)41 22.40 22.85	
from 23.35m to 23.60m assumed zone of no recovery											
from 24.10m to 24.20m assumed zone of no recovery				22.60	23.60	89	75	NA	NA		
from 25.55m to 25.60m assumed zone of no recovery										SPT(C)33 23.60 24.05	
from 25.95m to 26.00m assumed zone of no recovery				23.60	24.20	89	83	NA	NA		
Assumed zone of no recovery. Firm greyish brown boulder CLAY with sand bands and cobbles. (Driller's description)		26.40	-26.57								
Dense grey, pink and brown gravelly angular to subrounded COBBLES and BOULDERS of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. Recovered as angular to subrounded coarse gravel and cobble sized fragments. from 27.50m to 27.70m strong grey boulder of granite from 27.70m to 27.80m with medium to coarse gravel sized pockets of slightly gravelly sandy clay. from 27.80m to 28.00m assumed zone of no recovery		27.50	-27.67	26.00	27.50	89	27	NA	NA	SPT(C)32 25.60 26.05	
Strong grey granitic GNEISS. Discontinuities: 1) 10-20 degrees closely and medium spaced planar rough stained brown on surfaces. 2) 40-50 degrees medium spaced planar rough stained brown on surfaces. from 28.95m to 29.05m recovered as non intact core (angular coarse gravel sized fragments)		28.20	-28.37	27.50	28.10	89	50	NA	NA	SPT(C)34 26.00 26.45	
				28.10	28.70	89	100	83	48	SPT(C)50/0mm 27.50 27.50	
				28.70	29.80	89	100	91	24		

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A11
Engineer	Arch Henderson LLP		Sheet 4 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-0.17m CD	Coordinates	396693.40 E, 804798.70 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Remaining Detail : 29.80m - 29.84m : from 29.80m to 29.84m, 30.36m to 30.46m, 30.70m to 30.74m and 31.29m to 31.33m recovered as non intact core	[Wavy Pattern]	32.80	-32.97	29.80	32.80	89	100	93	66	NI 100 220	
Exploratory hole complete at 32.80 m.											

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. A19					
Project No. TA7148													Header					
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -2.58m CD					Coordinates 396805.70 E, 804917.80 N National Grid													
Date Started 31/08/2013					Date Completed 02/09/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00 0.10	0.10 9.80	CP RC	31/08/2013 31/08/2013	31/08/2013 02/09/2013	KL MM	DT DT	SWF	Impreg	Dando 3000 Deltabase 520									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow		
31/08/2013	1330	0.10	0.10	-6.00	End of CP													
31/08/2013	1345	0.10	0.10	-6.00	Start of Rotary													
31/08/2013	1900	2.70	2.70	-3.10	End of Shift													
01/09/2013	0900	2.70	2.70	-4.50	Start of Shift													
01/09/2013	1500	4.50	3.70	-4.00	End of Shift													
02/09/2013	0800	4.50	3.70	-4.50	Start of Shift													
02/09/2013	1715	9.80	5.00	-4.50	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
0.00		0.10		1130		0200		Chiselling			0.10	SPT(C)	50/0mm (25/0,50/0)		AR362	75	N/A	-6.10
											1.40	SPT(C)	50/81mm (20.5/0,32,18/6)		AR362	75	1.40	-3.50
											2.70	SPT(C)	50/4mm (25/0,50/4)		AR362	75	1.40	-3.00
											3.70	SPT(C)	50/95mm (12,13,41,9/20)		AR362	75	3.70	-4.10
											4.50	SPT(C)	50/10mm (25/15,50/10)		AR362	75	3.70	-4.00
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
0.10		5.00		Water		0		-										
5.00		9.80		Water		100		Clear										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %										
200	0.10	200	0.10															
150	3.70	150	3.70															
145	9.80																	
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section		Base of section		Material			Remarks											
0.00		4.50		Arisings														
4.50		9.80		Grout														
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
Unchecked Log Print Date And Time: 23/12/2013 10:24:40 Form No. SIEXPHOLEHDR Issue.Revision No. 1.05 Issue Date 22/10/2012																		

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A19
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		


Ground Level	-2.58m CD	Coordinates	396805.70 E, 804917.80 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
No recovery. Large BOULDER obstruction. (Driller's description)		0.10	-2.68	0.10	0.40	113	83	NA	NA	SPT(C)50/0mm 0.10 0.10	
Strong grey BOULDERS of granite. from 0.35m to 0.40m assumed zone of no recovery		0.58	-3.16								
Very stiff reddish brown slightly sandy slightly gravelly CLAY with high cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite and gneiss. Cobbles are angular of granite and gneiss. from 0.87m to 1.10m strong grey boulder of gneiss		1.40	-3.98	0.40	1.40	113	100	NA	NA	SPT(C)50/81mm 1.40 1.56	
Very dense pink, grey and dark grey COBBLES and BOULDERS of mixed igneous and metamorphic lithologies including granite and gneiss.		1.80	-4.38	1.40	2.70	113	31	NA	NA	NA	
Assumed zone of no recovery. Slightly claybound GRAVEL with frequent large granite boulders. (Driller's description)		2.70	-5.28							SPT(C)50/4mm 2.70 2.70	
Very dense pink, grey and dark grey COBBLES and BOULDERS of mixed igneous and metamorphic lithologies including granite and gneiss.		3.00	-5.58	2.70	3.70	113	30	NA	NA		
Assumed zone of no recovery. Slightly claybound GRAVEL with frequent large granite boulders. (Driller's description)		3.70	-6.28							SPT(C)50/95mm 3.70 3.95	
Very dense pink, grey and dark grey COBBLES and BOULDERS of mixed igneous and metamorphic lithologies including granite and gneiss.		4.20	-6.78	3.70	4.50	113	63	NA	NA		
Assumed zone of no recovery. Slightly claybound GRAVEL with frequent large granite boulders. (Driller's description)		4.50	-7.08							SPT(C)50/10mm 4.50 4.53	
Strong locally medium strong pink and grey coarse crystalline GRANITE. Discontinuities: 1) 10-20 degrees closely locally very closely spaced planar and undulose rough with patchy brown staining on surface. 2) 50-60 degrees medium spaced undulose rough with brown staining on surfaces. from 4.80m to 5.00m recovered as non intact core (angular coarse gravel sized fragments)		4.50		4.50	5.00	113	100	60	22		
from 5.75m to 6.09m weak stained reddish brown on surfaces and recovered as non intact core (angular coarse gravel sized fragments)		5.00		5.00	5.50	93	100	100	0	NI 60 140	
from 6.09m to 6.14m assumed zone of no recovery		5.50		5.50	6.50	93	95	61	14		
from 6.50m to 7.50m 10-20 degrees discontinuities medium locally closely spaced		6.50		6.50	7.50	93	100	96	62	NI 150 220	
from 6.76m to 6.80m recovered as non intact core (angular coarse gravel sized fragments)		7.50		7.50	9.00	93	100	93	42		
from 7.90m to 8.00m recovered as non intact core (angular coarse gravel sized fragments of schist)		7.50		7.50	9.00	93	100	93	42		
from 7.90m to 8.10m 1 No thin band of medium strong thinly (<3mm) foliated grey schist		9.00		9.00	9.80	93	100	100	64	NI 120 500	
from 8.10m to 9.40m 10-20 degrees discontinuities closely locally medium spaced		9.40	-11.98	9.00	9.80	93	100	100	64		
Medium strong closely (<3mm) foliated grey SCHIST. Discontinuities: 1) 40-50 degrees closely spaced planar rough		9.80	-12.38								

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	<h2 style="margin:0;">Exploratory Hole Log</h2>	Hole ID. <h1 style="margin:0;">A19</h1>
Sheet 1+ of 1		

Ground Level -2.58m CD	Coordinates 396805.70 E, 804917.80 N National Grid
Hole Type CP+RC	Inclination Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
clean. Exploratory hole complete at 9.80 m.											

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. A26					
Project No. TA7148													Header					
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -4.11m CD					Coordinates 396896.20 E, 804926.10 N National Grid													
Date Started 30/08/2013					Date Completed 30/08/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00	0.20	CP	30/08/2013	30/08/2013	KL	DT			Dando 3000									
0.20	4.10	RC	30/08/2013	30/08/2013	MM	DT	SWF	Impreg	Deltabase 520									
4.10	8.10	RC	30/08/2013	30/08/2013	MM	DT	T6116	Impreg	Deltabase 520									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow		
30/08/2013	1000	0.20	0.20	-6.50	End of CP													
30/08/2013	1015	0.20	0.20	-6.50	Start of Rotary													
30/08/2013	1900	8.10	3.10	-6.10	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
0.00		0.20		0800		0200		Chiselling			0.20	SPT(C)	50/0mm (25/0,50/0)		AR362	75	N/A	-4.80
											1.00	SPT(C)	50/152mm (18,7/0,22,21,7/2)		AR362	75	1.00	-6.45
											2.00	SPT(C)	50/83mm (25/10,37,13/8)		AR362	75	2.00	-6.35
											3.00	SPT(C)	50/55mm (8,17/35,50/55)		AR362	75	3.00	-6.20
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
0.20		8.10		Water		0		-										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %										
200	0.20	200	0.20															
150	3.10	150	3.10															
146	4.10																	
116	8.10																	
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top Base		ID	Pipe Top Base		Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00	8.10	Arisings																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
Unchecked Log Print Date And Time: 23/12/2013 10:24:55 Form No. SIEXPHOLEHDR Issue.Revision No. 1.05 Issue Date 22/10/2012																		

Ground Level	-4.11m CD	Coordinates	396896.20 E, 804926.10 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details		Installation
				Details	Dia.	TCR	SCR	RQD	IF			
No recovery. Large BOULDER obstruction. (Driller's description)		0.20	-4.31								SPT(C)50/0mm 0.20	
Grey angular to subangular fine to coarse GRAVEL and angular to subrounded COBBLES of granite, schist and gneiss.		0.47	-4.58	0.20	1.00	113	34	NA	NA			
Assumed zone of no recovery. Granite and quartz BOULDERS with sand lenses. (Driller's description)		1.00	-5.11								SPT(C)50/152mm 1.00	
Grey angular to rounded fine to coarse GRAVEL and subangular to rounded COBBLES of granite, gneiss and schist.		1.20	-5.31	1.00	2.00	113	20	NA	NA			
Assumed zone of no recovery. Granite and quartz BOULDERS with sand lenses. (Driller's description)		2.00	-6.11									
Grey subangular to rounded fine to coarse GRAVEL of subangular to rounded COBBLES of granite, gneiss and schist.		2.05	-6.16	2.00	3.00	113	25	NA	NA		SPT(C)50/83mm 2.00	
Assumed zone of no recovery. Granite and quartz BOULDERS with sand lenses. (Driller's description)		2.80	-6.91									
Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite, schist and gneiss.		3.20	-7.31								SPT(C)50/55mm 3.00	
Strong pink and grey coarse crystalline GRANITE. Discontinuities: 1) 60-70 degrees medium locally closely spaced planar rough with yellow staining on surfaces. from 3.20m to 3.35m very weak and stained brown and yellow with staining penetrating through whole diameter of core from 3.20m to 3.55m recovered as non intact core (angular coarse gravel sized fragments)		4.10	-8.21	3.00	4.10	113	100	50	40			
Weak locally very weak pink and grey stained yellow coarse crystalline GRANITE. Recovered as non intact core (angular gravel sized fragments and angular cobble sized fragments).				4.10	5.10	93	80	0	0			
				5.10	6.20	93	100	0	0			
		6.34	-10.45	6.20	7.30	93	100	62	12			
Medium strong to strong pink and grey coarse crystalline GRANITE. Discontinuities: 1) 10-20 degrees closely spaced planar rough with yellow and brown staining on fracture surfaces. 2) 60-70 degrees closely spaced planar rough with yellow and brown staining on surfaces. from 6.62m to 6.80m, 6.95m to 7.05m and 7.66m to 8.00m recovered as non intact core (angular coarse gravel sized fragments) from 7.40m to 8.10m discontinuities 2) medium spaced				7.30	8.10	93	100	58	45			
Exploratory hole complete at 8.10 m.		8.10	-12.21									

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	<h2 style="margin:0;">Exploratory Hole Log</h2>	Hole ID. A29 Header
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Ground Level -2.70m CD	Coordinates 396899.04 E, 804841.79 N National Grid	
Date Started 22/07/2013	Date Completed 25/07/2013	Inclination Vertical

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00	2.30	CP	22/07/2013	22/07/2013	KL	DT			Dando 2000		
2.30	14.50	RC	22/07/2013	23/07/2013	MM	DT	SWF	Impreg	Deltabase 520		
14.50	28.00	RC	23/07/2013	23/07/2013	MM	DT	T6116	Impreg	Deltabase 520		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow
22/07/2013	1130	2.30	2.30	-5.40	End of CP/Start of Rotary							
22/07/2013	2000	8.50	5.50	-3.00	End of Shift							
23/07/2013	0700	8.50	5.50	-1.50	Start of Shift							
23/07/2013	1930	21.50	14.50	-4.10	End of shift							
24/07/2013	0700	21.50	14.50	-1.10	Start of Shift							
24/07/2013	1730	24.00	20.00	-5.00	End of Shift							
25/07/2013	0700	24.00	20.00	-2.10	Start of Shift							
25/07/2013	1700	28.00	22.40	-6.00	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
2.30	2.30	0930	0200	Chiselling	0.50	SPT	N=13 (1,2,3,3,3,4)	AR362	75	N/A	-5.10
					1.50	SPT	N=23 (2,3,4,4,5,10)	AR362	75	1.50	-5.20
					2.30	SPT(C)	50/0mm (25/5,50/0)	AR362	75	2.30	-5.40
					3.00	SPT	50/5mm (7,18/10,50/5)	AR362	75	2.30	-4.10
					4.00	SPT(C)	50/245mm (8,10,14,16,16,4/20)	AR362	75	3.00	-3.00
					5.50	SPT(C)	50/270mm (7,10,12,12,13,13/45)	AR362	75	3.00	-4.00
					7.00	SPT(C)	50/260mm (7,8,10,13,15,12/35)	AR362	75	5.50	-4.10
					8.50	SPT(C)	50/25mm (25/70,50/25)	AR362	75	5.50	-1.00
					10.00	SPT(C)	50/200mm (8,12,15,21,14/50)	AR362	75	5.50	-1.00
					11.50	SPT(C)	50/230mm (7,10,12,13,18/7/5)	AR362	75	5.50	-1.20
					13.00	SPT(C)	50/200mm (9,12,15,23,12/50)	AR362	75	5.50	-2.00
					14.50	SPT(C)	50/5mm (20,5/5,50/5)	AR362	75	14.50	-5.00
					16.00	SPT(C)	50/230mm (7,9,12,18,18,2/5)	AR362	75	14.50	-5.20
					17.50	SPT(C)	50/230mm (6,10,10,17,20,3/5)	AR362	75	14.50	-6.00
					19.00	SPT(C)	50/100mm (7,12,14,36/25)	AR362	75	14.50	-6.40
					20.50	SPT(C)	50/265mm (5,7,9,13,15,13/40)	AR362	75	14.50	-6.80
					22.00	SPT(C)	50/80mm (7,10,45,5/5)	AR362	75	14.50	-11.00

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
2.30	6.50	Water	0	
6.50	7.00	Water	100	Brown
7.00	14.50	Water	0	
14.50	21.50	Water	100	Green
21.50	28.00	Water	100	Brown

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %
200	2.30	200	2.30					
150	5.50	150	5.50					
146	14.50	121	22.40					
121	22.40							
116	28.00							

INSTALLATION DETAILS				PIPE CONSTRUCTION				
Distance from G.L.	ID	Type	Response zone Top Base	ID	Pipe Top Base	Dia. of pipe	Type of pipe	

* Seating blows only.

BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	22.30	Arisings					
22.30	28.00	Grout					

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A29
Engineer	Arch Henderson LLP		Sheet 1 of 3
Employer	Aberdeen Harbour Board		

Ground Level	-2.70m CD	Coordinates	396899.04 E, 804841.79 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Medium dense grey slightly silty slightly gravelly fine to coarse SAND. Gravel is angular to subrounded fine of granite, schist and quartzite.		0.00		D001	0.00						
				D002	0.50-0.95					SPT13	0.95
				B003	0.50-1.00						
				D004	1.00						
				ES005	1.00						
Strong grey BOULDER of schist and quartzite.		2.30	-5.00	D006	1.50-1.95					SPT23	1.95
				B007	1.50-2.00						
Stiff brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		2.65	-5.35	2.30	3.00	107	57	NA	NA	SPT(C)50/0mm	2.31
Assumed zone of no recovery. Stiff to very stiff brown gravelly sandy CLAY. (Driller's description)		2.70	-5.40							SPT50/5mm	3.09
Stiff extremely high strength brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		3.00	-5.70	3.00	4.00	107	100	NA	NA	SPT(C)50/245mm	4.40
from 5.10m to 5.15m assumed zone of no recovery				4.00	4.50	107	100	NA	NA		
from 5.30m to 5.45m angular coarse gravel of granite, schist and quartzite				4.50	5.50	107	60	NA	NA		
Assumed zone of no recovery. Stiff to very stiff brown gravelly sandy CLAY. (Driller's description)		5.60	-8.30	5.50	6.50	107	35	NA	NA	SPT(C)50/270mm	5.92
Stiff extremely high strength brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		6.50	-9.20	6.50	7.00	107	80	NA	NA	SPT(C)50/260mm	7.41
from 6.90m to 7.00m assumed zone of no recovery				7.00	8.50	107	90	NA	NA		
from 8.35m to 8.50m assumed zone of no recovery				8.50	10.00	107	100	NA	NA	SPT(C)50/25mm	8.60

NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Unchecked Form No. SIEXPHOLELOG	Log Print Date And Time: 23/12/2013 10:25:10 Issue/Revision No. 1.05 Issue Date 22/10/2012	

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A29
Engineer	Arch Henderson LLP		Sheet 2 of 3
Employer	Aberdeen Harbour Board		

Ground Level	-2.70m CD	Coordinates	396899.04 E, 804841.79 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Stiff extremely high strength brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite. from 12.85m to 13.00m assumed zone of no recovery		10.00	-16.70	10.00	11.50	107	90	NA	NA	SPT(C)50/200mm 10.00 10.93	
				11.50	13.00	107	90	NA	NA	SPT(C)50/230mm 11.50 11.88	
				13.00	14.50	107	67	NA	NA	SPT(C)50/200mm 13.00 13.35	
Assumed zone of no recovery. Stiff to very stiff brown gravelly sandy CLAY. (Driller's description)		14.00	-16.70								
Stiff brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite. from 14.50m to 14.67m strong grey boulder of granite at 15.25m gravelly		14.50	-17.20	14.50	16.00	92	90	NA	NA	SPT(C)50/5mm 14.50 14.59	
				16.00	17.50	92	100	NA	NA	SPT(C)50/230mm 16.00 16.38	
				17.50	19.00	92	100	NA	NA	SPT(C)50/230mm 17.50 17.88	
				19.00	20.50	92	83	NA	NA	SPT(C)50/100mm 19.00 19.25	

NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Unchecked	Log Print Date And Time: 23/12/2013 10:25:14	
Form No. SIEXPHOLELOG	Issue/Revision No. 1.05 Issue Date 22/10/2012	

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A29
Engineer	Arch Henderson LLP		Sheet 3 of 3
Employer	Aberdeen Harbour Board		

Ground Level	-2.70m CD	Coordinates	396899.04 E, 804841.79 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Stiff brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite. from 20.25m to 20.50m assumed zone of no recovery		21.03	-23.73	20.50	21.50	92	53	NA	NA	SPT(C)50/265mm 20.50 20.92	
Assumed zone of no recovery. Stiff to very stiff brown sandy gravelly CLAY with occasional granite boulders. (Driller's description)		21.50	-24.20	21.50	22.00	92	100	NA	NA		
Stiff high strength brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		22.50	-25.20	22.00	22.50	92	100	NA	NA	SPT(C)50/80mm 22.00 22.23	
Medium strong pink and grey coarse crystalline GRANITE. Recovered as non intact core (angular medium to coarse gravel sized fragments stained yellow and brown).		22.50	-25.20	22.50	23.50	92	100	0	0		
from 24.00m to 24.25m intact core. Discontinuities: 1) 20-30 degrees closely spaced planar rough stained yellow and brown				23.50	24.00	92	80	0	0	NI NI 120	
from 25.30m to 25.50m intact core. Discontinuities: 1) 20-30 degrees closely spaced planar rough stained yellow and brown				24.00	25.50	92	100	16	8		
from 26.10m to 26.23m intact core. Discontinuities: 1) 20-30 degrees closely spaced planar rough stained yellow and brown				25.50	27.00	92	100	8	0		
from 27.10m to 27.15m intact core. Discontinuities: 1) 20-30 degrees closely spaced planar rough stained yellow and brown				27.00	28.00	92	100	6	0		
Exploratory hole complete at 28.00 m.		28.00	-30.70								

NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Unchecked	Log Print Date And Time: 23/12/2013 10:25:18	
Form No. SIEXPHOLELOG	Issue/Revision No. 1.05 Issue Date 22/10/2012	

Project Name Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No. TA7148		A31
Engineer Arch Henderson LLP		Header
Employer Aberdeen Harbour Board		

Ground Level -4.11m CD	Coordinates 396948.24 E, 804804.54 N National Grid
Date Started 19/07/2013	Date Completed 21/07/2013
Inclination Vertical	

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00	1.80	CP	17/07/2013	18/07/2013	KL	DT			Dando 2000		
1.80	23.50	RC	18/07/2013	20/07/2013	MM	DT	SWF	Impreg	Deltabase 520		
23.50	31.40	RC	20/07/2013	21/07/2013	MM	DT	T6116	Impreg	Deltabase 520		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow
18/07/2013	0915	1.80	1.80	-7.50	End of CP							
18/07/2013	1015	1.80	1.80	-7.50	End of shift							
18/07/2013	1030	1.80	1.80	-7.00	Start of Rotary							
18/07/2013	2030	8.50	7.30	-6.00	End of Shift							
19/07/2013	0700	8.50	7.30	-6.20	Start of Shift							
19/07/2013	2030	22.00	7.30	-6.00	End of Shift							
20/07/2013	0700	22.00	7.30	-1.20	Start of Shift							
20/07/2013	1900	28.50	23.50	-1.00	End of Shift							
21/07/2013	0800	28.50	23.50	-8.00	Start of Shift							
21/07/2013	1930	31.40	23.50	NR	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
1.55	1.80	1730	0230	Chiselling Chiselling	0.50	SPT	N=17 (2,3,3,3,5,6)	AR362	75	N/A	-6.10
1.80	1.80	0815	0100		1.50	SPT(C)	50/5mm (25/5,50/5)	AR362	75	1.50	-7.00
					3.30	SPT	50/200mm (10,15,14,18,18/50)	AR362	75	3.00	-8.00
					4.80	SPT	50/5mm (10,15,50/5)	AR362	75	NR	NR
					6.30	SPT	50/210mm (9,12,13,15,22/60)	AR362	75	3.00	-6.00
					7.30	SPT	50/220mm (10,14,15,16,19/70)	AR362	75	3.00	-4.00
					8.50	SPT	50/10mm (4,21/20,50/10)	AR362	75	7.30	-7.00
					10.00	SPT	50/20mm (7,18/50,50/20)	AR362	75	7.30	-7.30
					13.00	SPT	50/295mm (7,9,10,10,16,14/70)	AR362	75	7.30	-6.00
					14.50	SPT	52/245mm (9,12,12,14,16,10/20)	AR362	75	7.30	9.30
					16.00	SPT	50/225mm (8,8,11,14,21,4)	AR362	75	7.30	10.80
					17.50	SPT	50/5mm (25/10,50/5)	AR362	75	7.30	8.00
					19.00	SPT	52/255mm (8,10,12,13,15,12/30)	AR362	75	7.30	7.40
					20.50	SPT	50/85mm (10,15/30,40,10/10)	AR362	75	7.30	8.10
					22.00	SPT	50/70mm (25/15,50/70)	AR362	75	7.30	10.80
					23.50	SPT	50/220mm (9,12,15,16,19/70)	AR362	73	23.50	-5.00
					24.50	SPT	50/215mm (8,10,10,15,25/65)	AR362	75	23.50	-4.00
					26.00	SPT	50/40mm (13,12/40,50/40)	AR362	75	23.50	-1.00

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
1.80	3.30	Water	100	Brown
3.30	8.50	Water	0	-
8.50	16.00	Water	100	Brown
16.00	22.00	Water	100	Green
22.00	26.00	Water	100	Brown
26.00	28.50	Water	100	Green
28.50	31.40	Water	100	White

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time h:mm:ss	Recovery %
200	1.80	200	1.80					
150	7.30	150	7.30					
145	23.50	139	23.50					
116	31.40							

INSTALLATION DETAILS				PIPE CONSTRUCTION					
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe

* Seating blows only.

BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	26.00	Arisings					
26.00	31.40	Grout					

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A31
Engineer	Arch Henderson LLP		Sheet 1 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-4.11m CD	Coordinates	396948.24 E, 804804.54 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Medium dense grey slightly silty slightly gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of granite and schist.				D001 0.00							
				D001 0.50-0.95 B002 0.50-1.00						SPT17 0.50 0.95	
				D003 1.00 ES004 1.00							
Strong grey BOULDER of granite.		1.55	-5.66							SPT(C)50/5mm 1.50 1.51	
Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		1.80	-5.91								
				1.80 3.30	107	60	NA	NA			
Assumed zone of no recovery. Boulder CLAY with cobbles and boulders. (Driller's description)		2.70	-6.81								
Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		3.30	-7.41							SPT50/200mm 3.30 3.65	
				3.30 4.80	107	46	NA	NA			
Assumed zone of no recovery. Boulder CLAY with cobbles and boulders. (Driller's description)		4.00	-8.11								
Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		4.80	-8.91							SPT50/5mm 4.80 4.96	
				4.80 6.30	107	23	NA	NA			
Assumed zone of no recovery. Boulder CLAY with cobbles and boulders.		5.15	-9.26								
Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		6.30	-10.41							SPT50/210mm 6.30 6.66	
				6.30 7.30	107	40	NA	NA			
from 6.30m to 6.60m clayey subangular cobbles of schist and granite		6.70	-10.81								
Assumed zone of no recovery. Boulder CLAY with cobbles and boulders. (Driller's description)		7.30	-11.41							SPT50/220mm 7.30 7.67	
Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		7.60	-11.71								
				7.30 8.50	107	25	NA	NA			
from 7.30m to 7.40m clayey gravel		7.60	-11.71								
Assumed zone of no recovery. Boulder CLAY with cobbles and boulders. (Driller's description)		8.50	-12.61							SPT50/10mm 8.50 8.61	
Stiff extremely high strength brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.											
				8.50 9.70	107	100	NA	NA			
				9.70 10.00	107	100	NA	NA			

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A31
Engineer	Arch Henderson LLP		Sheet 2 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-4.11m CD	Coordinates	396948.24 E, 804804.54 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Stiff extremely high strength brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.				10.00	11.50	107	40	NA	NA	SPT50/20mm 10.00	
Assumed zone of no recovery. Boulder CLAY with cobbles and boulders. (Driller's description)		11.10	-15.21								
Zone of no recovery. Boulder CLAY with cobbles. (Driller's description)		11.50	-15.61	11.50	13.00	107	0	NA	NA		
Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		13.00	-17.11							SPT50/295mm 13.00	
Assumed zone of no recovery. Boulder CLAY with cobbles and boulders. (Driller's description)		13.40	-17.51	13.00	14.35	107	29	NA	NA		
Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		14.35	-18.46	14.35	14.50	107	100	NA	NA	SPT52/245mm 14.50	
Assumed zone of no recovery. Boulder CLAY with cobbles and boulders. (Driller's description)		15.30	-19.41	14.50	16.00	107	53	NA	NA		
Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		16.00	-20.11							SPT50/225mm 16.00	
Assumed zone of no recovery. Boulder CLAY with cobbles and boulders. (Driller's description)		16.47	-20.58	16.00	17.50	107	31	NA	NA		
Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		17.50	-21.61							SPT50/5mm 17.50	
Firm medium strength brown slightly sandy CLAY. Sand is fine.		19.00	-23.11	17.50	19.00	107	100	NA	NA		
				19.00	20.40	107	71	NA	NA	SPT52/255mm 19.00	

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A31
Engineer	Arch Henderson LLP		Sheet 3 of 4
Employer	Aberdeen Harbour Board		


Ground Level	-4.11m CD	Coordinates	396948.24 E, 804804.54 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Assumed zone of no recovery. Boulder CLAY with cobbles and boulders. (Driller's description)		20.00	-24.11								
Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		20.40	-24.51	20.40	20.50	107	100	NA	NA	SPT50/85mm 20.50	20.69
Assumed zone of no recovery. Boulder CLAY with cobbles and boulders. (Driller's description)		20.90	-25.01								
Soft to firm brown sandy CLAY.		22.00	-26.11							SPT50/70mm 22.00	22.09
from 22.45m to 22.60m strong grey dolerite boulder of granite		22.60	-26.71	22.00	23.50	107	40	NA	NA		
Assumed zone of no recovery. Boulder CLAY with cobbles and boulders. (Driller's description)		23.50	-27.61							SPT50/220mm 23.50	23.87
Stiff greyish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		23.90	-28.01	23.50	24.50	92	40	NA	NA		
Assumed zone of no recovery. Boulder CLAY with cobbles and boulders. (Driller's description)		24.50	-28.61							SPT50/215mm 24.50	24.87
Stiff greyish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		26.00	-30.11	24.50	26.00	92	100	NA	NA		
Medium strong greenish grey coarsely crystalline GRANITE. Recovered as non intact core (angular coarse gravel sized fragments and angular cobble sized fragments stained yellow and brown).				26.00	27.00	92	100	20	0	SPT50/40mm 26.00	26.16
from 26.40m to 26.47m recovered as intact core.											
Discontinuities: 1) 20-30 degrees closely spaced planar rough stained yellow and brown. 2) 60-70 degrees closely to medium spaced planar rough stained dark brown and grey											
from 26.72m to 26.85m recovered as intact core.											
Discontinuities: 1) 20-30 degrees closely spaced planar rough stained yellow and brown. 2) 60-70 degrees closely to medium spaced planar rough stained dark brown and grey											
from 27.23m to 27.35m recovered as intact core.				27.00	28.50	92	100	19	0		
Discontinuities: 1) 20-30 degrees closely spaced planar rough stained yellow and brown. 2) 60-70 degrees closely to medium spaced planar rough stained dark brown and grey											
from 27.53m to 27.70m recovered as intact core.											
Discontinuities: 1) 20-30 degrees closely spaced planar rough stained yellow and brown. 2) 60-70 degrees closely to medium spaced planar rough stained dark brown and grey				28.50	29.50	92	100	10	0		
from 29.40m to 29.55m recovered as intact core.											
Discontinuities: 1) 20-30 degrees closely spaced planar				29.50	30.00	92	100	10	0		

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A31
Engineer	Arch Henderson LLP		Sheet 4 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-4.11m CD	Coordinates	396948.24 E, 804804.54 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Remaining Detail : 29.40m - 29.55m : rough stained yellow and brown. 2) 60-70 degrees closely to medium spaced planar rough stained dark brown and grey from 30.50m to 31.00m recovered as intact core. Discontinuities: 1) 20-30 degrees closely spaced planar rough stained yellow and brown. 2) 60-70 degrees closely to medium spaced planar rough stained dark brown and grey			-35.51	30.00	31.40	92	100	35	0		
Exploratory hole complete at 31.40 m.											

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log				Hole ID. A34					
Project No. TA7148														Header					
Engineer Arch Henderson LLP																			
Employer Aberdeen Harbour Board																			
Ground Level -5.45m CD					Coordinates 396995.60 E, 804880.50 N National Grid														
Date Started 28/08/2013					Date Completed 29/08/2013					Inclination Vertical									
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment		Shoring / Support		Remarks						
0.00 2.30 11.10	2.30 11.10 15.30	CP RC RC	28/08/2013 28/08/2013 29/08/2013	28/08/2013 29/08/2013 29/08/2013	KL MM MM	TE DT DT	SWF T6116	Impreg Impreg	Dando 3000 Deltabase 520 Deltabase 520										
PROGRESS										WATER STRIKES									
Date	Time	Hole depth	Casing depth	Water depth	Remarks				Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow				
28/08/2013	1430	2.30	2.30	-7.00	End of CP														
28/08/2013	1440	2.30	2.30	-7.00	Start of Rotary														
28/08/2013	1900	11.10	2.30	-9.00	End of Shift														
29/08/2013	0700	11.10	2.30	-9.50	Start of Shift														
29/08/2013	1330	15.30	2.30	-9.50	End of Hole														
CABLE PERCUSSION DETAILS										SPT DETAILS									
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks				Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
2.20		2.30		1230		0200		Chiselling				0.50	SPT	N=13 (2,2,3,3,4,3)		AR362	75	N/A	-5.00
												1.50	SPT	N=20 (1,2,4,5,5,6)		AR362	75	1.50	-7.80
												2.20	SPT(C)	50/5mm (25/5,50/5)		AR362	75	2.20	-7.60
												2.30	SPT(C)	50/0mm (25/5,50/0)		AR362	75	2.30	-7.00
												3.60	SPT(C)	50/15mm (25/50,50/15)		AR362	75	2.30	-7.10
												5.10	SPT(C)	50/245mm (6,12,12,17,16,5/40)		AR362	75	2.30	-8.10
												6.60	SPT(C)	45/210mm (4,10,10,15/20/60)		AR362	75	2.30	-8.30
												8.10	SPT(C)	50/85mm (5,20,40,10/10)		AR362	75	2.30	-9.80
												9.60	SPT(C)	50/160mm (5,8,10,12,28/10)		AR362	75	2.30	-9.70
ROTARY FLUSH DETAILS																			
From depth		To depth		Flush type		Flush return %		Flush colour											
2.30 3.60		3.60 15.30		Water Water		70 0		Brown -											
HOLE DIAMETER / CASING				DYNAMIC SAMPLING															
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %											
200	2.30	200	2.30																
146	11.10																		
116	15.30																		
INSTALLATION DETAILS					PIPE CONSTRUCTION														
Distance from G.L.	ID	Type	Response zone Top Base		ID	Pipe Top Base		Dia. of pipe	Type of pipe										
BACKFILL DETAILS										GENERAL NOTES									
Top of section		Base of section		Material				Remarks											
0.00 11.10		11.10 15.30		Arisings Grout															
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group									
Unchecked					Log Print Date And Time: 23/12/2013 10:25:56														
Form No. SIEXPHOLEHDR					Issue/Revision No. 1.05					Issue Date 22/10/2012									

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A34
Engineer	Arch Henderson LLP		Sheet 1 of 2
Employer	Aberdeen Harbour Board		

Ground Level	-5.45m CD	Coordinates	396995.60 E, 804880.50 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Medium dense brown slightly silty slightly gravelly fine to coarse SAND. Gravel is subangular to rounded fine to medium locally coarse of mixed igneous and metamorphic lithologies. from 0.00m to 1.50m gravel absent				D001 0.00							
				D002 0.50						SPT13 0.50	0.95
				B003 0.50							
				D004 1.00							
				D005 1.50						SPT20 1.50	1.95
				B006 1.50							
D007 2.00											
from 2.20m to 2.30m driller notes boulder		2.30	-7.75							SPT(C)50/5mm 2.20	2.21
Very stiff brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite and gneiss. Cobbles are subangular to subrounded of granite and gneiss. from 2.30m to 2.40m strong pink and grey boulder of granite. (Recovered as angular cobble sized fragments) from 3.21m to 3.30m subangular cobble of schist				2.30 3.60	107	77	NA	NA		SPT(C)50/0m 2.31	2.30
Assumed zone of no recovery. Stiff to very stiff brown gravelly sandy CLAY with granite boulders. (Driller's description)										SPT(C)50/15mm 3.60	3.67
Very stiff extremely high strength brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. Cobbles are angular to subrounded of granite, schist and gneiss. from 4.10m to 4.30m recovered as angular to subrounded fine to coarse gravel of mixed igneous and metamorphic lithologies				3.60 5.10	107	67	NA	NA		SPT(C)50/245mm 5.10	5.50
from 6.20m to 6.30m subrounded cobble of granite				5.10 6.60	107	100	NA	NA		NA	
from 6.75m to 6.85m subangular cobble of gneiss				6.60 8.10	107	93	NA	NA		SPT(C)45/210mm 6.60	6.96
from 8.00m to 8.10m assumed zone no recovery				8.10 9.60	107	90	NA	NA		SPT(C)50/85mm 8.10	8.34
from 9.45m to 9.60m assumed zone of no recovery										SPT(C)50/160mm 9.60	9.91


NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Unchecked	Log Print Date And Time: 23/12/2013 10:26:00	
Form No. SIEXPHOLELOG	Issue/Revision No. 1.05 Issue Date 22/10/2012	

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A34
Engineer	Arch Henderson LLP		
Employer	Aberdeen Harbour Board		Sheet 2 of 2

Ground Level	-5.45m CD	Coordinates	396995.60 E, 804880.50 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Very stiff extremely high strength brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. Cobbles are angular to subrounded of granite, schist and gneiss.		10.35	-15.80	9.60	11.10	107	93	40	16		
Medium strong locally weak pink and grey coarse crystalline GRANITE. Discontinuities: 1) 10-20 degrees closely and very closely spaced planar to undulating rough with localised irregular orange staining on surfaces. 2) 70-80 degrees medium spaced planar rough stained orange on surfaces. from 10.80m to 10.95m recovered as non intact core (angular coarse gravel sized fragments) from 11.00m to 11.10m assumed zone of no recovery from 11.35m to 11.50m, 11.70m to 11.85m, 12.00m to 12.10m, 12.20m to 12.25m, 13.10m to 13.20m and 14.10m to 14.30m recovered as non intact core (angular coarse gravel sized fragments)				11.10	12.60	93	90	70	0		
				12.60	14.10	93	100	93	16	NI 45 160	
				14.10	15.30	93	58	42	0		
Assumed zone of no recovery. Medium strong GRANITE. (Driller's description)		14.80	-20.25							NA	
Exploratory hole complete at 15.30 m.		15.30	-20.75								

NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Unchecked	Log Print Date And Time: 23/12/2013 10:26:04	
Form No. SIEXPHOLELOG	Issue/Revision No. 1.05 Issue Date 22/10/2012	

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. A36				
Project No. TA7148																	
Engineer Arch Henderson LLP																	
Employer Aberdeen Harbour Board													Header				
Ground Level -5.22m CD					Coordinates 396992.50 E, 804954.90 N National Grid												
Date Started 20/08/2013					Date Completed 22/08/2013					Inclination Vertical							
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks						
0.00	0.40	CP	20/08/2013	20/08/2013	DS	TW			Dando 3000								
0.40	1.00	RC	20/08/2013	20/08/2013	MM	TW	T6116	Impreg	Deltabase 520								
1.00	2.10	RO	20/08/2013	20/08/2013	MM	MM	5 3/4 DHM		Deltabase 520								
2.10	4.70	RC	20/08/2013	22/08/2013	MM	TW	SF	Impreg	Deltabase 520								
4.70	9.70	RC	22/08/2013	22/08/2013	MM	TW	T6116	Impreg	Deltabase 520								
PROGRESS										WATER STRIKES							
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow	
20/08/2013	1530	0.40	0.40	-8.70	End of CP/Start of Rotary												
20/08/2013	1845	3.00	3.00	-8.12	End of Shift												
21/08/2013	0700	3.00	3.00	-8.90	Start of Shift												
21/08/2013	1930	3.50	3.50	-6.70	End of Shift												
22/08/2013	0700	3.50	3.50	-5.10	Start of Shift												
22/08/2013	1930	9.70	4.50	-7.60	End of Hole												
CABLE PERCUSSION DETAILS										SPT DETAILS							
Hard Strata Depth from to		Chiselling Start time hhmm Duration hhmm		Remarks					Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth	
0.00 0.40		1300 0200		Chiselling					3.00	SPT	50/5mm (22,3/0,50/5)		AR362	75	3.00	-8.12	
									3.50	SPT(C)	50/90mm (21,4/0,27,23/15)		AR362	75	3.00	-7.40	
ROTARY FLUSH DETAILS																	
From depth	To depth	Flush type		Flush return %	Flush colour												
0.00	1.00	Water		0													
1.00	2.10	Air/Mist		100	Green												
2.10	3.00	Water		30	Green												
3.00	4.70	Water		0	Green												
4.70	5.70	Water		100	Green												
5.70	6.70	Water		90	Green												
6.70	9.70	Water		0													
HOLE DIAMETER / CASING				DYNAMIC SAMPLING													
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %									
200	0.40	200	0.40														
150	3.00	150	3.00														
145	4.70																
116	9.70																
INSTALLATION DETAILS					PIPE CONSTRUCTION												
Distance from G.L.	ID	Type	Response zone Top Base		ID	Pipe Top Base		Dia. of pipe	Type of pipe								
BACKFILL DETAILS										GENERAL NOTES							
Top of section	Base of section	Material			Remarks												
0.00	4.70	Arisings															
4.70	9.70	Grout															
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group							
Log Print Date And Time: 23/12/2013 10:26:17																	
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012											

Ground Level -5.22m CD	Coordinates 396992.50 E, 804954.90 N National Grid	
Hole Type CP+RC	Inclination Vertical	


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
No recovery. Obstruction. (Driller's description)												
Very strong pink and grey BOULDER of granite.		0.40	-5.62									
Brown and grey slightly clayey subangular to subrounded fine to medium GRAVEL of schist and granite.		0.53 0.56	-5.75 -5.78	0.40	1.00	92	26	NA	NA			
Assumed zone of no recovery. Granite and quartz BOULDERS with sand lenses and cobbles. (Driller's description)		1.00	-6.22									
Rotary openhole drilling. Granite and quartz BOULDERS with sand lenses and cobbles. (Driller's description)												
Grey subangular to well rounded fine to coarse GRAVEL of granite, schist and quartz with low cobble content. Cobbles are subrounded of granite.		2.10	-7.32									
Assumed zone of no recovery. Granite and quartz BOULDERS with some lenses and cobbles. (Driller's description)		2.29	-7.51	2.10	2.50	107	48	NA	NA			
Zone of no recovery. Granite and quartz BOULDERS with sand lenses and cobbles. (Driller's description)		2.50	-7.72	2.50	3.00	107	0	NA	NA	NA		
Grey angular to subrounded fine to coarse GRAVEL of granite, schist and quartz.		3.00	-8.72	3.00	3.50	107	0	NA	NA	SPT50/5mm 3.00	3.08	
Assumed zone of no recovery. Granite and quartz COBBLES and BOULDERS. (Driller's description)		3.50	-8.92	3.50	4.00	107	40	NA	NA	SPT(C)50/90mm 3.50	3.67	
from 4.37m to 5.60m recovered as non intact core (angular fine to coarse gravel sized fragments)		4.00	-9.87	4.00	4.70	107	7	7	0			
Medium strong to strong grey GNEISS with closely to medium spaced intrusions of pink and grey granite. Discontinuities: 1) 10-20 degrees closely very closely spaced undulating rough clean. 2) 50-70 degrees medium spaced planar rough stained brown. 3) 80-90 degrees widely spaced planar rough stained brown.		4.65	-9.87	4.70	5.70	92	90	67	40			
from 4.86m to 4.97m 1 No discontinuity 50 degrees undulating rough clean												
from 5.00m to 5.10m 2 No incipient fractures 60-70 degrees very closely spaced planar												
from 5.60m to 5.70m assumed zone of no recovery												
from 5.70m to 5.73m recovered as non intact core (angular fine gravel sized fragments)												
from 5.87m to 6.08m 1 No incipient fracture 60-70 degrees planar												
at 6.20m 1 No discontinuity 0-10 degrees undulating smooth clean												
at 6.32m 1 No discontinuity 0-10 deg undulating rough clean												
from 6.50m to 6.80m recovered as non intact core (angular fine to medium gravel sized fragments)												
from 6.94m to 9.97m and 7.04m to 7.13m 1 No incipient fracture 90 degrees planar												
from 7.20m to 7.43m recovered as non intact core (angular fine to coarse gravel sized fragments)												
from 7.43m to 7.70m assumed zone of no recovery												
from 7.70m to 7.85m recovered as non intact core (angular fine to medium gravel sized fragments)												
from 7.97m to 8.00m 2 No discontinuities 0-10 degrees very closely spaced planar rough clean												
from 8.15m to 8.20m 1 No incipient fracture 60-70 degrees planar												
from 8.17m to 8.23m discontinuities: 2) very closely spaced												
from 8.60m to 8.70m assumed zone of no recovery												
from 9.15m to 9.23m recovered as non intact core (angular fine to coarse gravel sized fragments)												
		9.70	-14.92									

NOTES: All depths in metres, all diameters in millimetres.
 See header sheet for details of boring, progress and water.
 For details of abbreviations, see key

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	<h2 style="margin:0;">Exploratory Hole Log</h2>	Hole ID. <h1 style="margin:0;">A36</h1>
Sheet 1+ of 1		

Ground Level -5.22m CD	Coordinates 396992.50 E, 804954.90 N National Grid
Hole Type CP+RC	Inclination Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Remaining Detail : 9.34m - 9.43m : from 9.34m to 9.43m many incipient fractures 60-90 degrees extremely closely spaced planar;;; 9.64m - 9.70m : from 9.64m to 9.70m 1 No incipient fracture 60-70 degrees planar <hr style="border-top: 1px dashed black;"/> Exploratory hole complete at 9.70 m.											

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. A39					
Project No. TA7148													Header					
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -2.69m CD					Coordinates 397003.80 E, 805024.80 N National Grid													
Date Started 13/09/2013					Date Completed 14/09/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00	0.80	CP	13/09/2013	13/09/2013	IC	DT			Dando 3000									
0.80	3.65	RC	13/09/2013	13/09/2013	GS/MM	DT			Deltabase 520									
3.65	12.60	RC	13/09/2013	14/09/2013	MM	DT	SWF T6116	Impreg Impreg	Deltabase 520									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow		
13/09/2013	1430	0.80	0.70	-4.30	End of CP/Start of Rotary													
13/09/2013	1900	3.35	1.50	-3.60	End of Shift/Start of Shift													
14/09/2013	0800	12.60	2.50	-6.00	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
0.20		0.80		1230		0200		Chiselling			0.50	SPT(C)	50/0mm (25/0,50/0)		AR362	75	N/A	-4.10
											0.80	SPT(C)	50/0mm (25/0,50/0)		AR362	75	N/A	-4.30
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
0.80		1.50		Water		20		Brown										
1.50		3.35		Water		100		Brown										
3.35		3.65		Water		0												
3.65		12.60		Water		100		Pink										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmss	Recovery %										
150	2.50	150	2.50															
145	3.65																	
116	12.60																	
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top Base		ID	Pipe Top Base		Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section		Base of section		Material			Remarks											
0.00		3.65		Arisings														
3.65		12.60		Grout														
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
Log Print Date And Time: 23/12/2013 10:26:31																		
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012												

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A39
Engineer	Arch Henderson LLP		Sheet 1 of 2
Employer	Aberdeen Harbour Board		


Ground Level	-2.69m CD	Coordinates	397003.80 E, 805024.80 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
No recovery. BOULDERS and SAND. (Driller's description)		0.80	-3.49							SPT(C)50/0mm 0.50 0.50	
Rotary openhole drilling. BOULDERS of granite and schist. (Driller's description)		1.50	-4.19	1.50	2.45	107	100	63	34	NI 60 170	
Medium strong pink and grey coarse crystalline GRANITE. Discontinuities: 1) 30-40 degrees closely spaced undulating rough stained yellow on surfaces. 2) 70-80 degrees closely spaced planar rough stained yellow and brown on surfaces. from 1.80m to 2.10m 1 No medium band of very weak dark grey coarse crystalline granite. Recovered as non intact core (angular fine to coarse gravel sized fragments)		2.83	-5.52	2.45	3.35	107	100	42	0	NI	
Weak locally very weak dark grey coarse crystalline GRANITE. Recovered as non intact core (angular fine to coarse gravel and angular cobble sized fragments).		3.35	-6.04	3.35	3.65	107	100	66	0	NI 40 60	
Strong pink and grey coarse crystalline GRANITE. Discontinuities: 1) 30-40 degrees closely spaced planar rough stained yellow on surfaces. from 3.35m to 3.55m recovered as non intact core (angular coarse gravel and cobble sized fragments)		4.00	-6.69	3.65	5.15	89	100	23	7	NI	
Medium strong and weak locally very weak pink and grey coarse crystalline GRANITE. Recovered as non intact core (angular fine to coarse gravel sized fragments).		5.30	-7.99							40 80 180	
Strong pink and grey coarse crystalline GRANITE. Discontinuities: 1) 30-40 degrees closely spaced planar rough stained yellow on surfaces. from 5.50m to 5.65m recovered as non intact core (angular coarse gravel sized fragments)		5.65	-8.34	5.15	6.50	89	74	15	15	NI 30 160	
Weak grey very thinly and thinly bedded GNEISS. Discontinuities: 1) 20-30 degrees closely spaced undulose rough clean. from 5.65m to 5.95m recovered as non intact core (angular coarse gravel sized fragments) from 6.15m to 6.50m assumed zone of no recovery from 6.50m to 6.53m, 6.80m to 6.90m and 7.00m to 7.27m recovered as non intact core (angular coarse gravel sized fragments) from 7.27m to 7.60m assumed zone of no recovery		7.60	-10.29	6.50	7.60	89	73	36	18	NI 30 160	
Weak to medium strong pink, grey and dark grey coarse crystalline GRANITE GNEISS. Discontinuities: 1) 20-30 degrees closely to medium spaced planar to undulating rough clean. 2) 70-80 degrees medium spaced undulose rough clean.				7.60	9.10	89	100	100	77		
				9.10	10.60	89	100	95	69		

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A39
Engineer	Arch Henderson LLP		Sheet 2 of 2
Employer	Aberdeen Harbour Board		

Ground Level	-2.69m CD	Coordinates	397003.80 E, 805024.80 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Remaining Detail : 9.67m - 9.76m : from 9.67m to 9.76m and 12.00m to 12.20m recovered as non intact core (angular coarse gravel sized fragments)	+++++	12.60	-15.29							NI 790	[Pattern]
				10.60	11.60	89	100	100	90		
				11.60	12.60	89	100	80	80		
Exploratory hole complete at 12.60 m.											

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. A42				
Project No. TA7148													Header				
Engineer Arch Henderson LLP																	
Employer Aberdeen Harbour Board																	
Ground Level -3.29m CD					Coordinates 397091.30 E, 805037.20 N National Grid												
Date Started 12/09/2013					Date Completed 13/09/2013					Inclination Vertical							
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks						
0.00	0.50	CP	12/09/2013	12/09/2013	TT	DT			Dando 3000								
0.50	2.60	RO	12/09/2013	12/09/2013	TT	DT	5 3/4 RR		Deltabase 520								
2.60	5.00	RC	12/09/2013	12/09/2013	TT	DT	SWF		Deltabase 520								
5.00	12.50	RC	12/09/2013	13/09/2013	MM	DT	T6116	Impreg Impreg	Deltabase 520								
PROGRESS										WATER STRIKES							
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow	
12/09/2013	1300	0.50	0.50	-3.75	End of CP/Start of Rotary												
12/09/2013	1530	5.00	2.50	-3.75	End of Shift												
12/09/2013	1900	5.00	2.50	-5.10	Start of Shift												
13/09/2013	0700	12.50	2.50	-5.30	End of Hole												
CABLE PERCUSSION DETAILS										SPT DETAILS							
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks		Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
0.30		0.50		1100		0200		Chiselling		0.50	SPT	50/0mm (25/0,50/0)		AR362	75	N/A	-3.75
2.00										2.00	SPT	50/10mm (25/0,50/10)		AR362	75	2.00	-3.75
ROTARY FLUSH DETAILS																	
From depth		To depth		Flush type		Flush return %		Flush colour									
0.50		5.00		Water		100		Brown									
5.00		12.50		Water		100		Pink									
HOLE DIAMETER / CASING				DYNAMIC SAMPLING													
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %									
150	2.50	150	2.50														
145	4.50																
116	12.50																
INSTALLATION DETAILS					PIPE CONSTRUCTION												
Distance from G.L.	ID	Type	Response zone Top Base		ID	Pipe Top Base		Dia. of pipe	Type of pipe								
										* Seating blows only.							
BACKFILL DETAILS										GENERAL NOTES							
Top of section	Base of section	Material			Remarks												
0.00	2.50	Arisings															
2.50	12.50	Grout															
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group							
Log Print Date And Time: 23/12/2013 10:26:46																	
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012											

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A42
Engineer	Arch Henderson LLP		Sheet 1 of 2
Employer	Aberdeen Harbour Board		

Ground Level	-3.29m CD	Coordinates	397091.30 E, 805037.20 N National Grid
Hole Type	CP+RC	Inclination	Vertical


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
No recovery. BOULDERS of granite. (Driller's description)											
Rotary openhole drilling. Large BOULDERS of granite. (Driller's description)		0.50	-3.79							SPT50/0mm 0.50 0.50	
Rotary openhole drilling. Boulder CLAY. (Driller's description)		2.20	-5.49							SPT50/10mm 2.00 2.01	
Medium strong pink and grey coarse crystalline GRANITE. Discontinuities: 1) 10-20 degrees closely spaced planar rough clean and locally stained yellow on surfaces. from 2.50m to 2.70m weak and recovered as non intact core (angular coarse gravel and cobble sized fragments)		2.50	-5.79	2.50	3.50	107	100	27	26	NI NI 270	
Medium strong locally weak pink and grey coarse crystalline GRANITE. Recovered as non intact core (angular coarse gravel and cobble sized fragments).		2.97	-6.26							NI	
Strong pink and grey coarse crystalline GRANITE. Discontinuities: 1) 10-20 degrees closely locally very closely spaced planar and undulose rough clean and locally stained yellow on surfaces. 2) 70-80 degrees closely spaced planar rough stained yellow and dark brown on surfaces. from 4.40m to 4.50m recovered as non intact core (angular coarse gravel sized fragments)		3.85	-7.14	3.50	5.00	107	67	37	25	NI 150 200	
Assumed zone of no recovery. Highly weathered GRANITE. (Driller's description)		4.50	-7.79							NA	
Weak dark grey and pink coarse crystalline GRANITE. Discontinuities: 1) 10-20 degrees closely and very closely spaced undulating rough stained yellow on surfaces. 2) 40-50 degrees closely spaced planar rough stained yellow and dark brown on surfaces. from 5.00m to 5.30m recovered as non intact core (angular coarse gravel sized fragments) from 5.65m to 6.00m discontinuities 1) and 2) locally clay and sand infilled (<5mm) from 6.00m to 6.25m assumed zone of no recovery		5.00	-8.29	5.00	6.20	89	83	58	11	NI 60 130	
Medium strong locally weak dark grey coarse crystalline GRANITE. Discontinuities: 1) 10-20 degrees closely and very closely spaced planar and undulating rough stained yellow on surfaces. 2) 40-50 degrees closely spaced planar rough stained yellow on surfaces. from 6.36m to 6.49m, 6.64m to 6.80m, 6.90m to 7.00m, 7.20m to 7.50m and 7.65m to 7.90m recovered as non intact core (angular fine to coarse gravel sized fragments) from 7.90m to 8.00m assumed zone of no recovery		6.20	-9.49	6.20	7.00	89	100	51	0	NI 40 60	
Medium strong grey and pink coarse crystalline GRANITE. Recovered as non intact core (angular fine to coarse gravel sized fragments).		7.00	-11.29	7.00	8.00	89	90	35	0	NI	
Strong grey and pink coarse crystalline GRANITE. Discontinuities: 1) 10-20 degrees closely locally very closely spaced planar rough clean. 2) 70-80 degrees closely spaced planar rough stained yellow and brown on surfaces. from 8.68m to 8.89m, 9.06m to 9.26m, 9.50m to 9.60m and 10.46m to 10.60m recovered as non intact core (angular coarse gravel sized fragments)		8.00	-11.89	8.00	9.50	89	97	35	0	NI 680 170	

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A42
Engineer	Arch Henderson LLP		
Employer	Aberdeen Harbour Board		Sheet 2 of 2

Ground Level	-3.29m CD	Coordinates	397091.30 E, 805037.20 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Strong grey and pink coarse crystalline GRANITE. Discontinuities: 1) 10-20 degrees closely locally very closely spaced planar rough clean. 2) 70-80 degrees closely spaced planar rough stained yellow and brown on surfaces.	+	10.60	-13.89	9.50	11.00	89	93	57	20		
Medium strong locally weak dark grey coarse crystalline GRANITE. Recovered as non intact core (slightly sandy angular fine to coarse gravel sized fragments).	+									NI	
Assumed zone of no recovery. Highly fractures weathered GRANITE. (Driller's description)	+	12.00	-15.29	11.00	12.50	89	67	0	0		NA
Exploratory hole complete at 12.50 m.	+	12.50	-15.79								

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. A47 Header					
Project No. TA7148					Coordinates 397218.30 E, 805028.50 N National Grid													
Engineer Arch Henderson LLP					Date Started 03/09/2013					Date Completed 04/09/2013								
Employer Aberdeen Harbour Board					Inclination Vertical													
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00	0.10	CP	03/09/2013	03/09/2013	TT	DT			Dando 3000									
0.10	3.10	RC	03/09/2013	03/09/2013	MM	DT			Deltabase 520									
3.10	10.10	RC	03/09/2013	04/09/2013	MM	DT	SWF T6116	Impreg Inpreg	Deltabase 520									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow		
03/09/2013	1830	0.10	0.10	-8.20	End of CP													
04/09/2013	0200	0.10	0.10	-8.60	Start of Rotary													
04/09/2013	0700	7.20	0.10	-6.00	End of Shift													
05/09/2013	0100	7.20	0.10	-9.20	Start of Shift													
05/09/2013	0515	10.10	0.10	-8.70	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
0.00		0.10		0400		0200		Chiselling			0.00	SPT	50/10mm (25/0,50/10)		AR362	75	N/A	-8.20
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
0.10		10.10		Water		0												
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %										
150	0.10	150	0.10															
145	3.10																	
116	10.10																	
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Response zone Base	ID	Pipe Top	Pipe Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00	10.10	Grout																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
Log Print Date And Time: 23/12/2013 10:27:04																		
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012												

Ground Level -5.56m CD	Coordinates 397218.30 E, 805028.50 N National Grid
Hole Type CP+RC	Inclination Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
No recovery. Possible GRANITE. (Driller's description)	+++++	0.10	-5.66									
Strong pink and grey coarse crystalline GRANITE. Discontinuities: 1) 10-20 degrees closely spaced planar rough clean. from 0.10m to 0.22m recovered as non intact core (angular cobble sized fragments)	+++++	0.30	-5.86	0.10	160	107	100	85	60	NI	SPT50/10mm 0.00	
Strong dark grey GNEISS with closely spaced very thin bands of light grey granitic inclusions. Discontinuities: 1) 20-30 degrees closely and medium spaced planar and undulating rough clean. 2) 80-90 degrees widely spaced planar rough clean. from 1.00m to 1.10m recovered as non intact core (angular coarse gravel sized fragments) from 2.10m to 2.15m recovered as non intact core (angular coarse gravel sized fragments)	+++++			1.60	310	107	100	97	85	NI 280 400		
Strong light grey and pink coarse crystalline GRANITE. Discontinuities: 1) 20-30 degrees closely and medium spaced planar and undulose rough. 2) 80-90 degrees medium spaced. from 4.00m to 4.20m recovered as non intact core (angular coarse gravel and cobble sized fragments) from 4.50m to 4.68m recovered as non intact core (angular coarse gravel sized fragments)	+++++	3.28	-8.84	3.10	470	89	100	76	43	NI 180 500		
Strong grey GNEISS with closely spaced very thin bands of light grey granitic inclusions. Discontinuities: 1) 20-30 degrees medium spaced undulose rough clean.	+++++	4.70	-10.26	4.70	620	89	100	100	71	100 250 540		
Medium strong to strong light grey coarse crystalline GRANITE. Discontinuities: 1) 30-40 degrees closely to medium spaced planar rough clean. 2) 70-80 degrees medium spaced planar rough clean. from 6.00m to 6.30m weak from 7.20m to 7.44m recovered as non intact core (angular coarse gravel sized fragments) from 8.60m to 8.74m recovered as non intact core (angular coarse gravel sized fragments)	+++++	6.00	-11.56	6.20	720	89	100	100	80	NI 200 520		
	+++++			7.20	860	89	100	83	76			
	+++++			8.60	960	89	100	86	50			
	+++++			9.60	1010	89	80	100	68			

NOTES: All depths in metres, all diameters in millimetres.
 See header sheet for details of boring, progress and water.
 For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A47
Engineer	Arch Henderson LLP		
Employer	Aberdeen Harbour Board		Sheet 2 of 2

Ground Level	-5.56m CD	Coordinates	397218.30 E, 805028.50 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Medium strong to strong light grey coarse crystalline GRANITE. Discontinuities: 1) 30-40 degrees closely to medium spaced planar rough clean. 2) 70-80 degrees medium spaced planar rough clean. ----- Exploratory hole complete at 10.10 m.	+ + + +	10.10	-15.66								

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Project Name Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No. TA7148		A51
Engineer Arch Henderson LLP		Header
Employer Aberdeen Harbour Board		

Ground Level -6.95m CD	Coordinates 397214.99 E, 804952.60 N National Grid
Date Started 12/08/2013	Date Completed 13/08/2013
Inclination Vertical	

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00	2.10	CP	12/08/2013	12/08/2013	DS	DT			Dando 3000		
2.10	7.80	RC	12/08/2013	13/08/2013	MM	DT	SF	Impreg	Deltabase 520		
7.80	10.20	RC	13/08/2013	13/08/2013	MM	DT	T6116	Impreg	Deltabase 520		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow
12/08/2013	1330	2.10	2.10	-8.50	End of CP/Start of Rotary							
12/08/2013	1900	5.40	5.40	-10.40	End of Shift							
13/08/2013	0700	5.40	5.40	-9.90	Start of Shift							
13/08/2013	1200	10.20	5.40	-7.60	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
1.80	2.10	1100	0200	Chiselling	0.50	SPT	N=13 (2,2,3,3,3,4)	AR362	75	N/A	-8.10
					1.50	SPT	N=34 (2,3,3,4,10,17)	AR362	75	1.50	-8.30

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
2.10	5.20	Water	0	Clear
5.20	5.40	Water	50	
5.40	10.20	Water	0	

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %
200	2.10	200	2.10					
150	5.40	150	5.40					
145	6.30							
116	10.20							

INSTALLATION DETAILS				PIPE CONSTRUCTION					
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe

BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	5.20	Arisings					
5.20	10.20	Grout					

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A51
Engineer	Arch Henderson LLP		Sheet 1 of 2
Employer	Aberdeen Harbour Board		

Ground Level	-6.95m CD	Coordinates	397214.99 E, 804952.60 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Medium dense dark grey slightly silty slightly gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. from 1.80m to 2.10m driller notes large boulders				D001 0.00							
				D002 0.50-0.95						SPT13 0.50	0.95
				B003 0.50-1.00							
				ES004 1.00							
				D005 1.20							
				D006 1.50-1.95						SPT34 1.50	1.95
				B007 1.50-2.00							
				ES008 1.80							
Strong dark grey and pink COBBLES and BOULDERS of granite and gneiss.		2.10	-9.05								
Assumed zone of no recovery. Large BOULDERS. (Driller's description)		2.25	-9.20	2.10	3.20	107	14	NA	NA		
Strong pink speckled grey BOULDER of granite.		3.20	-10.15								
Assumed zone of no recovery. Large BOULDERS. (Driller's description)		3.35	-10.30	3.20	3.50	107	50	NA	NA		
Strong light and dark grey COBBLES and BOULDERS of granite.		3.50	-10.45								
Assumed zone of no recovery. Large BOULDERS. (Driller's description)		3.70	-10.65	3.50	4.20	107	28	NA	NA		
No recovery. Large BOULDERS. (Driller's description)		4.20	-11.15	4.20	5.20	107	0	NA	NA		
Strong to very strong grey and pink coarse crystalline GRANITE. Discontinuities: 1) 20-30 degrees closely spaced planar rough clean. 2) 50-60 degrees medium spaced planar rough clean locally stained yellow on surface. from 5.60m to 6.25m 1 No discontinuity 80-90 degrees undulating rough with yellow staining on surface		5.20	-12.15	5.20	5.40	107	100	100	100		
from 6.47m to 6.55m, 6.70m to 6.75m, 7.03m to 7.13m and 7.40m to 7.47m recovered as non intact core (angular coarse gravel sized fragments)				5.40	6.30	107	100	100	74	NI 75 360	
from 8.15m to 8.50m stained yellow. Recovered as non intact core (angular coarse gravel sized fragments)				6.30	7.80	92	100	80	53		
from 8.69m to 8.80m stained yellow. Recovered as non intact core (angular coarse gravel sized fragments)				7.80	9.10	92	83	46	19		
from 8.90m to 9.10m assumed zone of no recovery.											
from 9.10m to 9.20m recovered as non intact core (angular coarse gravel sized fragments) with yellow staining				9.10	10.20	92	100	91	59		
from 9.20m to 9.45m 2 No discontinuities 80-90 degrees planar rough with yellow staining on surface											

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A51
Engineer	Arch Henderson LLP		
Employer	Aberdeen Harbour Board		Sheet 2 of 2

Ground Level	-6.95m CD	Coordinates	397214.99 E, 804952.60 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Remaining Detail : 9.20m - 10.20m : from 9.20m to 10.20m Discontinuities: 1) and 2) stained yellow on fracture surfaces Detail 9.45m - 10.20m : from 9.45m to 10.20m 1 No discontinuity 80-90 degrees planar rough stained yellow on surface Exploratory hole complete at 10.20 m.	+++++	10.20	-17.15								

NOTES: All depths in metres, all diameters in millimetres.
 See header sheet for details of boring, progress and water.
 For details of abbreviations, see key

Project Name Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No. TA7148		A54
Engineer Arch Henderson LLP		Header
Employer Aberdeen Harbour Board		

Ground Level -6.64m CD	Coordinates 397212.14 E, 804882.50 N National Grid
Date Started 14/08/2013	Date Completed 16/08/2013
Inclination Vertical	

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00	4.50	CP	14/08/2013	14/08/2013	DS	TW			Dando 3000		
4.50	8.50	RC	14/08/2013	16/08/2013	MM	TW	SWF	Impreg	Deltabase 520		
8.50	16.50	RC	16/08/2013	16/08/2013	MM	TW	T6116	Impreg	Deltabase 520		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow
14/08/2013	1330	4.50	4.50	-7.60	End of CP/Start of Rotary							
14/08/2013	1900	7.00	5.85	-9.00	End of Shift							
16/08/2013	0700	7.00	5.85	-9.80	Start of Shift							
16/08/2013	2100	16.50	5.85	-10.00	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
4.30	4.50	1130	0200	Chiselling	0.50	SPT	N=11 (1,2,2,3,3,3)	AR362	75	N/A	-9.30
					1.50	SPT	N=17 (2,3,4,4,4,5)	AR362	75	1.50	-9.10
					2.50	SPT	N=20 (3,3,4,5,5,6)	AR362	75	2.50	-8.60
					3.50	SPT	N=27 (3,4,6,6,7,8)	AR362	75	3.50	-8.10
					5.20	SPT	N=51 (6,9,10,12,13,16)	AR362	75	5.20	-8.50
					7.00	SPT	50/85mm (21,4/0,39,11/10)	AR362	75	5.85	-8.90
					8.50	SPT	50/220mm (9,14,15,17,18/70)	AR362	75	5.85	-9.60
					10.00	SPT	50/80mm (17,8/5,37,13/5)	AR362	75	8.40	-9.00

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
4.50	8.00	Water	100	Brown
8.00	9.00	Water	50	Brown
9.00	11.00	Water	90	Brown
11.00	13.50	Water	100	Clear
13.50	15.00	Water	80	Light brown
15.00	16.50	Water	100	Clear

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmss	Recovery %
150	5.85	150	8.40					
145	8.50							
116	16.50							

INSTALLATION DETAILS				PIPE CONSTRUCTION					
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe

BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	11.50	Arisings					
11.50	16.50	Grout					

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A54
Engineer	Arch Henderson LLP		Sheet 1 of 2
Employer	Aberdeen Harbour Board		

Ground Level	-6.64m CD	Coordinates	397212.14 E, 804882.50 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation			
				Details	Dia.	TCR	SCR	RQD	IF					
Medium dense grey slightly silty slightly gravelly fine to coarse SAND. Gravel is subangular to rounded fine of mixed igneous and metamorphic lithologies.				D001	0.00									
				D002	0.50-0.95					SPT11	0.50	0.95		
				B003	0.50-1.00									
				D004	1.20									
				D005	1.50-1.95						SPT17	1.50	1.95	
				B006	1.50-2.00									
				D007	2.20									
				D008	2.50-2.95						SPT20	2.50	2.95	
				B009	2.50-3.00									
				D010	3.20									
				D011	3.50-3.95						SPT27	3.50	3.95	
				B012	3.50-4.00									
		No recovery. OBSTRUCTION. (Driller's description)		4.30	-10.94	D013	4.20							
Grey subangular to subrounded fine to medium GRAVEL of granite and schist.		4.50	-11.14											
		4.65	-11.29											
Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of mixed igneous and metamorphic lithologies.		4.90	-11.54	4.50	5.20	107	57	NA	NA					
		5.20	-11.84							SPT51	5.20	5.65		
		5.35	-11.99											
Assumed zone of no recovery. Boulder CLAY. (Driller's description)		5.55	-12.19	5.20	6.00	107	44	NA	NA					
Multicoloured subangular to rounded fine to medium GRAVEL of mixed igneous and metamorphic lithologies.		6.00	-12.64											
Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of mixed igneous and metamorphic lithologies.				6.00	7.00	107	85	NA	NA					
Assumed zone of no recovery. Boulder CLAY. (Driller's description)														
Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of mixed igneous and metamorphic lithologies. from 6.85m to 7.00m assumed zone of no recovery		7.40	-14.04	7.00	8.00	107	40	NA	NA	SPT50/85mm	7.00	7.16		
Assumed zone of no recovery. Boulder CLAY. (Driller's description)														
Stiff brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies. from 8.50m to 8.55m angular medium gravel of granite				8.00	8.50	107	90	NA	NA	NA				
from 8.90m to 9.00m assumed zone of no recovery														
from 9.18m to 9.34m 1 No very strong pink and grey boulder of granite				8.50	9.00	92	80	NA	NA	SPT50/220mm	8.50	8.87		
				9.00	10.00	92	74	NA	NA					

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A54
Engineer	Arch Henderson LLP		
Employer	Aberdeen Harbour Board		Sheet 2 of 2

Ground Level	-6.64m CD	Coordinates	397212.14 E, 804882.50 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Remaining Detail : 9.74m - 10.00m : from 9.74m to 10.00m assumed zone of no recovery										SPT50/80mm 10.00	
Assumed zone of no recovery. Boulder CLAY. (Driller's description)		10.66	-17.30	10.00	11.00	92	66	NA	NA		
Stiff brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of granite and schist. Cobbles are subangular of schist.		11.00	-17.64								
		11.25	-17.89								
Brown and grey subangular to angular fine to medium GRAVEL of schist and granite. from 11.55m to 11.65m assumed zone of no recovery		11.65	-18.29	11.00	12.00	92	90	20	10		
Strong pink and grey coarse crystalline GRANITE. Discontinuities: 1) 10-30 degrees very closely to closely spaced planar rough locally stained orangish brown. 2) 60-80 degrees closely to medium spaced planar rough stained orangish brown. from 11.65m to 11.75m recovered as non intact core (angular coarse gravel sized fragments) at 11.84m 1 No discontinuity 0 degrees planar rough stained brown at 11.88m 1 No incipient fracture 0 degrees planar from 11.92m to 12.00m recovered as non intact core (angular coarse gravel sized fragments) at 12.64m 1 No discontinuity 0 degrees planar rough clean at 12.68m 1 No discontinuity 0 degrees planar rough clean from 12.82m to 13.00m recovered as non intact core (angular coarse gravel sized fragments) at 13.16m 1 No discontinuity 0 degrees planar rough clean from 13.30m to 13.90m recovered as non intact core (angular coarse gravel sized fragments) at 14.05m 1 No incipient fracture 0 degrees planar from 14.30m to 14.33m 1 No incipient fracture 30 degrees planar from 14.36m to 14.46m recovered as non intact core (angular cobble sized fragments) from 14.49m to 14.53m 1 No discontinuity 10-70 degrees curved rough clean from 14.68m to 14.85m recovered as non intact core (angular medium to coarse gravel sized fragments and angular cobble sized fragments) from 14.90m to 15.25m recovered as non intact core (angular medium to coarse gravel sized fragments) at 15.49m 1 No incipient fracture 0 degrees planar from 15.70m to 15.85m recovered as non intact core (angular cobble sized fragments)				12.00	13.50	92	100	83	30		
				13.50	15.00	92	100	65	23	NI 80 250	
				15.00	16.50	92	100	80	62		
Exploratory hole complete at 16.50 m.		16.50	-23.14								

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No. TA7148		A57
Engineer Arch Henderson LLP		Header
Employer Aberdeen Harbour Board		

Ground Level -6.28m CD	Coordinates 397208.04 E, 804809.81 N National Grid
Date Started 06/08/2013	Date Completed 11/08/2013
	Inclination Vertical

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00	8.20	CP	06/08/2013	07/08/2013	DS	TW			Dando 3000		
8.20	17.30	RC	07/08/2013	08/08/2013	MM	TW	Geobore	Impreg	Deltabase 515		
17.30	32.00	RC	08/08/2013	11/08/2013	MM	TW	T6116	Impreg	Deltabase 515		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	to seal flow
06/08/2013	2130	5.80	5.80	-5.90	End of Shift							
07/08/2013	0700	5.80	5.80	-6.80	Start of Shift							
07/08/2013	1300	8.40	8.40	-8.90	End of CP/Start of Rotary							
07/08/2013	1930	11.90	8.40	-7.30	End of Shift							
08/08/2013	0700	11.90	8.40	-6.90	Start of Shift							
08/08/2013	2000	20.00	13.40	-6.90	End of Shift							
10/08/2013	0700	20.00	13.40	-7.00	Start of Shift							
10/08/2013	2000	29.50	16.40	-7.10	End of Shift							
11/08/2013	0700	29.50	16.40	-7.90	Start of Shift							
11/08/2013	1900	32.00	16.40	-7.70	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
8.20	84.00	1000	0200	Chiselling	0.50	SPT	N=11 (2,3,2,3,3,3)	AR362	75	N/A	-9.80
					1.50	SPT	N=16 (3,3,3,4,4,5)	AR362	75	1.50	-9.50
					2.50	SPT	N=17 (2,2,4,4,4,5)	AR362	75	2.50	-9.00
					3.50	SPT	N=21 (3,4,4,5,6,6)	AR362	75	3.50	-8.10
					4.50	SPT	N=23 (3,4,4,6,6,7)	AR362	75	4.50	-6.80
					6.00	SPT	50/230mm (6,12,14,16,17,3/5)	AR362	75	6.00	-6.30
					7.00	SPT	50/215mm (9,15,16,19,15/65)	AR362	75	7.50	-6.80
					9.00	SPT(C)	50/295mm (8,10,11,13,13,13/70)	AR362	75	9.00	-11.30
					10.50	SPT(C)	50/225mm (7,12,13,16,18,3/0)	AR362	75	10.50	-11.00
					11.90	SPT(C)	50/215mm (7,13,14,20,16/65)	AR362	75	11.90	-6.80
					14.20	SPT(C)	50/135mm (1,14/50,27,23/60)	AR362	75	13.40	-8.30
					15.80	SPT(C)	50/170mm (8,10,13,19,18/20)	AR362	75	13.40	-10.20
					17.30	SPT(C)	50/200mm (6,8,15,21,14/50)	AR362	75	13.40	-9.90
					18.80	SPT(C)	50/100mm (1,7,8/10,34,16/25)	AR362	75	13.40	-9.90
					20.00	SPT(C)	50/5mm (25/0,50/5)	AR362	75	13.40	-8.70
					21.80	SPT(C)	50/75mm (17,8/5,43,7/0)	AR362	75	16.40	-8.00
					23.30	SPT(C)	50/75mm (25/70,46,4/0)	AR362	75	16.40	-8.90
					24.50	SPT(C)	50/80mm (14,11/30,38,12/5)	AR365	75	16.40	-9.80
					26.00	SPT(C)	50/55mm (25/65,50/55)	AR362	75	16.40	-10.10
					27.50	SPT(C)	50/160mm (7,10,13,17,20/10)	AR362	75	16.40	-10.10

ROTARY FLUSH DETAILS					SPT DETAILS						
From depth	To depth	Flush type	Flush return %	Flush colour	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
8.40	12.70	Water	0		0.50	SPT	N=11 (2,3,2,3,3,3)	AR362	75	N/A	-9.80
12.70	14.20	Water	50	Brown	1.50	SPT	N=16 (3,3,3,4,4,5)	AR362	75	1.50	-9.50
14.20	15.20	Water	0		2.50	SPT	N=17 (2,2,4,4,4,5)	AR362	75	2.50	-9.00
15.20	18.80	Water	50	Brown	3.50	SPT	N=21 (3,4,4,5,6,6)	AR362	75	3.50	-8.10
18.80	20.30	Water	0		4.50	SPT	N=23 (3,4,4,6,6,7)	AR362	75	4.50	-6.80
20.30	21.80	Water	50	Clear	6.00	SPT	50/230mm (6,12,14,16,17,3/5)	AR362	75	6.00	-6.30
21.80	23.20	Water	0		7.00	SPT	50/215mm (9,15,16,19,15/65)	AR362	75	7.50	-6.80
23.20	27.50	Water	50	Clear	9.00	SPT(C)	50/295mm (8,10,11,13,13,13/70)	AR362	75	9.00	-11.30
27.50	32.00	Water	0		10.50	SPT(C)	50/225mm (7,12,13,16,18,3/0)	AR362	75	10.50	-11.00
					11.90	SPT(C)	50/215mm (7,13,14,20,16/65)	AR362	75	11.90	-6.80
					14.20	SPT(C)	50/135mm (1,14/50,27,23/60)	AR362	75	13.40	-8.30
					15.80	SPT(C)	50/170mm (8,10,13,19,18/20)	AR362	75	13.40	-10.20
					17.30	SPT(C)	50/200mm (6,8,15,21,14/50)	AR362	75	13.40	-9.90
					18.80	SPT(C)	50/100mm (1,7,8/10,34,16/25)	AR362	75	13.40	-9.90
					20.00	SPT(C)	50/5mm (25/0,50/5)	AR362	75	13.40	-8.70
					21.80	SPT(C)	50/75mm (17,8/5,43,7/0)	AR362	75	16.40	-8.00
					23.30	SPT(C)	50/75mm (25/70,46,4/0)	AR362	75	16.40	-8.90
					24.50	SPT(C)	50/80mm (14,11/30,38,12/5)	AR365	75	16.40	-9.80
					26.00	SPT(C)	50/55mm (25/65,50/55)	AR362	75	16.40	-10.10
					27.50	SPT(C)	50/160mm (7,10,13,17,20/10)	AR362	75	16.40	-10.10

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %
200	8.40	200	8.40					
150	16.40	150	16.40					
145	17.30							
116	32.00							

INSTALLATION DETAILS				PIPE CONSTRUCTION				
Distance from G.L.	ID	Type	Response zone Top Base	ID	Pipe Top Base	Dia. of pipe	Type of pipe	

BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	27.00	Arisings					
27.00	32.00	Grout					

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A57
Engineer	Arch Henderson LLP		Sheet 1 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-6.28m CD	Coordinates	397208.04 E, 804809.81 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation			
				Details	Dia.	TCR	SCR	RQD	IF					
Medium dense grey slightly gravelly silty fine to coarse SAND. Gravel is angular to rounded fine of granite and schist.		0.00		D001	0.00									
				D002	0.50-0.95						SPT11	0.50	0.95	
				B003	0.50-1.00									
				D004	1.20									
				D005	1.50-1.95							SPT16	1.50	1.95
				B006	1.50-2.00									
				D007	2.20									
				D008	2.50-2.95							SPT17	2.50	2.95
				B009	2.50-3.00									
				D010	3.20									
				D011	3.50-3.95							SPT21	3.50	3.95
				B012	3.50-4.00									
				D013	4.20									
				D014	4.50-4.95							SPT23	4.50	4.95
B015	4.50-5.00													
Stiff brown slightly sandy gravelly CLAY with low cobble content. Cobbles are subangular to subrounded of granite and schist. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies.		5.60	-11.88	D016	5.60									
				D017	6.00						SPT50/230mm	6.00	6.38	
				B018	6.00-6.50									
				D019	7.00							SPT50/215mm	7.00	7.37
from 8.74m to 8.80m 1 No strong grey boulder of granite		8.87	-15.15		8.40	9.20	107	59	NA	NA				
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)		9.20	-15.48											
Stiff extremely high strength brown slightly sandy gravelly CLAY. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies.					9.20	10.50	107	83	NA	NA				

NOTES: All depths in metres, all diameters in millimetres.
 See header sheet for details of boring, progress and water.
 For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A57
Engineer	Arch Henderson LLP		Sheet 2 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-6.28m CD	Coordinates	397208.04 E, 804809.81 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Stiff extremely high strength brown slightly sandy gravelly CLAY. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies. from 10.28m to 10.50m assumed zone of no recovery		10.50	-18.45	10.50	11.90	107	93	NA	NA	SPT(C)50/225mm 10.50 10.88	
from 11.70m to 11.90m assumed zone of no recovery				11.90	12.70	107	34	NA	NA	SPT(C)50/215mm 11.90 12.27	
Assumed zone of no recovery. Boulder CLAY. (Driller's description)		12.17	-18.45	11.90	12.70	107	34	NA	NA		
Grey subangular to subrounded fine to coarse GRAVEL of granite and schist with low cobble content. Cobbles are subangular of granite. (Driller notes boulder clay).		12.70	-18.98	12.70	14.20	107	48	NA	NA		
Assumed zone of no recovery. Boulder CLAY. (Driller's description)											
Stiff brown slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies.		14.20	-20.48	14.20	15.20	107	100	NA	NA	SPT(C)50/135mm 14.20 14.46	
Assumed zone of no recovery. Boulder CLAY. (Driller's description)				15.35	-21.63	15.20	15.80	107	70	NA	
Stiff brown slightly sandy gravelly CLAY with medium cobble content. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies. Cobbles are subangular of schist.		15.80	-22.08	15.80	17.30	107	78	NA	NA	SPT(C)50/170mm 15.80 16.12	
Assumed zone of no recovery. Boulder CLAY. (Driller's description)											
Stiff very high strength brown sandy gravelly CLAY with low cobble content. Gravel is subangular to rounded fine to coarse of mixed igneous and metamorphic lithologies. Cobbles are subangular of granite and schist. from 17.80m to 17.97m 1 No strong red boulder of granite		17.30	-23.58	17.30	18.80	92	97	NA	NA	NA SPT(C)50/200mm 17.30 17.65	
Assumed zone of no recovery. Boulder CLAY. (Driller's description)										18.80	

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A57
Engineer	Arch Henderson LLP		Sheet 3 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-6.28m CD	Coordinates	397208.04 E, 804809.81 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Stiff brown slightly sandy gravelly CLAY with low cobble content. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies. Cobbles are subangular of granite. from 20.00m to 20.14m angular to subangular fine to coarse gravel of schist and granite from 20.30m to 20.45m angular to subrounded fine to medium gravel of schist and granite		20.00	-26.28	20.00	20.30	107	100	NA	NA	SPT(C)50/55mm 20.00	
Assumed zone of no recovery. Boulder CLAY. (Driller's description)		20.90	-27.18	20.30	21.80	107	42	NA	NA		
Stiff brown slightly sandy gravelly CLAY with low cobble content. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies. Cobbles are subangular of granite.		21.30	-27.58							SPT(C)50/75mm 21.80	
Assumed zone of no recovery. Boulder CLAY. (Driller's description)		22.30	-28.58	21.80	23.30	107	40	NA	NA		
Stiff brown slightly sandy gravelly CLAY. Gravel is subangular to rounded fine to coarse of mixed lithologies.		23.30	-29.58							SPT(C)50/75mm 23.30	
Assumed zone of no recovery. Boulder CLAY. (Driller's description)		24.00	-30.28	23.30	24.50	107	48	NA	NA		
Stiff brown slightly sandy gravelly CLAY with low cobble content. Gravel is subangular to rounded fine to coarse of mixed igneous and metamorphic lithologies. Cobbles are subangular to subrounded of granite and schist.		24.50	-30.78							SPT(C)50/80mm 24.50	
Assumed zone of no recovery. Boulder CLAY. (Driller's description)		26.16	-32.44							SPT(C)50/55mm 26.00	
Assumed zone of no recovery. Weathered GRANITE. (Driller's description)		27.00	-33.28	26.00	27.50	107	20	7	0	NA	
Extremely to very weak grey and reddish brown coarse crystalline GRANITE. Discontinuities: 1) 20-30 degrees closely spaced planar rough stained dark brown. from 27.50m to 27.55m recovered as non intact core (subrounded coarse gravel sized fragments) from 27.64m to 27.75m recovered as non intact core (subrounded coarse gravel sized fragments)		27.34	-33.62							NI 45 80	
Weak grey coarse crystalline GRANITE. Discontinuities: 1) 70-80 degrees very closely spaced planar rough stained brown.		27.87	-34.15	27.50	28.50	107	60	30	0	80 80	
Assumed zone of no recovery. GRANITE. (Driller's description)		28.10	-34.38							NA	
Strong grey coarse crystalline GRANITE. Discontinuities: 1) 70-90 degrees closely spaced planar rough stained brown. from 28.58m to 28.64m recovered as non intact core (angular medium gravel sized fragments) from 28.64m to 28.78m recovered as non intact core (angular		28.50	-34.78							NI 40 60	
Assumed zone of no recovery. GRANITE. (Driller's description)		29.00	-35.28	28.50	29.50	107	100	40	0	NI	

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A57
Engineer	Arch Henderson LLP		
Employer	Aberdeen Harbour Board		Sheet 4 of 4

Ground Level	-6.28m CD	Coordinates	397208.04 E, 804809.81 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
28.50m - 29.00m : Remaining Detail : 28.64m - 28.78m : medium gravel sized fragments)	+++++	30.10	-36.38	29.50	30.50	107	70	0	0		
29.00m - 30.10m : Strong grey coarse crystalline GRANITE. Recovered as non intact core (angular fine to coarse gravel sized fragments). Detail 29.57m - 29.76m : from 29.57m to 29.76m weak Detail 30.00m - 30.10m : from 30.00m to 30.10m weak from 30.00m to 30.10m weak	+++++	30.50	-36.78								
Assumed zone of no recovery. GRANITE. (Driller's description)	+++++	31.50	-37.78								
Medium strong to strong grey coarse crystalline GRANITE. Recovered as non intact core (sandy angular to subangular fine to coarse gravel sized fragments. Sand sized fragments are fine to coarse). from 30.02m to 30.10m intact with many incipient fractures 70-80 degrees very closely spaced stained brown from 30.23m to 30.40m intact. Discontinuities: 1) 10-20 degrees closely spaced planar rough clean. 2) 70-80 degrees closely spaced planar rough clean	+++++	32.00	-38.28								
Assumed zone of no recovery. GRANITE. (Driller's description)	+++++										
Exploratory hole complete at 32.00 m.											

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A59
Engineer	Arch Henderson LLP		Header
Employer	Aberdeen Harbour Board		

Ground Level	-6.64m CD	Coordinates	397172.37 E, 804766.26 N National Grid
Date Started	29/07/2013	Date Completed	05/08/2013
		Inclination	Vertical

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00	9.00	CP	29/07/2013	30/07/2013	KL	DT			Dando 3000		
9.00	30.00	RC	30/07/2013	05/08/2013	MM	DT	Geobore S	Impreg	Deltabase 520		
30.00	31.00	RC	05/08/2013	05/08/2013	MM	DT	T6116	Impreg	Deltabase 520		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow
29/07/2013	1900	6.00	6.00	-7.00	End of Shift							
30/07/2013	0700	6.00	6.00	-8.10	Start of Shift							
30/07/2013	1400	9.00	9.00	-5.10	End of CP/Start of Rotary							
30/07/2013	2000	9.80	9.30	-8.10	End of Shift							
31/07/2013	0700	9.80	9.30	-9.00	Start of Shift							
31/07/2013	1930	19.00	19.00	-14.80	End of Shift							
02/08/2013	0700	19.00	19.00	-14.80	Start of Shift							
02/08/2013	1320	25.50	25.50	-15.30	End of Shift							
05/08/2013	0700	25.50	25.50	-4.74	Start of Shift							
05/08/2013	1930	31.00	30.10	-4.94	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	Hard Strata Depth to	Chiselling Start time hhmm	Chiselling Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
4.10	4.20	1000	0200	Chiselling	0.50	SPT	N=11 (2,2,3,2,3,3)	AR362	75	N/A	-6.00
4.20	4.60	1345	0200	Chiselling	1.50	SPT	N=16 (2,3,4,3,4,5)	AR362	75	1.50	-7.20
7.10	7.30	0900	0045	Chiselling	2.50	SPT	N=15 (2,3,2,3,4,6)	AR362	75	2.50	-7.00
8.10	8.30	1015	0045	Chiselling	3.50	SPT	N=23 (3,4,5,5,6,7)	AR362	75	3.50	-6.90
9.00	9.00	1200	0200	Chiselling	4.50	SPT(C)	50/5mm (25/0,50/5)	AR362	75	4.50	-6.70
					5.50	SPT	50/220mm (7,9,13,12,25/70)	AR362	75	5.50	-7.50
					7.50	SPT	50/245mm (7,10,12,15,15,8/20)	AR362	75	7.50	-7.00
					9.00	SPT	50/10mm (25/5,50/10)	AR362	75	9.00	-5.10
					10.00	SPT	N=49 (6,8,10,11,13,15)	AR362	75	10.00	-14.80
					11.50	SPT	50/275mm (4,8,10,13,15,12/50)	AR362	75	11.50	-14.60
					13.00	SPT	50/260mm (5,4,10,14,15,11/35)	AR362	75	13.00	-14.80
					14.50	SPT	50/0mm (25/0,50/0)	AR362	75	14.50	-14.60
					16.00	SPT	50/220mm (6,10,12,18,20/70)	AR362	75	16.00	-14.30
					17.50	SPT	50/10mm (7,18/25,50/10)	AR362	75	17.50	-14.50
					19.00	SPT	50/25mm (25/25,50/25)	AR362	75	19.00	-14.80
					20.50	SPT	50/10mm (5,20/10,50/10)	AR362	75	20.50	-15.80
					21.00	SPT(C)	50/240mm (5,9,10,13,20,7/15)	AR362	75	21.00	-15.80
					22.50	SPT(C)	53/295mm (4,3,11,12,14,16/70)	AR362	75	22.50	-15.80
					24.00	SPT(C)	50/160mm (7,10,12,18,20/10)	AR362	75	24.00	-15.80
					25.50	SPT(C)	50/230mm (8,11,14,16,15,5/5)	AR362	75	25.50	-4.74
					27.00	SPT(C)	50/0mm (10,14,50/0)	AR362	75	27.00	-4.98
					28.50	SPT(C)	50/235mm (25,20,18,12/85)	AR362	75	28.50	-5.15

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
9.00	9.80	Water	100	Brown
9.80	30.00	Water	90	Brown
30.00	31.00	Water	0	-

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %
200	9.30	200	9.30					
146	30.00	146	30.00					
139	30.10	139	30.10					
116	31.00							

INSTALLATION DETAILS				PIPE CONSTRUCTION				
Distance from G.L.	ID	Type	Response zone Top / Base	ID	Pipe Top / Base	Dia. of pipe	Type of pipe	

BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	31.00	Arisings					

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A59
Engineer	Arch Henderson LLP		Sheet 1 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-6.64m CD	Coordinates	397172.37 E, 804766.26 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation		
				Details	Dia.	TCR	SCR	RQD	IF				
Medium dense grey slightly silty slightly gravelly fine to coarse SAND. Gravel is angular to subrounded fine to medium of granite and schist.		0.00		D001	0.00								
				D002	0.50-0.95					SPT11	0.50	0.95	
				B003	0.50-1.00								
				D004	1.00								
				D005	1.50-1.95						SPT16	1.50	1.95
				B006	1.50-2.00								
				D007	2.00								
				D008	2.50-2.95						SPT15	2.50	2.95
				B009	2.50-3.00								
				D010	3.00								
				D011	3.50-3.95						SPT23	3.50	3.95
				B012	3.50-4.00								
				No recovery. BOULDER. (Driller's description)		4.10	-10.74	D013	4.00				
Stiff brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of granite, dolerite, schist and quartzite. from 6.00m to 9.00m driller notes small sand lenses		4.60	-11.24	B014	4.50-5.00					SPT(C)50/5mm	4.50	4.51	
				D015	5.00								
				B016	5.50-6.00						SPT50/220mm	5.50	5.87
				D017	6.00								
				D018	7.00								
				B019	7.00-7.50								
				D020	7.50-7.90						SPT50/245mm	7.50	7.90
				B021	7.50-8.00								
				D022	8.00								
				Strong pink and grey BOULDER of granite.		9.00	-15.64	B023	9.00				
Stiff extremely high strength brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular fine to coarse of granite, dolerite and schist. Cobbles are angular to subrounded of granite and dolerite.		9.20	-15.84		9.00	9.80	102	100	NA	NA			
					9.80	10.00	102	100	NA	NA			

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A59
Engineer	Arch Henderson LLP		Sheet 2 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-6.64m CD	Coordinates	397172.37 E, 804766.26 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Stiff extremely high strength brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular fine to coarse of granite, dolerite and schist. Cobbles are angular to subrounded of granite and dolerite. from 10.00m to 10.10m strong boulder of granite										SPT49 10.00 10.45	
		10.00	11.50	102	100	NA	NA				
from 11.91m to 12.00m strong boulder of dolerite			11.50	13.00	102	100	NA	NA		SPT50/275mm 11.50 11.93	
			13.00	14.50	102	87	NA	NA		SPT50/260mm 13.00 13.41	
from 14.30m to 14.50m assumed zone of no recovery from 14.50m to 14.70m strong grey boulder of dolerite			14.50	16.00	102	93	NA	NA		SPT50/0mm 14.50 14.50	
from 15.90m to 16.00m assumed zone of no recovery			16.00	17.50	102	83	NA	NA		SPT50/220mm 16.00 16.37	
from 17.25m to 17.50m assumed zone of no recovery from 17.58m to 17.75m strong light grey granite boulder			17.50	19.00	102	100	NA	NA		SPT50/10mm 17.50 17.61	
Assumed zone of no recovery. Stiff boulder CLAY with cobbles and boulders. (Driller's description)			19.00	20.50	102	34	NA	NA		SPT50/25mm 19.00 19.05	
		19.50									
			-26.14								

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.	A59
Project No.	TA7148		Sheet 3 of 4	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	-6.64m CD	Coordinates	397172.37 E, 804766.26 N National Grid	
Hole Type	CP+RC	Inclination	Vertical	

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Assumed zone of no recovery. Stiff boulder CLAY with cobbles and boulders. (Driller's description)										NA	
Stiff extremely high strength brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, dolerite and schist. from 20.85m to 21.00m assumed zone of no recovery from 22.30m to 22.50m assumed zone of no recovery from 25.40m to 25.50m assumed zone of no recovery from 28.40m to 28.50m assumed zone of no recovery from 29.30m to 29.50m strong light grey granite boulder		20.50	-27.14	20.50	21.00	102	70	NA	NA	SPT50/10mm 20.50 20.60	
				21.00	22.50	102	87	NA	NA	SPT(C)50/240mm 21.00 21.39	
				22.50	24.00	102	100	NA	NA	SPT(C)53/295mm 22.50 22.95	
				24.00	25.50	102	80	NA	NA	SPT(C)50/160mm 24.00 24.31	
				25.50	27.00	102	100	NA	NA	SPT(C)50/230mm 25.50 25.88	
				27.00	28.50	102	93	NA	NA	SPT(C)50/0mm 27.00 27.15	
				28.50	30.00	102	66	NA	NA	SPT(C)50/235mm 28.50 28.74	
Assumed zone of no recovery. SAND and GRAVEL. (Driller's		29.50	-36.14								

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A59
Engineer	Arch Henderson LLP		
Employer	Aberdeen Harbour Board		Sheet 4 of 4

Ground Level	-6.64m CD	Coordinates	397172.37 E, 804766.26 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
(description)		30.00	-36.64								
Light grey angular to rounded medium to coarse GRAVEL of granite and quartz.		30.50	-37.14	30.00	31.00	102	50	0	0		
Assumed zone of no recovery. COBBLES and BOULDERS. (Driller's description)		31.00	-37.64								
Exploratory hole complete at 31.00 m.											

NOTES: All depths in metres, all diameters in millimetres.
 See header sheet for details of boring, progress and water.
 For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A63
Engineer	Arch Henderson LLP		Header
Employer	Aberdeen Harbour Board		

Ground Level	-6.57m CD	Coordinates	397211.49 E, 804673.51 N National Grid
Date Started	08/07/2013	Date Completed	11/07/2013
		Inclination	Vertical

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00 9.30	9.30 25.50	CP RC	08/07/2013 10/07/2013	09/07/2013 11/07/2013	KL MM	TW TW	T6116	PCD	Dando 3000 Deltabase 520		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow
08/07/2013	1900	5.00	5.00	-6.00	End of Shift							
09/07/2013	0700	5.00	5.00	-6.20	Start of Shift							
09/07/2013	1900	9.30	9.30	-7.80	End of CP							
10/07/2013	0700	9.30	9.30	-7.20	Start of Rotary							
10/07/2013	1900	20.30	10.50	-9.70	End of Shift							
11/07/2013	0700	20.30	10.50	-7.20	Start of Shift							
11/07/2013	1515	25.50	10.50	-8.10	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	Hard Strata Depth to	Chiselling Start time hhmm	Chiselling Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
5.00	5.00	1410	0200	Chiselling	1.00	SPT	N=12 (2,3,3,2,3,4)	AR362	75	1.00	-8.50
5.00	5.20	0940	0100	Chiselling	2.00	SPT	N=15 (2,3,2,4,5,4)	AR362	75	2.00	-9.00
8.20	8.40	1330	0100	Chiselling	3.00	SPT	N=14 (2,2,3,3,3,5)	AR362	75	3.00	-9.10
8.80	9.30	1500	0300	Chiselling	4.00	SPT	N=11 (2,3,1,2,4,4)	AR362	75	4.00	-9.40
					6.50	SPT	N=39 (5,6,7,9,10,13)	AR362	75	6.50	-10.00
					8.50	SPT	50/85mm (4,9,10,40/10)	AR362	75	8.50	-8.10
					10.30	SPT(C)	50/10mm (25/10,50/10)	AR362	75	9.30	-7.50
					12.80	SPT(C)	50/5mm (4,8,50/5)	AR362	75	10.50	7.90
					14.30	SPT(C)	N=38 (4,5,6,8,10,14)	75	-	10.50	8.10
					15.80	SPT(C)	N=40 (3,5,8,10,9,13)	AR362	75	10.50	-8.50
					17.30	SPT(C)	N=31 (5,6,7,6,8,10)	AR362	75	10.50	-8.80
					18.80	SPT(C)	50/5mm (25/10,50/5)	AR362	75	10.50	-9.00
					20.30	SPT(C)	N=34 (7,6,7,9,8,10)	AR362	75	10.50	-9.70
					21.80	SPT(C)	N=41 (6,5,9,9,11,12)	AR362	75	10.50	-7.30
					23.20	SPT	N=49 (3,7,9,12,14,14)	AR362	75	10.50	-7.50
					24.00	SPT	50/295mm (4,6,12,11,11,16/70)	AR362	75	10.50	-7.90

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
9.30	25.50	Air/Mist	100	Grey

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %
200	9.30	200	9.30					
139	10.20	139	10.50					
116	25.50							

INSTALLATION DETAILS				PIPE CONSTRUCTION				
Distance from G.L.	ID	Type	Response zone Top / Base	ID	Pipe Top / Base	Dia. of pipe	Type of pipe	

* Seating blows only.

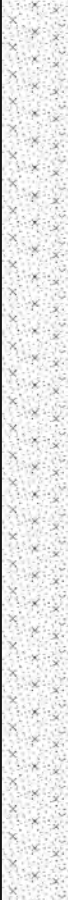


BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	25.50	Grout					

Project Name Bay of Nigg Harbour Development Ground Investigation
 Project No. TA7148
 Engineer Arch Henderson LLP
 Employer Aberdeen Harbour Board

Exploratory Hole Log

Hole ID.
A63
 Sheet 1 of 3

Ground Level -6.57m CD Coordinates 397211.49 E, 804673.51 N National Grid
 Hole Type CP+RC Inclination Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
Medium dense grey slightly silty slightly gravelly fine to medium SAND. Gravel is fine to medium. from 5.00m to 6.00m driller notes boulder obstruction		0.00	-12.57	D001	0.00	92	47	NA	NA	SPT12	1.00	1.45
				B002	0.00-0.50							
				D003	1.00							
				ES004	1.00							
				D005	1.00-1.45							
				B006	1.00-1.50							
				D007	2.00							
				ES008	2.00							
				D009	2.00-2.45							
				B010	2.00-2.50							
				D011	3.00							
				ES012	3.00							
				D013	3.00-3.45							
				B014	3.00-3.50							
				D015	4.00							
				ES016	4.00							
				D017	4.00-4.45							
				B018	4.00-4.50							
Stiff brown slightly sandy slightly gravelly CLAY with medium cobble content. Gravel is angular to rounded fine to coarse of granite, schist and quartzite. Cobbles are subangular to rounded of granite and schist. from 8.80m to 9.30m driller notes boulder obstruction		6.00	-12.57	D019	6.00	92	47	NA	NA	SPT39	6.50	6.95
				ES020	6.00							
				B021	6.00-6.50							
				D022	6.50-6.95							
				D023	7.00							
				B024	7.50-8.00							
				D025	8.00							
B026	8.00-8.50											
D027	8.50-8.75											
Strong grey BOULDER of granite. Strong grey and pink BOULDER of granite. Stiff grey slightly sandy gravelly CLAY. Gravel is subangular to rounded of granite and schist.		9.00	-15.57	D028	9.00	92	47	NA	NA	SPT50/85mm	8.50	8.74
				B029	9.00-9.13							
				D029	9.13							
				B030	9.13-9.18							
D030	9.18											
D031	9.18											
D032	9.18-9.47											
D033	9.47											
D034	9.47											
D035	9.47-9.90											
D036	9.90											
D037	9.90-10.30											

NOTES: All depths in metres, all diameters in millimetres.
 See header sheet for details of boring, progress and water.
 For details of abbreviations, see key

Log Print Date And Time: 23/12/2013 10:28:48



Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A63
Engineer	Arch Henderson LLP		Sheet 2 of 3
Employer	Aberdeen Harbour Board		

Ground Level	-6.57m CD	Coordinates	397211.49 E, 804673.51 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Assumes zone of no recovery. Silty CLAY with granite and boulders. (Driller's description)		10.30	-16.87							SPT(C)50/10mm 10.30 10.32	
Grey subangular coarse GRAVEL of granite.		10.57	-17.14								
Stiff grey slightly sandy gravelly CLAY. Gravel is angular to rounded fine to coarse of granite and schist.		10.76	-17.33								
Strong red BOULDER of granite.		10.86	-17.43	10.30	11.60	92	43	NA	NA		
Assumed zone of no recovery. Silty CLAY with granite boulders. (Driller's description)		11.60	-18.17								
Grey and red angular to subrounded fine to medium GRAVEL of granite, schist and quartzite.		11.80	-18.37								
Assumed zone of no recovery. Silty CLAY with granite boulders. (Driller's description)		11.60	-18.37	11.60	12.80	92	16	NA	NA		
Grey, red and pink slightly clayey slightly sandy angular to subrounded fine to coarse GRAVEL of granite and schist.		12.80	-19.37							SPT(C)50/5mm 12.80 12.96	
Assumed zone of no recovery. Silty CLAY with granite boulders. (Driller's description)		13.15	-19.72								
Grey, red and brown angular to subrounded fine GRAVEL of granite.		14.30	-20.87							SPT(C)38 14.30 14.75	
Grey and red slightly sandy clayey angular to rounded fine to coarse GRAVEL of granite and schist.		14.50	-21.07								
Grey and red slightly sandy clayey angular to rounded fine to coarse GRAVEL of granite and schist.		14.75	-21.32								
Assumed zone of no recovery. Silty CLAY with granite boulders. (Driller's description)		14.30	-21.32	14.30	15.80	92	30	NA	NA		
Grey and red slightly sandy clayey subangular to subrounded fine to medium GRAVEL of granite and schist.		15.80	-22.37							SPT(C)40 15.80 16.25	
Assumed zone of no recovery. Silty CLAY with granite boulders. (Driller's description)		15.95	-22.52								
Assumed zone of no recovery. Silty CLAY with granite boulders. (Driller's description)		15.80	-22.52	15.80	17.80	92	10	NA	NA		
Stiff grey slightly sandy gravelly CLAY. Gravel is angular to rounded fine to medium of granite and schist.		17.30	-23.87							SPT(C)31 17.30 17.75	
Assumed zone of no recovery. Silty CLAY with granite boulders (Driller's description)		17.48	-24.05								
Assumed zone of no recovery. Silty CLAY with granite boulders (Driller's description)		17.80	-24.05	17.80	18.80	92	12	NA	NA	NA	
Red and grey subangular to subrounded medium to coarse GRAVEL of granite.		18.80	-25.37							SPT(C)50/5mm 18.80 18.82	
Assumed zone of no recovery. Silty CLAY with granite boulders (Driller's description)		18.80	-25.37	18.80	20.30	92	40	NA	NA		

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		A63
Engineer	Arch Henderson LLP		Sheet 3 of 3
Employer	Aberdeen Harbour Board		

Ground Level	-6.57m CD	Coordinates	397211.49 E, 804673.51 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Red and grey subangular to subrounded medium to coarse GRAVEL of granite. from 20.00m to 20.10m very clayey from 20.10m to 20.30m assumed zone of no recovery		20.30 20.48	-26.87 -27.05							SPT(C)34 20.30 20.75	
Grey and red very angular to subangular fine to medium GRAVEL of granite and schist. from 20.44m to 20.48m very clayey Assumed zone of no recovery. Silty CLAY with cobbles. (Driller's description)				20.30	21.80	92	12	NA	NA		
No recovery. SAND and GRAVEL. (Driller's description)		21.80	-28.37							SPT(C)41 21.80 22.25	
				21.80	23.20	92	0	NA	NA		
No recovery. Sandy silty CLAY and cobbles. (Driller's description)		23.50	-30.07							SPT49 23.20 23.65	
				23.20	24.80	92	0	NA	NA	SPT50/295mm 24.00 24.45	
Multicoloured angular to rounded fine to medium GRAVEL of mixed igneous and metamorphic lithologies.		24.80 25.00 25.10	-31.37 -31.57 -31.67								
Firm brown slightly gravelly sandy CLAY. Gravel is angular to subrounded fine to medium of granite and schist.				24.80	25.50	92	42	NA	NA		
Assumed zone of no recovery. Sandy silty CLAY and cobbles. Exploratory hole complete at 25.50 m.		25.50	-32.07								

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		B61
Engineer	Arch Henderson LLP		Header
Employer	Aberdeen Harbour Board		

Ground Level	-7.88m CD	Coordinates	397241.41 E, 804702.42 N National Grid
Date Started	11/07/2013	Date Completed	16/07/2013
		Inclination	Vertical

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00	5.00	CP	11/07/2013	12/07/2013	KL	DT			Dando 3000		
5.00	26.50	RC	12/07/2013	15/07/2013	MM	DT	SWF	Impreg	Deltabase 520		
26.50	36.80	RC	15/07/2013	16/07/2013	MM	DT	T6116	Impreg	Deltabase 520		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow
11/07/2013	1845	4.00	4.00	-8.60	End of Shift							
12/07/2013	0700	4.00	4.00	-8.10	Start of Shift							
12/07/2013	1300	5.00	5.00	-9.00	End of CP/Start of Rotary							
12/07/2013	1930	6.00	6.00	-10.30	End of Shift							
13/07/2013	0700	6.00	6.00	-7.40	Start of Shift							
13/07/2013	1900	16.50	10.50	-10.20	End of Shift							
15/07/2013	0700	16.50	10.50	-9.00	Start of Shift							
15/07/2013	2030	28.00	26.50	-6.10	End of Shift							
16/07/2013	0700	28.00	26.50	-9.10	Start of Shift							
16/07/2013	2030	36.80	28.00	-8.30	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
4.50	4.65	0830	0100	Chiselling	0.50	SPT	N=8 (1,2,1,2,3,2)	AR362	75	N/A	-9.40
4.65	4.85	0930	0100	Chiselling	1.50	SPT	N=9 (1,2,1,2,3,3)	AR362	75	1.50	-9.20
4.85	5.00	1030	0100	Chiselling	2.50	SPT	N=14 (2,2,3,3,4,4)	AR362	75	2.50	-9.30
5.00	5.00	1130	0100	Chiselling	3.50	SPT	N=25 (2,2,3,3,7,12)	AR362	75	3.50	-8.70
					4.50	SPT(C)	50/0mm (25/5,50/0)	AR362	75	4.50	-8.30
					6.00	SPT	50/150mm (9,14,22,26,2/0)	AR362	75	6.00	-9.30
					7.50	SPT	50/150mm (8,15,19,25,6/0)	AR362	75	6.00	-9.40
					9.00	SPT	50/10mm (25/5,50/10)	AR362	75	6.00	-9.00
					10.50	SPT(C)	N=37 (4,6,7,8,10,12)	AR362	75	10.50	-8.30
					12.00	SPT(C)	50/105mm (6,9,10,40/30)	AR362	75	10.50	-9.80
					13.50	SPT(C)	50/30mm (25/70,50/30)	AR362	75	10.50	-10.30
					15.00	SPT(C)	N=36 (4,5,7,8,10,11)	AR362	65	10.50	-11.00
					16.50	SPT(C)	50/195mm (3,8,10,18,22/45)	AR362	75	10.50	-1.00
					18.00	SPT(C)	50/115mm (7,18,50,30,20/40)	AR362	75	10.50	-2.10
					19.50	SPT(C)	50/145mm (8,9,11,39/70)	AR362	75	10.50	-3.00
					21.00	SPT(C)	50/150mm (25/25,20,30/75)	AR362	75	10.50	5.10
					22.50	SPT(C)	50/10mm (10,12,50/10)	AR362	75	10.50	3.20
					24.00	SPT(C)	50/95mm (7,10,19,31/20)	AR362	75	10.50	1.20
					25.50	SPT(C)	50/0mm (25/5,50/0)	AR362	75	10.50	2.30
					28.00	SPT(C)	50/10mm (25/10,50/10)	AR362	75	28.00	-8.10

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
5.00	13.50	Water	100	Brown
13.50	16.50	Water	100	Brown/Green
16.50	30.00	Air/Mist	100	Brown
30.00	31.50	Air/Mist	100	Brown/Grey
31.50	36.80	Air/Mist	100	Grey

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %
200	5.00	200	5.00					
150	10.50	150	10.50					
139	28.00	139	28.00					
116	36.80							

INSTALLATION DETAILS				PIPE CONSTRUCTION				
Distance from G.L.	ID	Type	Response zone Top / Base	ID	Pipe Top / Base	Dia. of pipe	Type of pipe	

BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	36.80	Grout					

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		B61
Engineer	Arch Henderson LLP		Sheet 1 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-7.88m CD	Coordinates	397241.41 E, 804702.42 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation			
				Details	Dia.	TCR	SCR	RQD	IF					
Medium dense grey slightly silty slightly gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite, dolerite, schist and gneiss.				D001	0.00									
				D002	0.50-0.95						SPT8	0.95		
				B003	0.50-1.00									
				D004	1.00									
				ES005	1.00									
				D006	1.50-1.95							SPT9	1.95	
				B007	1.50-2.00									
				D008	2.00									
				ES009	2.00									
				D010	2.50-2.95							SPT14	2.95	
				B011	2.50-3.00									
				D012	3.00									
		ES013	3.00											
		D014	3.50-3.95							SPT25	3.95			
		B015	3.50-4.00											
		D016	4.00											
		ES017	4.00											
No recovery. BOULDER. (Driller's description)		4.50	-12.38							SPT(C)50/0mm	4.51			
Stiff to very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed lithologies including schist, granite, quartzite and dolerite. from 5.00m to 5.13m 1 No very strong dolerite boulder		5.00	-12.88											
		5.38	-13.26	5.00	6.00	92	38	12	12					
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)		6.00	-13.88	D018	6.00-6.30					SPT50/150mm	6.30			
No recovery. Sandy boulder CLAY. (Driller's description)				6.00	7.50	92	0	0	0					
Stiff to very stiff brown slightly gravelly sandy CLAY with high cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed lithologies including schist, granite, quartzite and dolerite. Cobbles are angular to subrounded of granite, dolerite and schist.		7.50	-15.38	D019	7.50-7.80					SPT50/150mm	7.80			
		7.72	-15.60	7.50	8.25	92	29	0	0					
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)		8.25	-16.13											
		8.45	-16.33	8.25	9.00	92	27	0	0					
Stiff to very stiff brown slightly gravelly sandy CLAY with high cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed lithologies including schist, granite, quartzite and dolerite. Cobbles are angular to subrounded of granite, dolerite and schist.		9.00	-16.88							SPT50/10mm	9.06			
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)		9.50	-17.38	9.00	10.50	92	33	0	0					

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		B61
Engineer	Arch Henderson LLP		Sheet 2 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-7.88m CD	Coordinates	397241.41 E, 804702.42 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
9.00m - 9.50m : Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed lithologies including schist, granite, quartzite and dolerite. Detail 9.00m - 9.10m : from 9.00m to 9.10m recovered as angular coarse gravel		10.50	-18.38							SPT(C)37 10.50	10.95	
		10.80	-18.68	10.50	11.50	92	30	0	0			
9.50m - 10.50m : Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			11.50	-19.38	11.50	12.00	92	100	20	20		
Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed lithologies schist, granite, quartzite and dolerite.			12.50	-20.38	12.00	13.50	92	33	6	0	SPT(C)50/105mm 12.00	12.26
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			13.50	-21.38							SPT(C)50/30mm 13.50	13.60
Very stiff brown slightly gravelly sandy CLAY with high cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed lithologies including schist, granite, quartzite and dolerite. Cobbles are angular to subrounded of granite, dolerite and schist.			14.05	-21.93	13.50	15.00	92	37	0	0		
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			15.00	-22.88							SPT(C)36 15.00	15.45
Very stiff brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed lithologies including granite, schist, dolerite and quartzite. Cobbles are angular to subrounded of granite and schist.			15.40	-23.28	15.00	16.50	92	27	8	8		
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description) from 16.90m to 17.05m 1 No cobble of very strong grey speckled pink and white granite			16.50	-24.38							SPT(C)50/195mm 16.50	16.85
Very stiff brown slightly gravelly sandy CLAY with high cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed lithologies including granite, schist, dolerite and quartzite. Cobbles are angular to subrounded of granite and schist.			17.20	-25.08	16.50	18.00	92	47	20	10		
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			18.00	-25.88							SPT(C)50/115mm 18.00	18.24
Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed lithologies including granite, schist and quartzite.			18.20	-26.08	18.00	19.50	92	13	0	0		
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			19.50	-27.38							SPT(C)50/145mm 19.50	19.80
Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of			19.90	-27.78								

NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key	
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		B61
Engineer	Arch Henderson LLP		Sheet 3 of 4
Employer	Aberdeen Harbour Board		

Ground Level	-7.88m CD	Coordinates	397241.41 E, 804702.42 N National Grid
Hole Type	CP+RC	Inclination	Vertical


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
19.50m - 19.90m : mixed lithologies including granite, schist and quartzite.				19.50	21.00	92	27	0	0		
19.90m - 21.00m : Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			21.00	-28.88							NA
Very stiff brown slightly gravelly sandy CLAY with high cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite. Cobbles are angular to subrounded of granite and schist. from 21.00m to 21.25m recovered as angular to subrounded fine to coarse gravel and cobbles of granite and schist				21.00	22.50	92	40	17	11		
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			21.60	-29.48							
Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite and schist.				22.50							
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			22.50	-30.38							
Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite and schist.				22.50	24.00	92	30	0	0		
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			22.95	-30.83							
Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite and schist.				24.00							
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			24.00	-31.88							
Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite and schist. from 25.50m to 25.65m 1 No very strong granite cobble or boulder				24.30							
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			24.30	-32.18							
Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite and schist. from 25.50m to 25.65m 1 No very strong granite cobble or boulder				24.00	25.50	92	20	0	0		
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			24.30	-32.18							
Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite and schist. from 25.50m to 25.65m 1 No very strong granite cobble or boulder				25.50							
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			25.50	-33.38							
Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite and schist. from 25.50m to 25.65m 1 No very strong granite cobble or boulder				25.50	26.50	92	30	15	15		
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			25.80	-33.68							
No recovery. Sandy boulder CLAY. (Driller's description)				26.50							
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			26.50	-34.38							
No recovery. Sandy boulder CLAY. (Driller's description)				26.50	28.00	92	0	0	0		
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			26.50	-34.38							
Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite and schist.				28.00							
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			28.00	-35.88							
from 28.88m to 29.00m 1 No very strong granite cobble				28.00	28.50	92	60	50	50		
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			28.00	-35.88							
from 29.40m to 29.50m 1 No very strong granite cobble				28.50							
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			28.50	-37.38							
from 29.40m to 29.50m 1 No very strong granite cobble				28.50	30.00	92	63	63	48		
Assumed zone of no recovery. Sandy boulder CLAY. (Driller's description)			29.50	-37.38							

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		B61
Engineer	Arch Henderson LLP		
Employer	Aberdeen Harbour Board		Sheet 4 of 4

Ground Level	-7.88m CD	Coordinates	397241.41 E, 804702.42 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
(description) Very stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite and schist.		30.00	-37.88	30.00	31.50	92	100	85	85		
Weak dark greyish grey SCHIST. Recovered as non intact core (angular fine to coarse gravel sized fragments).		31.30	-39.18								
Medium strong pinkish grey GRANITE. Recovered as non intact core (angular medium to coarse gravel sized fragments). from 31.80m to 32.00m assumed zone of no recovery		31.50	-39.38	31.50	32.00	92	60	0	0		
from 33.30m to 33.50m assumed zone of no recovery				32.00	33.50	92	86	0	0		
from 34.90m to 35.00m assumed zone of no recovery				33.50	35.00	92	93	0	0		
				35.00	35.80	92	100	0	0		
				35.80	36.80	92	100	0	0		
Exploratory hole complete at 36.80 m.		36.80	-44.68								

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. C79							
Project No. TA7148													Header							
Engineer Arch Henderson LLP																				
Employer Aberdeen Harbour Board																				
Ground Level -6.59m CD					Coordinates 397082.70 E, 804920.10 N National Grid															
Date Started 20/09/2013					Date Completed 21/09/2013					Inclination Vertical										
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment		Shoring / Support		Remarks							
0.00 0.90	0.90 8.00	CP RC	20/09/2013 21/09/2013	20/09/2013 21/09/2013	AOH RJ	TW TW	T6116	Impreg	Dando 3000 Deltabase 515											
PROGRESS										WATER STRIKES										
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow				
20/09/2013 21/09/2013 21/09/2013	1900 0700 1500	0.90 0.90 8.00	0.80 0.80 0.90	-7.10 -5.00 -8.60	End of CP Start of Shift End of Hole															
CABLE PERCUSSION DETAILS										SPT DETAILS										
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks					Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
0.80		0.90		1630		0200		Chiselling					0.50	SPT(C)	50/245mm (3,4,4,5,7,34/20)		AR360	75	N/A	-9.80
ROTARY FLUSH DETAILS																				
From depth		To depth		Flush type		Flush return %		Flush colour												
0.90 6.70		6.70 8.00		Water Water		0 70		- Brown												
HOLE DIAMETER / CASING				DYNAMIC SAMPLING																
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %												
155 116	0.90 8.00	150	0.90																	
INSTALLATION DETAILS					PIPE CONSTRUCTION															
Distance from G.L.	ID	Type	Response zone Top Base		ID	Pipe Top Base		Dia. of pipe	Type of pipe											
BACKFILL DETAILS										GENERAL NOTES										
Top of section		Base of section		Material		Remarks														
0.00 0.90		0.90 8.00		Arisings Grout																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group										
Log Print Date And Time: 23/12/2013 10:29:32																				
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012														

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		C79
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-6.59m CD	Coordinates	397082.70 E, 804920.10 N National Grid
Hole Type	CP+RC	Inclination	Vertical


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
Medium dense brown slightly silty gravelly fine to medium SAND. Gravel is angular to rounded fine to medium of mixed igneous and metamorphic lithologies.		0.80	-7.39	D001 0.00						SPT(C)50/245mm 0.50 0.90		
No recovery. Possible rockhead. (Driller's description)		0.90	-7.49	B002 0.50-0.80								
Medium strong to strong coarse crystalline pink and grey GRANITE. Discontinuities: 1) 10-30 degrees very closely to closely spaced planar rough stained brown. 2) 60-80 degrees closely to medium spaced planar rough stained brown. from 0.90m to 1.01m recovered as non intact core (angular coarse gravel sized fragments) from 0.90m to 1.58m discontinuities: 2) very closely to closely spaced from 1.14m to 1.22m 1 No discontinuity 50 degrees planar rough clean from 1.36m to 1.43m weak. Recovered as non intact core (angular fine to medium gravel sized fragments) from 1.45m to 1.58m discontinuities: 2) with clay smearing on surfaces from 1.62m to 1.74m 1 No incipient fracture 80 degrees planar from 1.97m to 2.00m weak. Recovered as non intact core (angular fine to medium gravel sized fragments) from 2.01m to 2.35m 2 No incipient fractures very closely spaced 8 degrees planar from 2.57m to 2.88m strong grey gneiss from 3.03m to 3.20m weak to medium strong with 3 No incipient fractures 30-60 degrees very closely spaced planar from 3.74m to 3.95m discontinuities: 2) perpendicular through core axis from 3.91m to 3.98m 1 No discontinuity 50 degrees planar rough brown from 4.15m to 4.50m 5 No incipient fractures very closely spaced 80-90 degrees planar from 4.27m to 4.32m 1 No discontinuity 40 degrees planar rough stained brown from 4.86m to 5.00m 1 No incipient fracture 80-90 degrees planar from 5.00m to 5.78m 1 No discontinuity 80-90 degrees planar rough stained brown from 5.13m to 5.30m recovered as non intact core (angular to subangular fine to coarse gravel sized fragments) from 5.46m to 5.50m recovered as non intact core (angular medium gravel sized fragments) from 5.80m to 5.88m 1 No discontinuity 50 degrees planar rough stained brown from 5.90m to 6.00m recovered as non intact core (angular fine to medium gravel sized fragments) from 6.00m to 6.13m 3 No discontinuities 50-60 degrees very closely spaced planar rough stained brown		6.13	-12.72	0.90 2.20	92	100	93	45		NI 90 300		
				2.20 3.20	92	100	97	63				
				3.20 4.80	92	100	93	70				
				4.80 6.70	92	100	63	38				
				6.70 7.60	92	100	18	0				
				7.60 8.00	92	100	60	50				
Weak locally very weak coarse crystalline pink and grey GRANITE stained dark brown. Recovered as non intact core (slightly sandy very angular to subangular fine to coarse gravel sized fragments. Sand sized fragments are fine to coarse). from 6.33m to 6.39m clayey from 6.70m to 6.92m intact core. Weak to medium strong with 3 No discontinuities 10-30 degrees very closely to closely spaced planar rough stained brown and 1 No discontinuity 60-70 degrees planar rough stained brown from 7.67m to 7.89m 1 No discontinuity 80-90 degrees planar rough clean		7.74	-14.33									
Medium strong coarse crystalline pink and grey GRANITE. Discontinuities: 1) 10-30 degrees planar rough clean.		8.00	-14.59									

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	<h2 style="margin:0;">Exploratory Hole Log</h2>	Hole ID. <h1 style="margin:0;">C79</h1>
Sheet 1+ of 1		

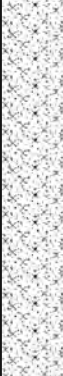



Ground Level	-6.59m CD	Coordinates	397082.70 E, 804920.10 N National Grid
Hole Type	CP+RC	Inclination	Vertical


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Remaining Detail : 7.88m - 7.93m : from 7.88m to 7.93m 1 No incipient fracture 80 degrees planar <hr style="border-top: 1px dashed black;"/> Exploratory hole complete at 8.00 m.											

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. C81					
Project No. TA7148																		
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board													Header					
Ground Level -6.27m CD					Coordinates 397076.10 E, 804817.90 N National Grid													
Date Started 22/09/2013					Date Completed 22/09/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00	2.80	CP	22/09/2013	22/09/2013	AOH	TW			Dando 3000									
2.80	4.40	RO	22/09/2013	22/09/2013	RJ	TW			Deltabase 515									
4.40	8.00	RC	22/09/2013	22/09/2013	RJ	TW	T6116	3/4 R Impreg	Deltabase 515									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow		
22/09/2013	1200	2.80	2.50	-5.20	End of CP/Start of Rotary													
22/09/2013	1530	8.00	4.40	-9.00	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
2.50		2.80		1000		0200		Chiselling			0.50	SPT(C)	N=23 (3,4,4,5,6,8)		AR362	75	N/A	-8.30
											1.50	SPT(C)	N=23 (4,4,5,5,6,7)		AR362	75	1.50	-7.30
											2.50	SPT(C)	50/15mm (75/10,50/15)		AR362	75	2.50	-6.00
											3.50	SPT(C)	50/95mm (8,10,11,39/20)		AR362	75	3.50	-6.40
											5.90	SPT(C)	50/70mm (25/70,50/70)		AR362	75	4.40	-7.10
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
2.80		8.00		Water		100		Brown										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %										
150	4.40	116	8.00															
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00	8.00	Arisings																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
Log Print Date And Time: 23/12/2013 10:29:43																		
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012												

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.	C81
Project No.	TA7148		Sheet 1 of 1	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	-6.27m CD	Coordinates	397076.10 E, 804817.90 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Medium dense brown slightly silty gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies. from 0.50m to 1.00m very gravelly				D001 0.50 B002 0.50-1.00						SPT(C)23 0.50 0.95	
				D003 1.50 B004 1.50-2.00						SPT(C)23 1.50 1.95	
Rotary openhole drilling. COBBLES and BOULDERS with sand.		2.50	-8.77	D005 2.50 B006 2.50						SPT(C)50/15mm 2.50 2.53	
										SPT(C)50/95mm 3.50 3.75	
Stiff very high strength brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of granite, schist, gneiss and granite. Cobbles are subangular of granite. at 4.40m extremely high strength		4.40	-10.67	4.40 5.90	92	100	NA	NA			
				5.90 8.00	92	100	NA	NA	NA	SPT(C)50/70mm 5.90 6.04	
Exploratory hole complete at 8.00 m.		8.00	-14.27								

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. C83 Header				
Project No. TA7148					Coordinates 396926.20 E, 804700.27 N National Grid												
Engineer Arch Henderson LLP					Date Started 27/07/2013					Date Completed 27/07/2013							
Employer Aberdeen Harbour Board					Inclination Vertical												
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks						
0.00 2.50	2.50 10.10	CP RC	27/07/2013 27/07/2013	27/07/2013 27/07/2013	TP WW	DT DT	T6116	Impreg	Dando 3000 Deltabase 515								
PROGRESS										WATER STRIKES							
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow	
27/07/2013 27/07/2013	1500 1930	2.50 10.10	2.35 2.50	-2.50 -8.00	End of CP/Start of Rotary End of Hole												
CABLE PERCUSSION DETAILS										SPT DETAILS							
Hard Strata Depth from to		Chiselling Start time hhmm Duration hhmm		Remarks					Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth	
2.30 2.50		1300 0200		Chiselling					1.00	SPT(C)	N=26 (4,5,7,5,7,7)		AR360	75	1.00	-2.60	
									2.00	SPT(C)	50/75mm (9,16,50/75)		AR360	75	2.00	-2.70	
									4.00	SPT	50/75mm (6,11,50/75)		AR360	75	2.50	-2.50	
									5.55	SPT(C)	50/100mm (7,16,50/100)		AR360	75	2.50	-4.50	
									7.15	SPT	50/0mm (25/0,50/0)		AR360	75	2.50	-6.40	
									8.65	SPT	50/80mm (11,16,50/80)		AR360	75	2.50	-8.10	
ROTARY FLUSH DETAILS																	
From depth To depth		Flush type		Flush return %		Flush colour											
2.50 7.15 7.15 10.10		Water Water		100 100		Brown Grey											
HOLE DIAMETER / CASING				DYNAMIC SAMPLING													
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %									
200 116	2.50 10.10	200 139	2.35 2.50														
INSTALLATION DETAILS					PIPE CONSTRUCTION												
Distance from G.L.	ID	Type	Response zone Top	Response zone Base	ID	Pipe Top	Pipe Base	Dia. of pipe	Type of pipe								
BACKFILL DETAILS										GENERAL NOTES							
Top of section	Base of section	Material			Remarks												
0.00	10.10	Arisings															
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group							
Unchecked					Log Print Date And Time: 23/12/2013 10:29:51												
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012											

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		C83
Engineer	Arch Henderson LLP		Sheet 1 of 2
Employer	Aberdeen Harbour Board		


Ground Level	-3.74m CD	Coordinates	396926.20 E, 804700.27 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
Medium dense grey slightly silty slightly gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of granite and schist.				B002	0.00-1.00							
				ES001	0.50							
				D003	1.00-1.45					SPT(C)26	1.00	1.45
				ES004	1.50							
				D005	2.00-2.30					SPT(C)50/75mm	2.00	2.23
No recovery. HARD STRATA. (Driller's description)		2.30	-6.04									
Stiff high strength reddish brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite. Cobbles are angular to subrounded of granite and schist.		2.50	-6.24									
at 3.60m extremely high strength												
from 3.85m to 4.00m assumed zone of no recovery												
Stiff greyish brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite and schist. Cobbles are angular to subrounded of granite and schist.												
				2.50	4.00	92	90	NA	NA			
				4.00	-7.74					SPT50/75mm	4.00	4.23
				4.00	5.55	92	100	NA	NA			
				5.55	7.15	92	100	0	0	NA	SPT(C)50/100mm	5.55
		7.15	8.65	92	93	0	0		SPT50/0mm	7.15	7.15	
		8.65	10.10	92	100	0	0		SPT50/80mm	8.65	8.88	
from 8.55m to 8.65m assumed zone of no recovery												

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	<h2 style="margin:0;">Exploratory Hole Log</h2>	Hole ID. <h1 style="margin:0;">C83</h1>
Sheet 2 of 2		

Ground Level -3.74m CD	Coordinates 396926.20 E, 804700.27 N National Grid
Hole Type CP+RC	Inclination Vertical


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Stiff greyish brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite and schist. Cobbles are angular to subrounded of granite and schist. ----- Exploratory hole complete at 10.10 m.		10.10	-13.84								

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. C84					
Project No. TA7148													Header					
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -5.21m CD					Coordinates 397059.53 E, 804703.63 N National Grid													
Date Started 20/07/2013					Date Completed 21/07/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00 1.00	1.00 7.40	CP RC	20/07/2013 20/07/2013	20/07/2013 21/07/2013	TP WW	DT DT	T6116	Impreg	Dando 3000 Deltabase 515									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow		
20/07/2013	1330	1.00	1.00	-10.30	End of CP													
20/07/2013	1345	1.00	1.00	-9.90	Start of Rotary													
20/07/2013	1900	3.30	2.00	-8.80	End of Shift													
21/07/2013	1000	3.30	2.00	-13.00	Start of Shift													
21/07/2013	1900	7.40	2.00	-12.40	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
1.00		1.00		1130		0200		Chiselling			1.00	SPT(C)	50/0mm (25/0,50/0)		AR360	75	1.00	-10.30
											1.40	SPT	50/0mm (13,12/70,50/0)		AR360	75	1.00	-9.20
											3.30	SPT	50/0mm (11,14,50/0)		AR360	75	2.00	-13.00
											4.80	SPT	50/0mm (25/0,50/0)		AR360	75	2.00	-12.80
											5.80	SPT	N=39 (7,9,7,11,10,11)		AR360	75	2.00	-12.60
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
1.00		3.30		Water		100		Brown										
3.30		7.40		Water		80		Brown										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmss	Recovery %										
200	1.00	200	1.00															
116	7.40																	
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00	7.40	Grout																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
Log Print Date And Time: 23/12/2013 10:30:02																		
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012												

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		C84
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		


Ground Level	-5.21m CD	Coordinates	397059.53 E, 804703.63 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Grey slightly silty very gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.				ES001 0.30 B002 0.30-1.00							
Strong grey BOULDER of granite.		1.00	-6.21	1.00 1.40	92	100	NA	NA		SPT(C)50/0mm 1.00 1.00	
Stiff brown slightly sandy slightly gravelly CLAY with low to medium cobble content. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite. Cobbles are angular to subrounded of granite, schist and gneiss.		1.40	-6.61	1.40 2.10	92	100	NA	NA		SPT50/0mm 1.40 1.55	
from 1.95m to 2.10m angular coarse gravel of schist and granite				2.10 3.30	92	91	NA	NA			
from 3.20m to 3.30m assumed zone of no recovery				3.30 4.80	92	97	NA	NA	NA	SPT50/0mm 3.30 3.45	
from 4.75m to 4.80m assumed zone of no recovery				4.80 5.80	92	85	NA	NA		SPT50/0mm 4.80 4.80	
from 5.65m to 5.80m assumed zone of no recovery				5.80 7.40	92	100	NA	NA		SPT39 5.80 6.25	
at 7.10m gravelly											
Exploratory hole complete at 7.40 m.		7.40	-12.61								

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. C87					
Project No. TA7148													Header					
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -2.85m CD					Coordinates 396858.54 E, 804606.18 N National Grid													
Date Started 31/07/2013					Date Completed 02/08/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00 1.10 1.20	1.10 1.20 8.50	CP RO RC	31/07/2013 31/07/2013 31/07/2013	31/07/2013 31/07/2013 02/08/2013	TP WW WW	DT WW DT	T6116	Tricone Impreg	Dando 3000 Deltabase 515 Deltabase 515									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike	depth to seal flow		
31/07/2013	1515	1.10	1.10	-4.80	End of CP/Start of Rotary													
31/07/2013	1930	5.20	1.20	-9.00	End of Shift													
02/08/2013	0700	5.20	1.20	-4.60	Start of Shift													
02/08/2013	1450	8.50	1.20	-6.10	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
1.00		1.10		1315		0200		Chiselling			1.00	SPT(C)	50/0mm (25/0,50/0)		AR360	75	1.00	-4.30
											1.10	SPT(C)	50/0mm (25/0,50/0)		AR360	75	1.10	-4.70
											2.20	SPT	N=56 (9,11,12,12,16,16)		AR360	75	1.20	-6.00
											3.70	SPT	N=73 (6,8,14,17,18,24)		AR360	75	1.20	-7.40
											5.20	SPT	50/5mm (50/5)		AR360	75	1.20	-4.60
											6.75	SPT	30/75mm (8,14,30/75)		AR360	75	1.20	-7.50
											8.50	SPT(C)	50/95mm (14,34/20)		AR360	75	1.20	-7.15
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
1.20		8.50		Water		100		Brown										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %										
200	1.10	200	1.10															
139	1.20	139	1.20															
116	8.50																	
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00	8.50	Arisings																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
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Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012												

Ground Level -2.85m CD	Coordinates 396858.54 E, 804606.18 N National Grid
Hole Type CP+RC	Inclination Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install-ation
				Details	Dia.	TCR	SCR	RQD	IF		
Medium dense grey slightly silty slightly gravelly fine to coarse SAND. Gravel is angular to subrounded fine to medium of granite and schist.		1.10	-3.95	B002	0.00-1.00					SPT(C)50/0mm 1.00 1.00	
Rotary openhole drilling. HARD STRATA. (Driller's description)		1.20	-4.05	E001	0.50					SPT(C)50/0mm 1.10	
Stiff very high strength greyish brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, dolerite, schist and quartzite. Cobbles are angular to subrounded fine to coarse of granite and schist. from 1.20m to 1.30m strong grey boulder of dolerite. Recovered as angular coarse gravel sized fragments		2.20		D003	1.00-1.10					SPT56 2.20 2.65	
from 7.01m to 7.15m assumed zone of no recovery		3.70								SPT73 3.70 4.15	
at 8.45m extremely high strength Exploratory hole complete at 8.50 m.		8.50	-11.35							SPT50/5mm 5.20 5.21	
										SPT30/75mm 6.75 6.98	
										SPT(C)50/95mm 8.50 8.60	


Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. C88							
Project No. TA7148													Header							
Engineer Arch Henderson LLP																				
Employer Aberdeen Harbour Board																				
Ground Level -4.75m CD					Coordinates 396986.52 E, 804614.01 N National Grid															
Date Started 22/07/2013					Date Completed 24/07/2013					Inclination Vertical										
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment		Shoring / Support		Remarks							
0.00 1.00	1.00 8.25	CP RC	22/07/2013 22/07/2013	22/07/2013 24/07/2013	TP WW	DT DT	T6116	Impreg	Dando 3000 Deltabase 515											
PROGRESS										WATER STRIKES										
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike	depth to seal flow				
22/07/2013	1630	1.00	1.00	-10.90	End of CP/Start of Rotary															
23/07/2013	0700	1.00	1.00	-3.50	Start of Shift															
23/07/2013	1900	5.40	1.00	-8.00	End of Shift															
24/07/2013	0700	5.40	1.00	-7.50	Start of Shift															
24/07/2013	1330	8.25	2.50	-10.60	End of Hole															
CABLE PERCUSSION DETAILS										SPT DETAILS										
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks					Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
1.00		1.00		1230		0200		Chiselling					1.00	SPT(C)	50/0mm (25/0,50/0)		AR360	75	1.00	-7.90
													2.70	SPT	50/0mm (25/0,50/0)		AR360	75	1.00	-11.00
													4.20	SPT	N=34 (7,7,7,9,11)		AR360	75	1.00	-10.40
													5.40	SPT	50/150mm (6,7,11,25,14/0)		AR360	75	1.00	-7.00
													6.60	SPT	50/0mm (25/0,50/0)		AR360	75	2.50	-7.50
													8.10	SPT	50/0mm (11,25,50/0)		AR360	75	2.50	-9.00
ROTARY FLUSH DETAILS																				
From depth		To depth		Flush type		Flush return %		Flush colour												
1.00		8.25		Water		0														
HOLE DIAMETER / CASING				DYNAMIC SAMPLING																
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %												
200 116	1.00 8.25	200	2.50																	
INSTALLATION DETAILS					PIPE CONSTRUCTION															
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe											
BACKFILL DETAILS										GENERAL NOTES										
Top of section	Base of section	Material			Remarks															
0.00	8.25	Arisings																		
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group										
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		C88
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-4.75m CD	Coordinates	396986.52 E, 804614.01 N National Grid
Hole Type	CP+RC	Inclination	Vertical


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Grey slightly silty very gravelly fine to coarse SAND with low cobble content. Gravel is angular to subrounded fine to medium of granite, schist and quartzite. Cobbles are angular to subrounded of granite schist and gneiss.				B002 0.00-1.00							
		1.00	-5.75	ES001 0.50							
Strong pink and grey BOULDER of granite.		1.20	-5.95	1.00 1.20	92	100	NA	NA		SPT(C)50/0mm 1.00 1.00	
Stiff very high strength brown slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite. Cobbles are angular to subrounded of granite and schist.				1.20 2.70	92	96	NA	NA			
Assumed zone of no recovery. Stiff greyish brown slightly sandy boulder CLAY with occasional cobbles. (Driller's description)		2.65	-7.40								
Stiff brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite. Cobbles are angular to subrounded of granite and schist.		2.70	-7.45							SPT50/0mm 2.70 2.70	
				2.70 4.20	92	100	NA	NA			
				4.20 5.40	92	83	NA	NA	NA	SPT34 4.20 4.65	
from 5.20m to 5.40m, 6.40m to 6.60m and 6.90m to 7.00m assumed zone of no recovery				5.40 6.60	92	83	NA	NA		SPT50/150mm 5.40 5.70	
from 6.40m to 6.60m assumed zone of no recovery				6.60 7.00	92	75	NA	NA		SPT50/0mm 6.60 6.60	
from 6.90m to 7.00m assumed zone of no recovery				7.00 8.25	92	47	NA	NA			
Assumed zone of no recovery. Stiff greyish brown slightly sandy boulder CLAY with occasional cobbles. (Driller's description)		7.52	-12.27								
Exploratory hole complete at 8.25 m.		8.25	-13.00							SPT50/0mm 8.10 8.25	

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. C96					
Project No. TA7148													Header					
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -4.22m CD					Coordinates 397028.28 E, 804417.35 N National Grid													
Date Started 19/08/2013					Date Completed 20/08/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment		Shoring / Support		Remarks					
0.00 4.50	4.50 7.30	CP RC	19/08/2013 19/08/2013	19/08/2013 19/08/2013	TP WW	DT DT	T6116	Impreg	Dando 3000 Deltabase 515									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike	depth to seal flow		
19/08/2013	1700	4.50	4.30	-8.40	End of CP/Start of Rotary													
19/08/2013	1930	5.70	4.50	-7.00	End of Shift													
20/08/2013	0810	5.70	4.50	-5.50	Start of Shift													
20/08/2013	1045	7.30	4.50	-8.50	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
4.30		4.50		1500		0200		Chiselling			0.50	SPT(C)	N=23 (3,5,5,7,6,5)		AR362	75	N/A	-7.80
											1.50	SPT(C)	N=28 (4,6,6,7,7,8)		AR362	75	1.50	-7.90
											2.50	SPT(C)	N=37 (5,7,8,9,9,11)		AR362	75	2.50	-8.10
											3.50	SPT(C)	N=44 (6,9,9,11,11,13)		AR362	75	3.50	-8.20
											4.50	SPT(C)	50/0mm (25/0,50/0)		AR362	75	4.30	-8.40
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
4.50		7.30		Water		100		Orange										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %										
200 116	4.50 7.30	200	4.50															
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section		Base of section		Material			Remarks											
0.00 4.50		4.50 7.30		Arisings Grout														
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
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Ground Level -4.22m CD	Coordinates 397028.28 E, 804417.35 N National Grid
Hole Type CP+RC	Inclination Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install-ation			
				Details	Dia.	TCR	SCR	RQD	IF					
Medium dense grey and greyish brown slightly silty slightly gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, schist, gneiss and quartz.				B001	0.00-0.50									
				ES002	0.50						SPT(C)23	0.50	0.95	
				B003	0.50-0.95									
				ES004	1.00									
				D005	1.50						SPT(C)28	1.50	1.95	
				B006	1.50-1.95									
				ES007	2.00									
				D008	2.00									
				B009	2.50-2.95						SPT(C)37	2.50	2.95	
				ES010	3.00									
				D011	3.00									
				B012	3.50-3.95						SPT(C)44	3.50	3.95	
				ES013	4.00									
D014	4.00													
Weak locally medium strong grey coarse crystalline GRANITE with localised patches of orange staining penetrating full core diameter. Discontinuities: 1) 30-40 degrees closely spaced planar rough with orange staining on surfaces. 2) 70-80 degrees medium spaced planar rough with brown staining on fracture surfaces. from 4.50m to 4.70m and 4.85m to 5.00m extremely weak. Recovered as non intact core (angular coarse gravel sized fragments) from 5.10m to 5.25m medium strong from 5.40m to 5.50m and 6.35m to 6.60m very weak. Recovered as non intact core (angular coarse gravel sized fragments) from 6.50m to 6.80m medium strong from 7.10m to 7.20m very weak. Recovered as non intact core (angular coarse gravel sized fragments)				4.50	5.70	90	100	63	0					
				5.70	7.30	90	100	90	24		NI 80 200			
												SPT(C)50/0mm	4.50	4.50
Exploratory hole complete at 7.30 m.														


Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. D98					
Project No. TA7148													Header					
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -7.57m CD					Coordinates 397195.66 E, 804425.09 N National Grid													
Date Started 18/08/2013					Date Completed 18/08/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00 2.10	2.10 4.10	CP RC	18/08/2013 18/08/2013	18/08/2013 18/08/2013	TP MM	DT DT	T6116	Impreg	Dando 3000 Deltabase 515									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow		
18/08/2013 18/08/2013	1500 1930	2.10 4.10	2.00 2.10	-8.60 -7.10	End of CP/Start of Rotary End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
2.00		2.10		1300		0200		Chiselling			0.50 1.50 2.10	SPT(C) SPT(C) SPT(C)	N=25 (5,6,6,6,5,8) N=50 (7,8,11,11,13,15) 50/0mm (25/0,50/0)		AR362 AR362 AR362	75 75 75	N/A 1.50 2.00	-8.20 -8.30 -8.50
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
2.10		4.10		Water		90		Grey										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmss	Recovery %										
200 116	2.10 4.10	200	2.00															
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00 2.10	2.10 4.10	Arisings Grout																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
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Project Name	Bay of Nigg Harbour Development Ground Investigation	<h1>Exploratory Hole Log</h1>	Hole ID.
Project No.	TA7148		D98
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-7.57m CD	Coordinates	397195.66 E, 804425.09 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Medium dense grey slightly silty fine to coarse SAND. from 1.50m to 2.00m dense				B001 0.00-0.50							
				D002 0.50-0.95 B003 0.50-0.95						SPT(C)25 0.50 0.95	
				D004 1.00							
				D005 1.50 B006 1.50-1.95						SPT(C)50 1.50 1.95	
No recovery. SCHIST. (Driller's description)		2.00	-9.57								
Medium strong grey GNEISS with medium spaced thin bands of weak thinly foliated (<1mm) grey inclusions schist. Discontinuities: 1) 20-30 degrees very closely locally closely spaced planar rough with slight yellow and brown staining on surfaces. 2) 80-90 degrees medium spaced planar rough with dark brown staining on surfaces. from 2.10m to 2.25m weak grey schist. Recovered as non intact core (angular coarse gravel sized fragments) from 2.32m to 2.40m thin band of weak thinly foliated (<1mm) grey schist from 2.60m to 2.70m weak grey schist. Recovered as non intact core (angular coarse gravel sized fragments) from 3.00m to 3.10m assumed zone of no recovery from 3.10m to 3.35m weak grey schist. Recovered as non intact core (angular coarse gravel sized fragments) from 3.80m to 4.00m recovered as non intact core (angular coarse gravel sized fragments)		2.10	-9.67	2.10 3.10	90	90	65	11		SPT(C)50/0mm 2.10 2.10	
				3.10 4.10	90	100	55	0		NI 45 110	
Exploratory hole complete at 4.10 m.		4.10	-11.67								


NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. D99 Header						
Project No. TA7148					Coordinates 397146.90 E, 804558.10 N National Grid														
Engineer Arch Henderson LLP					Date Started 20/08/2013					Date Completed 21/08/2013									
Employer Aberdeen Harbour Board					Inclination Vertical														
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment		Shoring / Support		Remarks						
0.00 4.10	4.10 7.10	CP RC	20/08/2013 20/08/2013	20/08/2013 21/08/2013	TP WW	DT DT			Dando 3000 Deltabase 515										
PROGRESS									WATER STRIKES										
Date	Time	Hole depth	Casing depth	Water depth	Remarks				Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing at strike time	depth to seal flow				
20/08/2013	1830	4.10	4.10	-9.80	End of CP														
20/08/2013	1930	4.10	4.10	-9.60	End of Shift														
21/08/2013	0730	4.10	4.10	NR	Start of Shift														
21/08/2013	1930	7.10	5.40	-9.40	End of Hole														
CABLE PERCUSSION DETAILS									SPT DETAILS										
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks				Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
3.70		4.10		1630		0200		Chiselling				0.50	SPT(C)	N=13 (3,3,4,3,3,3)		AR360	75	N/A	-10.70
												1.50	SPT(C)	N=20 (4,4,5,4,5,6)		AR360	75	1.50	-10.50
												3.50	SPT(C)	50/0mm (11,14,50/0)		AR360	75	3.50	-10.20
												4.10	SPT(C)	50/0mm (25/0,50/0)		AR360	75	4.10	-9.80
												5.60	SPT(C)	50/0mm (25/0,50/0)		AR360	75	4.10	-10.00
ROTARY FLUSH DETAILS																			
From depth		To depth		Flush type		Flush return %		Flush colour											
4.10		5.60		Water		100		Brown											
5.60		7.10		Water		70		Orange											
HOLE DIAMETER / CASING				DYNAMIC SAMPLING															
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmss	Recovery %											
116	7.10	127	5.40																
INSTALLATION DETAILS				PIPE CONSTRUCTION															
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe										
BACKFILL DETAILS									GENERAL NOTES										
Top of section	Base of section	Material			Remarks														
0.00	7.10	Arisings																	
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group									
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Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012													

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		D99
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-6.29m CD	Coordinates	397146.90 E, 804558.10 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation		
				Details	Dia.	TCR	SCR	RQD	IF				
Medium dense grey slightly gravelly silty fine to coarse SAND. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, schist, gneiss and quartz. from 3.70m to 4.10m dense		0.00-0.50		B001	0.00-0.50								
				ES002	0.50					SPT(C)13	0.50	0.95	
				B003	0.50-0.95								
				D004	1.00								
				ES005	1.50						SPT(C)20	1.50	1.95
				B006	1.50-1.95								
				D007	2.00								
				ES008	2.00								
				D009	3.00								
				ES010	3.50							SPT(C)50/0mm	3.50
B011	3.50-3.70												
Stiff greyish brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, schist, gneiss and dolerite.		4.10	-10.39								SPT(C)50/0mm	4.10	4.10
Assumed zone of no recovery. Stiff boulder CLAY. (Driller's description)		5.00	-11.29	4.10	5.60	90	66	NA	NA				
Strong pink and grey BOULDERS of granite.		5.60	-11.89							NA	SPT(C)50/0mm	5.60	5.60
Stiff greyish brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, schist, gneiss and dolerite.		6.00	-12.29	5.60	7.10	90	100	NA	NA				
Exploratory hole complete at 7.10 m.		7.10	-13.39										

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. D100							
Project No. TA7148													Header							
Engineer Arch Henderson LLP																				
Employer Aberdeen Harbour Board																				
Ground Level -11.06m CD					Coordinates 397303.23 E, 804483.34 N National Grid															
Date Started 10/08/2013					Date Completed 10/08/2013					Inclination Vertical										
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment		Shoring / Support		Remarks							
0.00 3.10	3.10 4.00	CP RC	10/08/2013 10/08/2013	10/08/2013 10/08/2013	TT TT	TW TW	T6116	Impreg	Dand0 3000 Deltabase 515											
PROGRESS										WATER STRIKES										
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow				
10/08/2013 10/08/2013	1800 2000	3.10 4.00	3.10 3.10	-15.70 -15.00	End of CP/Start of Rotary End of Hole															
CABLE PERCUSSION DETAILS										SPT DETAILS										
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks					Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
3.00		3.10		1600		0200		Chiselling					0.50	SPT	N=20 (3,3,5,5,4,6)		AR362	75	N/A	-15.30
													1.50	SPT	N=25 (4,5,5,5,7,8)		AR362	75	1.50	-15.70
													2.50	SPT	N=23 (3,6,4,6,6,7)		AR362	75	2.50	-15.40
													3.10	SPT	50/0mm (25/5,50/0)		AR362	75	3.10	-15.20
ROTARY FLUSH DETAILS																				
From depth		To depth		Flush type		Flush return %		Flush colour												
3.10		4.00		Water		100		Brown												
HOLE DIAMETER / CASING				DYNAMIC SAMPLING																
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %												
150 116	3.10 4.00	150	3.10																	
INSTALLATION DETAILS					PIPE CONSTRUCTION															
Distance from G.L.	ID	Type		Response zone Top Base		ID	Pipe Top Base		Dia. of pipe	Type of pipe										
BACKFILL DETAILS										GENERAL NOTES										
Top of section		Base of section		Material			Remarks													
0.00 3.10		3.10 4.00		Arisings Grout																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group										
Log Print Date And Time: 23/12/2013 10:30:52																				
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012														

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		D100
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-11.06m CD	Coordinates	397303.23 E, 804483.34 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation		
				Details	Dia.	TCR	SCR	RQD	IF				
Medium dense grey slightly silty slightly gravelly fine to medium SAND. gravel is fine. (Driller notes occasional boulders).		0.00-0.10		D001	0.00-0.10								
				D002	0.50-0.95					SPT20	0.50	0.95	
				B003	0.50-1.00								
				D004	1.00-1.20								
				D005	1.50-1.95						SPT25	1.50	1.95
				B006	1.50-2.00								
				D007	2.00-2.20								
				D008	2.50-2.95						SPT23	2.50	2.95
				D009	2.50-3.00								
Strong pink and grey medium crystalline GRANITE. Discontinuities: 1) 50-60 degrees medium spaced undulating rough clean. from 3.50m to 3.72m 1 No discontinuity 80 degrees planar rough clean at 3.85m 1 No discontinuity 0-10 degrees planar rough clean from 3.87m to 4.00m assumed zone of no recovery Exploratory hole complete at 4.00 m.		3.10	-14.16							SPT50/0mm	3.10	3.11	
		4.00	-15.06	3.10	4.00	92	86	86	67	20 120 260			

Project Name Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No. TA7148		D101
Engineer Arch Henderson LLP		Header
Employer Aberdeen Harbour Board		

Ground Level -9.00m CD	Coordinates 397259.00 E, 804574.50 N National Grid
Date Started 24/09/2013	Date Completed 26/09/2013
Inclination Vertical	

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00 4.80	4.80 8.80	CP RC	24/09/2013 24/09/2013	24/09/2013 26/09/2013	AO'H RJ/TT	DT DT	T6116	Impreg	Dando 3000 Deltabase 515		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow
24/09/2013	1300	4.80	4.50	-6.70	End of CP/Start of Rotary							
24/09/2013	1800	6.80	4.50	-8.90	End of Shift							
26/09/2013	0700	6.80	4.50	NR	Start of Shift							
26/09/2013	1800	8.80	8.80	NR	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
4.50	4.80	1100	0200	Chiselling	0.50	SPT(C)	N=19 (3,3,4,4,5,6)	AR360	75	N/A	-9.60
					1.50	SPT(C)	N=27 (3,4,6,7,7,7)	AR360	75	1.50	-9.10
					2.50	SPT(C)	N=28 (4,4,5,7,8,8)	AR360	75	2.50	-8.30
					3.50	SPT(C)	N=28 (6,6,6,7,7,8)	AR360	75	3.50	-7.80
					4.50	SPT(C)	50/145mm (10,12,15,35/70)	AR360	75	4.50	-7.20
					5.80	SPT(C)	50/85mm (25/65,40,10/10)	AR360	75	4.50	-7.20

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
4.80	8.80	Water	100	Brown

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %
150	8.80	150	8.80					

INSTALLATION DETAILS				PIPE CONSTRUCTION					
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe


BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	8.80	Arisings					

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.	D101
Project No.	TA7148		Sheet 1 of 1	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	-9.00m CD	Coordinates	397259.00 E, 804574.50 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation		
				Details	Dia.	TCR	SCR	RQD	IF				
Medium dense brown slightly silty slightly gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite, schist, gneiss and quartz.		0.50	-13.80	D001	0.50					SPT(C)19 0.50			
				B002	0.50-1.00								
				D003	1.50								
				B004	1.50-2.00								
				D005	2.00								
No recovery. Boulder CLAY. (Driller's description)		4.80	-13.80										
				4.80	5.80	89	0	NA	NA				
				Stiff brown slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. Cobbles are angular to subrounded of granite and gneiss.	5.80	-14.80	5.80	6.80	89	90	NA	NA	SPT(C)50/85mm 5.80
from 6.70m to 6.80m assumed zone of no recovery				6.80	7.80	89	55	NA	NA				
Assumed zone of no recovery. Stiff boulder CLAY with large granite boulders. (Driller's description).		7.35	-16.35										
Stiff brown slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. Cobbles are angular to subrounded of granite and gneiss.		7.80	-16.80										
				7.80	8.80	89	50	NA	NA				
Assumed zone of no recovery. Stiff boulder CLAY with large granite boulders. (Driller's description).		8.30	-17.30										
Exploratory hole complete at 8.80 m.		8.80	-17.80										

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log				Hole ID. D102				
Project No. TA7148														Header				
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -10.12m CD					Coordinates 397409.67 E, 804534.08 N National Grid													
Date Started 08/08/2013					Date Completed 08/08/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment		Shoring / Support		Remarks					
0.00	3.00	CP	08/08/2013	08/08/2013	TP	TW			Dando 3000									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow		
08/08/2013	1900	3.00	3.00	-13.30	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
											0.50	SPT	N=18 (4,3,5,4,4,5)		AR360	75	N/A	-13.20
											1.50	SPT	N=29 (5,6,7,6,8,8)		AR360	75	1.50	-13.30
											2.50	SPT	N=42 (6,8,9,9,11,13)		AR360	75	2.50	-13.30
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmss	Recovery %										
150	3.00	150	3.00															
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top Base		ID	Pipe Top Base		Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00	3.00	Arisings																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key																		
Log Print Date And Time: 23/12/2013 10:22:13																		
Form No. SIEXPHOLEHDR										Issue/Revision No. 1.05				Issue Date 22/10/2012		 SOIL ENGINEERING Part of the Bachy Soletanche Group		

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.	D102
Project No.	TA7148		Sheet 1 of 1	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	-10.12m CD	Coordinates	397409.67 E, 804534.08 N National Grid
Hole Type	CP	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation			
				Details	Dia.	TCR	SCR	RQD						
Medium dense grey slightly gravelly silty fine to medium SAND. Gravel is subangular to rounded fine to medium of granite, schist and gneiss. from 1.50m to 3.00m dense		0.00 0.50 1.00 1.50 2.00 2.50 3.00	-13.12	B001	0.00-0.50									
				D002	0.50					SPT18	0.50		0.95	
				B003	0.50-0.95									
				D004	1.00									
				D005	1.50						SPT29		1.50	1.95
				B006	1.50-1.95									
				D007	2.00									
				D008	2.50						SPT42		2.50	2.95
				B009	2.50-2.95									
Exploratory hole complete at 3.00 m.														

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	<h2 style="margin:0;">Exploratory Hole Log</h2>	Hole ID. <h1 style="margin:0;">D104</h1> Header
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Ground Level -9.80m CD	Coordinates 397462.40 E, 804685.20 N National Grid	
Date Started 22/09/2013	Date Completed 23/09/2013	Inclination Vertical

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00 8.25	8.25 11.60	CP RC	22/09/2013 23/09/2013	23/09/2013 23/09/2013	IC WW/RJ	DT DT	T6116	Impreg	Dando 3000 Deltabase 515		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow
22/09/2013	0400	8.25	7.95	-13.30	End of CP/Start of Rotary							
23/09/2013	0700	10.60	8.00	-13.80	End of Shift/Start of Shift							
23/09/2013	1300	11.60	10.00	-17.70	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
7.95	8.25	0200	0200	Chiselling	0.50	SPT(C)	N=32 (4,6,4,9,7,12)	AR360	75	N/A	-12.80
					1.50	SPT(C)	N=41 (10,12,12,10,9,10)	AR360	75	1.50	-13.00
					2.50	SPT(C)	50/150mm (15,10,18,32)	AR360	75	2.50	-14.00
					3.50	SPT(C)	N=52 (12,12,12,14,14,12)	AR360	75	3.50	-14.20
					4.50	SPT(C)	50/50mm (9,16,50/50)	AR360	75	4.50	-14.00
					5.50	SPT(C)	N=48 (9,8,9,9,16,14)	AR360	75	5.50	-13.45
					7.00	SPT(C)	50/250mm (10,10,12,17,11,10/25)	AR360	75	7.00	-13.45
					8.25	SPT(C)	50/0mm (25/0,50/0)	AR360	75	7.95	-13.30
					10.30	SPT(C)	50/156mm (7,9,14,11,25/6)	AR360	75	NR	NR

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
8.25	10.60	Water	100	Milky
10.60	11.60	Water	100	Brown

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmss	Recovery %
200	8.25	200	8.00					
121	10.00	121	10.00					
116	11.60							

INSTALLATION DETAILS				PIPE CONSTRUCTION				
Distance from G.L.	ID	Type	Response zone		ID	Pipe		Type of pipe
			Top	Base		Top	Base	

BACKFILL DETAILS				GENERAL NOTES							
Top of section	Base of section	Material	Remarks								
0.00	11.60	Arisings									

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.	D104
Project No.	TA7148		Sheet 1 of 2	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	-9.80m CD	Coordinates	397462.40 E, 804685.20 N National Grid	
Hole Type	CP+RC	Inclination	Vertical	

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
Loose to dense grey fine to coarse SAND.												
Dense grey slightly silty very gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz.	[Gravelly Sand Pattern]	0.50	-10.30	D001 0.50 B002 0.50-1.00						SPT(C)32 0.50	0.95	
				D003 1.50 B004 1.50-2.00						SPT(C)41 1.50	1.95	
				D005 2.50 B006 2.50-3.00						SPT(C)50/150mm 2.50	2.80	
				D007 3.50 D008 3.50-4.00						SPT(C)52 3.50	3.95	
				D009 4.50 B010 4.50-5.00						SPT(C)50/50mm 4.50	4.70	
				D011 5.50 B012 5.50-6.00						SPT(C)48 5.50	5.95	
				D013 6.50								
				B014 7.00-7.50						SPT(C)50/250mm 7.00	7.40	
				D015 7.50								
		No recovery. GRANITE boulder. (Driller's description)	*****	7.95	-17.75							
		Firm brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite and gneiss. Cobbles are angular to subrounded of granite and gneiss. from 8.25m to 8.40m strong grey boulder of granite	[Clay with Cobble Pattern]	8.25	-18.05	8.25 8.60 89 100 NA NA					SPT(C)50/0mm 8.25	8.25
						8.60 10.30 89 71 NA NA						
				9.80	-19.60							


NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		D104
Engineer	Arch Henderson LLP		Sheet 2 of 2
Employer	Aberdeen Harbour Board		

Ground Level	-9.80m CD	Coordinates	397462.40 E, 804685.20 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
Assumed zone of no recovery. Stiff greyish brown slightly sandy boulder clay with granite cobbles. (Driller's description)										SPT(C)50/156mm 10.30 10.61		
Firm brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite and gneiss. Cobbles are angular to subrounded of granite and gneiss. from 11.00m to 11.10m strong grey boulder of granite		10.60	-20.40	10.60 10.90	89	100	NA	NA				
Exploratory hole complete at 11.60 m.		11.60	-21.40	10.90 11.60	89	100	NA	NA				

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log				Hole ID. E65						
Project No. TA7148																				
Engineer Arch Henderson LLP																				
Employer Aberdeen Harbour Board														Header						
Ground Level -7.68m CD					Coordinates 397302.50 E, 804627.40 N National Grid															
Date Started 28/08/2013					Date Completed 29/08/2013					Inclination Vertical										
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment		Shoring / Support		Remarks							
0.00 7.50	7.50 10.60	CP RC	28/08/2013 29/08/2013	28/08/2013 29/08/2013	TP WW	TE TE	T6116	Impreg	Dando 3000 Deltabase 515											
PROGRESS										WATER STRIKES										
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow				
28/08/2013	1900	7.50	7.40	-6.60	End of CP															
29/08/2013	0730	7.50	7.40	NR	Start of Rotary															
29/08/2013	1900	10.60	7.50	-9.70	End of Hole															
CABLE PERCUSSION DETAILS										SPT DETAILS										
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks					Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
7.40		7.50		1615		0200		Chiselling					0.50	SPT	N=17 (3,4,4,4,5,4)		AR360	75	N/A	-9.30
													1.50	SPT	N=31 (5,6,7,7,8,9)		AR360	75	1.50	-9.10
													2.60	SPT	N=34 (5,7,8,8,9,9)		AR360	75	2.50	-8.90
													3.50	SPT	N=37 (6,7,8,9,9,11)		AR360	75	3.50	-8.60
													4.50	SPT	N=41 (7,7,9,11,10,11)		AR360	75	4.50	-8.40
													5.50	SPT	N=42 (7,9,11,9,12,10)		AR360	75	5.50	-8.00
													7.40	SPT(C)	50/0mm (25/0,50/0)		AR360	75	7.40	-7.70
													7.50	SPT(C)	50/0mm (25/0,50/0)		AR360	75	7.40	-6.60
													8.60	SPT(C)	N=43 (7,7,8,9,12,14)		AR360	75	7.50	-10.00
													9.50	SPT(C)	N=56 (6,9,11,11,14,20)		AR360	75	7.50	-10.30
ROTARY FLUSH DETAILS																				
From depth		To depth		Flush type		Flush return %		Flush colour												
7.50		10.60		Water		100		Brown												
HOLE DIAMETER / CASING				DYNAMIC SAMPLING																
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %												
200	7.40	200	7.50																	
121	7.50	121	7.80																	
116	10.60																			
INSTALLATION DETAILS					PIPE CONSTRUCTION															
Distance from G.L.	ID	Type	Response zone Top Base		ID	Pipe Top Base		Dia. of pipe	Type of pipe											
BACKFILL DETAILS										GENERAL NOTES										
Top of section	Base of section	Material			Remarks															
0.00	10.60	Arisings																		
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group										
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E65
Engineer	Arch Henderson LLP		Sheet 1 of 2
Employer	Aberdeen Harbour Board		

Ground Level	-7.68m CD	Coordinates	397302.50 E, 804627.40 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation				
				Details	Dia.	TCR	SCR	RQD	IF						
Dense brown slightly silty slightly gravelly fine to coarse SAND. Gravel is angular to subrounded fine to medium of granite, schist and gneiss. from 0.00m to 1.50m medium dense		0.00	-12.18	B001	0.00										
				D002	0.50					SPT17	0.50	0.95			
				B003	0.50-0.95										
				D004	1.00										
				D005	1.50						SPT31	1.50	1.95		
				B006	1.50-1.95										
				D007	2.00										
				D008	2.50						SPT34	2.60	3.05		
				B009	2.50-2.95										
				D010	3.00										
				D011	3.50						SPT37	3.50	3.95		
				B012	3.50-3.95										
				Dense brown slightly silty gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies.		4.50	-12.18	D014	4.50						
B015	4.50-4.95									SPT41	4.50	4.95			
D016	5.00														
D017	5.50										SPT42	5.50	5.95		
B018	5.50-5.95														
D019	6.00														
Very stiff high strength brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies. Cobbles are subangular to subrounded of granite, schist and gneiss. from 7.50m to 7.60m subangular to subrounded coarse gravel of granite and schist and subangular to subrounded cobbles of granite		7.50	-15.18		7.50	8.60	92	95	NA	NA		SPT(C)50/0mm 7.40 SPT(C)50/0mm 7.50	7.40 7.50		
												SPT(C)43	8.60	9.20	
					8.60	9.50	92	83	NA	NA	NA				
													SPT(C)56	9.50	10.10

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E65
Engineer	Arch Henderson LLP		Sheet 2 of 2
Employer	Aberdeen Harbour Board		

Ground Level	-7.68m CD	Coordinates	397302.50 E, 804627.40 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling			Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details		Dia.	TCR	SCR	RQD	IF		
Very stiff high strength brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies. Cobbles are subangular to subrounded of granite, schist and gneiss. Exploratory hole complete at 10.60 m.		10.60	-18.28	9.50	10.60	92	100	NA	NA			

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No. TA7148		E66
Engineer Arch Henderson LLP		Header
Employer Aberdeen Harbour Board		

Ground Level -8.19m CD	Coordinates 397333.60 E, 804672.90 N National Grid
Date Started 01/09/2013	Date Completed 02/09/2013
Inclination Vertical	

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00	10.40	CP	01/09/2013	02/09/2013	TP	TE			Dando 3000		
10.40	10.70	RO	02/09/2013	02/09/2013	WW	TE		4 3/4 R	Deltabase 515		
10.70	14.25	RC	02/09/2013	02/09/2013	WW	TE	T6116	Impreg	Deltabase 515		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow
01/09/2013	1900	10.10	10.10	-10.30	End of Shift							
02/09/2013	0700	10.10	10.10	-9.60	Start of Shift							
02/09/2013	1000	10.40	10.20	-9.90	End of CP/Start of Rotary							
02/09/2013	1900	14.25	11.00	-9.50	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
10.10	10.40	0800	0200	Chiselling	0.50	SPT(C)	N=17 (3,3,4,4,5,4)	AR360	75	N/A	-9.20
					1.50	SPT(C)	N=20 (4,5,4,5,5,6)	AR360	75	1.50	-9.30
					2.50	SPT(C)	N=30 (5,6,7,7,9)	AR360	75	2.50	-9.40
					3.50	SPT(C)	N=38 (6,8,8,9,11,10)	AR360	75	3.50	-9.40
					4.50	SPT(C)	N=43 (7,8,9,11,11,12)	AR360	75	4.50	-9.60
					5.50	SPT(C)	N=43 (8,9,11,10,10,12)	AR360	75	5.50	-9.70
					6.50	SPT(C)	N=49 (7,11,12,13,13,11)	AR360	75	6.50	-9.80
					8.00	SPT(C)	N=43 (9,10,11,10,10,12)	AR360	75	8.00	-9.90
					9.50	SPT(C)	N=52 (9,11,12,12,14,14)	AR360	75	9.50	-9.90
					10.20	SPT(C)	50/0mm (25/50,50/0)	AR360	75	10.20	-9.90
					11.00	SPT	N=32 (4,4,6,8,9,9)	AR360	75	11.00	-10.20
					12.80	SPT	N=31 (7,4,5,6,9,11)	AR360	75	11.00	-9.80

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
10.40	14.25	Water	100	Brown

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %
200	10.20	200	10.20					
121	11.00	125	11.00					
116	14.25							

INSTALLATION DETAILS				PIPE CONSTRUCTION					
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe

* Seating blows only.

BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	14.25	Arisings					

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.	E66
Project No.	TA7148		Sheet 1 of 3	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	-8.19m CD	Coordinates	397333.60 E, 804672.90 N National Grid	
Hole Type	RO+RC	Inclination	Vertical	

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation		
				Details	Dia.	TCR	SCR	RQD	IF				
Medium dense grey slightly gravelly silty fine to coarse SAND. Gravel is subangular to rounded fine of granite, schist and gneiss.				B001	0.00-0.50								
				B002	0.50-0.95					SPT(C)17 0.50	0.95		
				D003	1.00								
				B004	1.50-1.95					SPT(C)20 1.50	1.95		
				D005	2.00								
				B006	2.50-2.95					SPT(C)30 2.50	2.95		
				D007	3.00								
Dense grey slightly gravelly silty fine to coarse SAND. Gravel is angular to rounded fine of mixed igneous and metamorphic lithologies.		3.20	-11.39										
				B008	3.50-3.95				SPT(C)38 3.50	3.95			
				D009	4.00								
		B010	4.50-4.95					SPT(C)43 4.50	4.95				

NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key		 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.	E66
Project No.	TA7148		Sheet 2 of 3	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	-8.19m CD	Coordinates	397333.60 E, 804672.90 N National Grid	
Hole Type	RO+RC	Inclination	Vertical	

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
				D011	5.00							
				B012	5.50-5.95					SPT(C)43 5.50	5.95	
				D013	6.00							
				B014	6.50-6.95					SPT(C)49 6.50	6.95	
				D015	7.00							
				B016	8.00-8.45					SPT(C)43 8.00	8.45	
				D017	9.00							
				B018	9.50-9.95					SPT(C)52 9.50	9.95	

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.	E66
Project No.	TA7148		Sheet 3 of 3	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	-8.19m CD	Coordinates	397333.60 E, 804672.90 N National Grid	
Hole Type	RO+RC	Inclination	Vertical	

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
Hard strata. (Driller's description)		10.10	-18.29	D019 10.00								
Rotary openhole drilling. BOULDERS. (Driller's description)		10.40	-18.59							SPT(C)50/0mm 10.20		
No recovery. Stiff brown slightly sandy boulder CLAY. (Driller's description)		10.70	-18.89	10.70 11.00	92	0	NA	NA				
Very stiff high strength brown slightly sandy gravelly CLAY with low cobble content. Sand is fine. Gravel is subangular to rounded of mixed igneous and metamorphic lithologies. Cobbles are subangular to subrounded of granite and schist. from 11.32m to 11.60m assumed zone of no recovery		11.00	-19.19	11.00 11.60	92	53	NA	NA		SPT32 11.00		
				11.60 12.80	92	100	NA	NA		NA		
				12.80 14.25	92	100	NA	NA		SPT31 12.80		
Exploratory hole complete at 14.25 m.		14.25	-22.44									

NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key		 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No. TA7148		E69
Engineer Arch Henderson LLP		Header
Employer Aberdeen Harbour Board		

Ground Level -7.10m CD	Coordinates 397306.30 E, 804773.60 N National Grid
Date Started 03/09/2013	Date Completed 04/09/2013
Inclination Vertical	

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00 7.30	7.30 10.60	CP RC	03/09/2013 03/09/2013	03/09/2013 04/09/2013	TF MM	DT DT	T6116	Impreg	Dando 3000 Deltabase 515		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow
03/09/2013	1700	7.30	7.00	-5.00	End of CP							
03/09/2013	1900	7.30	7.00	-9.30	Start of Rotary							
04/09/2013	0200	10.60	7.60	-9.70	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
6.90	7.50	1500	0200	Chiselling	0.50	SPT(C)	N=17 (3,3,4,5,4,4)	AR360	75	N/A	-6.60
					1.50	SPT(C)	N=19 (3,4,4,4,5,6)	AR360	75	1.50	-6.50
					2.50	SPT(C)	N=29 (4,6,7,7,8,7)	AR360	75	2.50	-6.40
					3.50	SPT(C)	N=39 (7,8,9,10,9,11)	AR360	75	3.50	-6.20
					4.50	SPT(C)	N=40 (7,10,11,9,10,10)	AR360	75	4.50	-6.10
					6.00	SPT(C)	N=49 (8,10,11,12,12,14)	AR360	75	6.00	-5.70
					8.60	SPT	50/235mm (5,9,12,15,15,8/10)	AR360	75	7.20	-9.60
					9.60	SPT	50/230mm (6,10,12,14,18,6/5)	AR360	75	7.60	-9.70

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
7.30	10.60	Water	100	Brown

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %
200 116	7.30 10.60	200	7.20					

INSTALLATION DETAILS				PIPE CONSTRUCTION				
Distance from G.L.	ID	Type	Response zone Top / Base	ID	Pipe Top / Base	Dia. of pipe	Type of pipe	

BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	10.60	Arisings					

Project Name Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No. TA7148		E69
Engineer Arch Henderson LLP		
Employer Aberdeen Harbour Board		Sheet 1 of 2

Ground Level -7.10m CD	Coordinates 397306.30 E, 804773.60 N National Grid
Hole Type CP+RC	Inclination Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation			
				Details	Dia.	TCR	SCR	RQD	IF					
Medium dense grey slightly gravelly silty fine to coarse SAND. Gravel is angular to subrounded fine to medium of mixed igneous and metamorphic lithologies including granite, schist, gneiss and quartz.				B001	0.00-0.50									
				B002	0.50-0.95						SPT(C)17 0.50	0.95		
				D003	1.00									
				B004	1.50-1.95							SPT(C)19 1.50	1.95	
				D005	2.00									
				B006	2.50-2.95							SPT(C)29 2.50	2.95	
				D007	3.00									
				B008	3.50-3.95							SPT(C)39 3.50	3.95	
				D009	4.00									
				B010	4.50-4.95							SPT(C)40 4.50	4.95	
				D011	5.00									
				B012	6.00-6.45							SPT(C)49 6.00	6.45	
				D013	6.50									
No recovery. Large granite and gneiss BOULDERS. (Driller's description)		6.90	-14.00											
Very stiff very high strength brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite, schist, gneiss and quartz. Cobbles are angular to subangular of granite, gneiss and schist.		7.30	-14.40											
				7.30	8.60	93	100	NA	NA					
				8.60	9.60	93	100	NA	NA	NA	SPT50/235mm 8.60	8.99		
										SPT50/230mm 9.60	9.98			

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E69
Engineer	Arch Henderson LLP		Sheet 2 of 2
Employer	Aberdeen Harbour Board		

Ground Level	-7.10m CD	Coordinates	397306.30 E, 804773.60 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
<p>Very stiff very high strength brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite, schist, gneiss and quartz. Cobbles are angular to subangular of granite, gneiss and schist.</p> <p style="padding-left: 20px;">from 10.26m to 10.45m 1 No very strong pink and grey boulder of granite</p> <p style="padding-left: 20px;">from 10.45m to 10.60m assumed zone of no recovery</p> <p>Exploratory hole complete at 10.60 m.</p>		10.60	-17.70	9.60	10.60	93	85	NA	NA		

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Project Name Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No. TA7148		E71
Engineer Arch Henderson LLP		Header
Employer Aberdeen Harbour Board		

Ground Level -7.18m CD	Coordinates 397326.90 E, 804825.20 N National Grid
Date Started 13/09/2013	Date Completed 13/09/2013
Inclination Vertical	

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00 10.30	10.30 13.30	CP RC	13/09/2013 13/09/2013	13/09/2013 13/09/2013	TP WW	DT DT	T6116	Impreg	Dando 3000 Deltabase 515		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow
13/09/2013	1730	10.30	10.00	-8.40	End of CP/Start of Rotary							
13/09/2013	1940	13.30	10.00	-6.90	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
9.50	10.30	1500	0200	Chiselling	0.50	SPT(C)	N=19 (3,4,4,5,5,5)	AR360	75	N/A	-10.90
					1.50	SPT(C)	N=20 (4,5,4,5,5,6)	AR360	75	1.50	-10.70
					2.50	SPT(C)	N=25 (5,7,6,7,6,6)	AR360	75	2.50	-10.60
					3.50	SPT(C)	N=35 (7,8,8,9,9,9)	AR360	75	3.50	-10.30
					4.50	SPT(C)	N=40 (6,9,10,9,10,11)	AR360	75	4.50	-10.40
					6.00	SPT(C)	N=40 (10,9,11,10,9,10)	AR360	75	6.00	-9.80
					7.50	SPT(C)	N=44 (9,11,10,11,11,12)	AR360	75	7.50	-9.60
					9.00	SPT(C)	N=50 (10,12,11,13,12,14)	AR360	75	9.00	-9.10
					9.50	SPT(C)	50/0mm (25/0,50/0)	AR360	75	9.50	-9.10
					10.30	SPT(C)	50/0mm (25/0,50/0)	AR360	75	10.00	-8.40
					11.80	SPT(C)	N=35 (6,6,8,7,9,11)	AR360	75	10.00	-7.70

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
10.30	13.30	Water	100	Brown




HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %
200 116	10.00 13.30	200	10.00					


INSTALLATION DETAILS				PIPE CONSTRUCTION					
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe

BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	13.30	Arisings					

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.	E71
Project No.	TA7148		Sheet 1 of 2	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	-7.18m CD	Coordinates	397326.90 E, 804825.20 N National Grid	
Hole Type	CP+RC	Inclination	Vertical	

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Medium dense grey slightly gravelly silty fine to coarse SAND. Gravel is subangular to rounded fine to medium of mixed igneous and metamorphic lithologies.		0.00-0.50		B001	0.00-0.50						
				B002	0.50-0.95					SPT(C)19 0.50	0.95
				D003	1.06						
				B004	1.50-1.95					SPT(C)20 1.50	1.95
				D005	2.00						
				B006	2.50-2.95					SPT(C)25 2.50	2.95
				D007	3.00						
Medium dense grey slightly gravelly silty fine to coarse SAND. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and quartz.		3.40	-10.58	B008	3.50-3.95					SPT(C)35 3.50	3.95
				D009	4.00						
				B010	4.50-4.95					SPT(C)40 4.50	4.95
				D011	5.00						
				B012	6.00-6.45					SPT(C)40 6.00	6.45
				D013	6.50						
				B014	7.50-7.95					SPT(C)44 7.50	7.95
No recovery. Boulder CLAY with boulders. (Driller's description)		9.50	-16.68	B016	9.00-9.45					SPT(C)50 9.00	9.45
										SPT(C)50/0mm 9.50	9.50


NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key		 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E71
Engineer	Arch Henderson LLP		
Employer	Aberdeen Harbour Board		Sheet 2 of 2



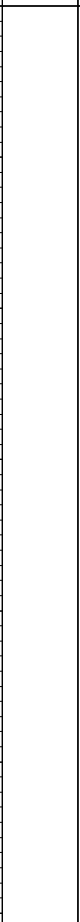






Ground Level	-7.18m CD	Coordinates	397326.90 E, 804825.20 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
No recovery. Boulder CLAY with boulders. (Driller's description)		10.30	-17.48								
Stiff very high to extremely high strength brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite and gneiss. Cobbles are angular to subrounded of granite and gneiss.				10.30	11.80	89	87	NA	NA	NA	SPT(C)50/0mm 10.30 10.30
from 11.50m to 11.60m 1 No subangular cobble of pink and grey granite from 11.60m to 11.80m assumed zone of no recovery from 11.85m to 11.94m 1 No subangular cobble of dark grey gneiss				11.80	13.30	89	100	NA	NA	NA	SPT(C)35 11.80 12.25
from 13.27m to 13.30m assumed zone of no recovery Exploratory hole complete at 13.30 m.		13.30	-20.48								

NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Unchecked	Log Print Date And Time: 23/12/2013 10:31:46	
Form No. SIEXPHOLELOG	Issue/Revision No. 1.05 Issue Date 22/10/2012	

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. E72							
Project No. TA7148													Header							
Engineer Arch Henderson LLP																				
Employer Aberdeen Harbour Board																				
Ground Level -5.59m CD					Coordinates 397295.90 E, 804919.80 N National Grid															
Date Started 14/09/2013					Date Completed 14/09/2013					Inclination Vertical										
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment		Shoring / Support		Remarks							
0.00 6.50	6.50 9.60	CP RC	14/09/2013 14/09/2013	14/09/2013 14/09/2013	TP WW	DT DT	T6116	Impreg	Dando 3000 Deltabase 515											
PROGRESS										WATER STRIKES										
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike	depth to seal flow				
14/09/2013 14/09/2013	1500 1900	6.50 9.60	6.10 6.50	-8.90 -9.00	End of CP/Start of Rotary End of Hole															
CABLE PERCUSSION DETAILS										SPT DETAILS										
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks					Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
6.15		6.50		1230		0200		Chiselling					0.50	SPT(C)	N=15 (3,3,4,3,4,4)		AR360	75	N/A	-9.60
													1.50	SPT(C)	N=26 (4,5,6,6,8,6)		AR360	75	1.50	-9.50
													2.00	SPT(C)	N=31 (5,7,7,8,7,9)		AR360	75	2.50	-9.30
													3.50	SPT(C)	N=40 (5,8,9,9,11,11)		AR360	75	3.50	-9.20
													4.50	SPT(C)	N=42 (6,7,9,11,10,12)		AR360	75	4.50	-9.10
													6.00	SPT(C)	50/0mm (11,14,50/0)		AR360	75	6.00	-8.90
ROTARY FLUSH DETAILS																				
From depth		To depth		Flush type		Flush return %		Flush colour												
6.50		9.60		Water		100		Brown												
HOLE DIAMETER / CASING				DYNAMIC SAMPLING																
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmss	Recovery %												
200	6.50	121	6.10																	
121	6.50	121	6.50																	
116	9.60																			
INSTALLATION DETAILS					PIPE CONSTRUCTION															
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe											
BACKFILL DETAILS										GENERAL NOTES										
Top of section		Base of section		Material		Remarks														
0.00 6.90		6.90 9.60		Arisings Grout																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group										
Unchecked					Log Print Date And Time: 23/12/2013 10:31:52															
Form No. SIEXPHOLEHDR					Issue/Revision No. 1.05					Issue Date 22/10/2012										

Ground Level	-5.59m CD	Coordinates	397295.90 E, 804919.80 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation			
				Details	Dia.	TCR	SCR	RQD	IF					
Medium dense brown silty gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. from 1.50m to 1.95m slightly gravelly				B001	0.00-0.50									
				B002	0.50-0.95						SPT(C)15	0.50	0.95	
				D003	1.00									
				B004	1.50-1.95							SPT(C)26	1.50	1.95
				D005	2.00							SPT(C)31	2.00	2.45
				B006	2.50-2.95									
				D007	3.00									
				B008	3.50-3.95							SPT(C)40	3.50	3.95
				D009	4.00									
				D010	5.00							SPT(C)42	4.50	4.95
								SPT(C)50/0mm	6.00	6.15				
No recovery. Hard strata, BOULDERS and possible boulder clay. (Driller's description)		6.15	-11.74											
Very strong light grey BOULDER of gneiss.		6.50	-12.09											
Stiff brown sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist.		6.66	-12.25								NA			
Extremely weak reddish brown speckled grey GNEISS. Recovered as non intact core (angular fine to coarse gravel sized fragments) and with dark brown staining penetrating full core diameter.		6.90	-12.49		6.50	8.00	92	73	27	9	NI			
Assumed zone of no recovery. Decomposed GRANITE. (Driller's description)		7.85	-13.44								NA			
Weak locally medium strong light grey GNEISS. Discontinuities: 1) 40-50 degrees closely spaced planar rough stained brown on surfaces.		8.00	-13.59		8.00	8.90	92	100	55	11	NA			
from 8.20m to 8.50m, 8.90m to 9.15m and 9.30m to 9.40m extremely weak dark reddish brown stained and recovered as non intact core (angular fine to coarse gravel sized fragments)					8.90	9.60	92	71	7	0	NA			
from 9.10m to 9.20m reddish brown, recovered as non intact core (sandy clay. Sand is fine to coarse)											100			
		9.60	-15.19											


NOTES: All depths in metres, all diameters in millimetres.
 See header sheet for details of boring, progress and water.
 For details of abbreviations, see key

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.	E72
Project No.	TA7148		Sheet 1+ of 1	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	-5.59m CD	Coordinates	397295.90 E, 804919.80 N National Grid	
Hole Type	CP+RC	Inclination	Vertical	

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Remaining Detail : 9.40m - 9.60m : from 9.40m to 9.60m assumed zone of no recovery ----- Exploratory hole complete at 9.60 m.											


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Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. E74			
Project No. TA7148													Header			
Engineer Arch Henderson LLP																
Employer Aberdeen Harbour Board																
Ground Level -7.99m CD					Coordinates 397299.50 E, 805021.10 N National Grid											
Date Started 17/09/2013					Date Completed 19/09/2013					Inclination Vertical						
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks					
0.00 0.40	0.40 6.10	CP RC	17/09/2013 18/09/2013	18/09/2013 19/09/2013	TT TT	DT TW	T6116	Impreg	Dando 3000 Deltabase 515							
PROGRESS										WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow
18/09/2013	0930	0.40	0.40	-8.60	End of CP/Start of Rotary											
18/09/2013	1930	4.60	3.10	-8.00	End of Shift/Start of Shift											
19/09/2013	0700	6.10	3.10	-7.10	End of Hole											
CABLE PERCUSSION DETAILS										SPT DETAILS						
Hard Strata Depth from to		Chiselling Start time hhmm Duration hhmm		Remarks					Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
0.20	0.25	1800	0100	Chiselling					0.40	SPT(C)	50/0mm (25/0,50/0)		AR360	75	N/A	-8.20
0.25	0.40	0830	0100	Chiselling					1.30	SPT(C)	50/10mm (25/10,50/10)		AR360	75	1.30	-8.30
									3.10	SPT(C)	50/0mm (25/0,50/0)		AR360	75	3.10	-8.05
ROTARY FLUSH DETAILS																
From depth	To depth	Flush type		Flush return %	Flush colour											
0.40	6.10	Water		0	-											
HOLE DIAMETER / CASING				DYNAMIC SAMPLING												
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time h:mm:ss	Recovery %								
155	3.10	150	3.10													
116	6.10															
INSTALLATION DETAILS					PIPE CONSTRUCTION											
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe							
BACKFILL DETAILS										GENERAL NOTES						
Top of section	Base of section	Material			Remarks											
0.00	3.10	Arisings														
3.10	6.10	Grout														
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group						
Log Print Date And Time: 23/12/2013 10:32:03																
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012										

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E74
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-7.99m CD	Coordinates	397299.50 E, 805021.10 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
COBBLES and BOULDERS with sand lenses. (Driller's description)										SPT(C)50/0mm 0.40	
COBBLES and BOULDERS of mixed igneous and metamorphic lithologies including granite and gneiss. Recovered as angular cobble and boulder sized fragments.		0.90	-8.89	0.90	1.30	92	100	NA	NA	SPT(C)50/10mm 1.30	
Strong pink and grey BOULDER of granite.		1.00	-8.99	1.30	1.70	92	100	NA	NA		
COBBLES and BOULDERS of mixed igneous and metamorphic lithologies including granite and gneiss. Recovered as angular cobble sized fragments.		1.70	-9.69	1.70	1.80	92	100	NA	NA	NA	
from 2.21m to 2.40m assumed zone of no recovery		1.80		1.80	2.40	92	76	NA	NA		
No recovery. BOULDERS with sand lenses. (Driller's description)		2.40	-10.39	2.40	3.10	92	0	0	0	SPT(C)50/0mm 3.10	
Assumed zone of no recovery. BOULDERS with sand lenses (drillers descrption)		3.10	-11.09								
Strong pink and grey coarse crystalline GRANITE. Discontinuities: 1) 20-40 degrees closely locally very closely spaced planar rough locally clay smeared. 2) 70-90 degrees very closely to closely spaced planar rough stained brown. from 3.50m to 3.65m 1 No incipient fracture 80 degrees planar from 3.77m to 3.88m many randomly orientated incipient fractures from 3.97m to 4.09m 1 No discontinuity 10 degrees planar stained dark brown from 4.15m to 4.22m recovered as non intact core (very angular medium gravel sized fragments) from 4.32m to 4.47m recovered as non intact core (very angular medium to coarse gravel sized fragments) from 4.60m to 6.10m discontinuities: 1) closely to medium spaced at 4.70m 1 No discontinuity 10-20 degrees undulating smooth clean from 4.92m to 5.02m 1 No discontinuity 70 degrees undulating smooth clean from 5.14m to 5.28m discontinuities: 2) perpendicular through core axis from 5.50m to 5.68m recovered as non intact core (very angular medium to coarse gravel sized fragments) from 5.95m to 6.10m assumed zone of no recovery		3.50	-11.49	3.10	4.60	92	70	65	45	NI 170 320	
Exploratory hole complete at 6.10 m.		6.10	-14.09	4.60	6.10	92	90	78	61		

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. E75								
Project No. TA7148																					
Engineer Arch Henderson LLP																					
Employer Aberdeen Harbour Board													Header								
Ground Level -8.36m CD					Coordinates 397342.40 E, 805059.50 N National Grid																
Date Started 19/09/2013					Date Completed 20/09/2013					Inclination Vertical											
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment		Shoring / Support		Remarks								
0.00 4.00	4.00 6.90	CP RC	19/09/2013 20/09/2013	19/09/2013 20/09/2013	TT RJ	DT DT	T6116	Impreg	Dando 3000 Deltabase 515												
PROGRESS										WATER STRIKES											
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow					
19/09/2013	1900	4.00	4.00	-14.70	End of CP																
20/09/2013	0700	4.00	4.00	-11.30	Start of Rotary																
20/09/2013	1200	6.90	4.00	-12.00	End of Hole																
CABLE PERCUSSION DETAILS										SPT DETAILS											
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks					Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth	
0.25		0.50		1100		0030		Chiselling					0.50	SPT(C)	50/50mm (25/70,50/50)		AR360	75	N/A	-11.40	
0.90		1.00		1145		0030		Chiselling					1.50	SPT(C)	50/50mm (25/65,50/50)		AR360	75	1.50	-11.60	
1.25		1.50		1235		0100		Chiselling					3.00	SPT(C)	50/50mm (25/45,50/50)		AR360	75	3.00	-11.70	
3.80		4.00		1430		0100		Chiselling													
ROTARY FLUSH DETAILS																					
From depth		To depth		Flush type		Flush return %		Flush colour													
4.00		6.90		Water		100		Pink													
HOLE DIAMETER / CASING				DYNAMIC SAMPLING																	
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %													
155	4.00	150	4.00																		
116	6.90																				
INSTALLATION DETAILS					PIPE CONSTRUCTION																
Distance from G.L.	ID	Type	Response zone Top Base		ID	Pipe Top Base		Dia. of pipe	Type of pipe												
BACKFILL DETAILS										GENERAL NOTES											
Top of section		Base of section		Material		Remarks															
0.00		4.00		Arisings																	
4.00		6.90		Grout																	
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group											
Log Print Date And Time: 23/12/2013 10:32:12																					
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012															

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E75
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-8.36m CD	Coordinates	397342.40 E, 805059.50 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation						
				Details	Dia.	TCR	SCR	RQD	IF								
Very dense slightly silty sandy angular to rounded fine to coarse GRAVEL of mixed igneous and metamorphic lithologies. Sand is fine to coarse. from 0.25m to 0.50m driller notes boulder		0.60	-8.96	D001	0.00-0.20												
B002				0.50-0.60	SPT(C)50/50mm								0.50	0.62			
D003				1.00-1.20													
B004				1.00-1.50													
D005				2.00-2.20													
B006				2.50-3.00													
D007				3.50-3.60													
No recovery. Pink and grey GRANITE. (Driller's description)		3.60	-11.96														
Very weak to weak pink and grey coarse crystalline GRANITE (locally with quartz mineralisation). Recovered as non intact core (slightly sandy angular to subrounded fine to coarse gravel sized fragments. Sand sized fragments are fine to medium). from 5.40m to 5.46m intact with 1 No discontinuity 90 degrees planar smooth clean and quartz mineralisation from 5.89m to 6.02m intact with 1 No discontinuity 80 degrees planar smooth with quartz mineralisation from 5.99m to 6.02m 1 No 80-90 degrees thin vein of quartz		4.00	-12.36	4.00	5.30	92	100	0	0	NI NI 130							
5.30				6.90	92	100	12	8									
Exploratory hole complete at 6.90 m.																	
		6.90	-15.26														

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	<h2 style="margin:0;">Exploratory Hole Log</h2>	Hole ID. <h1 style="margin:0;">E105</h1> Header
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Ground Level -13.88m CD	Coordinates 397563.99 E, 804558.35 N National Grid	
Date Started 18/07/2013	Date Completed 18/07/2013	Inclination Vertical

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00	6.00	CP	18/07/2013	18/07/2013	TP	DT			Dando 3000		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow
18/07/2013	2000	6.00	6.00	-15.20	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
					1.00	SPT	N=16 (3,3,4,3,4,5)	AR360	75	1.00	-15.70
					2.00	SPT	N=25 (3,5,6,5,6,8)	AR360	75	2.00	-15.60
					3.00	SPT	N=30 (4,6,7,6,8,9)	AR360	75	3.00	-15.20
					4.00	SPT	N=29 (4,5,6,7,7,9)	AR360	75	4.00	-15.00
					5.00	SPT	N=40 (7,8,9,9,11,11)	AR360	75	5.00	-14.70

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time h:mm:ss	Recovery %
200	6.00	200	6.00					


INSTALLATION DETAILS				PIPE CONSTRUCTION					
Distance from G.L.	ID	Type	Response zone		ID	Pipe		Dia. of pipe	Type of pipe
			Top	Base		Top	Base		

BACKFILL DETAILS				GENERAL NOTES							
Top of section	Base of section	Material	Remarks								
0.00	6.00	Grout									

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E105
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-13.88m CD	Coordinates	397563.99 E, 804558.35 N National Grid
Hole Type	CP	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD				
Grey slightly silty gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.		0.90	-14.78	B002	0.00-1.00							
ES001				0.50								
Medium dense grey slightly silty gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of granite, schist and quartzite.				D003	1.00-1.45						SPT16	1.45
				B004	1.00-1.45						1.00	
				ES005	1.50							
				B006	1.50-2.00							
				D007	2.00-2.45						SPT25	2.45
				B008	2.00-2.45						2.00	
				ES009	2.50							
				B010	2.50-3.00							
				D011	3.00-3.45						SPT30	3.45
				B012	3.00-3.45						3.00	
ES013				3.50								
B014				3.50-4.00								
D015				4.00-4.45						SPT29	4.45	
B016				4.00-4.45						4.00		
ES017				4.50								
B018				4.50-5.00								
D019				5.00-5.45						SPT40	5.45	
B020				5.00-5.45						5.00		
ES021				5.50								
B022				5.50-6.00								
Exploratory hole complete at 6.00 m.		6.00	-19.88									


Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log				Hole ID. E106					
Project No. TA7148														Header					
Engineer Arch Henderson LLP																			
Employer Aberdeen Harbour Board																			
Ground Level -14.70m CD					Coordinates 397599.89 E, 804543.38 N National Grid														
Date Started 19/07/2013					Date Completed 19/07/2013					Inclination Vertical									
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks								
0.00	6.00	CP	19/07/2013	19/07/2013	TP	DT			Dando 3000										
PROGRESS										WATER STRIKES									
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow			
19/07/2013	1400	6.00	6.00	-16.30	End of Hole														
CABLE PERCUSSION DETAILS										SPT DETAILS									
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm			Hammer No.	Energy ratio %	Casing depth	Water depth
											1.00	SPT	N=13 (2,3,3,4,3,3)			AR360	75	1.00	-16.70
											2.00	SPT	N=25 (3,4,5,7,7,6)			AR360	75	2.00	-16.80
											3.00	SPT	N=32 (4,5,7,8,7,10)			AR360	75	3.00	-13.00
											4.00	SPT	N=46 (6,7,9,11,12,14)			AR360	75	4.00	-17.70
											5.00	SPT	N=50 (7,8,11,12,12,15)			AR360	75	5.00	-16.30
ROTARY FLUSH DETAILS																			
From depth		To depth		Flush type		Flush return %		Flush colour											
HOLE DIAMETER / CASING				DYNAMIC SAMPLING															
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmss	Recovery %											
200	6.00	200	6.00																
INSTALLATION DETAILS					PIPE CONSTRUCTION														
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe										
BACKFILL DETAILS										GENERAL NOTES									
Top of section	Base of section	Material			Remarks														
0.00	6.00	Grout																	
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group									
Log Print Date And Time: 23/12/2013 10:22:30																			
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012													

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E106
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-14.70m CD	Coordinates	397599.89 E, 804543.38 N National Grid
Hole Type	CP	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation			
				Details	Dia.	TCR	SCR	RQD						
Medium dense grey slightly silty slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of granite, schist and quartzite.		1.30	-16.00	B002	0.00-1.00									
ES001				0.50										
D003				1.00-1.45							SPT13	1.45		
B004				1.00-1.45										
Medium dense grey slightly silty slightly gravelly fine to coarse SAND. Gravel is angular to subrounded fine to medium of granite, schist and quartzite.			3.80	-18.50	ES005	1.50								
B006					1.50-2.00									
D007					2.00-2.45							SPT25	2.45	
B008					2.00-2.45									
ES009					2.50									
B010					2.50-3.00									
from 3.00m to 3.80m dense				6.00	-20.70	D011	3.00-3.45					SPT32	3.45	
B012						3.00-3.45								
ES013						3.50								
B014						3.50-4.00								
Dense grey slightly silty slightly gravelly fine to coarse SAND. Gravel is angular to subrounded fine to medium of granite, schist and quartzite.		6.00	-20.70	D015	4.00-4.45					SPT46	4.45			
B016				4.00-4.45										
ES017				4.50										
B018				4.50-5.00										
D019				5.00-5.45								SPT50	5.45	
B020				5.00-5.45										
Exploratory hole complete at 6.00 m.				ES021	5.50									
				B022	5.50-6.00									

NOTES: All depths in metres, all diameters in millimetres.
 See header sheet for details of boring, progress and water.
 For details of abbreviations, see key


Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. E107					
Project No. TA7148													Header					
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -13.15m CD					Coordinates 397600.63 E, 804504.87 N National Grid													
Date Started 07/08/2013					Date Completed 07/08/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00	3.00	CP	07/08/2013	07/08/2013	TP	TW			Dando 3000									
3.00	4.50	RO	07/08/2013	07/08/2013	WW	TW	5 3/4 RR		Deltabase 515									
4.50	6.00	CP	07/08/2013	07/08/2013	TP	TW	T6116	Impreg	Dando 3000									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow		
07/08/2013	1900	6.00	6.00	-14.60	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
2.95		3.00		1100		0200		Chiselling			0.50	SPT	N=19 (3,4,5,5,6,3)		AR360	75	N/A	-13.20
											1.50	SPT	N=32 (4,7,7,8,9,8)		AR360	75	1.50	-13.10
											2.50	SPT	N=47 (2,9,8,11,12,16)		AR360	75	2.50	-13.60
											3.50	SPT(C)	50/0mm (25/0,50/0)		AR360	75	3.50	-13.90
											4.50	SPT(C)	N=42 (8,11,11,10,9,12)		AR360	75	4.50	-14.50
											5.50	SPT(C)	N=43 (7,10,10,11,10,12)		AR360	75	5.50	-14.60
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
3.00		4.50		Air/Mist		100		Brown & grey										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %										
200	6.00	200	6.00															
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00	6.00	Arisings																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
Log Print Date And Time: 23/12/2013 10:33:28																		
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012												

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E107
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-13.15m CD	Coordinates	397600.63 E, 804504.87 N National Grid
Hole Type	CP+RO	Inclination	Vertical


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation		
				Details	Dia.	TCR	SCR	RQD					
Medium dense slightly silty slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of mixed igneous and metamorphic lithologies.				B001	0.00-0.50								
				D002	0.50					SPT19	0.50	0.95	
				B003	0.50-0.95								
				D004	1.00								
				D005	1.50					SPT32	1.50	1.95	
				B006	1.50-1.95								
				D007	2.00								
				D008	2.50					SPT47	2.50	2.95	
				B009	2.50-2.95								
Rotary openhole drilling. COBBLES and BOULDERS. (Driller's description)		2.95	-16.10										
										SPT(C)50/0mm	3.50	3.50	
Dense grey slightly gravelly silty fine to coarse SAND. Gravel is subangular to subrounded fine of mixed igneous and metamorphic lithologies.		4.50	-17.65	D010	4.50					SPT(C)42	4.50	4.95	
					B011	4.50-4.95							
					D012	5.00							
					D013	5.50				SPT(C)43	5.50	5.95	
Exploratory hole complete at 6.00 m.		6.00	-19.15										

NOTES: All depths in metres, all diameters in millimetres.
 See header sheet for details of boring, progress and water.
 For details of abbreviations, see key

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log				Hole ID. E108				
Project No. TA7148														Header				
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -12.64m CD					Coordinates 397487.08 E, 804460.80 N National Grid													
Date Started 11/07/2013					Date Completed 13/07/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00 3.65	3.65 6.65	CP RC	11/07/2013 12/07/2013	11/07/2013 13/07/2013	TP WW	DT DT	T6116	Impreg	Dando 3000 Deltabase 515									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow		
11/07/2013	1700	3.65	3.65	-13.40	End of CP													
11/07/2013	1710	3.65	3.65	-13.40	Start of Rotary													
11/07/2013	1900	3.85	3.65	-13.50	End of Shift													
12/07/2013	0700	3.85	3.65	NR	Start of Shift													
12/07/2013	1900	4.85	3.65	NR	End of Shift													
13/07/2013	0700	4.85	3.65	-14.60	Start of Shift													
13/07/2013	1400	6.65	3.65	-14.10	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
3.60		3.65		1430		0100		Chiselling			1.00	SPT	N=4 (1,1,1,1,1)		AR360	75	1.00	-13.70
3.65		3.65		1530		0100		Chiselling			2.00	SPT	N=7 (1,2,1,2,2,2)		AR360	75	2.00	-13.80
											3.00	SPT(C)	N=34 (4,6,8,8,9,9)		AR360	75	3.00	-13.80
											3.65	SPT(C)	50/0mm (25/0,50/0)		AR360	75	3.65	-15.60
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
3.65		6.65		Air/Mist		100		Pink										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmss	Recovery %										
200	3.65	200	3.65															
116	6.65																	
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00	6.65	Grout																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
Log Print Date And Time: 23/12/2013 10:32:19																		
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012												

Ground Level -12.64m CD	Coordinates 397487.08 E, 804460.80 N National Grid	
Hole Type CP+RC	Inclination Vertical	


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation			
				Details	Dia.	TCR	SCR	RQD	IF					
Loose dark grey slightly silty gravelly fine to coarse SAND. Gravel is angular to subrounded fine of mixed igneous and metamorphic lithologies.		1.90 3.60 3.65	-14.54 -16.24 -16.29	B001	0.00-1.00									
				ES002	0.40									
				D003	1.00							SPT4	1.45	
				D004	1.00-1.45									
				B005	1.00-1.45									
				D006	1.50-1.95									
Medium dense dark grey slightly silty gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of mixed igneous and metamorphic lithologies. from 1.90m to 3.60m driller notes clay bands		3.60 3.65	-16.24 -16.29	D007	2.00-2.45									
				B008	2.00-2.45							SPT7	2.45	
				ES009	2.50									
				B010	2.60-3.40									
				B011	3.00-3.45								SPT(C)34	3.45
				D012	3.00-3.45									
Dense dark grey very gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of granite and schist. Strong to very strong grey speckled pink GRANITE. Discontinuities: 1) 20-30 degrees closely spaced planar rough clean. 2) 70-80 degrees medium spaced planar rough clean. from 4.20m to 4.52m 1 No pink and white quartzite vein 10-80 degrees undulating (8-22mm) from 4.65m to 4.70m recovered as non intact core (angular coarse gravel sized fragments) from 5.68m to 5.89m recovered as non intact core (angular coarse gravel sized fragments) from 6.35m to 6.40m recovered as non intact core (angular coarse gravel sized fragments)		3.65 4.85 5.95 6.65	-16.29 -19.29		3.65	4.85	92	100	96	22				
					4.85	5.95	92	100	81	31				
					5.95	6.65	92	100	93	17				
Exploratory hole complete at 6.65 m.														

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. E109					
Project No. TA7148													Header					
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -12.23m CD					Coordinates 397491.45 E, 804500.34 N National Grid													
Date Started 17/07/2013					Date Completed 17/07/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00	5.90	CP	17/07/2013	17/07/2013	TP	DT			Dando 3000									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow		
17/07/2013	2000	5.90	5.80	-10.00	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
5.80		5.90		1730		0200		Chiselling			1.00	SPT	N=24 (2,2,3,5,7,9)		AR360	75	1.00	-13.95
											2.00	SPT	N=32 (4,6,7,8,8,9)		AR360	75	2.00	-13.15
											3.00	SPT	N=34 (4,6,8,8,9,9)		AR360	75	3.00	-13.20
											4.00	SPT	N=34 (5,7,7,9,9,9)		AR360	75	4.00	-12.20
											5.00	SPT	N=37 (6,8,9,8,9,11)		AR360	75	5.00	-12.35
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time h:mm:ss	Recovery %										
200	5.90	200	5.80															
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Response zone Base	ID	Pipe Top	Pipe Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00	5.90	Grout																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
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Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012												

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E109
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-12.23m CD	Coordinates	397491.45 E, 804500.34 N National Grid
Hole Type	CP	Inclination	Vertical


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD			
Grey slightly silty fine to coarse SAND.	[Pattern]	1.00	-13.23	B002	0.00-1.00						
				ES001	0.50						
Dense grey slightly silty very gravelly fine to coarse SAND. Gravel is angular to subrounded fine to medium of granite, schist and quartzite.		D003	1.00-1.45						SPT24	1.45	
		B004	1.00-1.45								
		ES005	1.50								
		B006	1.50-2.00								
		D007	2.00-2.45						SPT32	2.45	
		B008	2.00-2.45								
		ES009	2.50								
		B010	2.50-3.00								
		D011	3.00-3.45						SPT34	3.45	
		B012	3.00-3.45								
ES013		3.50									
B014		3.50-4.00									
D015		4.00-4.45						SPT34	4.45		
B016		4.00-4.45									
ES017		4.50									
D018		5.00-5.45						SPT37	5.45		
B019	5.00-5.45										
ES020	5.50										
No recovery. Possible rockhead. (Driller's description)		5.80	-18.03								
Exploratory hole complete at 5.90 m.		5.90	-18.13								

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. E110							
Project No. TA7148													Header							
Engineer Arch Henderson LLP																				
Employer Aberdeen Harbour Board																				
Ground Level -14.73m CD					Coordinates 397497.53 E, 804434.73 N National Grid															
Date Started 15/07/2013					Date Completed 15/07/2013					Inclination Vertical										
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment		Shoring / Support		Remarks							
0.00 2.15	2.15 5.85	CP RC	15/07/2013 15/07/2013	15/07/2013 16/07/2013	TP WW	DT DT	T6116	Impreg	Dando 3000 Deltabase 515											
PROGRESS										WATER STRIKES										
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow				
15/07/2013	1200	2.15	2.15	-13.80	End of CP															
15/07/2013	2000	2.30	2.30	NR	End of Shift															
16/07/2013	0730	2.30	2.30	-18.15	Start of Shift															
16/07/2013	2000	5.85	2.30	-17.90	End of Hole															
CABLE PERCUSSION DETAILS										SPT DETAILS										
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks					Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
2.10		2.15		0930		0200		Chiselling					1.50 2.15	SPT SPT	N=31 (3,4,8,7,8,8) 50/0mm (25/0,50/0)		AR360 AR360	75 75	1.50 2.15	-13.80 -13.80
ROTARY FLUSH DETAILS																				
From depth		To depth		Flush type		Flush return %		Flush colour												
2.15 2.30		2.30 5.85		Air/Mist Air/Mist		100 100		Grey Pink/Grey												
HOLE DIAMETER / CASING				DYNAMIC SAMPLING																
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %												
200 139 116	2.15 2.30 5.85	200 139	2.15 2.30																	
INSTALLATION DETAILS					PIPE CONSTRUCTION															
Distance from G.L.	ID	Type	Response zone Top Base		ID	Pipe Top Base		Dia. of pipe	Type of pipe											
BACKFILL DETAILS										GENERAL NOTES										
Top of section	Base of section	Material			Remarks															
0.00	5.85	Grout																		
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group										
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Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012														

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E110
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-14.73m CD	Coordinates	397497.53 E, 804434.73 N National Grid
Hole Type	CP+RC	Inclination	Vertical


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Medium dense dark grey slightly silty slightly gravelly fine to coarse SAND. Gravel is angular to subangular fine to coarse of schist and granite. from 0.00m to 1.50m driller notes loose				B001 0.00-1.35							
				ES002 1.40 D003 1.45 D004 1.50-1.95 B005 1.50-1.95						SPT31 1.50 1.95	
No recovery. GRANITE. (Driller's description)		2.15 2.30	-16.88 -17.03	ES006 2.00 B007 2.00-2.10						SPT50/0mm 2.15 2.15	
Strong to very strong grey and pink coarse crystalline GRANITE. Discontinuities: 1) 10-20 degrees closely to medium spaced planar rough clean. 2) 70-80 degrees medium spaced planar rough clean.				2.30 3.15	92	100	100	86			
				3.15 4.75	92	100	100	87	50 160 200		
from 5.22m to 5.30m recovered as non intact core (angular coarse gravel sized fragments) from 5.52m to 5.77m recovered as non intact core (angular medium to coarse gravel sized fragments)				4.75 5.85	92	100	72	58	NI 140 200		
Exploratory hole complete at 5.85 m.		5.85	-20.58								

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. E111					
Project No. TA7148													Header					
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -12.72m CD					Coordinates 397386.91 E, 804391.24 N National Grid													
Date Started 12/08/2013					Date Completed 13/08/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00	3.50	CP	12/08/2013	12/08/2013	TT	TW			Dando 3000									
3.50	4.40	RC	12/08/2013	12/08/2013	TT	TW	T6116	Impreg	Deltabase 515									
4.40	6.00	RC	13/08/2013	13/08/2013	WW	TW	T6116	Impreg	Deltabase 515									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike	depth to seal flow		
12/08/2013	1710	3.30	3.30	-14.90	End of CP/Start of Rotary													
12/08/2013	1900	4.40	4.00	-20.10	End of Shift													
13/08/2013	0700	4.40	4.40	-15.20	Start of Shift													
13/08/2013	1200	6.00	4.00	-20.10	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
											0.50	SPT	N=28 (2,4,5,7,7,9)		AR360	75	N/A	-13.40
											1.50	SPT	N=28 (3,4,5,6,6,11)		AR360	75	1.50	-13.80
											2.50	SPT	N=36 (5,6,6,8,9,13)		AR360	75	2.50	-14.60
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
3.30		6.00		Water		100		Brown										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmss	Recovery %										
150	4.00	150	4.00															
116	6.00																	
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00	3.30	Arisings																
3.30	6.00	Grout																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
Unchecked					Log Print Date And Time: 23/12/2013 10:32:34													
Form No. SIEXPHOLEHDR					Issue/Revision No. 1.05					Issue Date 22/10/2012								

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E111
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-12.72m CD	Coordinates	397386.91 E, 804391.24 N National Grid
Hole Type	CP+RC	Inclination	Vertical


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Medium dense grey silty fine to coarse SAND. (Driller notes boulders). from 2.50m to 3.30m dense				D001 0.00-0.20							
				D002 0.50-0.95 B003 0.50-1.00						SPT28 0.50	0.95
				D004 1.00-1.20							
				D005 1.50-1.95 B006 1.50-2.00						SPT28 1.50	1.95
				D007 2.00-2.20							
				D008 2.50-2.95 B009 2.50-3.00						SPT36 2.50	2.95
Weak pink and grey coarse crystalline GRANITE. Discontinuities: 1) 0-10 degrees closely spaced planar rough stained reddish brown. from 3.30m to 3.60m stained reddish brown. Recovered as non intact core (angular to subangular fine to coarse gravel sized fragments) from 3.72m to 3.80m 1 No discontinuity 60 degrees planar rough stained brown from 3.89m to 3.95m 1 No quartz vein stained reddish brown. Recovered as non intact core (angular coarse gravel sized fragments) from 3.95m to 4.00m assumed zone of no recovery		3.30	-16.02	3.30 4.00	92	93	41	14		NI 60 100	
		4.00	-16.72	4.00 4.40	92	88	0	0		NI	
		4.40	-17.12	4.40 5.15	92	60	40	13		NI 90 100	
Medium strong pink and grey coarse crystalline GRANITE stained reddish brown. Recovered as non intact core (angular medium to coarse gravel sized fragments). from 4.35m to 4.40m assumed zone of no recovery		5.25	-17.97	5.15 6.00	92	100	12	12		NI	
Medium strong to strong pink and grey coarse crystalline GRANITE. Discontinuities: 1) 50-70 degrees closely spaced planar rough stained reddish brown. from 4.50m to 4.71m recovered as non intact core (angular medium gravel sized fragments) from 4.77m to 4.90m 1 No discontinuity 90 degrees planar rough stained reddish brown from 5.00m to 5.15m assumed zone of no recovery		6.00	-18.72								
Medium strong to strong pink and grey coarse crystalline GRANITE stained reddish brown. Recovered as non intact core (angular to subangular fine to coarse gravel sized fragments). Exploratory hole complete at 6.00 m.											

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. E112					
Project No. TA7148													Header					
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -12.67m CD					Coordinates 397398.02 E, 804437.20 N National Grid													
Date Started 09/07/2013					Date Completed 10/07/2013					Inclination -								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00 2.75	2.75 6.05	CP RC	09/07/2013 10/07/2013	09/07/2013 10/07/2013	TP WW	DT DT	T6116	Impreg	Dando 3000 Deltabase 515									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike	depth to seal flow		
09/07/2013	1603	2.75	2.75	-16.20	End of CP													
09/07/2013	1630	2.75	2.70	-16.20	Start of Rotary													
09/07/2013	1900	3.00	3.00	-15.30	End of Shift													
10/07/2013	0700	3.00	2.70	-13.50	Start of Shift													
10/07/2013	1735	6.05	2.70	-16.10	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
2.70		2.75		1335		0200		Chiselling			1.00	SPT	N=2 (0,0,0,1,1)		AR360	75	1.00	-14.20
											1.50	SPT	N=6 (1,1,1,2,2)		AR360	75	1.50	-12.60
											2.50	SPT	50/50mm (5,20,50)		AR360	75	2.50	-15.35
											2.75	SPT(C)	50/0mm (25/0,50/0)		AR360	75	2.75	-16.20
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
2.75		6.05		Air/Mist		100		Pink										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %										
200 116	2.75 6.05	200	2.75															
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00	6.05	Grout																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
Unchecked					Log Print Date And Time: 23/12/2013 10:32:43													
Form No. SIEXPHOLEHDR					Issue/Revision No. 1.05					Issue Date 22/10/2012								

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E112
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-12.67m CD	Coordinates	397398.02 E, 804437.20 N National Grid
Hole Type	CP+RC	Inclination	-


Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation		
				Details	Dia.	TCR	SCR	RQD	IF				
Very loose dark grey slightly silty slightly gravelly fine to medium SAND. Gravel is subangular to rounded fine to medium of mixed igneous and metamorphic lithologies, including granite, schist and gneiss.		1.50		B001	0.00-1.00								
				ES002	0.50								
				D003	1.00						SPT2 1.00	1.45	
Medium dense dark grey slightly silty gravelly fine to coarse SAND. Gravel is angular to subangular fine to medium of mixed lithologies including granite, schist and quartzite.		1.50		D004	1.50-1.95								
				ES005	1.50						SPT6 1.50	1.95	
Strong grey GRANITE. (Recovered as angular coarse gravel sized fragments). Strong to very strong grey speckled pink GRANITE. Discontinuities: 1) 50-60 degrees closely spaced planar rough clean. 2) 70-80 degrees medium spaced planar rough clean. from 2.94m to 3.25m recovered as non intact core (angular coarse gravel sized fragments and angular cobble sized fragments) from 4.00m to 4.08m recovered as non intact core (angular coarse gravel sized fragments and cobble sized fragments) from 4.17m to 4.35m recovered as non intact core (angular coarse gravel sized fragments and angular cobble sized fragments)		2.70 2.75		D007	2.50-2.70								
				ES008	2.50						SPT50/50mm 2.50	2.70	
					2.75	3.25	92	100	58	38		SPT(C)50/0mm 2.75	2.75
					3.25	3.80	92	100	100	82			
					3.80	5.10	92	100	80	54		NI 125 300	
Exploratory hole complete at 6.06 m.		6.05			5.10	6.05	92	100	100	66			

Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. E115					
Project No. TA7148													Header					
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -12.67m CD					Coordinates 397300.79 E, 804361.01 N National Grid													
Date Started 13/08/2013					Date Completed 14/08/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00 1.70	1.70 5.70	CP RC	13/08/2013 14/08/2013	13/08/2013 14/08/2013	TP WW	TW TW	T6116	Impreg	Dando 3000 Deltabase 515									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow		
13/08/2013 14/08/2013 14/08/2013	1815 0700 1930	1.70 1.50 5.70	1.50 1.50 1.70	-15.30 NR -14.10	End of CP Start of Rotary End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
1.50		1.70		1600		0200		Chiselling			0.50 1.70	SPT SPT(C)	N=22 (4,6,5,4,6,7) 50/0mm (25/0,50/0)		AR360 AR360	75 75	N/A 1.50	-12.90 -14.30
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
1.70		5.70		Water		100		White										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %										
150 116	1.70 5.70	150	1.70															
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Base	ID	Pipe Top	Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00 1.70	1.70 5.70	Arisings Grout																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E115
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-12.67m CD	Coordinates	397300.79 E, 804361.01 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Medium dense grey slightly gravelly silty fine to coarse SAND. Gravel is subangular to subrounded fine to of schist and gneiss.				B001 0.00-0.50							
				D002 0.50-0.95						SPT22 0.50 0.95	
				B003 0.50-0.95							
				D004 1.00							
No recovery. HARD strata. (Driller's description)		1.50	-14.17								
Medium strong grey GNEISS. Recovered as non intact core (angular fine to coarse gravel sized fragments).		1.70	-14.37							SPT(C)50/0mm 1.70 1.70	
from 2.50m to 2.55m recovered as intact core. Discontinuities: 1) 10-20 degrees very closely spaced planar rough clean				1.70 2.60	92	100	5	0			
from 2.60m to 2.70m recovered as intact core. Discontinuities: 1) 10-20 degrees closely spaced planar rough clean				2.60 3.40	92	83	43	0	NI NI 100		
from 2.96m to 3.15m recovered as intact core. Discontinuities: 1) 10-20 degrees very closely spaced planar rough clean. 2) 20-30 degrees closely spaced planar rough clean				3.40 3.75	92	100	11	0			
from 3.25m to 3.40m assumed zone of no recovery from 3.71m to 3.75m recovered as intact core. Discontinuities: 1) 20-30 degrees very closely spaced planar rough stained brown on surface				3.75 4.70	92	86	36	0			
from 3.90m to 4.10m with schistose foliation (<1mm) from 4.11m to 4.25m recovered as intact core. Discontinuities: 1) 30-40 degrees closely spaced planar rough clean. 2) 70-80 degrees closely spaced planar rough clean				4.70 5.70	92	100	80	29	NI 65 150		
Strong grey GNEISS. Discontinuities: 1) 30-40 degrees closely spaced planar rough clean locally stained yellow on surfaces. from 4.55m to 4.70m assumed zone of no recovery from 5.10m to 5.40m dark grey with schistose foliation (<1mm) and yellow staining on surfaces from 5.25m to 5.45m recovered as non intact core (angular coarse gravel sized fragments)		4.35	-17.02								
Exploratory hole complete at 5.70 m.		5.70	-18.37								


Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. E116					
Project No. TA7148													Header					
Engineer Arch Henderson LLP																		
Employer Aberdeen Harbour Board																		
Ground Level -10.81m CD					Coordinates 397296.83 E, 804299.30 N National Grid													
Date Started 06/07/2013					Date Completed 08/07/2013					Inclination Vertical								
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks							
0.00 1.10	1.10 4.50	CP RC	06/07/2013 08/07/2013	06/07/2013 08/07/2013	TP WW	DT DT	T6116	PCD	Dando 3000 Deltabase 515									
PROGRESS										WATER STRIKES								
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow		
06/07/2013	1630	1.10	1.10	-13.20	End of CP													
08/07/2013	0930	1.10	1.10	-12.20	Start of Rotary													
08/07/2013	1600	4.50	1.10	-12.00	End of Hole													
CABLE PERCUSSION DETAILS										SPT DETAILS								
Hard Strata Depth from		to		Chiselling Start time hhmm		Duration hhmm		Remarks			Depth	Type	Incremental blow count / penetration in mm		Hammer No.	Energy ratio %	Casing depth	Water depth
0.40		0.70				0100		Chiselling			1.00	SPT	50/0mm (25/50,50/0)		AR360	75	1.00	-13.10
0.80		1.00				0100		Chiselling										
1.05		1.10				0100		Chiselling										
1.10		1.10				0100		Chiselling										
ROTARY FLUSH DETAILS																		
From depth		To depth		Flush type		Flush return %		Flush colour										
1.00		4.50		Air/Mist		100		Grey/Pink										
HOLE DIAMETER / CASING				DYNAMIC SAMPLING														
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %										
200	1.10	200	1.10															
116	4.50																	
INSTALLATION DETAILS					PIPE CONSTRUCTION													
Distance from G.L.	ID	Type	Response zone Top	Response zone Base	ID	Pipe Top	Pipe Base	Dia. of pipe	Type of pipe									
BACKFILL DETAILS										GENERAL NOTES								
Top of section	Base of section	Material			Remarks													
0.00	4.50	Grout																
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group								
Log Print Date And Time: 23/12/2013 10:32:58																		
Form No. SIEXPHOLEHDR			Issue/Revision No. 1.05			Issue Date 22/10/2012												

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		E116
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	-10.81m CD	Coordinates	397296.83 E, 804299.30 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Dark greyish brown slightly silty very gravelly fine to coarse SAND with low cobble content. Gravel is angular to subangular fine to coarse of granite and schist. Cobbles are angular to subangular of granite and schist.		1.00	-11.81	ES001 0.50 B002 0.50 D003 0.50							
Weak greenish grey SCHIST. (Recovered as angular to subangular fine to coarse gravel sized fragments).		1.10	-11.91	D004 1.00-1.05						SPT50/0mm 1.00 1.05	
Strong greenish grey SCHIST with very closely spaced randomly orientated veins of strong to very strong pink and grey granite. Discontinuities: 1) 20-30 degrees closely spaced planar rough clean. 2) 80-90 degrees medium spaced planar and undulating rough clean. from 1.10m to 1.17m recovered as non intact core (angular medium to coarse gravel sized fragments) from 1.10m to 2.70m discontinuities: 1) and 2) locally stained dark brown from 1.25m to 1.35m 1 No 20-30 degrees thin bed of pink granite from 1.45m to 1.50m recovered as non intact core (angular medium to coarse gravel sized fragments)		1.50	-12.31	1.10 1.60	92	80	54	24		NI 65 100	
Assumed zone of no recovery. Weathered GRANITE (Driller's description)		2.30	-13.11	1.60 2.90	92	46	15	0		NA	
Strong greenish grey SCHIST with very closely spaced randomly orientated veins of strong to very strong pink and grey granite. Discontinuities: 1) 20-30 degrees closely spaced planar rough clean. 2) 80-90 degrees medium spaced planar and undulating rough clean. from 2.30m to 2.47m recovered as non intact core (angular to subangular medium to coarse gravel sized fragments) from 2.50m to 3.40m discontinuities: 1) 30-40 degrees from 2.55m to 2.60m recovered as non intact core (angular medium to coarse gravel sized fragments) from 2.64m to 2.70m recovered as non intact core (angular medium to coarse gravel sized fragments) from 2.80m to 3.93m with closely spaced with thin to medium beds, recovered as non intact core (angular medium to coarse gravel sized fragments) from 4.00m to 4.30m 1 No discontinuity 70-80 degrees planar rough stained reddish brown		2.90	-13.11	2.90 3.40	92	100	30	0		NI 40 85	
Exploratory hole complete at 4.50 m.		4.50	-15.31	3.40 4.50	92	100	78	0			

NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key	
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Project Name Bay of Nigg Harbour Development Ground Investigation										Exploratory Hole Log			Hole ID. GS11									
Project No. TA7148					Coordinates 396714.16 E, 804575.84 N National Grid					Inclination Vertical												
Engineer Arch Henderson LLP					Date Completed 08/10/2013																	
Employer Aberdeen Harbour Board					Date Started 06/10/2013																	
Ground Level	-1.42m CD				Coordinates 396714.16 E, 804575.84 N National Grid					Inclination Vertical												
Date Started	06/10/2013				Date Completed 08/10/2013																	
Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks											
0.00 2.00 3.30	2.00 3.30 19.00	CP RO RC	06/10/2013 06/10/2013 07/10/2013	06/10/2013 07/10/2013 08/10/2013	TP TT TT	DT DT DT	SWF	Impreg	Dando 3000 Deltabase 520 Deltabase 520													
PROGRESS										WATER STRIKES												
Date	Time	Hole depth	Casing depth	Water depth	Remarks					Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	Water depth to seal flow						
06/10/2013	2300	2.00	2.00	-4.80	End of CP/Start of RO																	
07/10/2013	0450	3.30	3.00	-4.25	End of RO/Start of RC																	
07/10/2013	0700	4.10	3.70	-4.30	End of Shift/Start of Shift																	
07/10/2013	1900	9.20	4.20	-9.00	End of Shift/Start of Shift																	
08/10/2013	0700	16.00	4.20	-8.00	End of Shift/Start of Shift																	
08/10/2013	1330	19.00	4.20	-5.30	End of Hole																	
CABLE PERCUSSION DETAILS										SPT DETAILS												
Hard Strata Depth from to		Chiselling Start time hhmm Duration hhmm		Remarks						Depth	Type	Incremental blow count / penetration in mm			Hammer No.	Energy ratio %	Casing depth	Water depth				
1.70	2.00	2100	0200	Chiselling						0.50	SPT(C)	50/0mm (25/0,50/0)			AR362	75	N/A	-2.70				
										1.50	SPT(C)	50/0mm (25/0,50/0)			AR362	75	1.50	-2.80				
										3.00	SPT(C)	50/85mm (25/77,50/85)			AR362	75	3.00	-4.25				
										4.10	SPT(C)	50/100mm (25/77,50/100)			AR362	75	4.10	-9.00				
										5.60	SPT(C)	50/95mm (25/76,50/95)			AR362	75	4.20	-9.00				
										7.10	SPT(C)	50/85mm (25/75,50/85)			AR362	75	4.20	-9.00				
										8.60	SPT(C)	50/10mm (25/10,50/10)			AR362	75	4.20	-9.00				
										10.20	SPT(C)	50/15mm (25/10,50/15)			AR362	75	4.20	-8.00				
										11.70	SPT(C)	50/200mm (7,12,15,18,17/50)			AR362	75	4.20	-8.00				
										12.70	SPT(C)	50/260mm (4,9,10,15,15,10/35)			AR362	75	4.20	-8.00				
										14.20	SPT(C)	50/20mm (7,18/20,50/20)			AR362	75	4.20	-8.00				
										15.70	SPT(C)	50/90mm (25/70,42,8/15)			AR362	75	4.20	-8.00				
										17.60	SPT(C)	50/10mm (25/10,50/10)			AR362	75	4.20	-8.00				
										19.00	SPT(C)	50/295mm (6,10,12,12,16,10/70)			AR362	75	4.20	-7.20				
ROTARY FLUSH DETAILS																						
From depth	To depth	Flush type		Flush return %	Flush colour																	
3.30	4.10	Water		50	Brown																	
4.10	16.00	Water		100	Brown																	
16.00	19.00	Water		100	Brown																	
HOLE DIAMETER / CASING				DYNAMIC SAMPLING																		
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time h:mm:ss	Recovery %														
200	4.20	200	4.20																			
146	19.00																					
INSTALLATION DETAILS					PIPE CONSTRUCTION																	
Distance from G.L.	ID	Type	Response zone Top Base		ID	Pipe Top Base		Dia. of pipe	Type of pipe													
BACKFILL DETAILS										GENERAL NOTES												
Top of section	Base of section	Material			Remarks																	
0.00	19.00	Arisings																				
NOTES: All depths in metres, all diameters in millimetres. Water strike rise time in minutes, hard strata time in hhmm For details of abbreviations, see key										 SOIL ENGINEERING Part of the Bachy Soletanche Group												
Unchecked Log Print Date And Time: 23/12/2013 10:22:48 Form No. SIEXPHOLEHDR Issue/Revision No. 1.05 Issue Date 22/10/2012																						

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		GS11
Engineer	Arch Henderson LLP		Sheet 1 of 2
Employer	Aberdeen Harbour Board		

Ground Level	-1.42m CD	Coordinates	396714.16 E, 804575.84 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation	
				Details	Dia.	TCR	SCR	RQD	IF			
No recovery. Granite BOULDERS sand and gravel. (Driller's description)												
Rotary openhole drilling: Firm to stiff brown CLAY with granite boulders. (Driller's description)		2.40	-3.82							SPT(C)50/0mm 0.50 0.50		
Stiff very high to extremely high strength brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. Cobbles are subangular of granite and gneiss. from 9.00m to 9.20m assumed zone of no recovery		3.30	-4.72	3.30	4.10	107	100	NA	NA	SPT(C)50/85mm 3.00 3.16		
		4.10		4.10	5.60	107	100	NA	NA	SPT(C)50/100mm 4.10 4.28		
		5.60		5.60	7.10	107	100	NA	NA	SPT(C)50/95mm 5.60 5.77		
		7.10		7.10	8.60	107	100	NA	NA	SPT(C)50/85mm 7.10 7.26		
		8.60		8.60	9.20	107	66	NA	NA	SPT(C)50/10mm 8.60 8.62		
		9.20		9.20	10.20	107	100	NA	NA			

NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Unchecked Form No. SIEXPHOLELOG	Log Print Date And Time: 23/12/2013 10:22:52 Issue/Revision No. 1.05 Issue Date 22/10/2012	

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		GS11
Engineer	Arch Henderson LLP		Sheet 2 of 2
Employer	Aberdeen Harbour Board		

Ground Level	-1.42m CD	Coordinates	396714.16 E, 804575.84 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation		
				Details	Dia.	TCR	SCR	RQD	IF				
<p>Stiff very high to extremely high strength brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. Cobbles are subangular of granite and gneiss.</p> <p>Assumed zone of no recovery. Firm to stiff brown CLAY with granite boulders. (Driller's description)</p> <p>Stiff extremely high strength brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. Cobbles are subangular of granite and gneiss.</p> <p>from 14.70m to 14.78m gneiss cobble</p> <p>from 15.50m to 15.70m assumed zone of no recovery</p> <p>from 15.92m to 16.00m assumed zone of no recovery</p>		10.20	-11.62								SPT(C)50/15mm 10.20 10.23		
		10.70	-12.12	10.20	11.70	107	66	NA	NA	NA			
		11.70	12.70	107	100	NA	NA			SPT(C)50/200mm 11.70 12.05			
		12.70	14.20	107	100	NA	NA			SPT(C)50/260mm 12.70 13.11			
		14.20	15.70	107	87	NA	NA			SPT(C)50/20mm 14.20 14.32			
		15.70	16.00	107	73	NA	NA			SPT(C)50/90mm 15.70 15.86			
		16.00	16.10	107	100	NA	NA						
		16.85	-18.27	16.10	17.60	107	78	NA	NA				SPT(C)50/10mm 17.60 17.62
		17.60	18.10	107	53	NA	NA						
		18.10	19.00	107	50	NA	NA						
Assumed zone of no recovery. Firm to stiff brown CLAY with granite boulders. (Driller's description)		18.34	-19.76										
Exploratory hole complete at 19.00 m.		19.00	-20.42								SPT(C)50/295mm 19.00 19.45		

NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Unchecked	Log Print Date And Time: 23/12/2013 10:22:56	
Form No. SIEXPHOLELOG	Issue/Revision No. 1.05 Issue Date 22/10/2012	

Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		L01
Engineer	Arch Henderson LLP		Header
Employer	Aberdeen Harbour Board		

Ground Level	6.97m CD	Coordinates	396570.35 E, 804915.78 N National Grid
Date Started	28/10/2013	Date Completed	02/11/2013
		Inclination	Vertical

Top	Base	Type	Date Started	Date Ended	Crew	Section Logged By	Core Barrel	Core Bit	Equipment	Shoring / Support	Remarks
0.00	3.90	CP	28/10/2013	28/10/2013	TP	DT			Dando 3000		
3.90	4.00	RO	28/10/2013	28/10/2013	WW	DT			Deltabase 520		
4.00	12.00	RC	28/10/2013	30/10/2013	WW/TT	DT	SWF	Impreg	Deltabase 520		
12.00	14.00	RO	30/10/2013	30/10/2013	WW/TT	DT			Deltabase 520		
14.00	16.60	RC	30/10/2013	30/10/2013	WW/TT	DT	SWF	Impreg	Deltabase 520		
16.60	20.30	RO	30/10/2013	01/11/2013	WW/TT	DT			Deltabase 520		
20.30	25.55	RC	01/11/2013	02/11/2013	WW/TT	DT	T6116	Impreg	Deltabase 520		

PROGRESS						WATER STRIKES						
Date	Time	Hole depth	Casing depth	Water depth	Remarks	Date	Time	Strike at depth	Rise to depth	Time taken to rise	Casing depth at strike time	depth to seal flow
28/10/2013	1430	3.90	3.90	DRY	End of CP							
28/10/2013	1900	3.90	3.90	DRY	End of Shift/Start of Shift							
29/10/2013	0700	10.70	9.80	5.00	End of Shift							
29/10/2013	1900	10.70	9.80	6.20	Start of Shift							
30/10/2013	0700	9.80	9.80	5.30	End of Shift/Start of Shift							
30/10/2013	1900	13.00	13.00	12.70	End of Shift/Start of Shift							
31/10/2013	0700	17.00	13.00	4.15	End of Shift/Start of Shift							
31/10/2013	1900	18.00	18.00	DRY	End of Shift/Start of Shift							
01/11/2013	0700	20.00	20.00	DRY	End of Shift							
01/11/2013	1900	20.00	20.00	DRY	Start of Shift							
02/11/2013	0700	25.55	20.00	3.00	End of Hole							

CABLE PERCUSSION DETAILS					SPT DETAILS						
Hard Strata Depth from	to	Chiselling Start time hhmm	Duration hhmm	Remarks	Depth	Type	Incremental blow count / penetration in mm	Hammer No.	Energy ratio %	Casing depth	Water depth
3.70	3.90	1200	0200	Chiselling	1.50	SPT(C)	N=18 (4,5,4,4,5,5)	AR362	75	1.50	DRY
					2.50	SPT(C)	N=39 (5,7,9,9,11,10)	AR362	75	2.50	DRY
					3.50	SPT(C)	50/0mm (11,14,50/0)	AR362	75	3.50	DRY
					3.90	SPT(C)	50/0mm (25/0,50/0)	AR362	75	3.90	DRY
					4.00	SPT(C)	50/5mm (25/0,50/5)	AR362	75	3.90	DRY
					5.00	SPT(C)	50/0mm (25/0,50/0)	AR362	75	3.90	DRY
					6.50	SPT(C)	50/0mm (25/10,50/0)	AR362	75	5.00	DRY
					8.00	SPT(C)	N=58 (3,4,9,13,15,21)	AR362	75	8.00	DRY
					9.50	SPT(C)	50/170mm (6,10,18,21,11/20)	AR362	75	9.50	DRY
					13.00	SPT(C)	50/225mm (9,14,14,17,18,1/0)	AR362	75	13.00	10.60
					15.00	SPT(C)	50/5mm (25/5,50/5)	AR362	75	13.00	4.20
					17.00	SPT(C)	50/0mm (9,11,50/0)	AR362	75	17.00	DRY
					18.50	SPT(C)	50/230mm (8,10,13,16,16,5/5)	AR362	75	18.50	DRY

ROTARY FLUSH DETAILS				
From depth	To depth	Flush type	Flush return %	Flush colour
3.90	10.70	Water	30	Brown
10.70	12.00	Water	20	Brown
12.00	13.00	Air	100	Brown
13.00	17.00	Water	100	Brown
17.00	20.00	Air	100	Brown
20.00	20.55	Water	100	Brown

HOLE DIAMETER / CASING				DYNAMIC SAMPLING				
Hole diameter	Depth of hole	Casing diameter	Depth of casing	Top	Base	Diameter	Time hhmmss	Recovery %
200	3.90	200	3.90					
150	9.80	150	9.80					
128	12.00	125	20.00					
125	20.00							
116	25.55							

INSTALLATION DETAILS				PIPE CONSTRUCTION				
Distance from G.L.	ID	Type	Response zone Top Base	ID	Pipe Top Base	Dia. of pipe	Type of pipe	

* Seating blows only.

BACKFILL DETAILS				GENERAL NOTES			
Top of section	Base of section	Material	Remarks				
0.00	20.00	Arisings					
20.00	25.55	Grout					


Ground Level 6.97m CD Hole Type CP+RC	Coordinates 396570.35 E, 804915.78 N National Grid Inclination Vertical
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Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Brown medium to coarse SAND.	[Pattern]			B001	0.50-1.00						
Medium dense brown medium to coarse SAND.	[Pattern]	1.00	5.97	D002	1.00					SPT(C)18 1.50	1.95
	[Pattern]			B003	1.50-2.00						
	[Pattern]			D004	2.00						
Dense greyish brown very gravelly fine to coarse SAND with medium cobble content. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss, schist and quartz. Cobbles are angular to rounded of granite and gneiss.	[Pattern]	2.30	4.67	B005	2.50-3.00					SPT(C)39 2.50	2.95
	[Pattern]			D006	3.00						
No recovery. COBBLES and BOULDERS. (Driller's description)	[Pattern]	3.50	3.47	B007	3.50					SPT(C)50/0mm 3.50	3.65
	[Pattern]			D008	3.50						
Rotary openhole drilling. Large BOULDERS. (Driller's description)	[Pattern]	3.90	3.07							SPT(C)50/0mm 3.90	3.90
	[Pattern]									SPT(C)50/5mm#0.01 4.00	4.00
No recovery. Large BOULDERS. (Driller's description)	[Pattern]	4.00	2.97			4.00	5.00	107	0	NA	NA
	[Pattern]										
	[Pattern]					5.00	5.70	107	0	NA	NA
	[Pattern]										
	[Pattern]					5.70	6.50	107	0	NA	NA
	[Pattern]										
	[Pattern]					6.50	6.80	107	0	NA	NA
	[Pattern]	6.80	0.17								
No recovery. Coarse SAND and GRAVEL with boulders. (Driller's description)	[Pattern]					6.80	8.00	107	0	NA	NA
	[Pattern]										
	[Pattern]					8.00	8.70	107	0	NA	NA
	[Pattern]									NA	
	[Pattern]					8.70	9.50	107	0	NA	NA
	[Pattern]										
	[Pattern]	9.50	-2.53							SPT(C)50/170mm 9.50	9.82
Grey subangular to rounded coarse GRAVEL and subangular to rounded cobbles of granite and schist.	[Pattern]	9.90	-2.93								





Project Name	Bay of Nigg Harbour Development Ground Investigation	Exploratory Hole Log	Hole ID.
Project No.	TA7148		L01
Engineer	Arch Henderson LLP		Sheet 2 of 3
Employer	Aberdeen Harbour Board		

Ground Level	6.97m CD	Coordinates	396570.35 E, 804915.78 N National Grid
Hole Type	CP+RC	Inclination	Vertical

Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
9.50m - 9.90m : Remaining Detail : 9.80m - 9.90m : from 9.80m to 9.90m strong grey boulder of granite				9.50	10.70	107	25	NA	NA		
9.90m - 10.70m : Assumed zone of no recovery. Coarse SAND and GRAVEL with boulders. (Driller's description)		10.70	-3.73	10.70	11.00	107	0	NA	NA		
No recovery. Large BOULDERS with sand and gravel. (Driller's description)				11.00	11.50	107	0	NA	NA		
				11.50	12.00	107	0	NA	NA		
Rotary openhole drilling. BOULDERS with sand and gravel. (Driller's description)		12.00	-5.03								
Rotary openhole drilling. Boulder CLAY. (Driller's description)		12.60	-5.63								
Rotary openhole drilling. Very sandy CLAY with gravel and large boulders. (Driller's description)		13.00	-6.03							SPT(C)50/225mm 13.00 13.38	
Soft brown sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, schist and quartz.		14.00	-7.03								
Assumed zone of no recovery. Very sandy CLAY with gravel and large boulders. (Driller's description)		14.45	-7.48	14.00	15.00	90	45	NA	NA		
Stiff brown very sandy CLAY. Sand is fine to coarse. from 15.30m to 15.60m assumed zone of no recovery		15.00	-8.03	15.00	15.60	90	50	NA	NA	NA	SPT(C)50/5mm 15.00 15.01
Soft brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed igneous and metamorphic lithologies including granite, gneiss and schist. from 15.60m to 15.80m gneiss boulder from 15.80m to 15.85m coarse gravel of schist, gneiss and granite		15.60	-8.63	15.60	16.60	90	25	NA	NA		
Assumed zone of no recovery. Very sandy CLAY with gravel and large boulders. (Driller's description)		15.85	-8.88								
Rotary openhole drilling. Firm greyish brown sandy boulder CLAY with cobbles and boulders. (Driller's description)		16.60	-9.63								SPT(C)50/0mm 17.00 17.15
											SPT(C)50/230mm 18.50 18.88

NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Unchecked Form No. SIEXPHOLELOG	Log Print Date And Time: 23/12/2013 10:33:13 Issue/Revision No. 1.05 Issue Date 22/10/2012	

Ground Level 6.97m CD Hole Type CP+RC	Coordinates 396570.35 E, 804915.78 N National Grid Inclination Vertical	
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Description of Strata	Legend	Depth	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	RQD	IF		
Rotary openhole drilling. Firm greyish brown sandy boulder CLAY with cobbles and boulders. (Driller's description)		20.30	-13.33								
Strong dark grey GNEISS. Discontinuities: 1) 40-50 degrees very closely and closely spaced planar rough clean. from 20.70m to 20.79m recovered as non intact core (angular coarse gravel sized fragments) from 21.20m to 21.40m recovered as non intact core (angular coarse gravel sized fragments) from 21.55m to 21.95m discontinuities: 1) 50-60 degrees from 21.95m to 22.10m recovered as non intact core (angular coarse gravel sized fragments) from 22.70m to 22.95m 1 No discontinuity 80-90 degrees smooth planar				20.30	20.70	89	100	100	0		
				20.70	21.75	89	100	72	0	NI 50 130	
				21.75	22.95	89	100	79	29		
Medium strong locally weak pinkish grey stained orange coarse crystalline GRANITIC GNEISS. Recovered as non intact core (angular coarse gravel sized fragments). from 23.95m to 24.00m assumed zone of no recovery			23.17	-16.20	22.95	24.00	90	95	9	0	NI NI NI
Very strong pinkish grey coarse crystalline GRANITIC GNEISS. Discontinuities: 1) 10-20 degrees closely spaced planar rough clean. from 24.00m to 24.23m 1 No discontinuity 80-90 degrees planar rough stained orange on surface			24.00	-17.03	24.00	25.55	90	100	100	100	140 200 300
Exploratory hole complete at 25.55 m.		25.55	-18.58								



SUPPORTING FACTUAL DATA

SECTION A

Exploratory Hole Records and Field Data

EXCAVATION RECORDS

Project Name	Bay of Nigg Harbour Development Ground Investigation	Excavation Log	Hole ID.
Project No.	TA7148		TP01
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	2.53m CD	Coordinates	396830.40 E, 805054.60 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	26/09/2013	Date Completed	26/09/2013	Logged by GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
Multicoloured subangular to rounded COBBLES of mixed igneous and metamorphic lithologies.		0.15	2.38	B 001 0.10 - 0.40 D 002 0.20		
Greyish brown sandy subangular to subrounded fine to coarse GRAVEL of mixed igneous and metamorphic lithologies with high cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of mixed igneous and metamorphic lithologies predominantly schist.		0.55	1.98	B 003 0.50 - 0.80 D 004 0.60		
Soft to firm reddish brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of schist.		0.85	1.68	B 005 1.00 D 006 1.20		
Medium strong dark grey granitic SCHIST.		1.70	0.83			
Excavation complete at 1.70 m.						

Stability All faces stable Shoring None used Remarks 1. Trial pit terminated at 1.70m due to bedrock.	Excavation dimensions and orientation				
	Length (sides A and C)		3.80m		
	Width (sides B and D)		2.20m		
Depth		1.70m			
Bearing of side A		260°			
WATER STRIKES					
Date	Time	Strike at depth	Rise to depth	Time taken to rise	
26/09/2013		0.95	0.50	2	

Project Name	Bay of Nigg Harbour Development Ground Investigation	<h1>Excavation Log</h1>	Hole ID.
Project No.	TA7148		TP02
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	2.99m CD	Coordinates	396752.70 E, 805060.10 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	26/09/2013	Date Completed	26/09/2013	Logged by
				GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
Greyish brown sandy subangular to subrounded fine to coarse GRAVEL of mixed igneous and metamorphic lithologies with medium cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of mixed igneous and metamorphic lithologies.		0.40	2.59	B 001 0.00 - 0.40 D 002 0.20		
Firm reddish brown sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of schist. Cobbles are subangular to subrounded of schist.		1.00	1.99	B 003 0.50 - 1.00 D 004 0.60		
Medium strong dark grey granitic SCHIST.		2.10	0.89	B 005 1.00 - 2.00 D 006 1.20		
Excavation complete at 2.10 m.						

Stability	All faces stable	Excavation dimensions and orientation				
Shoring	None used	Length (sides A and C)	3.80m			
Remarks	1. Trial pit terminated at 2.10m due to bedrock.	Width (sides B and D)	1.70m			
		Depth	2.10m			
		Bearing of side A	265°			
WATER STRIKES						
		Date	Time	Strike at depth	Rise to depth	Time taken to rise
		26/09/2013		1.00	0.90	5

Notes: All depths in metres, all soil strengths are average in kPa All bearings given relate to magnetic North See legend sheet for key to symbols and abbreviations For in situ test results, see accompanying records	Log Print Date And Time: 23/12/2013 10:33:52	 SOIL ENGINEERING
Form No. SI EXC LOG	Issue/Revision No. 1.04	Issue Date 22/10/2012
		Part of the Bachy Soletanche group

Project Name	Bay of Nigg Harbour Development Ground Investigation	<h1>Excavation Log</h1>	Hole ID.
Project No.	TA7148		TP03
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	1.71m CD	Coordinates	396723.00 E, 805002.10 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	26/09/2013	Date Completed	26/09/2013	Logged by GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
Grey slightly gravelly fine to coarse SAND with high cobble content. Sand is fine to coarse. Gravel is subrounded of mixed igneous and metamorphic lithologies predominantly schist. Cobbles are subrounded of mixed igneous and metamorphic lithologies predominantly schist. from 0.30m to 0.55m cobbles absent		0.55	1.16	B 001 0.00 - 0.40 D 002 0.20 B 003 0.60 - 1.00		
Firm reddish brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies predominantly schist. Cobbles are subrounded of mixed igneous and metamorphic lithologies predominantly schist. from 1.50m to 2.40m very sandy clay with high cobble content				D 004 1.00 B 005 1.50 - 2.00 D 006 2.00		
Medium strong dark grey granitic SCHIST.		2.40	-0.69	D 007 2.60		
Excavation complete at 2.70 m.		2.70	-0.99			

Stability Trial pit spalling from 0.00m to 0.55m on all faces Shoring None used Remarks 1. Trial pit terminated at 2.70m due to b bedrock.	Excavation dimensions and orientation				
	Length (sides A and C)	1.80m			
	Width (sides B and D)	3.60m			
	Depth	2.70m			
	Bearing of side A	45°			
	WATER STRIKES				
	Date	Time	Strike at depth	Rise to depth	Time taken to rise
	26/09/2013		1.00	0.35	5

Notes: All depths in metres, all soil strengths are average in kPa All bearings given relate to magnetic North See legend sheet for key to symbols and abbreviations For in situ test results, see accompanying records	 SOIL ENGINEERING Part of the Bachy Soletanche group
Log Print Date And Time: 23/12/2013 10:33:55	
Form No. SI EXC LOG	Issue/Revision No. 1.04
	Issue Date 22/10/2012

Project Name	Bay of Nigg Harbour Development Ground Investigation	Excavation Log	Hole ID.
Project No.	TA7148		TP04
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	1.75m CD	Coordinates	396656.00 E, 804977.10 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	27/09/2013	Date Completed	27/09/2013	Logged by GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
Grey slightly gravelly fine to coarse SAND with high cobble content. Gravel is subrounded of mixed igneous and metamorphic lithologies. Cobbles are subrounded of mixed igneous and metamorphic lithologies.		0.60	1.15	B 001 0.00 - 0.70 D 002 0.50		
Firm reddish brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies. Cobbles are subrounded of mixed igneous and metamorphic lithologies predominantly schist. from 1.80m to 3.30m with high cobble content				B 003 1.00 - 1.50 D 004 1.50 B 005 2.00 - 2.50		
Excavation complete at 3.30 m.		3.30	-1.55	D 006 3.20		

Stability	Trial pit spalling from 0.00m to 0.60m on all faces	Excavation dimensions and orientation				
Shoring	None used	Length (sides A and C) 3.90m				
Remarks	1. Trial pit terminated at 3.30m due to constant collapse and surface water ingress.	Width (sides B and D) 1.90m				
		Depth 3.30m				
		Bearing of side A 285°				
WATER STRIKES						
		Date	Time	Strike at depth	Rise to depth	Time taken to rise
		27/09/2013		0.00	0.00	0

Project Name	Bay of Nigg Harbour Development Ground Investigation	<h1>Excavation Log</h1>	Hole ID.	TP05
Project No.	TA7148		Sheet 1 of 1	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	2.77m CD	Coordinates	396595.70 E, 804882.30 N National Grid		
Hole Type	TP	Method and equipment	20T Tracked Excavator		
Date Started	26/09/2013	Date Completed	26/09/2013	Logged by	GD

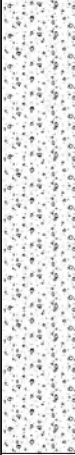

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
Multicoloured slightly sandy subangular to subrounded fine to coarse GRAVEL of mixed igneous and metamorphic lithologies with high cobble content and high boulder content. Sand is fine to coarse. Cobbles are subangular to subrounded occasionally rounded of mixed igneous and metamorphic lithologies. Boulders (up to 1.00m x 0.60m x 0.60m) are of mixed igneous and metamorphic lithologies predominantly granite.		1.30	1.47	B 001 0.00 - 0.50		
				D 002 0.50		
			B 003 0.50 - 1.00			
			D 004 1.00			
Firm greenish grey slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded fine to coarse of granite and dark grey schist. Cobbles are subrounded of granite and predominantly dark grey schist.			B 005 1.50 - 2.00			
			D 006 2.00			
Excavation complete at 3.20 m.		3.20	-0.43			

Stability Collapse from 0.00m to 1.30m on all faces Shoring None used Remarks 1. Trial pit terminated at 3.20m due to constant collapse.	Excavation dimensions and orientation				
	Length (sides A and C)	3.80m			
	Width (sides B and D)	3.80m			
	Depth	3.20m			
	Bearing of side A 330°				
WATER STRIKES					
	Date	Time	Strike at depth	Rise to depth	Time taken to rise
	26/09/2013		1.00	0.80	2


Notes: All depths in metres, all soil strengths are average in kPa All bearings given relate to magnetic North See legend sheet for key to symbols and abbreviations For in situ test results, see accompanying records	 SOIL ENGINEERING Part of the Bachy Soletanche group
Log Print Date And Time: 23/12/2013 10:34:00	
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	Issue Date 22/10/2012

Project Name	Bay of Nigg Harbour Development Ground Investigation	Excavation Log	Hole ID.
Project No.	TA7148		TP06
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	7.06m CD	Coordinates	396523.30 E, 804863.20 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	25/09/2013	Date Completed	25/09/2013	Logged by GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
Brown sandy subangular to subrounded fine to coarse GRAVEL of mixed igneous and metamorphic lithologies with high cobble content and high boulder content. Sand is coarse. Cobbles are subangular to rounded fine to coarse of mixed igneous and metamorphic lithologies. Boulders are (up to 500mm x 400mm x 400mm) of mixed igneous and metamorphic lithologies.		3.00	4.06	D 001 0.50 D 002 0.50 - 1.00		
				D 003 1.50 B 004 1.50 - 2.00		
				D 005 2.50 B 006 2.50 - 3.00		
Excavation complete at 3.00 m.						

Stability Collapse from 0.00m to 3.00m on all faces Shoring None used Remarks 1. Trial pit terminated at 3.00m due to constant collapse.	Excavation dimensions and orientation				
	Length (sides A and C)		4.20m		
	Width (sides B and D)		3.30m		
Depth		3.00m			
Bearing of side A		300°			
WATER STRIKES					
Date	Time	Strike at depth	Rise to depth	Time taken to rise	

Notes: All depths in metres, all soil strengths are average in kPa All bearings given relate to magnetic North See legend sheet for key to symbols and abbreviations For in situ test results, see accompanying records	 SOIL ENGINEERING Part of the Bachy Soletanche group
Log Print Date And Time: 23/12/2013 10:34:03	
Form No. SI EXC LOG	Issue/Revision No. 1.04
	Issue Date 22/10/2012

Project Name	Bay of Nigg Harbour Development Ground Investigation	Excavation Log	Hole ID.
Project No.	TA7148		TP07
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	3.89m CD	Coordinates	396566.10 E, 804828.70 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	25/09/2013	Date Completed	25/09/2013	Logged by GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
Brown sandy subangular to subrounded fine to coarse GRAVEL of mixed igneous and metamorphic lithologies with high cobble content and high boulder content. Sand is fine to coarse. Cobbles are subangular to rounded of mixed igneous and metamorphic lithologies. Boulders are (up to 350mm x 350mm x 400mm) of mixed igneous and metamorphic lithologies.				D 001 1.00 B 002 1.00		
Excavation complete at 2.00 m.		2.00	1.89	D 003 2.00 B 004 2.00		

Stability Collapse from 0.00m to 2.00m on all faces Shoring None used Remarks 1. Trial pit terminated at 2.00m due to constant collapse.	Excavation dimensions and orientation					
	Length (sides A and C)		2.20m			
	Width (sides B and D)		2.20m			
Depth		2.00m			Bearing of side A 160°	
WATER STRIKES						
Date	Time	Strike at depth	Rise to depth	Time taken to rise		
25/09/2013		0.40	0.40	1		

Notes: All depths in metres, all soil strengths are average in kPa All bearings given relate to magnetic North See legend sheet for key to symbols and abbreviations For in situ test results, see accompanying records	 SOIL ENGINEERING Part of the Bachy Soletanche group
Log Print Date And Time: 23/12/2013 10:34:06	
Form No. SI EXC LOG	Issue/Revision No. 1.04
	Issue Date 22/10/2012

Project Name	Bay of Nigg Harbour Development Ground Investigation	Excavation Log	Hole ID.
Project No.	TA7148		TP08
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	6.65m CD	Coordinates	396506.00 E, 804777.00 N National Grid
Hole Type	TP	Method and equipment	20T Tracked Excavator
Date Started	25/09/2013	Date Completed	25/09/2013
		Logged by	GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
MADE GROUND: Topsoil.		0.30	6.35	B 001 0.50 - 1.00 D 002 0.50		
MADE GROUND: Brown subangular to rounded fine to coarse cobble sized fragments and subangular to rounded boulder sized fragments (up to 500mm x 400mm x 400m) of mixed igneous and metamorphic lithologies with much sandy gravel sized fragments, occasional coal fragments, occasional plastic packaging fragments and occasional ceramic fragments. Sand sized fragments are fine to coarse. Gravel sized fragments are subangular to rounded fine to coarse of mixed igneous and metamorphic lithologies. from 0.30m to 0.50m band of subangular to rounded cobble sized fragments				B 003 1.50 - 2.00 D 004 1.50		
Orangish brown sandy GRAVEL with high cobble content and high boulder content. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of mixed igneous and metamorphic lithologies. Cobbles are subangular to rounded of mixed igneous and metamorphic lithologies. Boulders (up to 500mm x 500mm x 400mm) are of mixed igneous and metamorphic lithologies.		2.50	4.15	B 005 2.50 - 3.00 D 006 2.50		
Excavation complete at 3.80 m.		3.80	2.85	B 007 3.50 - 4.00 D 008 3.50		

Stability	Collapse from 0.30m to 3.80m on all faces	Excavation dimensions and orientation				
Shoring	None used	Length (sides A and C)		1.90m		
Remarks	1. Trial pit terminated at 3.80m due to constant collapse.	Width (sides B and D)		4.00m		
		Depth		3.80m		
		Bearing of side A		320°		
WATER STRIKES						
		Date	Time	Strike at depth	Rise to depth	Time taken to rise
		25/09/2013		3.10	3.00	5

Notes: All depths in metres, all soil strengths are average in kPa All bearings given relate to magnetic North See legend sheet for key to symbols and abbreviations For in situ test results, see accompanying records	Log Print Date And Time: 23/12/2013 10:34:08	 SOIL ENGINEERING Part of the Bachy Soletanche group
Form No. SI EXC LOG	Issue/Revision No. 1.04	Issue Date 22/10/2012

Project Name	Bay of Nigg Harbour Development Ground Investigation	Excavation Log	Hole ID.	TP09
Project No.	TA7148		Sheet 1 of 1	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	3.32m CD	Coordinates	396563.70 E, 804724.40 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	25/09/2013	Date Completed	25/09/2013	Logged by GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
Multicoloured subangular to subrounded fine to coarse COBBLES and subangular to subrounded BOULDERS (up to 500mm x 500mm x 400mm) of mixed igneous and metamorphic lithologies with much slightly sandy gravel. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies.				B 001 0.40 - 0.60 D 002 0.40 B 003 0.60 - 1.00 D 004 1.00 B 005 1.20 - 2.00 D 006 1.50		
Firm to stiff brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies. Cobbles are subangular to subrounded occasionally rounded of mixed igneous and metamorphic lithologies.		2.40	0.92	B 007 2.50 - 3.00 D 008 2.50 B 009 3.00 - 3.50		
Excavation complete at 3.80 m.		3.80	-0.48			


Stability	Collapse from 0.80m to 2.80m on all faces	Excavation dimensions and orientation				
Shoring	None used	Length (sides A and C)		1.80m		
Remarks	1. Trial pit terminated at 3.80m due to constant collapse.	Width (sides B and D)		4.00m		
		Depth		3.80m		
		Bearing of side A		250°		
WATER STRIKES						
		Date	Time	Strike at depth	Rise to depth	Time taken to rise
		25/09/2013		0.80	0.80	1

Project Name	Bay of Nigg Harbour Development Ground Investigation	Excavation Log	Hole ID.
Project No.	TA7148		TP10
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	6.49m CD	Coordinates	396524.50 E, 804651.50 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	25/09/2013	Date Completed	25/09/2013	Logged by GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
MADE GROUND: Topsoil.		0.20	6.29			
MADE GROUND: Greyish brown very sandy gravel sized fragments with high cobble content and high boulder content. Sand sized fragments are fine to coarse. Gravel sized fragments are angular to subrounded fine to coarse of mixed igneous and metamorphic lithologies, brick and tarmacadam. Cobble sized fragments are subangular to subrounded of mixed igneous and metamorphic lithologies, red brick and tarmacadam. Boulder sized fragments are of reinforced concrete and granite. at 1.00m some plastic packaging and some electrical cable				B 001 0.50 - 1.00 D 002 0.50 B 003 1.50 - 2.00 D 004 1.50 B 005 2.00 - 3.00		
Brown gravelly fine to coarse SAND with low cobble content. Gravel is subangular to rounded fine to coarse of mixed igneous and metamorphic lithologies. Cobbles are subangular to rounded of granite, schist and gneiss. from 3.00m to 3.20m dark brown/black staining		2.40	4.09	D 006 2.50		
Firm to stiff orangish brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to rounded medium to coarse of mixed igneous and metamorphic lithologies. Cobbles are subrounded of granite and predominantly schist.		3.20	3.29	B 007 3.50 - 4.00 D 008 3.50 B 009 4.00 - 4.40		
Excavation complete at 4.40 m.		4.40	2.09	D 010 4.40		

Stability	All faces stable	Excavation dimensions and orientation				
	Shoring	None used	Length (sides A and C)	1.80m		
		Remarks		Width (sides B and D)	3.90m	
			Depth	4.40m		
			Bearing of side A	350°		
WATER STRIKES						
		Date	Time	Strike at depth	Rise to depth	Time taken to rise
		25/09/2013		3.10	3.00	5

Notes: All depths in metres, all soil strengths are average in kPa All bearings given relate to magnetic North See legend sheet for key to symbols and abbreviations For in situ test results, see accompanying records	 SOIL ENGINEERING Part of the Bachy Soletanche group
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	Issue Date 22/10/2012

Project Name	Bay of Nigg Harbour Development Ground Investigation	<h1>Excavation Log</h1>	Hole ID.	TP11
Project No.	TA7148		Sheet 1 of 1	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	2.64m CD	Coordinates	396574.90 E, 804657.90 N National Grid		
Hole Type	TP	Method and equipment	20T Tracked Excavator		
Date Started	24/09/2013	Date Completed	24/09/2013	Logged by	GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
MADE GROUND: Multicoloured subangular to subrounded cobbles and boulder sized fragments (up to 400mm x 400mm x 400mm) of mixed igneous and metamorphic lithologies and occasional concrete with much slightly sandy gravel. Sand sized fragments are fine to coarse. Gravel sized fragments are subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies.				B 001 0.50 - 1.00 D 002 0.50		
				B 003 1.50 - 2.00 D 004 1.50		
Firm to stiff brown slightly sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to rounded medium to coarse of mixed igneous and metamorphic lithologies. Cobbles are subrounded of granite and predominantly schist.		2.30	0.34	B 005 2.50 - 2.80 D 006 2.50		
				B 007 2.80 - 3.10 D 008 2.80		
Excavation complete at 3.10 m.		3.10	-0.46			

Stability	Collapse from 1.40m to 2.30m on all faces	Excavation dimensions and orientation				
Shoring	None used	Length (sides A and C)	1.80m			
Remarks	1. Trial pit terminated at 3.10m due to groundwater inflow and constant collapse.	Width (sides B and D)	3.60m			
		Depth	3.10m			
		Bearing of side A	5°			
WATER STRIKES						
		Date	Time	Strike at depth	Rise to depth	Time taken to rise
		24/09/2013		1.40	1.00	2


Notes: All depths in metres, all soil strengths are average in kPa All bearings given relate to magnetic North See legend sheet for key to symbols and abbreviations For in situ test results, see accompanying records	Log Print Date And Time: 23/12/2013 10:34:17	 SOIL ENGINEERING
Form No. SI EXC LOG	Issue/Revision No. 1.04	Issue Date 22/10/2012
		Part of the Bachy Soletanche group

Project Name	Bay of Nigg Harbour Development Ground Investigation	<h1>Excavation Log</h1>	Hole ID.
Project No.	TA7148		TP12
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	8.62m CD	Coordinates	396537.00 E, 804566.40 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	24/09/2013	Date Completed	24/09/2013	Logged by GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
MADE GROUND: Topsoil.						
MADE GROUND: Dark greyish brown gravelly sand sized fragments with high cobble content, high boulder content, occasional plastic bottles and plastic packaging, occasional polystyrene fragments, occasional cast iron pipe fragments and occasional coal fragments. Sand sized fragments are fine to coarse. Gravel sized fragments are subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies. Cobble sized fragments are subangular to subrounded of mixed igneous and metamorphic lithologies, tarmacadam and brick. Boulder sized fragments are of granite (up to 1000mm x 300mm x 200mm) and reinforced concrete with rebar (2cm) (up to 2000mm x 600mm x 400mm).		0.30	8.32	D 001 0.50 B 002 0.50 - 1.00 D 003 1.20 B 004 1.50 - 2.00 D 005 2.20 B 006 2.50 - 3.00 D 007 3.20		
Excavation complete at 3.70 m.		3.70	4.92			

Stability Collapse from 0.30m to 3.70m on all faces Shoring None used Remarks 1. Trial pit terminated at 3.70m due to constant collapse.	Excavation dimensions and orientation				
	Length (sides A and C)	4.40m			
	Width (sides B and D)	1.40m			
	Depth	3.70m			
	Bearing of side A	170°			
	WATER STRIKES				
	Date	Time	Strike at depth	Rise to depth	Time taken to rise

Notes: All depths in metres, all soil strengths are average in kPa All bearings given relate to magnetic North See legend sheet for key to symbols and abbreviations For in situ test results, see accompanying records	 SOIL ENGINEERING Part of the Bachy Soletanche group
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Excavation Log	Hole ID.
Project No.	TA7148		TP13
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	3.26m CD	Coordinates	396583.50 E, 804506.80 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	24/09/2013	Date Completed	24/09/2013	Logged by GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
MADE GROUND: Multicoloured gravel with high cobble and high boulder content, occasional plastic packaging, occasional plastic pipe and occasional metal strip. Gravel sized fragments are subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies and occasional brick. Cobble sized fragments are subangular to subrounded of mixed igneous and metamorphic lithologies, brick and concrete. Boulder sized fragments (up to 1000mm x 300mm x 300mm) are of reinforced concrete and granite.				B 001 0.50 - 1.00 D 002 0.50 D 004 1.20 B 003 1.50 - 2.00 B 005 2.00 - 2.50 D 006 2.00		
Firm to stiff greenish grey sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to medium occasionally coarse of mixed igneous and metamorphic lithologies. Cobbles are subangular to subrounded of granite.		2.50	0.76	B 007 2.50 - 3.00		
Excavation complete at 3.50 m.		3.50	-0.24	D 008 3.50		

Stability Collapse from 0.00m to 2.50m on all faces Shoring None used Remarks 1. Trial pit terminated at 3.50m due to constant collapse.	Excavation dimensions and orientation				
	Length (sides A and C)		1.90m		
	Width (sides B and D)		4.00m		
Depth		3.50m			
Bearing of side A		200°			
WATER STRIKES					
Date	Time	Strike at depth	Rise to depth	Time taken to rise	
24/09/2013		1.40	1.40	3	


Notes: All depths in metres, all soil strengths are average in kPa All bearings given relate to magnetic North See legend sheet for key to symbols and abbreviations For in situ test results, see accompanying records	 SOIL ENGINEERING Part of the Bachy Soletanche group
Log Print Date And Time: 23/12/2013 10:34:22	
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Excavation Log	Hole ID.
Project No.	TA7148		TP14
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	9.66m CD	Coordinates	396585.00 E, 804443.20 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	24/09/2013	Date Completed	24/09/2013	Logged by GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
MADE GROUND: Topsoil.		0.20	9.46			
MADE GROUND: Dark greyish brown very gravelly sand sized fragments with high cobble content, high boulder content, occasional ceramic fragments, occasional glass fragments, occasional plastic packaging fragments and occasional concrete paving slabs. Sand sized fragments are fine to coarse. Gravel sized fragments are subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies. Cobble sized fragments are angular to subrounded of concrete, mixed igneous and metamorphic lithologies, red brick and tarmacadam. Boulders are (up to 2000mm x 300mm x 300mm) of granite and reinforced concrete.				D 001 0.50 B 002 0.50 - 1.00		
from 1.80m to 3.00m with some cobble sized fragments of orange brown sandy gravelly clay				D 003 1.20 B 004 1.50 - 2.00		
from 2.20m to 2.60m 1 No large boulder of reinforced concrete (2.80m x 0.60m x 0.40m)				D 005 2.20 B 006 2.50 - 3.00		
from 3.00m to 3.50m greyish brown with sand and gravel sized fragments of cement				B 008 3.00 - 3.50 D 007 3.20		
Excavation complete at 3.50 m.		3.50	6.16			

Stability Collapse from 1.00m to 3.50m of faces C and D Shoring None used Remarks 1. Trial pit terminated at 3.50m due to constant collapse.	Excavation dimensions and orientation				
	Length (sides A and C)	1.80m			
	Width (sides B and D)	5.10m			
	Depth	3.50m			
	Bearing of side A	340°			
	WATER STRIKES				
	Date	Time	Strike at depth	Rise to depth	Time taken to rise

Notes: All depths in metres, all soil strengths are average in kPa All bearings given relate to magnetic North See legend sheet for key to symbols and abbreviations For in situ test results, see accompanying records	 SOIL ENGINEERING Part of the Bachy Soletanche group
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Form No. SI EXC LOG	Issue/Revision No. 1.04
	Issue Date 22/10/2012

Project Name	Bay of Nigg Harbour Development Ground Investigation	Excavation Log	Hole ID.
Project No.	TA7148		TP15
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		









Ground Level	2.47m CD	Coordinates	396667.20 E, 804415.10 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	24/09/2013	Date Completed	24/09/2013	Logged by GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
MADE GROUND: Brown sandy gravel sized fragments with high cobble content, high boulder content and plastic packaging. Sand sized fragments are medium to coarse. Gravel sized fragments are subangular to rounded fine to coarse of mixed igneous and metamorphic lithologies. Cobble sized fragments are subrounded of mixed igneous and metamorphic lithologies. Boulder sized fragments (up to 600mm x 600mm x 400mm) are subrounded of granite and schist. from 0.30m to 0.60m plastic packaging absent		0.60	1.87	B 001 0.50 - 1.00 D 002 0.50		
Brown sandy subangular to rounded fine to coarse GRAVEL of mixed igneous and metamorphic lithologies with high cobble content and high boulder content. Sand is coarse. Cobbles are subrounded of mixed igneous and metamorphic lithologies. Boulders (up to 600mm x 400mm x 400mm) are of granite and schist.				B 003 1.80 - 2.50 D 004 1.80		
Excavation complete at 2.90 m.		2.90	-0.43	B 005 2.80 - 3.50 D 006 2.80		

Stability Collapse from 0.60m to 2.90m on all faces Shoring None used Remarks 1. Trial pit terminated at 2.90m due to constant collapse.	Excavation dimensions and orientation				
	Length (sides A and C)	1.90m			
	Width (sides B and D)	3.80m			
	Depth	2.90m			
	Bearing of side A	330°			
	WATER STRIKES				
	Date	Time	Strike at depth	Rise to depth	Time taken to rise

Project Name	Bay of Nigg Harbour Development Ground Investigation	Excavation Log	Hole ID.
Project No.	TA7148		TP16
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	2.11m CD	Coordinates	396704.70 E, 805025.70 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	27/09/2013	Date Completed	27/09/2013	Logged by
				GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
Dark grey subangular to subrounded fine to coarse GRAVEL and subangular to subrounded COBBLES of mixed igneous and metamorphic lithologies.		0.10	2.01	B 001 0.00 - 0.50 D 002 0.20		
Firm reddish brown slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies predominantly schist. Cobbles are subangular to subrounded of mixed igneous and metamorphic lithologies predominantly schist.		0.60	1.51	B 003 1.00 - 1.50 D 004 1.20		
Grey clayey gravelly fine to coarse SAND with high cobble content and high boulder content. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies predominantly schist. Cobbles are subangular to subrounded of mixed igneous and metamorphic lithologies predominantly schist. Boulders (up to 1.00m x 0.60m x 0.50m) are of granite and schist.				B 005 2.00 - 2.50 D 006 2.20		
Medium strong dark grey granitic SCHIST.		2.50	-0.40	D 007 2.60		
Excavation complete at 2.80 m.		2.80	-0.70			

Stability Spalling from 0.00m to 2.50m on faces B and D Shoring None used Remarks 1. Trial pit terminated at 2.80m due to bedrock.	Excavation dimensions and orientation				
	Length (sides A and C)	3.20m			
	Width (sides B and D)	1.20m			
	Depth	2.80m			
	Bearing of side A	210°			
	WATER STRIKES				
	Date	Time	Strike at depth	Rise to depth	Time taken to rise

Project Name	Bay of Nigg Harbour Development Ground Investigation	<h1>Excavation Log</h1>	Hole ID.	TP17
Project No.	TA7148		Sheet 1 of 1	
Engineer	Arch Henderson LLP			
Employer	Aberdeen Harbour Board			

Ground Level	1.64m CD	Coordinates	396634.80 E, 804950.10 N National Grid	
Hole Type	TP	Method and equipment	20T Tracked Excavator	
Date Started	27/09/2013	Date Completed	27/09/2013	Logged by GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
Grey clayey gravelly fine to coarse SAND with low cobble content. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies. Cobbles are subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies.				D 001 0.50		
Firm reddish brown sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed igneous and metamorphic lithologies. Cobbles are subangular to subrounded of mixed igneous and metamorphic lithologies.		0.80	0.84	B 002 1.00 - 1.50 D 003 1.20		
Grey slightly gravelly clayey fine to medium SAND. Gravel is subangular to subrounded fine to coarse of dark grey schist.		2.00	-0.36	B 004 2.00 - 2.50 D 005 2.20		
from 3.00m to 4.40m medium cobble content. Cobbles are subangular to subrounded of mixed lithologies predominantly schist				B 006 3.00 - 3.50 D 007 3.50		
Excavation complete at 4.40 m.		4.40	-2.76			

Stability	Spalling from 2.00m to 4.40m on all faces	Excavation dimensions and orientation				
Shoring	None used	Length (sides A and C)	3.80m			
Remarks	1. Trial pit terminated at 4.40m due maximum depth reached.	Width (sides B and D)	1.90m			
		Depth	4.40m			
		Bearing of side A	180°			
		WATER STRIKES				
		Date	Time	Strike at depth	Rise to depth	Time taken to rise

Project Name	Bay of Nigg Harbour Development Ground Investigation	Excavation Log	Hole ID.
Project No.	TA7148		TP18
Engineer	Arch Henderson LLP		Sheet 1 of 1
Employer	Aberdeen Harbour Board		

Ground Level	2.93m CD	Coordinates	396607.30 E, 804908.10 N National Grid		
Hole Type	TP	Method and equipment	20T Tracked Excavator		
Date Started	27/09/2013	Date Completed	27/09/2013	Logged by	GD

Description of Strata	Legend	Depth	Datum Level	Sample Details	In Situ Test Details	Installation
Multicoloured subangular to subrounded fine to coarse GRAVEL of mixed igneous and metamorphic lithologies with high cobble content and high boulder content. Cobbles are subangular to subrounded of mixed igneous and metamorphic lithologies. Boulders (up to 0.80m x 0.60m x 0.50m) are subangular of mixed igneous and metamorphic lithologies predominantly granite.				B 001 0.50 - 1.00		
Firm greenish grey slightly gravelly sandy CLAY with low cobble content. Sand is fine to coarse. Gravel is subrounded fine to coarse of granite and schist. Cobbles are subrounded of granite and predominantly dark grey schist.		1.10	1.83	D 002 1.00		
Excavation complete at 2.00 m.		2.00	0.93	D 004 2.00		

Stability Collapse from 0.00m to 1.30m on all faces Shoring None used Remarks 1. Trial pit terminated at 2.00m due to constant collapse.	Excavation dimensions and orientation					
	Length (sides A and C)		3.90m			
	Width (sides B and D)		3.60m			
Depth		2.00m			Bearing of side A	330°
WATER STRIKES						
Date	Time	Strike at depth	Rise to depth	Time taken to rise		
27/09/2013		1.00	1.00	0		



SUPPORTING FACTUAL DATA

SECTION A

Exploratory Hole Records and Field Data

GROUNDWATER / GAS MONITORING RESULTS



SOIL engineering

SUPPORTING FACTUAL DATA

SECTION B

Laboratory Testing

KEY TO LABORATORY TEST RESULTS AND SUMMARY SHEETS

SECTION B: KEY TO LABORATORY TEST RESULTS AND SUMMARY SHEETS

FIELD IDENTIFICATION

Sample Type	U	Undisturbed sample	D	Small disturbed sample
	UT	Thin wall open drive tube sample	B	Bulk disturbed sample
	P	Piston sample	AMAL	Amalgamated sample
	TW	Thin walled sample	BLK	Block sample
	L	Liner sample	C	Core sample
Test status	Any result in italics indicates a test that is not within the scope of the UKAS accreditation for this laboratory.			

SUMMARY OF LABORATORY SOIL TESTS: INDEX / CLASSIFICATION TESTS

Particle density	p	Small pyknometer method	g	Gas jar method
Plastic index	N/P	Non plastic, although liquid limit will have been determined if requested		
Particle size (PSD)	1	Following value in silt column denotes combined clay and silt fraction		
	p	Following value in clay column denotes sedimentation by pipette, else sedimentation is by hydrometer.		

SUMMARY OF LABORATORY SOIL TESTS: STRENGTH AND PERMEABILITY TESTS

Triaxial	UU	Single stage unconsolidated quick undrained
	UUM	Multi stage unconsolidated quick undrained
	UU3	Set of 3 unconsolidated quick undrained
	CU	Single stage consolidated undrained
	CUM	Multi stage consolidated undrained
	CU3	Set of 3 consolidated undrained
	CD	Single stage consolidated drained
	CDM	Multi stage consolidated drained
	CD3	Set of 3 consolidated drained
		Note that single stage tests are reported assuming $\phi = 0$ for total stress
Consolidation	Oed	One-dimensional oedometer
	mv	Coefficient of compressibility quoted for range p_0 to $p_0 + 100\text{kPa}$, where determined
Permeability	C	Constant head permeability
Shearbox	SSB	Small shear box
	LSB	Large shear box
	p	Peak value
	r	Residual shear strength
	RS	Ring shear

SECTION B: KEY TO LABORATORY TEST RESULTS AND SUMMARY SHEETS

SUMMARY OF LABORATORY SOIL RE-USE TESTS

MCV	s	MCV value at natural or specified moisture content
	int	Intercept of calibration line in MCV calibration

SUMMARY OF LABORATORY ROCK STRENGTH TESTS

Point Load	Type (combination of)	D	Diametral	A	Axial
		I	Irregular lump	B	Block
		L	Test performed parallel to planes of weakness		
		P	Test performed perpendicular to planes of weakness		
		X	Invalid failure of point load (not broken between points of load application)		

SUMMARY OF LABORATORY ROCK MATERIALS TESTS

Ten% fines	w	Soaked test	d	Dry test
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Important note:

Summary sheets are provided for convenience and in no way replace individual test result sheets which shall, without exception, be regarded as the definitive result.

POINT LOAD INDEX RESULT

Point Load	Type (combination of)	D	Diametral	A	Axial
		I	Irregular lump	B	Block
		L	Test performed parallel to planes of weakness		
		P	Test performed perpendicular to planes of weakness		
		X	Invalid failure of point load (not broken between points of load application)		
Dimensions		W	Diameter of core or average smallest width perpendicular to axis of loading in a block or irregular lump		
		D	Distance between platens when just in contact with specimen		
		D'	Distance between platens at point of failure		
		De	Equivalent core diameter	Is	P/De^2
		Is(50)	$F \times Is$	F	$(De/50)^{0.45}$
<p>Is(50) point load strength index corrected for a diametral test of core diameter 50mm For Axial/Lump tests $De^2 = (4/\pi) \times (W \times D')$ For Diametral tests $De^2 = D \times D'$</p>					



SOIL engineering

SUPPORTING FACTUAL DATA


SECTION B

Laboratory Testing

LABORATORY SOIL TEST SUMMARY SHEETS


Project Name	Bay of Nigg Harbour Development Ground Investigation	Classification Tests Summary
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content	Bulk Density	Dry Density	Particle Density	Liquid Limit	Plastic Limit	Plastic Index	Passing 425µm	Linear Shrinkage	Particle size					
						%	Mg/m ³			%	%	%	%	%	Clay	Silt	Sand	Gravel	Cobbles	
															%	%	%	%	%	
D101	1.50	004	B	1.50	01											8 ¹	80	12	0	
D101	3.50	008	B	3.50	01											6 ¹	71	24	0	
L01	0.50	001	B	0.50	01											7 ¹	85	8	0	
L01	2.50	005	B	2.50	01											4 ¹	52	30	14	
A05	1.40	001	B	1.40	01											9	18	43	30	0
A05	5.98		C	5.98	02	11				29	15	14	66							
A05	5.98		C	5.98	03											12	19	38	31	0
A05	19.64		C	19.64	01	8.6														
A05	22.10		C	22.10	01	7.4				22	14	8	61							
A08	0.50	001	B	0.50	01											5	13	27	55	0
A08	7.73		C	7.73	02	8.7				27	15	12	65							
A08	7.73		C	7.73	03											12	19	37	32	0
A08	17.60		C	17.60	02	8.6				26	13	13	66							
A08	29.10		C	29.10	01	8.5														
A11	0.00	002	B	0.00	01												4 ¹	95	1	0
A11	8.58		C	8.58	01	7.3				31	16	15	67							
A11	8.58		C	8.58	02											9	22	35	33	1
A11	12.78		C	12.78	01											22	37	21	21	0
A11	25.28		C	25.28	01	7.3														
A11	25.28		C	25.28	02											8	19	40	31	2

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Classification Tests Summary
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content	Bulk Density	Dry Density	Particle Density	Liquid Limit	Plastic Limit	Plastic Index	Passing 425µm	Linear Shrinkage	Particle size				
						%	Mg/m ³		%	%	%	%	%	Clay	Silt	Sand	Gravel	Cobbles	
A29	0.50	003	B	0.50	01											2 ¹	95	3	0
A29	4.70	010	C	4.70	01										13	22	39	25	2
A29	10.80	011	C	10.80	03	8.1				31	17	14	59						
A29	15.25	012	C	15.25	01										9	21	33	37	0
A29	21.50	014	C	21.71	01										26	36	24	14	0
A31	0.50	002	B	0.50	01											5 ¹	93	2	0
A31	4.80	005	C	4.80	01										11	21	36	32	0
A31	15.76	008	C	15.76	02	11				31	16	15	64						
A31	19.30	009	C	19.52	01										59	36	4	0	0
A34	0.50	002	D	0.50	01											6 ¹	94	0	0
A34	1.00	004	D	1.00	01				2.67 p										
A34	1.50	006	B	1.50	01											4 ¹	95	1	0
A34	4.75		C	4.75	01										11	23	37	29	0
A34	6.25		C	6.25	02	12				29	16	13	64						
A51	0.50	003	B	0.50	01											8 ¹	92	1	0
A54	1.50	006	B	1.50	01											4 ¹	94	3	0
A54	6.00	014	C	6.16	01	7.1	2.21	2.07											
A54	6.00	014	C	6.00	02										11	22	37	30	0
A54	8.00	015	C	8.24	02	11				36	19	17	68						
A54	10.15	016	C	10.15	01	14	2.16	1.90											

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Classification Tests Summary
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content	Bulk Density	Dry Density	Particle Density	Liquid Limit	Plastic Limit	Plastic Index	Passing 425µm	Linear Shrinkage	Particle size				
						%	Mg/m ³			%	%	%	%	%	Clay	Silt	Sand	Gravel	Cobbles
															%	%	%	%	%
A54	10.15	016	C	10.15	02										20	23	33	24	0
A57	0.50	003	B	0.50	01											10 ¹	84	6	0
A57	1.50	006	B	1.50	01											10 ¹	84	5	0
A57	4.50	015	B	4.50	01											11 ¹	87	2	0
A57	7.00	019	D	7.00	01	10				31	17	14	40						
A57	9.20	022	C	9.20	01										10	20	34	32	4
A57	17.30	025	C	17.30	01										11	19	35	35	0
A59	1.50	006	B	1.50	01											9 ¹	90	1	0
A59	5.50	016	B	5.50	01										6	15	31	21	27
A59	7.50	020	D	7.50	01	7.7				37	19	18	67						
A59	10.45	024	C	10.72	01										14	23	40	23	0
A59	21.20	027	C	21.43	01										9	17	39	32	2
A59	26.60	028	C	26.60	01	5.8				30			62						
A63	1.00	006	B	1.00	01											6 ¹	92	1	0
A63	2.00	010	B	2.00	01											7 ¹	91	2	0
A63	3.00	014	B	3.00	01											8 ¹	89	4	0
A63	6.50	022	D	6.50	01	12				30	17	13	66						
A63	7.50	024	B	7.50	01										9	18	34	40	0
B61	1.50	007	B	1.50	01											6 ¹	89	5	0
B61	2.00	008	D	2.00	01				2.67 p										

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Classification Tests Summary
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content	Bulk Density	Dry Density	Particle Density	Liquid Limit	Plastic Limit	Plastic Index	Passing 425µm	Linear Shrinkage	Particle size				
						%	Mg/m ³			%	%	%	%	%	Clay	Silt	Sand	Gravel	Cobbles
															%	%	%	%	%
B61	3.50	015	B	3.50	01											3 ¹	93	4	0
B61	28.05	020	C	28.07	01	3.6	2.07	1.99											
B61	28.05	020	C	28.10	02										9	20	36	35	0
B61	30.30	021	C	30.35	01	7.2	2.16	2.02											
B61	30.30	021	C	30.30	02										10	19	34	36	0
B61	30.30	021	C	30.30	03	7.2				34	20	14	62						
B61	30.80	022	C	30.85	01	6.5	2.19	2.05											
B61	30.80	022	C	30.80	02										9	20	35	35	0
C79	0.50	002	B	0.50	01											5 ¹	55	40	0
C81	0.50	002	B	0.50	01											6 ¹	53	41	0
C81	1.50	004	B	1.50	01											7 ¹	77	16	0
C81	4.40		C	4.40	01	9.5				30	17	13	60						
C81	6.30		C	6.30	01										10	25	40	25	0
C83	0.00	002	B	0.00	01											2 ¹	72	27	0
C83	1.00	003	D	1.00	01				2.66 p										
C83	2.75	008	C	2.90	01										14	22	37	27	0
C83	2.75	008	C	2.75	03	12				32	15	17	56						
C83	9.05	010	C	9.05	01										13	19	40	28	0
C83	9.05	010	C	9.05	02	8.4													
C84	0.30	002	B	0.30	01											2 ¹	56	42	0

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Classification Tests Summary
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content	Bulk Density	Dry Density	Particle Density	Liquid Limit	Plastic Limit	Plastic Index	Passing 425µm	Linear Shrinkage	Particle size				
						%	Mg/m ³			%	%	%	%	%	Clay	Silt	Sand	Gravel	Cobbles
															%	%	%	%	%
C84	3.60	006	C	3.75	01										7	12	24	18	38
C84	5.50	007	C	5.50	02	9.4				33	17	16	54						
C84	7.10	008	C	7.10	01										10	16	29	42	3
C84	7.10	008	C	7.10	02	10.0				30	15	15	68						
C87	0.00	002	B	0.00	01											4 ¹	90	6	0
C87	2.40	004	C	2.40	01	8.3													
C87	4.15	005	C	4.37	01										13	20	39	27	2
C88	0.00	002	B	0.00	01											2 ¹	56	32	10
C88	2.05	005	C	2.05	01										10	16	31	29	14
C88	4.30	006	C	4.30	01	8.9				30	18	12	65						
C88	6.20	007	C	6.20	01										13	20	38	28	0
C88	6.20	007	C	6.20	02	29													
C96	0.50	003	B	0.50	01											4 ¹	85	11	0
C96	3.50	012	B	3.50	01											9 ¹	83	8	0
D98	0.00	001	B	0.00	01											8 ¹	92	0	0
D98	1.50	006	B	1.50	01											11 ¹	89	0	0
D99	0.50	003	B	0.50	01											5 ¹	86	9	0
D99	1.50	006	B	1.50	01											7 ¹	88	6	0
D99	6.00		C	6.00	01										11	21	36	32	0
D100	0.50	003	B	0.50	01											7 ¹	92	1	0

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Classification Tests Summary
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content	Bulk Density	Dry Density	Particle Density	Liquid Limit	Plastic Limit	Plastic Index	Passing 425µm	Linear Shrinkage	Particle size					
						%	Mg/m ³			%	%	%	%	%	Clay	Silt	Sand	Gravel	Cobbles	
															%	%	%	%	%	
D100	1.50	006	B	1.50	01	24				26	NP	NP	100							
D100	2.50	009	B	2.50	01												5 ¹	95	1	0
D102	0.50	003	B	0.50	01												6 ¹	92	2	0
D102	1.50	006	B	1.50	02				2.68 p											
D102	2.50	009	B	2.50	01												4 ¹	95	1	0
D104	1.50	004	B	1.50	01												4 ¹	50	46	0
D104	5.50	012	B	5.50	01												7 ¹	85	8	0
E65	0.50	003	B	0.50	01												10 ¹	83	7	0
E65	1.50	005	D	1.50	01				2.67 p											
E65	2.50	009	B	2.50	01												10 ¹	83	8	0
E65	4.50	015	B	4.50	01												3 ¹	63	34	0
E65	8.00		C	8.24	01										10		22	33	36	0
E65	9.80		C	9.80	01	9.6				31	19	12	55							
E66	1.50	004	B	1.50	01												5 ¹	87	8	0
E66	3.50	008	B	3.50	01												6 ¹	89	4	0
E66	6.50	014	B	6.50	01												7 ¹	84	9	0
E66	11.60		C	11.60	01										11		19	34	36	0
E66	12.80		C	12.80	02	11				31	16	15	55							
E69	1.50	004	B	1.50	01												11 ¹	87	3	0
E69	3.50	008	B	3.50	01												8 ¹	83	10	0

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Classification Tests Summary
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content	Bulk Density	Dry Density	Particle Density	Liquid Limit	Plastic Limit	Plastic Index	Passing 425µm	Linear Shrinkage	Particle size				
						%	Mg/m ³			%	%	%	%	%	Clay	Silt	Sand	Gravel	Cobbles
															%	%	%	%	%
E69	8.10		C	8.10	01										10	21	32	38	0
E69	8.80		C	8.80	01	8.0				27	20	7	60						
E71	1.50	004	B	1.50	01											8 ¹	86	6	0
E71	2.00	005	D	2.00	01				2.66 p										
E71	4.50	010	B	4.50	01											8 ¹	84	8	0
E71	9.00	016	B	9.00	01											8 ¹	85	7	0
E71	10.30		C	10.30	01	10				31	17	14	56						
E72	1.50	004	B	1.50	01											11 ¹	84	5	0
E72	3.50	008	B	3.50	01											9 ¹	86	6	0
E75	0.50	002	B	0.50	01											3 ¹	33	63	0
E75	2.50	006	B	2.50	01											4 ¹	43	53	0
E105	0.00	002	B	0.00	01											2 ¹	83	15	0
E105	1.50	006	B	1.50	01				2.68 p										
E105	3.50	014	B	3.50	01											2 ¹	88	10	0
E105	5.50	022	B	5.50	01											1 ¹	73	26	0
E106	0.00	002	B	0.00	01											2 ¹	92	6	0
E106	2.50	010	B	2.50	01											2 ¹	87	11	0
E106	4.50	018	B	4.50	01											2 ¹	93	5	0
E107	0.50	003	B	0.50	01											3 ¹	93	5	0
E107	4.50	011	B	4.50	01											8 ¹	90	3	0

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Sushil Sharda	Print date 28/11/2013	
Revision No.	2.03	Issue Date 20/11/2012
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Classification Tests Summary
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content	Bulk Density	Dry Density	Particle Density	Liquid Limit	Plastic Limit	Plastic Index	Passing 425µm	Linear Shrinkage	Particle size						
						%	Mg/m ³			%	%	%	%	%	%	%	%	%			
E107	5.00	012	D	5.00	01				2.68 p												
E108	0.00	001	B	0.00	01												2 ¹	75	22	0	
E108	2.00	008	B	2.00	01												11 ¹	63	26	0	
E108	3.00	011	B	3.00	01												4 ¹	60	36	0	
E109	0.00	002	B	0.00	01												4 ¹	95	1	0	
E109	2.00	008	B	2.00	01				2.67 p												
E109	2.50	010	B	2.50	01												1 ¹	61	38	0	
E109	5.00	019	B	5.00	01												4 ¹	75	21	0	
E110	1.50	005	B	1.50	01												2 ¹	67	31	0	
E111	0.50	003	B	0.50	01												6 ¹	87	7	0	
E111	2.50	009	B	2.50	01												5 ¹	94	0	0	
E112	0.00	001	B	0.00	01												5 ¹	65	30	0	
E112	2.00	006	B	2.00	01												4 ¹	96	0	0	
E112	2.00	006	B	2.00	02				2.67 p												
E115	0.50	003	B	0.50	01												5 ¹	74	21	0	
E116	0.50	002	B	0.50	01												7 ¹	58	27	8	
GS11	6.80		C	6.80	01	8.0				52	21	31	63								
GS11	6.80		C	6.80	02												10	23	40	27	0
TP01	0.10	001	B	0.10	01												2 ¹	11	67	20	
TP01	0.50	003	B	0.50	01	9.4				36	21	15	49								

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Classification Tests Summary
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content	Bulk Density	Dry Density	Particle Density	Liquid Limit	Plastic Limit	Plastic Index	Passing 425µm	Linear Shrinkage	Particle size				
						%	Mg/m ³			%	%	%	%	%	Clay	Silt	Sand	Gravel	Cobbles
															%	%	%	%	%
TP02	0.50	003	B	0.50	01										6	18	35	40	0
TP03	0.00	001	B	0.00	01											12 ¹	61	16	11
TP03	1.50	005	B	1.50	01	14				30	18	12	63						
TP04	2.00	005	B	2.00	01										7	21	43	29	0
TP05	0.50	003	B	0.50	01				2.67 g										
TP05	0.50	003	B	0.50	02											0 ¹	6	65	29
TP05	1.50	005	B	1.50	01	12				26	14	12	56						
TP06	2.50	006	B	2.50	01											1 ¹	26	49	24
TP07	1.00	002	B	1.00	01											1 ¹	15	82	2
TP08	1.50	003	B	1.50	01											3 ¹	18	58	21
TP09	0.60	003	B	0.60	01											3 ¹	21	66	11
TP09	2.50	008	D	2.50	01	15				20	NP	NP	66						
TP10	0.50	001	B	0.50	01											2 ¹	26	62	10
TP11	1.50	003	B	1.50	01											1 ¹	27	57	15
TP11	2.80	007	B	2.80	01	5.9				29	19	10	56						
TP11	2.80	007	B	2.80	02										3	21	38	37	0
TP12	1.50	004	B	1.50	01											11 ¹	44	44	1
TP13	1.50	003	B	1.50	01											3 ¹	36	56	6
TP13	3.50	008	D	3.50	01	7.0				27	15	12	63						
TP14	0.50	002	B	0.50	01											11 ¹	37	48	4

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Classification Tests Summary
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content	Bulk Density	Dry Density	Particle Density	Liquid Limit	Plastic Limit	Plastic Index	Passing 425µm	Linear Shrinkage	Particle size					
						%	Mg/m ³			%	%	%	%	%	Clay	Silt	Sand	Gravel	Cobbles	
TP14	1.20	003	D	1.20	01				2.61 p											
TP15	1.80	003	B	1.80	01												3 ¹	22	64	11
TP16	0.00	001	B	0.00	01										6	19	39	32	4	
TP17	1.20	003	D	1.20	01	25				22	NP	NP	100							
TP17	3.00	006	B	3.00	01												10 ¹	46	11	33
TP18	0.50	001	B	0.50	01										2	19	25	52	1	
							End													

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Summary Of Laboratory Soil Re-Use Tests
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content %	Bulk Density Mg/m ³	Compaction		MCV	CBR		Pinhole Dispersion	
								OMC %	Max DD Mg/m ³		Top %	Base %		
TP17	1.00	002	B	1.00	01	16	2.20				0.49	0.65		
TP18	1.50	003	B	1.50	01	14	2.24				0.31	0.45		
								End						

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Strength and Permeability Summary
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content		Triaxial			Consol		Permeability		Shearbox		
						%	Mg/m ³	Type	c kPa	Ø °	Type	m _v m ² /MN	Type	K m/s	Type	c kPa	Ø °
A05	5.00		C	5.02	1	9.2	2.19	UU	254	0							
A05	7.95		C	7.98	1	10	2.27	UU	135	0							
A05	21.20		C	21.21	1	8.5	2.36	UU	391	0							
A08	4.63		C	4.63	1	9.5	2.34	UU	187	0							
A08	12.23		C	12.25	1	6.4	2.16	UU	351	0							
A08	20.95		C	21.05	1	9.4	2.31	UU	228	0							
A11	7.63		C	7.64	1	9	2.25	CUM	18	29.5							
A11	9.81		C	9.99	1	7.0	2.37	UU	488	0							
A11	11.64		C	11.75	1	7.7	2.31	UU	331	0							
A11	21.75		C	21.77	1	8.8	2.22	UU	388	0							
A29	4.70	010	C	4.92	2	8.2	2.34	UU	458	0							
A29	10.80	011	C	10.81	1	10.0	2.27	UU	355	0							
A29	21.50	014	C	21.53	2	18	2.11	UU	114	0							
A31	9.70	006	C	9.72	1	8.1	2.31	UU	393	0							
A31	13.00		C	13.04	1	10	2.24	UU	166	0							
A31	19.30	009	C	19.32	2	32	1.96	UU	58	0							
A34	4.75		C	4.88	2	7.7	2.33	UU	448	0							
A34	8.50		C	8.50	1	8.6	2.27	UU	313	0							
A54	2.50	009	B	2.50	1										SSB	p7.5	p40
A54	8.00	015	C	8.05	3	9	2.38	CUM	17	35.5							


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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board						Strength and Permeability Summary											
Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content		Triaxial			Consol		Permeability		Shearbox		
						%	Mg/m ³	Type	c kPa	Ø °	Type	m _v m ² /MN	Type	K m/s	Type	c kPa	Ø °
A57	9.20	022	C	9.30	2	7.8	2.33	UU	441	0							
A57	17.30	025	C	17.33	2	9.1	2.26	UU	202	0							
A59	10.45	024	C	10.50	2	8.7	2.36	UU	452	0							
A59	21.20	027	C	21.22	2	8.5	2.29	UU	417	0							
B61	2.50	011	B	2.50	1										SSB	p6.9 r1.8	p35.5 r34.5
C81	4.40		C	4.61	2	8.4	2.36	UU	364	0							
C81	7.59		C	7.61	1	9.2	2.29	UU	218	0							
C83	2.75	008	C	2.77	2	9.8	2.34	UU	131	0							
C84	3.60	006	C	3.80	2	8.0	2.36	UU	380	0							
C87	4.15	005	C	4.17	2	9.2	2.37	UU	254	0							
C87	8.45	007	C	8.48	1	8.1	2.35	UU	374	0							
C88	2.05	005	C	2.24	2	8.4	2.31	UU	228	0							
D99	6.60		C	6.61	1	9.1	2.28	UU	190	0							
E65	8.00		C	8.03	2	9.3	2.25	CU									
E65	9.80		C	10.10	1	9.3	2.24	UU	320	0							
E66	12.80		C	13.06	1	11	2.24	UU	111	0							
E69	2.50	006	B	2.50	1										SSB	p2.5	p39
E69	8.10		C	8.12	2	10	2.39	CU									
E69	8.80		C	8.82	2	9.1	2.28	UU	168	0							
E69	9.80		C	9.85	2	9.7	2.26	UU	173	0							
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							Print date 28/11/2013										
Revision No. 3.03			Issue Date 23/11/2012				Part of the Bachy Soletanche Group										



Project Name	Bay of Nigg Harbour Development Ground Investigation	Strength and Permeability Summary
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	

Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Moisture Content %	Bulk Density Mg/m ³	Triaxial			Consol		Permeability		Shearbox		
								Type	c	Ø	Type	m _v	Type	K	Type	c	Ø
									kPa	°		m ² /MN		m/s		kPa	°
E71	10.30		C	10.56	2	9.3	2.32	UU	242	0							
E71	11.92		C	11.92	1	10	2.40	CUM	19	33.0							
E71	12.55		C	12.76	2	9.1	2.25	UU	312	0							
E105	2.00	008	B	2.00	1									SSB	p8.1 r4.9	p39.5 r34	
E108	1.00	005	B	1.00	1									SSB	p10 r1.0	p41 r38	
E111	1.50	006	B	1.50	1									SSB	p0.28	p42	
GS11	4.70		C	4.80	1	8.4	2.32	UU	306	0							
GS11	7.27		C	7.29	1	9.8	2.34	UU	232	0							
GS11	13.70		C	13.72	1	8.7	2.34	UU	478	0							
								End									

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Revision No.	3.03	Print date 28/11/2013
Issue Date	23/11/2012	Part of the Bachy Soletanche Group



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SUPPORTING FACTUAL DATA


SECTION B

Laboratory Testing

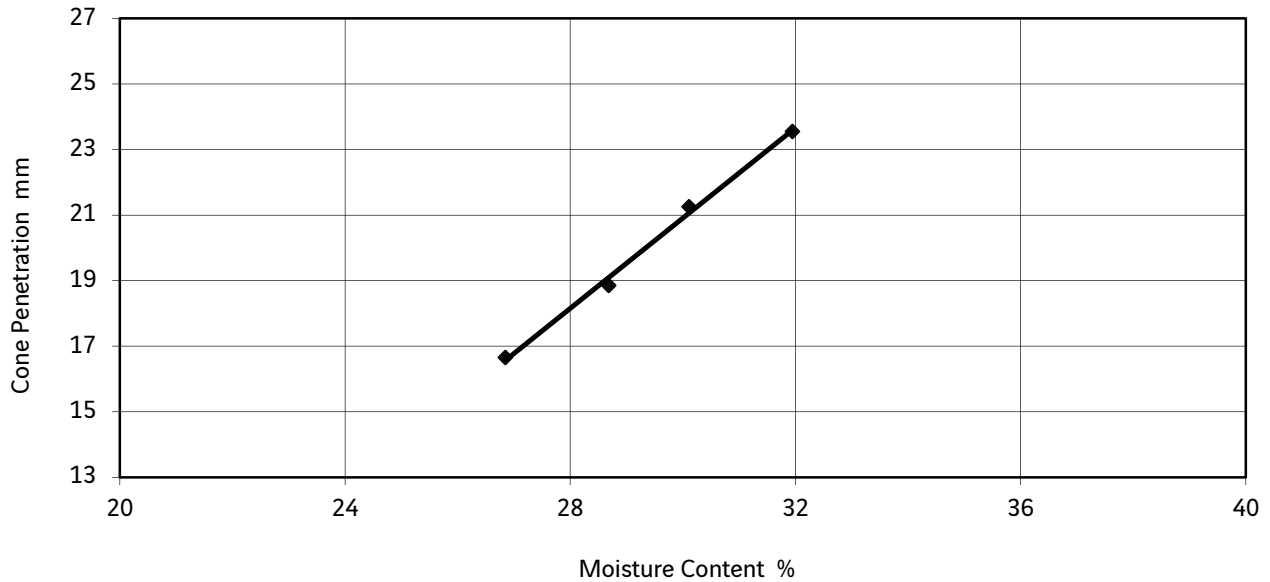
LABORATORY SOIL TEST DATA SHEETS

Project Name	Bay of Nigg Harbour Development Ground Investigation	Moisture Content
Project No.	TA7148	
Engineer	Arch Henderson LLP	
Employer	Aberdeen Harbour Board	BS1377: Part 2: 1990: 3.2

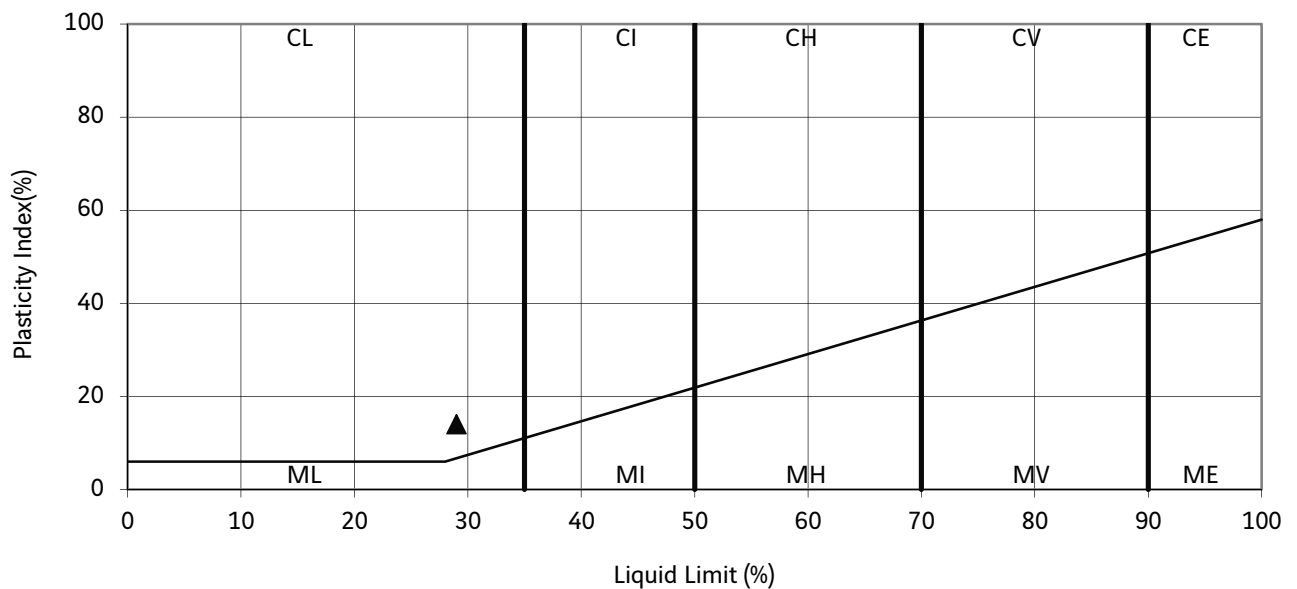
Hole ID	Sample depth m	Sample no.	Sample type	Specimen depth m	Specimen no.	Description	Remarks	Moisture Content %
A05	19.64		C	19.64	01	Brown sandy gravelly CLAY. Gravel is medium to coarse subangular.		8.6
A08	29.10		C	29.10	01	Brown sandy gravelly CLAY. Gravel is medium to coarse subangular.		8.5
A11	25.28		C	25.28	01	Brown sandy gravelly CLAY. Gravel is medium to coarse subangular.		7.3
C83	9.05	010	C	9.05	02	Greyish brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium angular.		8.4
C87	2.40	004	C	2.40	01	Brown sandy gravelly CLAY. Gravel is medium to coarse subangular.		8.3
C88	6.20	007	C	6.20	02	Greyish brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular.		29
End								

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Revision No.	2.03	Issue Date	21/11/2012

Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	A05
Project No.	TA7148		Sample Depth	5.98m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample Type	C
Description			Brown sandy gravelly CLAY. Gravel is medium to coarse subangular.	Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5
			Specimen Depth	5.98m
			Specimen Number	2

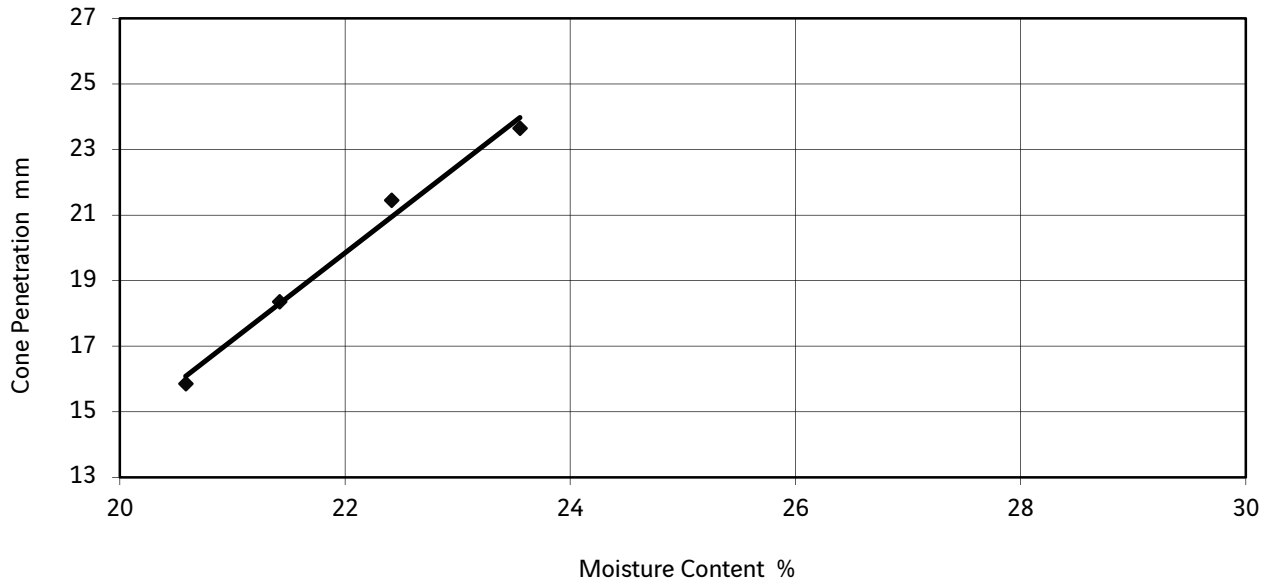


Natural moisture content:	11%	Percentage retained on 425µm sieve:	34%
Liquid limit:	29%	Preparation of sample:	Wet sieve
Plastic limit:	15%	Remarks:	
Plasticity index:	14%		
Moisture content of soil passing 425µm	17%		
Liquidity index:	0.11		

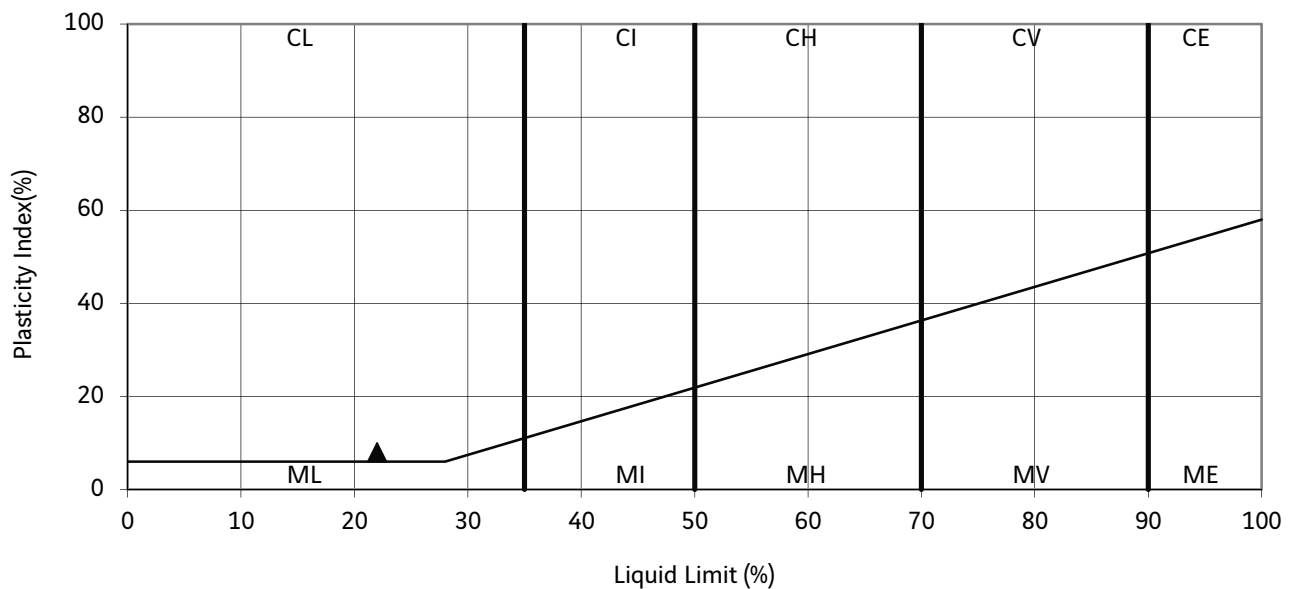



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Revision No.	2.07	Issue Date	19/11/2012	Print date	28/11/2013	Part of the Bachy Soletanche Group

Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	A05
Project No.	TA7148		Sample Depth	22.10m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample Type	C
Description		Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Specimen Depth	22.10m
			Specimen Number	1

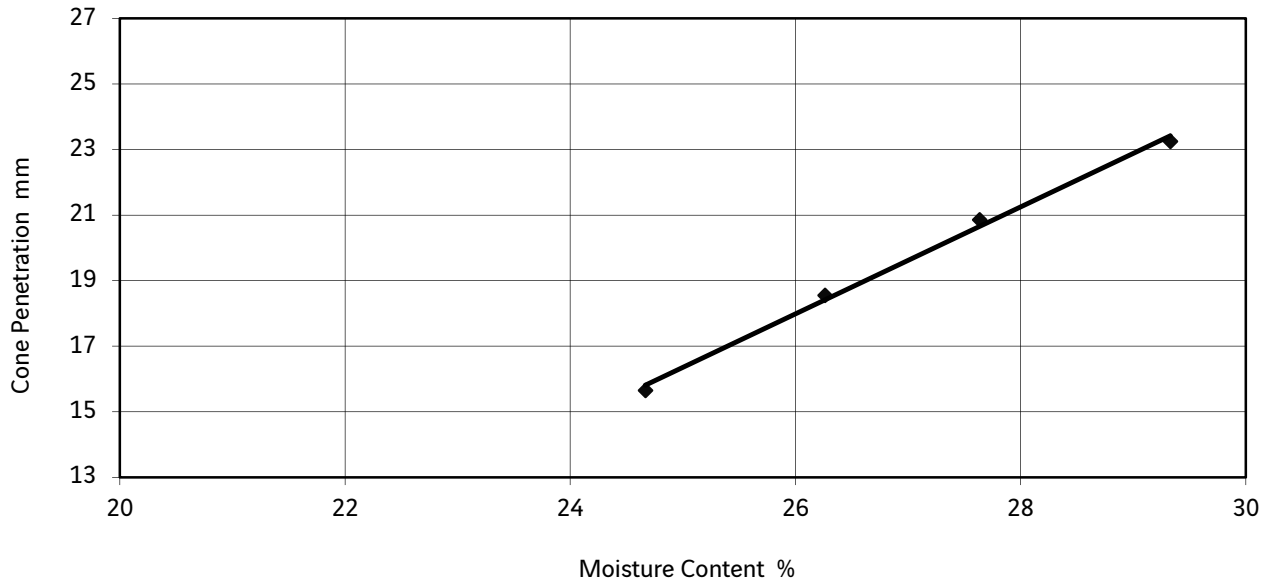


Natural moisture content:	7.4%	Percentage retained on 425µm sieve:	39%
Liquid limit:	22%	Preparation of sample:	Wet sieve
Plastic limit:	14%	Remarks:	
Plasticity index:	8%		
Moisture content of soil passing 425µm	12%		
Liquidity index:	-0.23		

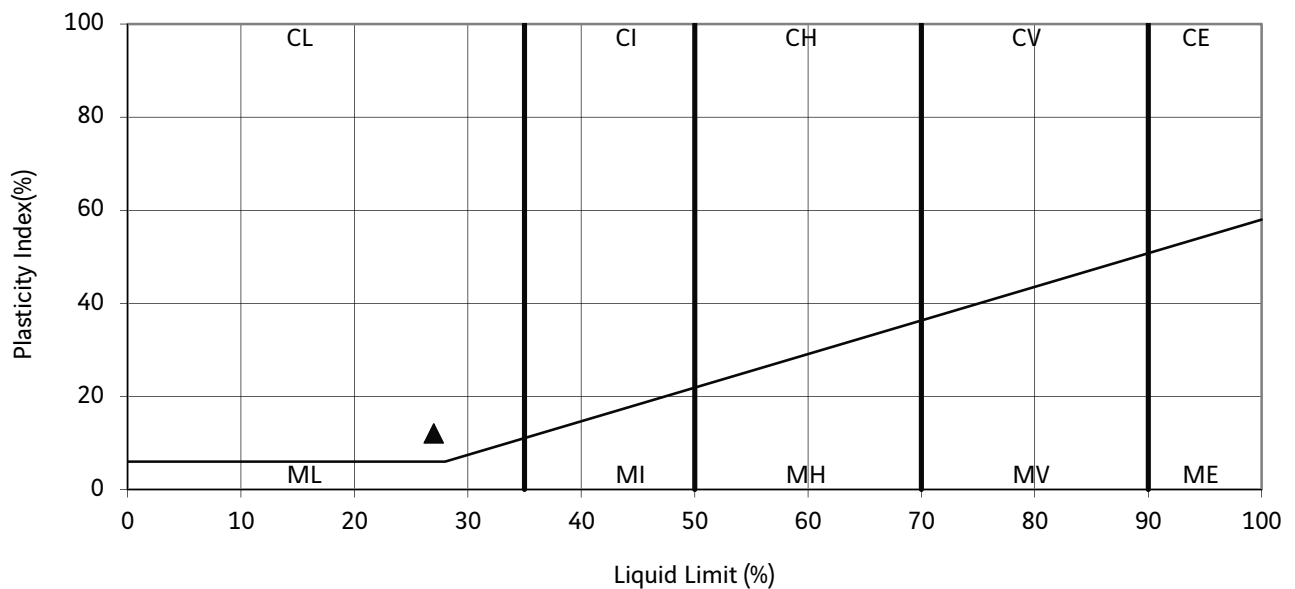



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Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	A08
Project No.	TA7148		Sample Depth	7.73m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample Type	C
Description		Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Specimen Depth	7.73m
			Specimen Number	2

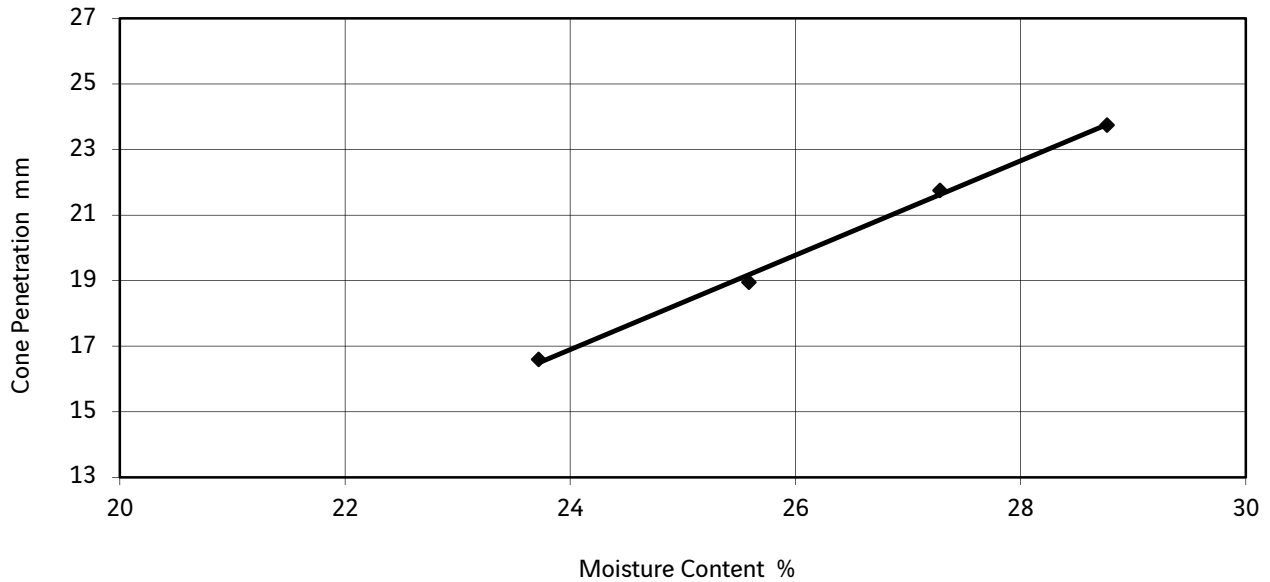


Natural moisture content:	8.7%	Percentage retained on 425µm sieve:	35%
Liquid limit:	27%	Preparation of sample: Wet sieve	
Plastic limit:	15%	Remarks:	
Plasticity index:	12%		
Moisture content of soil passing 425µm	13%		
Liquidity index:	-0.13		

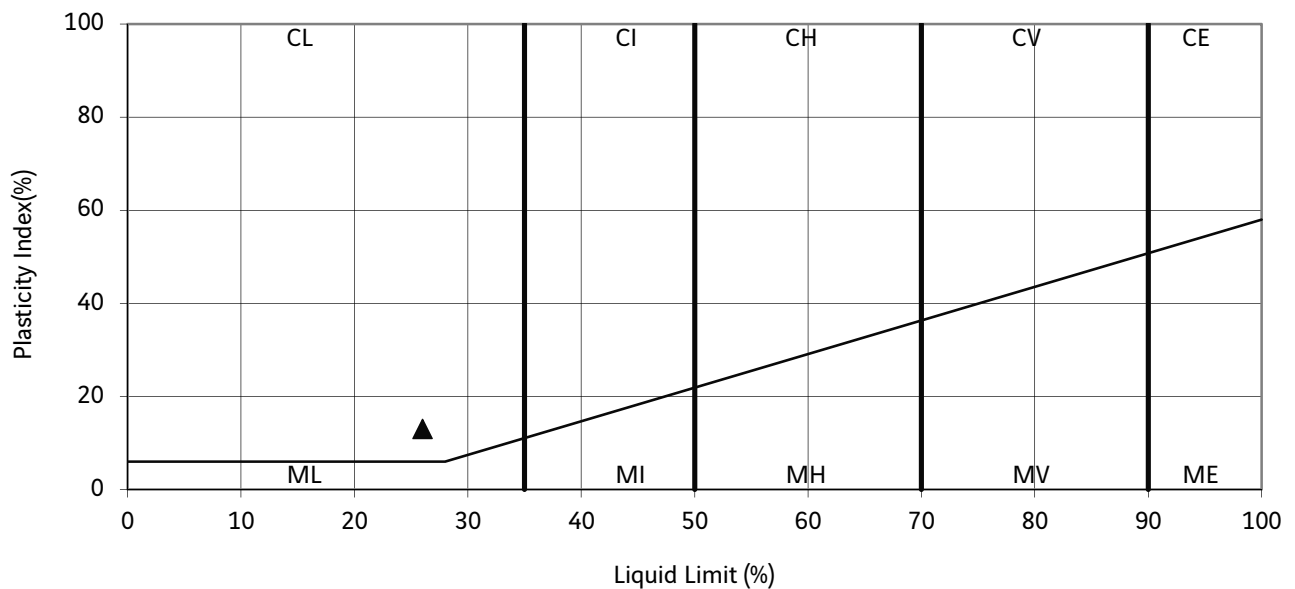



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Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID A08
Project No.	TA7148		Sample Depth 17.60m
Engineer	Arch Henderson LLP		Sample Number
Employer	Aberdeen Harbour Board		Sample Type C
Description	Brown sandy gravelly CLAY. Gravel is medium to coarse subangular.		Specimen Depth 17.60m
		Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Specimen Number 2

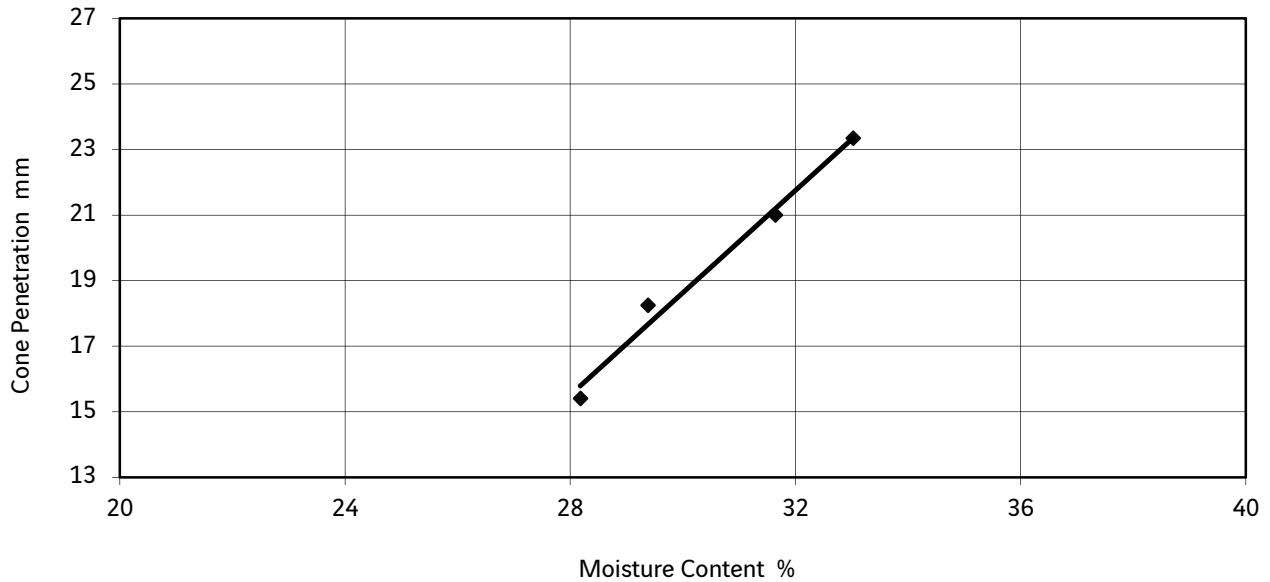


Natural moisture content:	8.6%	Percentage retained on 425µm sieve:	34%
Liquid limit:	26%	Preparation of sample:	Wet sieve
Plastic limit:	13%	Remarks:	
Plasticity index:	13%		
Moisture content of soil passing 425µm	13%		
Liquidity index:	0.01		

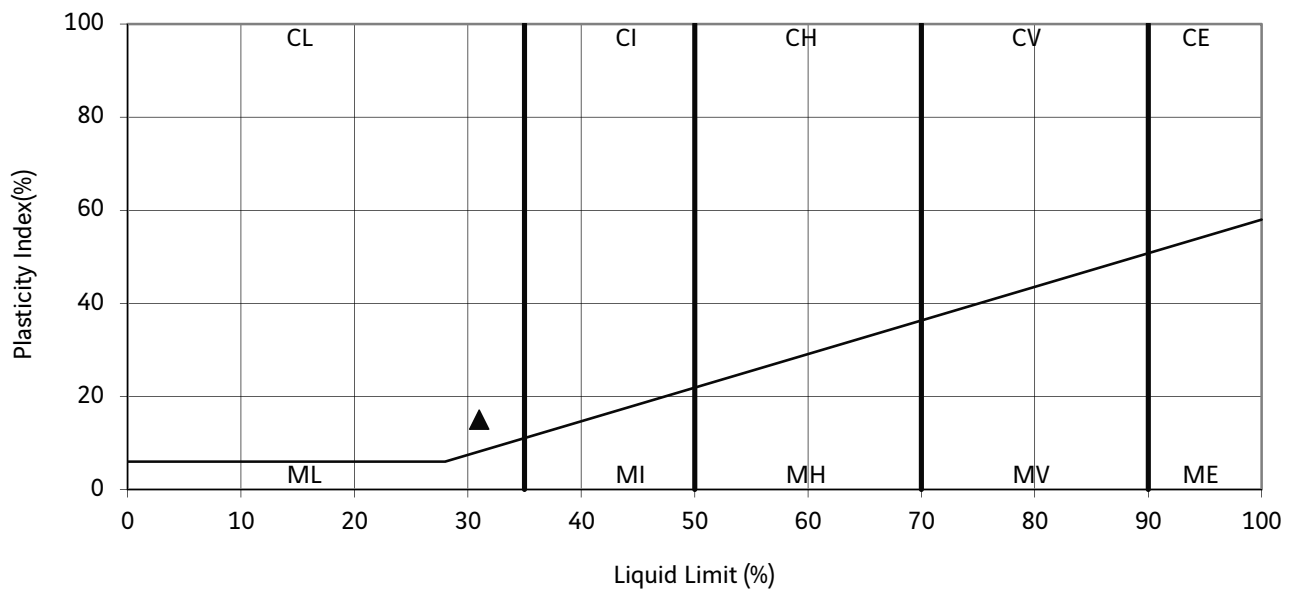


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Revision No.	2.07	Issue Date	19/11/2012	Print date	28/11/2013	Part of the Bachy Soletanche Group

Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID A11
Project No.	TA7148		Sample Depth 8.58m
Engineer	Arch Henderson LLP		Sample Number
Employer	Aberdeen Harbour Board		Sample Type C
Description	Brown gravelly slightly sandy CLAY. Gravel is medium to coarse subangular.	Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Specimen Depth 8.58m
			Specimen Number 1

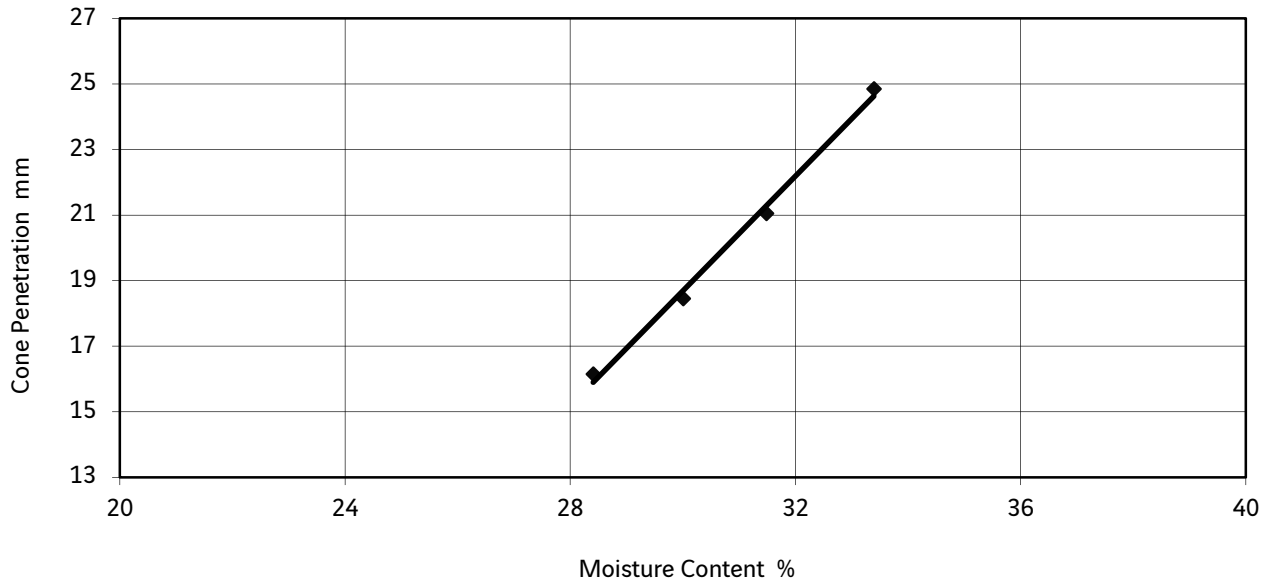


Natural moisture content:	7.3%	Percentage retained on 425µm sieve:	33%
Liquid limit:	31%	Preparation of sample: Wet sieve	
Plastic limit:	16%	Remarks:	
Plasticity index:	15%		
Moisture content of soil passing 425µm	11%		
Liquidity index:	-0.33		

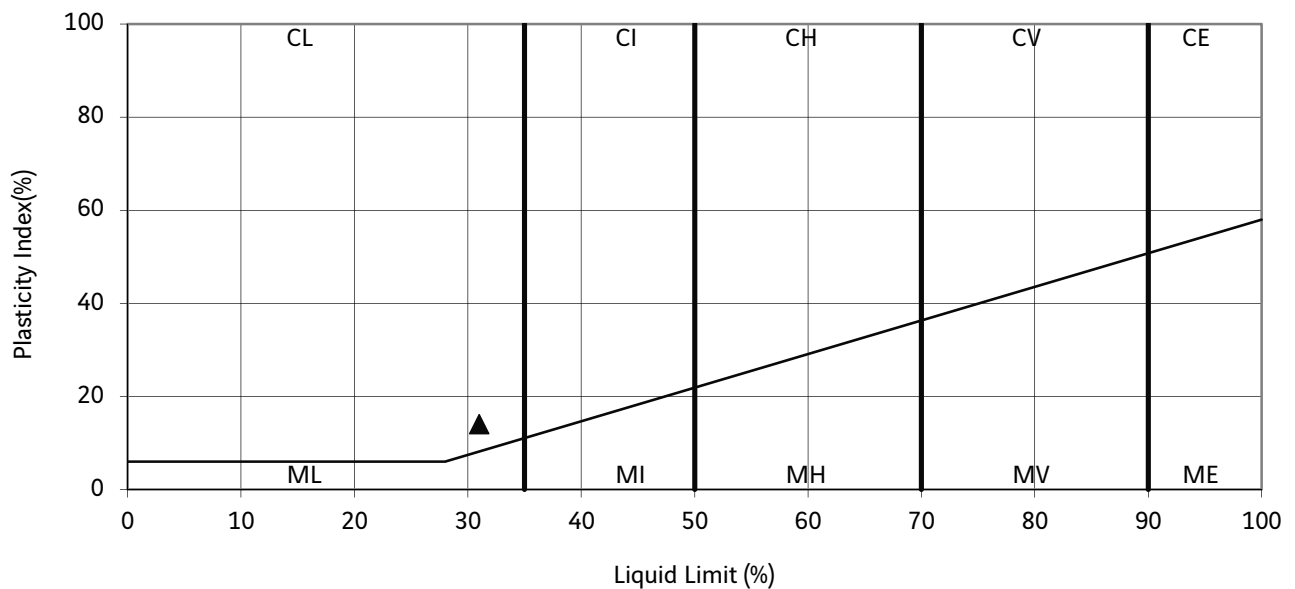



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Sushil Sharda						
Revision No.	2.07	Issue Date	19/11/2012	Print date	28/11/2013	Part of the Bachy Soletanche Group

Project Name Investigation Project No. Engineer Employer	Bay of Nigg Harbour Development Ground TA7148 Arch Henderson LLP Aberdeen Harbour Board	Liquid And Plastic Limit Test	Hole ID A29
			Sample Depth 10.80m
			Sample Number 011
			Sample Type C
Description Brown sandy gravelly CLAY. Gravel is fine to coarse angular.			Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5
			Specimen Depth 10.80m
			Specimen Number 3

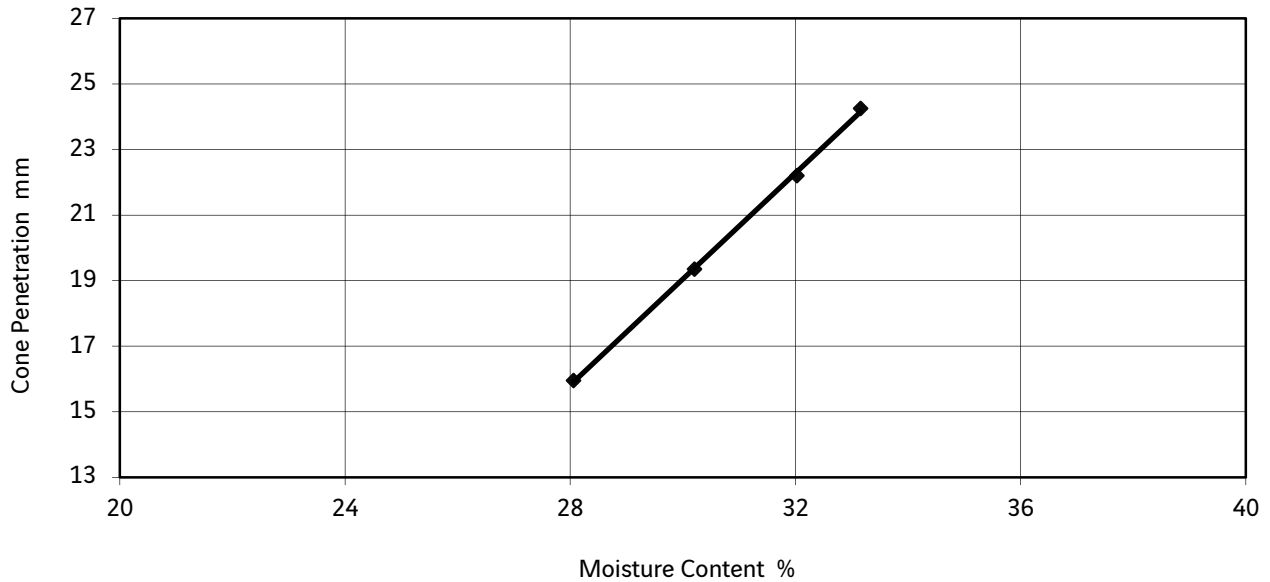


Natural moisture content:	8.1%	Percentage retained on 425µm sieve:	41%
Liquid limit:	31%	Preparation of sample:	Wet sieve
Plastic limit:	17%	Remarks:	
Plasticity index:	14%		
Moisture content of soil passing 425µm	14%		
Liquidity index:	-0.23		

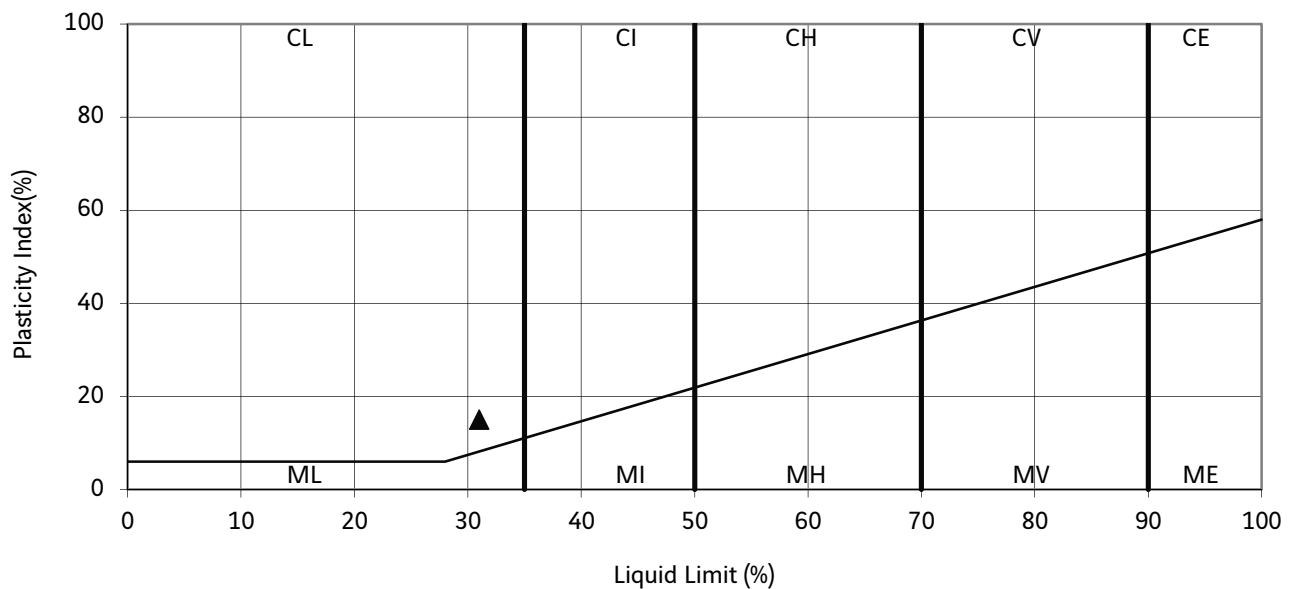



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		Print date	28/11/2013
Revision No.	2.07	Issue Date	19/11/2012
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	A31	
Project No.	TA7148		Sample Depth	15.76m	
Engineer	Arch Henderson LLP		Sample Number	008	
Employer	Aberdeen Harbour Board		Sample Type	C	
Description		Brown sandy gravelly CLAY. Gravel is medium to coarse subangular.	Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Specimen Depth	15.76m
				Specimen Number	2

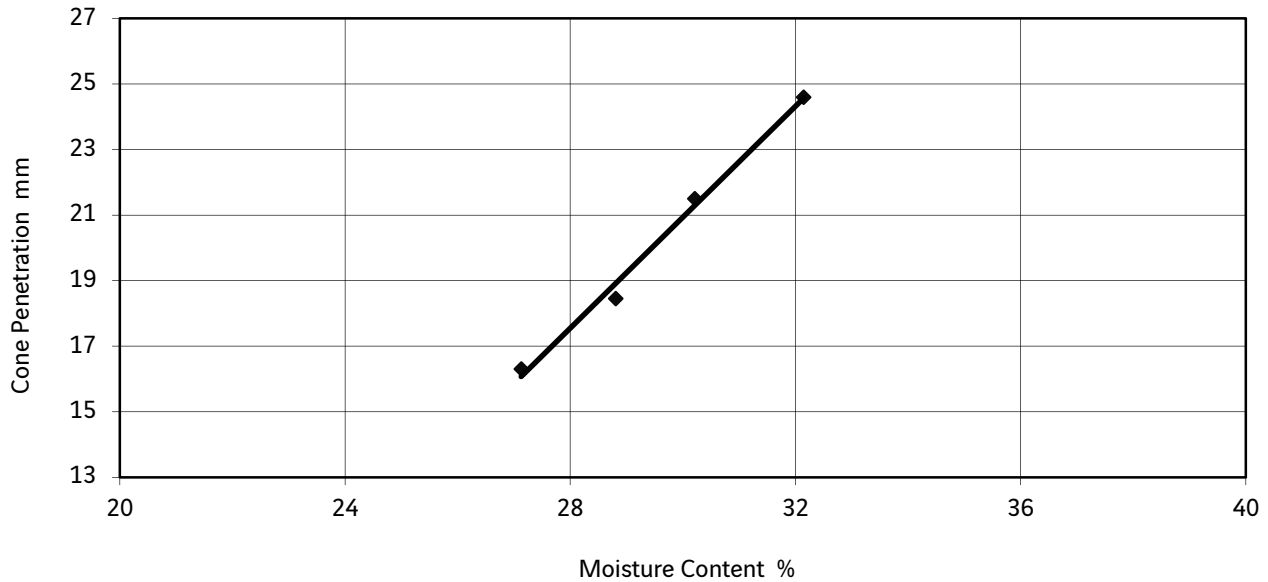


Natural moisture content:	11%	Percentage retained on 425µm sieve:	36%
Liquid limit:	31%	Preparation of sample:	Wet sieve
Plastic limit:	16%	Remarks:	
Plasticity index:	15%		
Moisture content of soil passing 425µm	18%		
Liquidity index:	0.12		

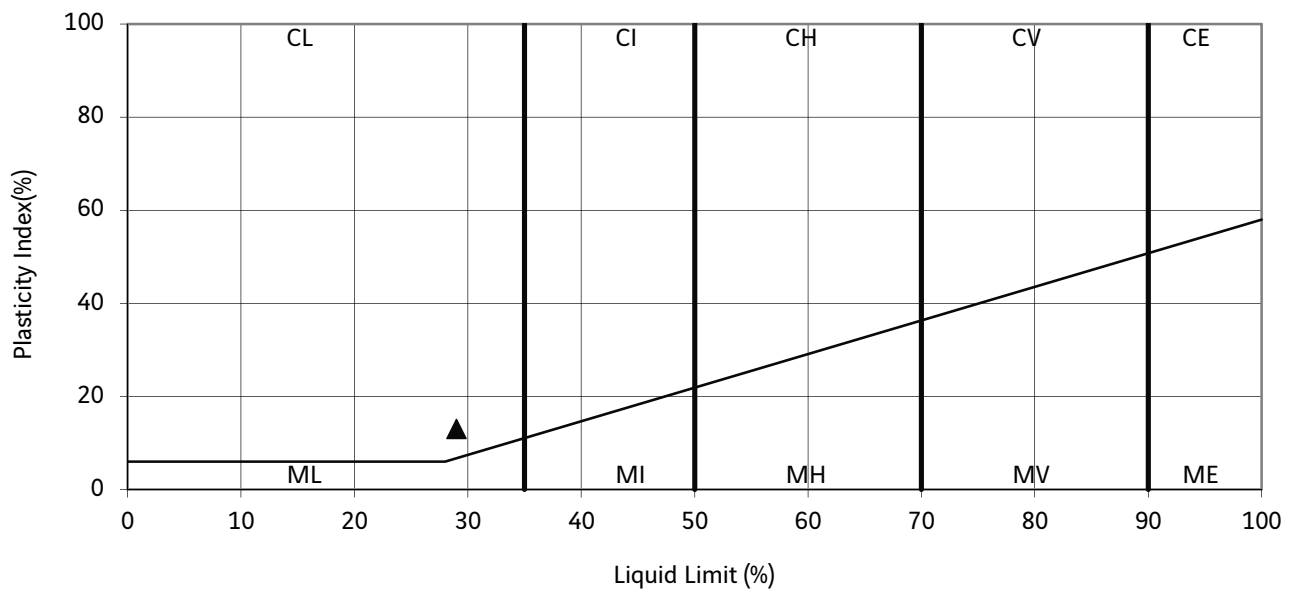



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Revision No.	2.07	Issue Date	19/11/2012	Print date	28/11/2013
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Liquid And Plastic Limit Test Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Hole ID A34
		Sample Depth 6.25m
		Sample Number
		Sample Type C
Description Brown sandy gravelly CLAY. Gravel is medium to coarse subangular.		Specimen Depth 6.25m Specimen Number 2

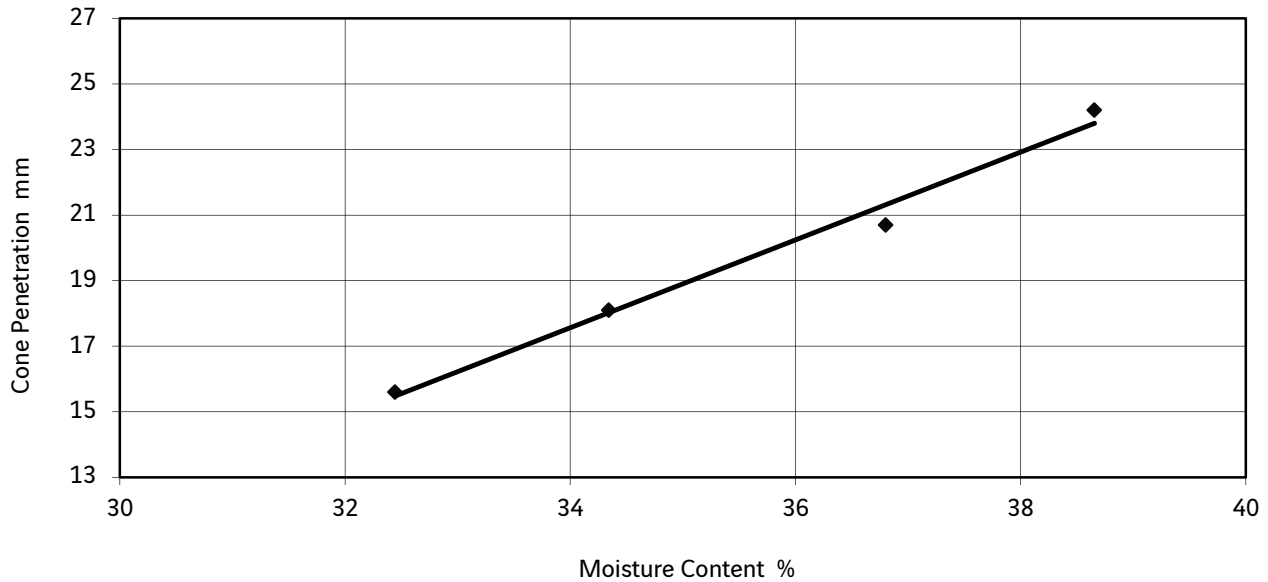


Natural moisture content:	12%	Percentage retained on 425µm sieve:	36%
Liquid limit:	29%	Preparation of sample:	Wet sieve
Plastic limit:	16%	Remarks:	
Plasticity index:	13%		
Moisture content of soil passing 425µm	18%		
Liquidity index:	0.17		

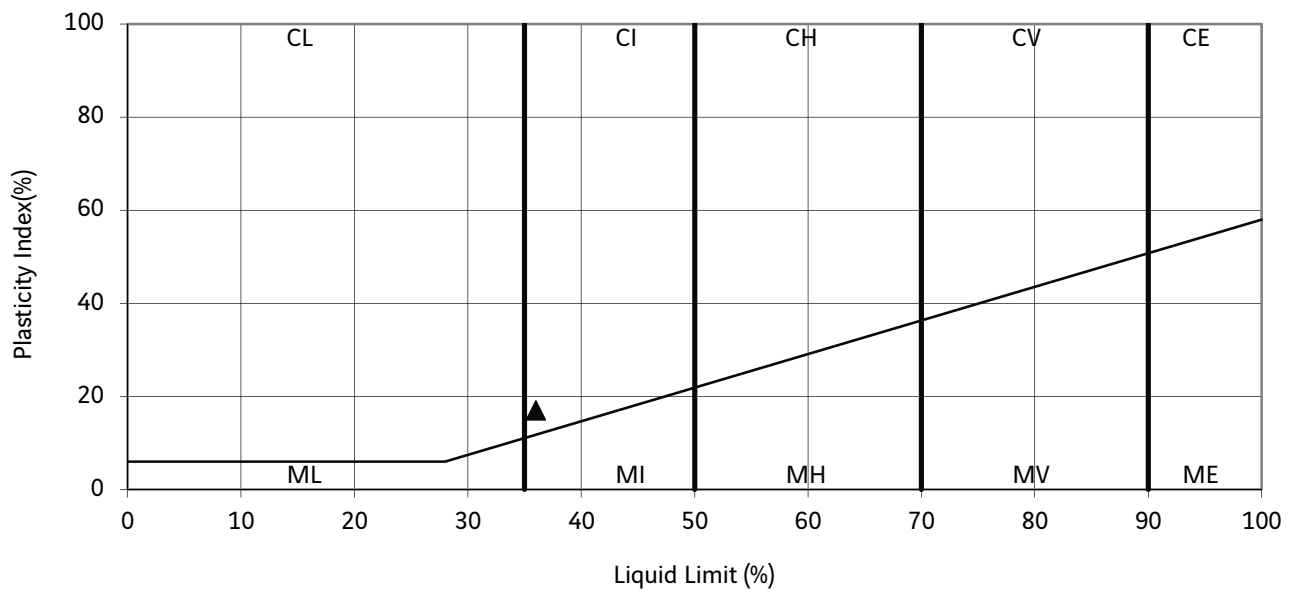



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Revision No. 2.07	Issue Date 19/11/2012	Print date 28/11/2013

Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	A54	
Project No.	TA7148		Sample Depth	8.00m	
Engineer	Arch Henderson LLP		Sample Number	015	
Employer	Aberdeen Harbour Board		Sample Type	C	
Description		Brown gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded	Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Specimen Depth	8.24m
				Specimen Number	2

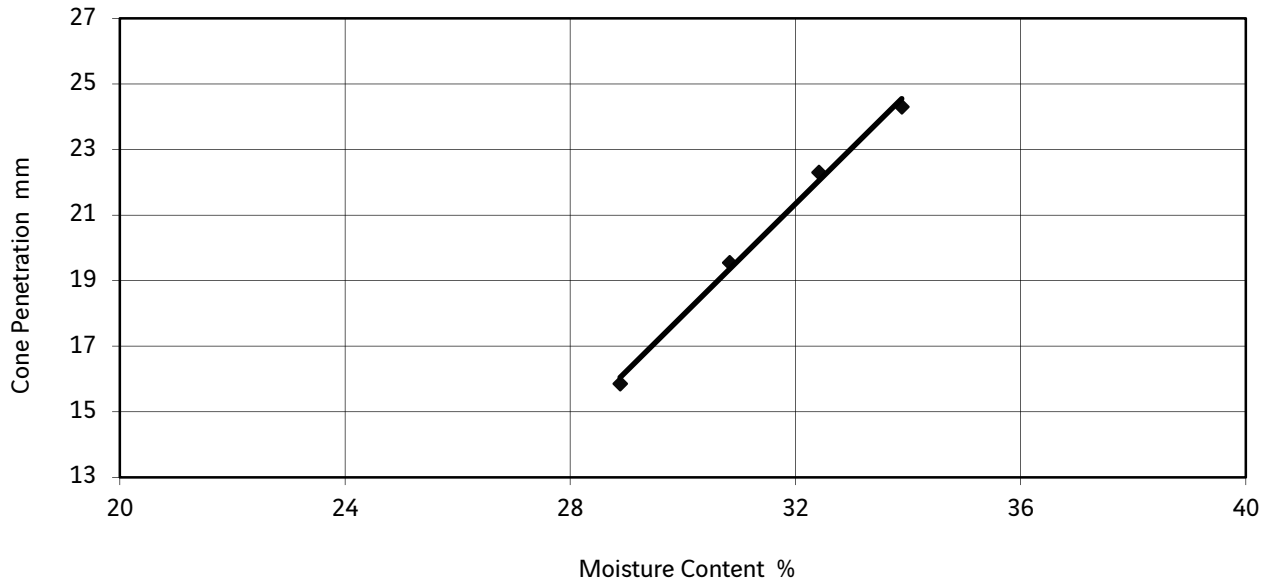


Natural moisture content:	11%	Percentage retained on 425µm sieve:	32%
Liquid limit:	36%	Preparation of sample:	Wet sieve
Plastic limit:	19%	Remarks:	
Plasticity index:	17%		
Moisture content of soil passing 425µm	17%		
Liquidity index:	-0.14		

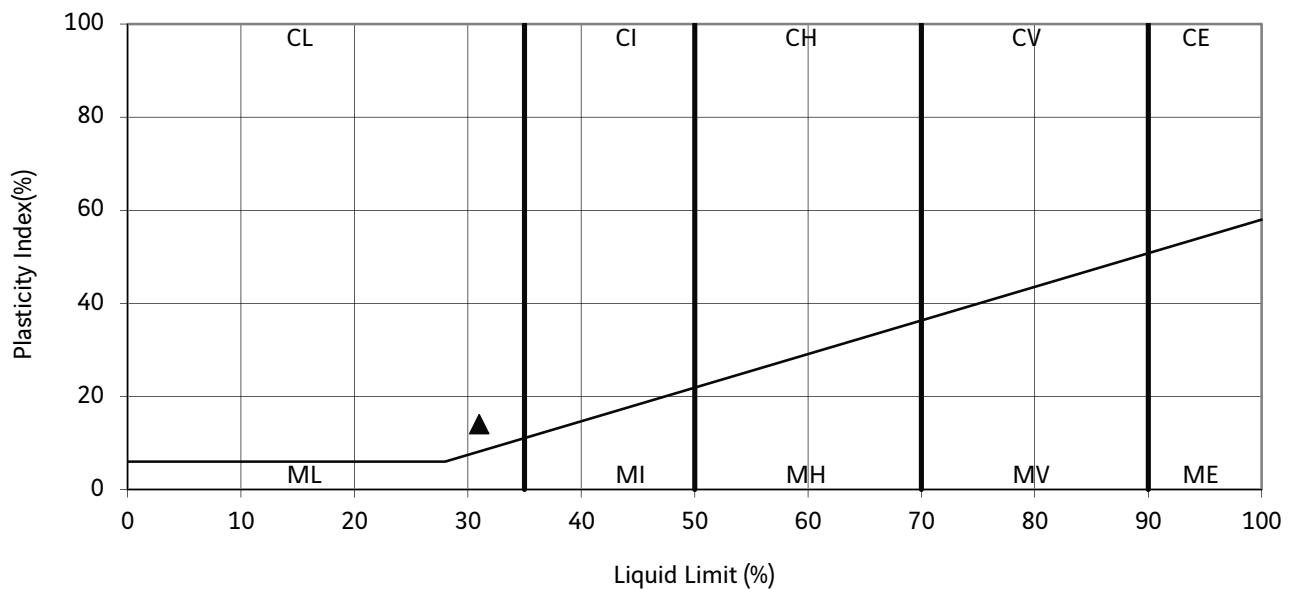


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Revision No.	2.07	Issue Date	19/11/2012	Print date	28/11/2013	Part of the Bachy Soletanche Group

Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	A57
Project No.	TA7148		Sample Depth	7.00m
Engineer	Arch Henderson LLP		Sample Number	019
Employer	Aberdeen Harbour Board		Sample Type	D
Description			Brown gravelly slightly sandy CLAY. Gravel is fine to coarse angular.	
			Specimen Depth	7.00m
			Specimen Number	1

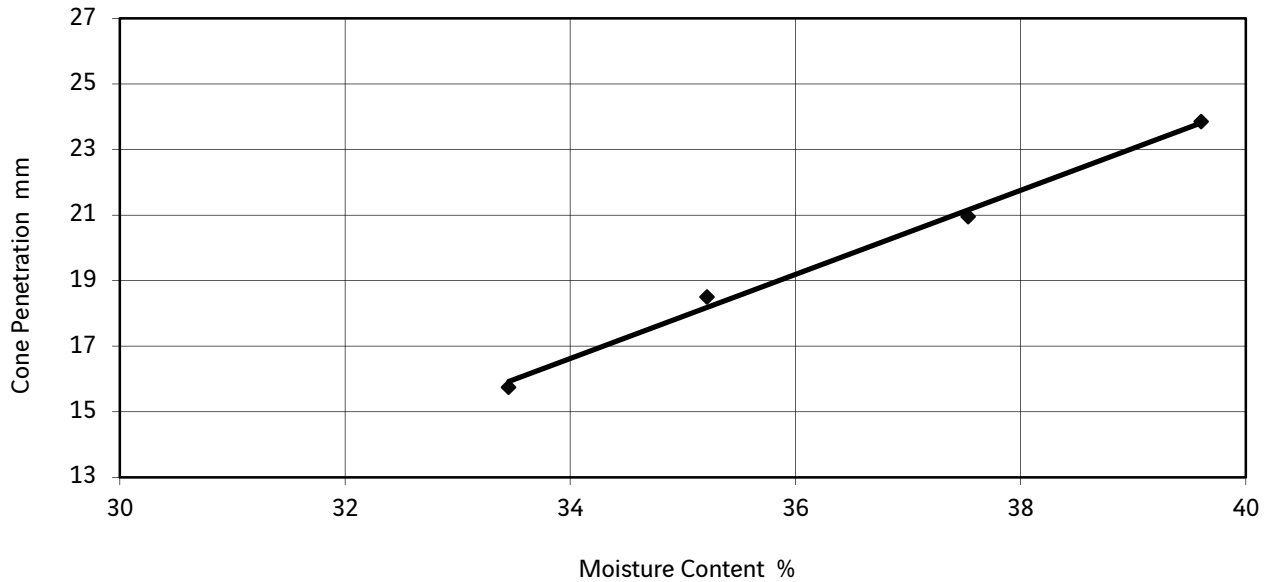


Natural moisture content:	10%	Percentage retained on 425µm sieve:	60%
Liquid limit:	31%	Preparation of sample:	Wet sieve
Plastic limit:	17%	Remarks:	
Plasticity index:	14%		
Moisture content of soil passing 425µm	26%		
Liquidity index:	0.68		

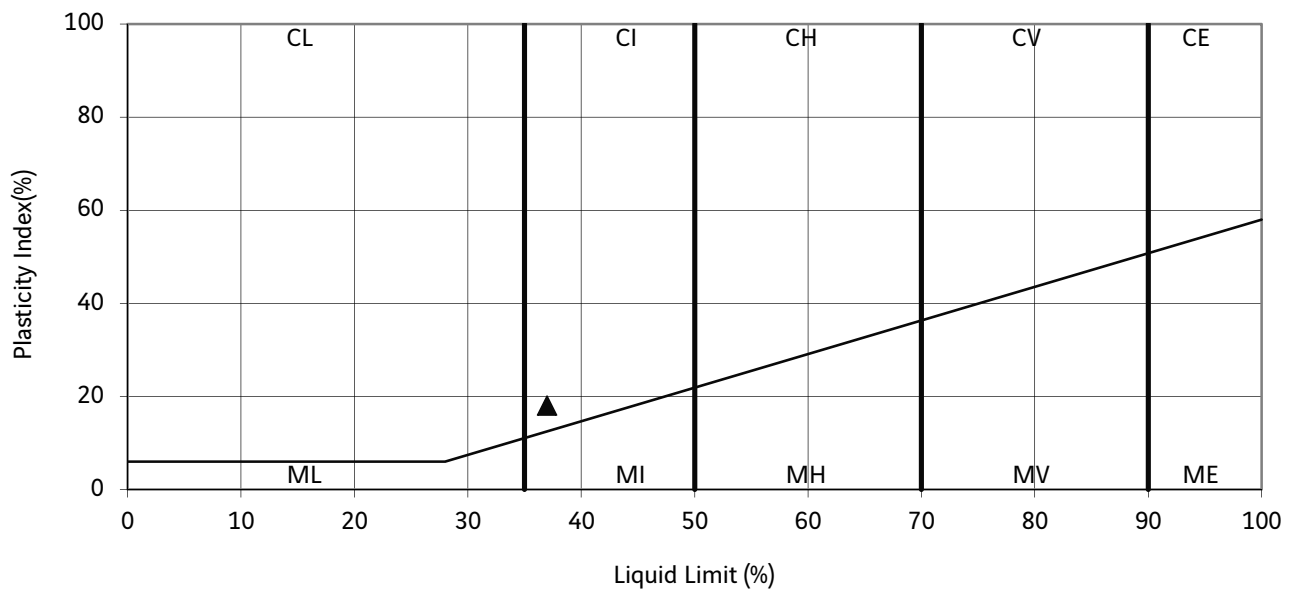



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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Liquid And Plastic Limit Test Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Hole ID A59
		Sample Depth 7.50m
		Sample Number 020
		Sample Type D
Description Brown sandy gravelly CLAY.		Specimen Depth 7.50m
		Specimen Number 1



Natural moisture content:	7.7%	Percentage retained on 425µm sieve:	33%
Liquid limit:	37%	Preparation of sample: Wet sieve	
Plastic limit:	19%	Remarks:	
Plasticity index:	18%		
Moisture content of soil passing 425µm	12%		
Liquidity index:	-0.41		

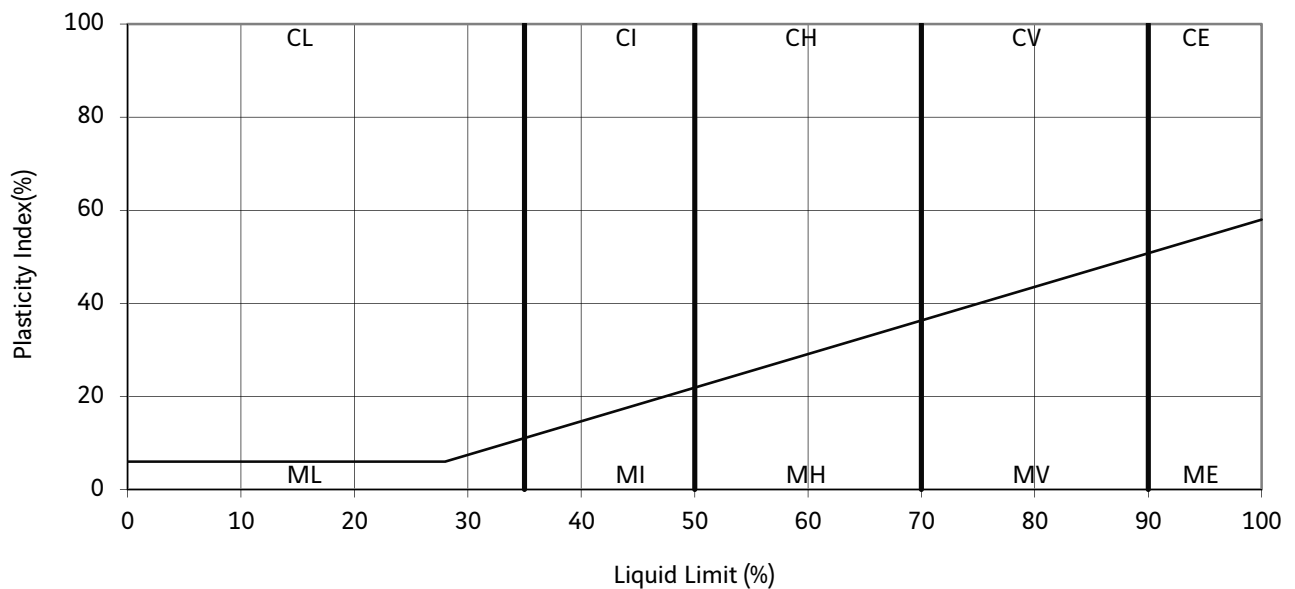


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Project Name Investigation Project No. Engineer Employer	Bay of Nigg Harbour Development Ground TA7148 Arch Henderson LLP Aberdeen Harbour Board	Liquid And Plastic Limit Test	Hole ID A59
			Sample Depth 26.60m
			Sample Number 028
			Sample Type C
Description Brown sandy gravelly CLAY. Gravel is medium to coarse subangular.			Specimen Depth 26.60m
			Specimen Number 1

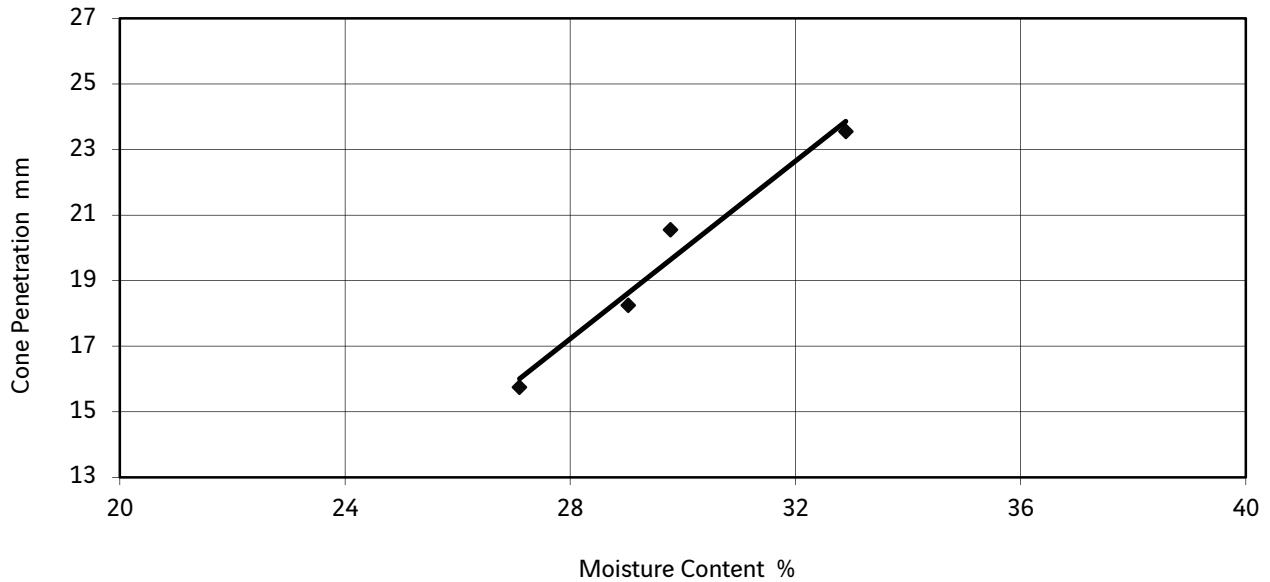


Natural moisture content:	5.8%	Percentage retained on 425µm sieve:	38%
Liquid limit:	30%	Preparation of sample:	Wet sieve
Plastic limit:		Remarks:	
Plasticity index:			
Moisture content of soil passing 425µm	9.4%		
Liquidity index:			

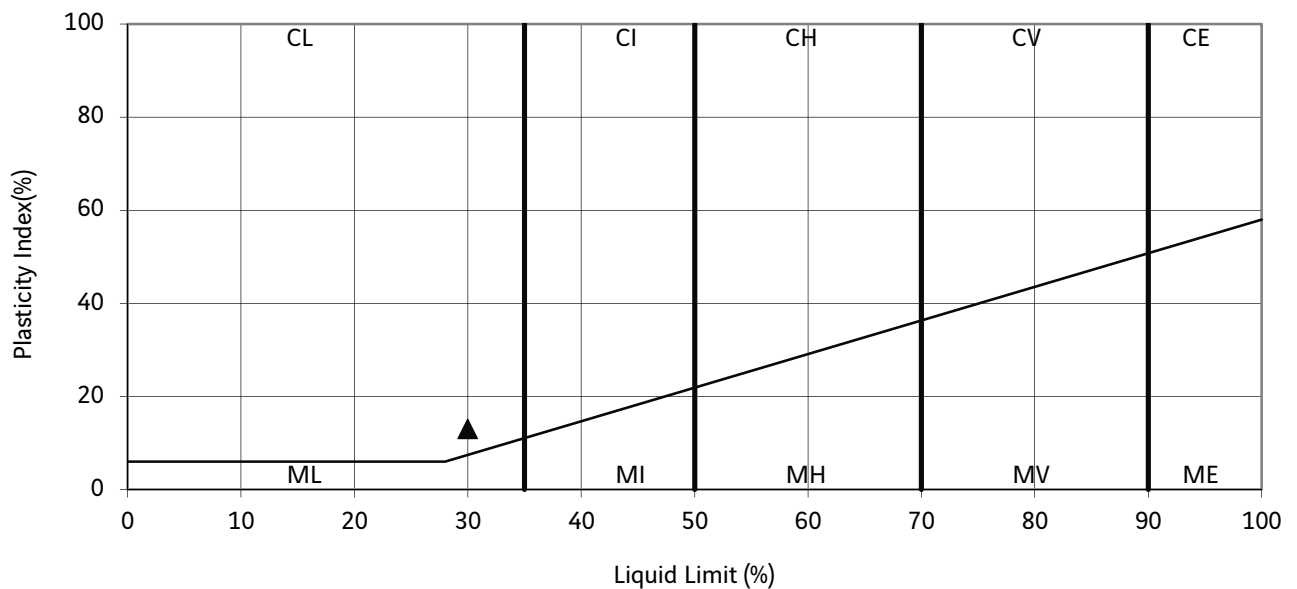


Approved by: Sushil Sharda	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	A63	
Project No.	TA7148		Sample Depth	6.50m	
Engineer	Arch Henderson LLP		Sample Number	022	
Employer	Aberdeen Harbour Board		Sample Type	D	
Description		Brown sandy slightly gravelly CLAY.	Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Specimen Depth	6.50m
				Specimen Number	1

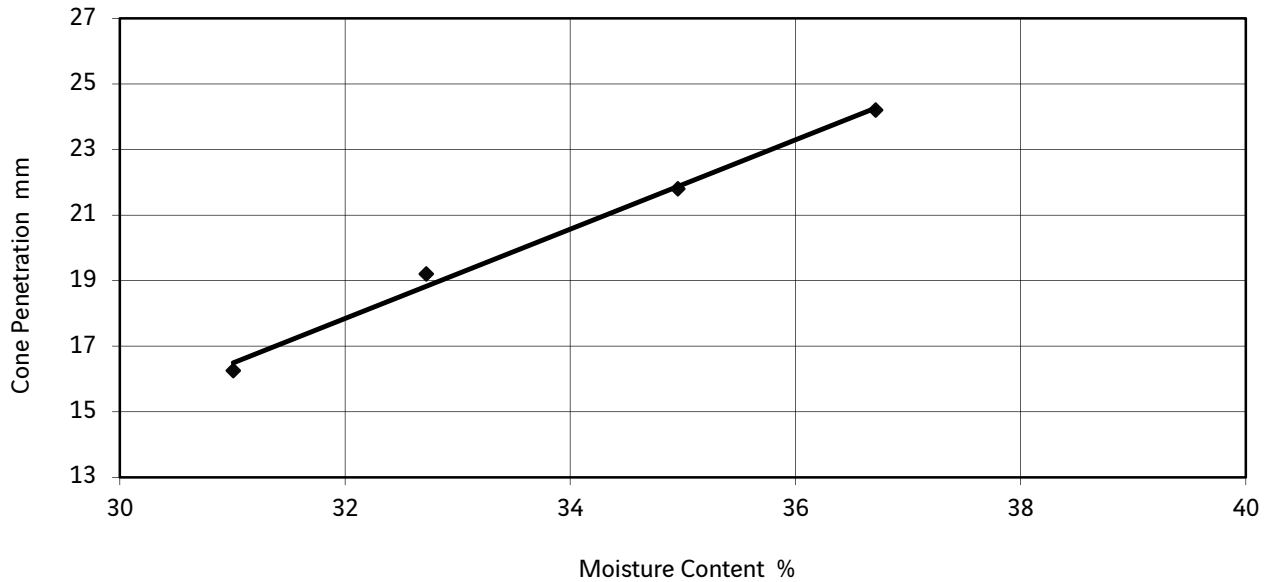


Natural moisture content:	12%	Percentage retained on 425µm sieve:	34%
Liquid limit:	30%	Preparation of sample:	Wet sieve
Plastic limit:	17%	Remarks:	
Plasticity index:	13%		
Moisture content of soil passing 425µm	18%		
Liquidity index:	0.06		

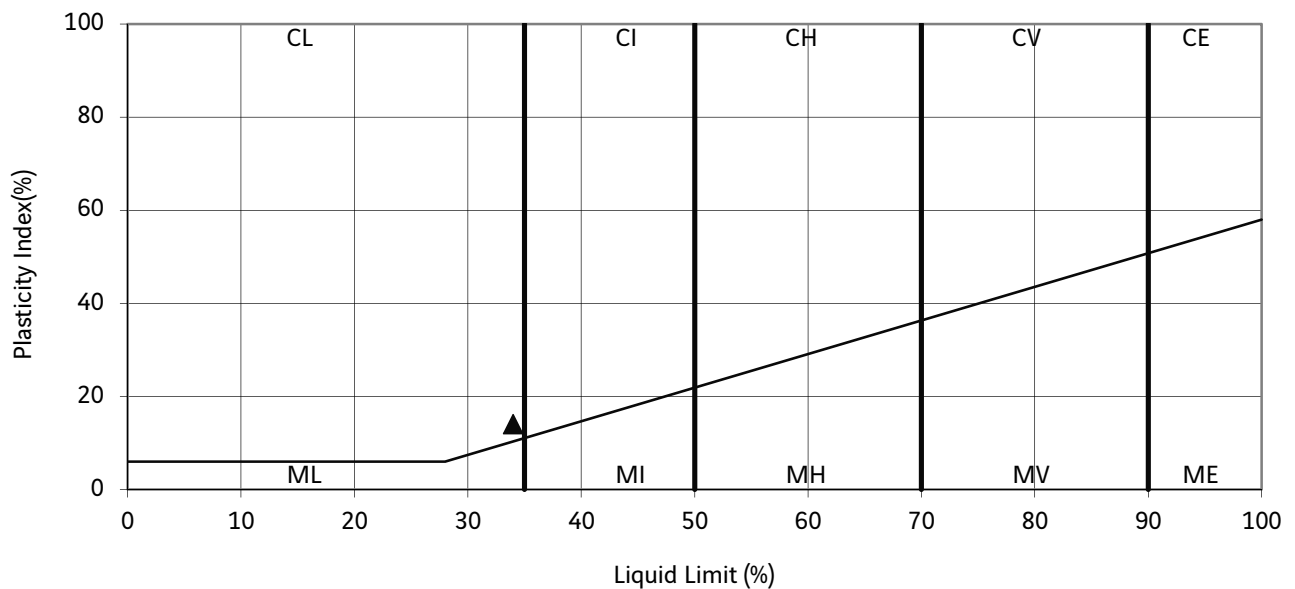


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Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	B61
Project No.	TA7148		Sample Depth	30.30m
Engineer	Arch Henderson LLP		Sample Number	021
Employer	Aberdeen Harbour Board		Sample Type	C
Description		Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Specimen Depth	30.30m
			Specimen Number	3

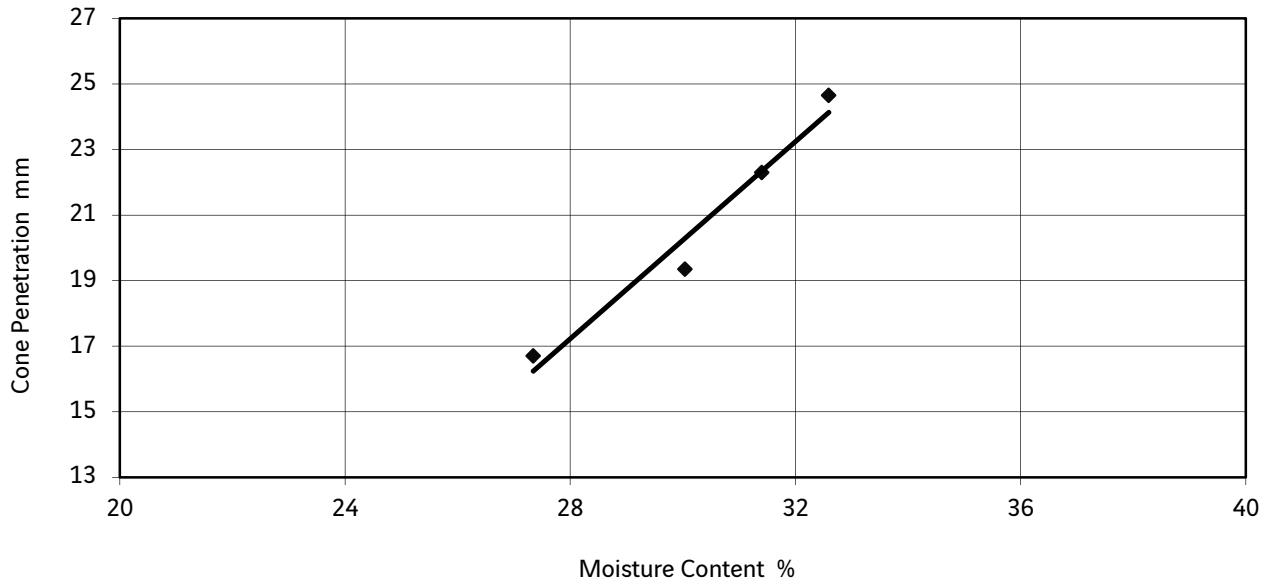


Natural moisture content:	7.2%	Percentage retained on 425µm sieve:	38%
Liquid limit:	34%	Preparation of sample:	Wet sieve
Plastic limit:	20%	Remarks:	
Plasticity index:	14%		
Moisture content of soil passing 425µm	12%		
Liquidity index:	-0.60		

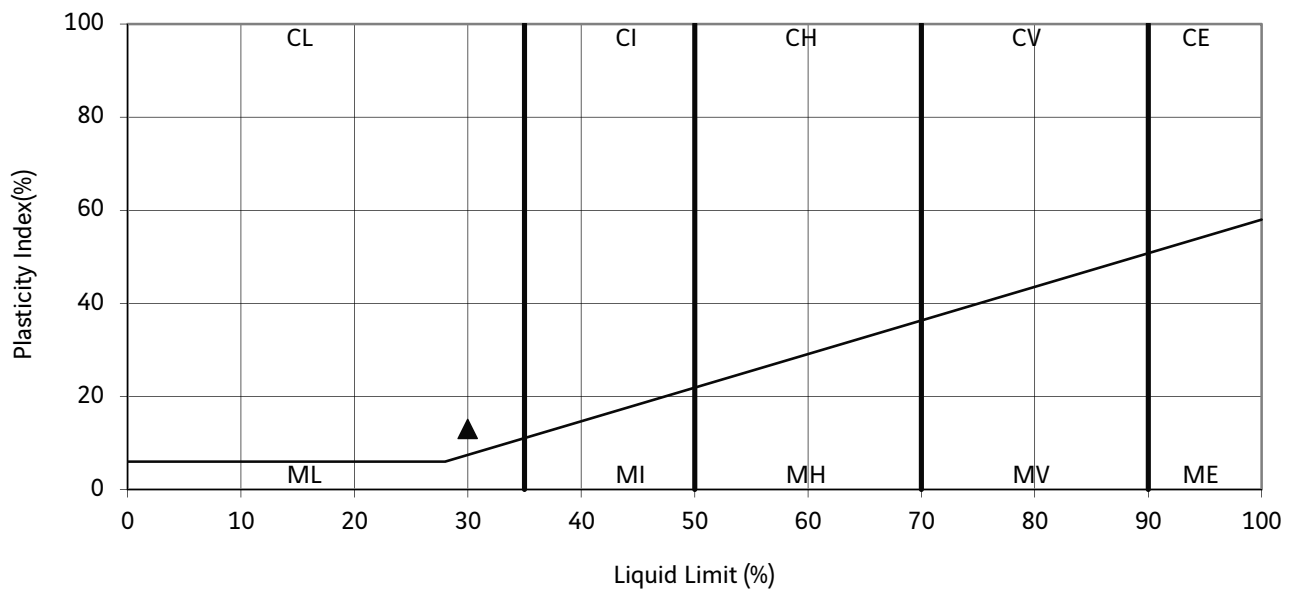


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Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	C81
Project No.	TA7148		Sample Depth	4.40m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample Type	C
Description			Brown gravelly slightly sandy CLAY. Gravel is fine to coarse angular.	
			Specimen Depth	4.40m
			Specimen Number	1

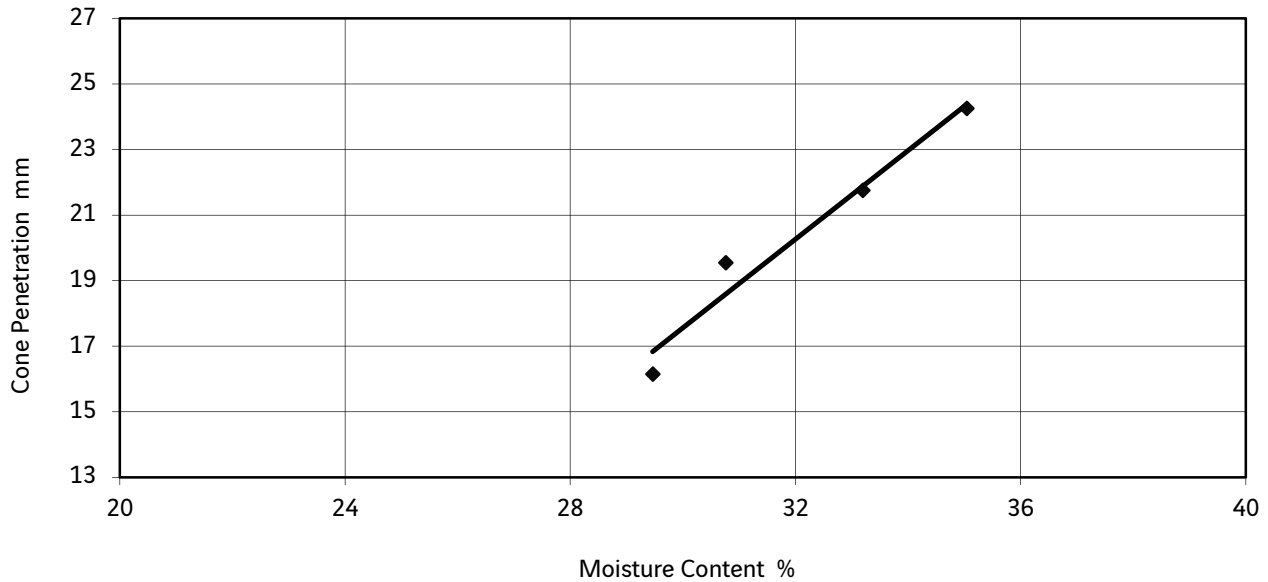


Natural moisture content:	9.5%	Percentage retained on 425µm sieve:	40%
Liquid limit:	30%	Preparation of sample:	Wet sieve
Plastic limit:	17%	Remarks:	
Plasticity index:	13%		
Moisture content of soil passing 425µm	16%		
Liquidity index:	-0.09		

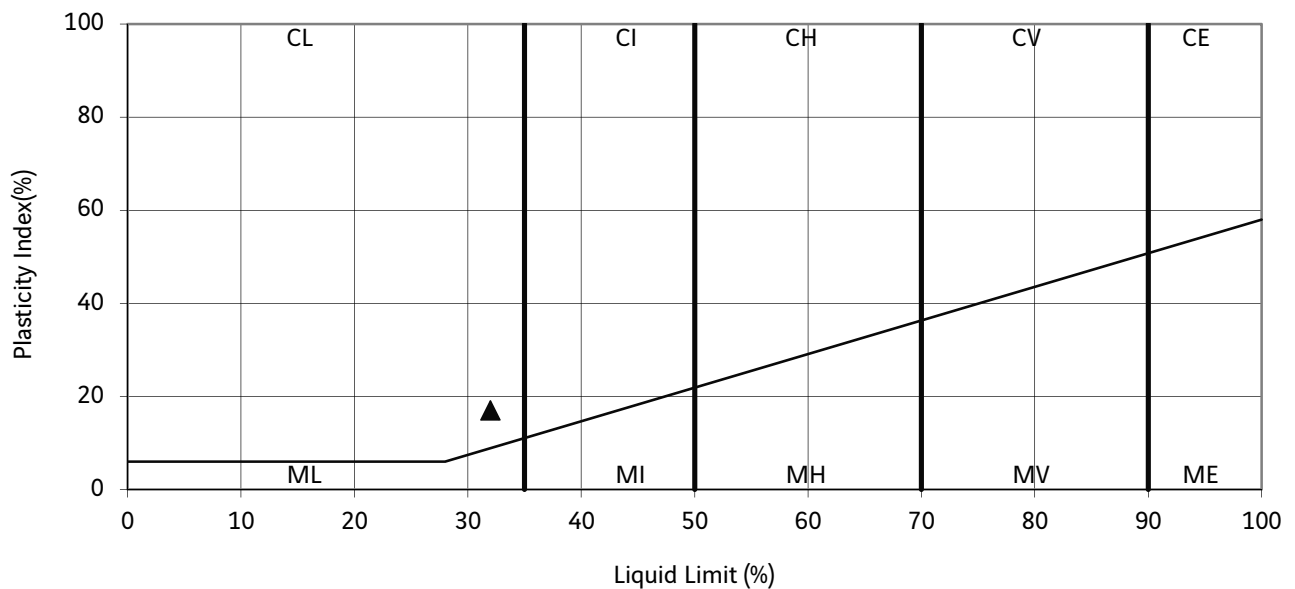



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Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	C83
Project No.	TA7148		Sample Depth	2.75m
Engineer	Arch Henderson LLP		Sample Number	008
Employer	Aberdeen Harbour Board		Sample Type	C
Description		Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Specimen Depth	2.75m
			Specimen Number	3

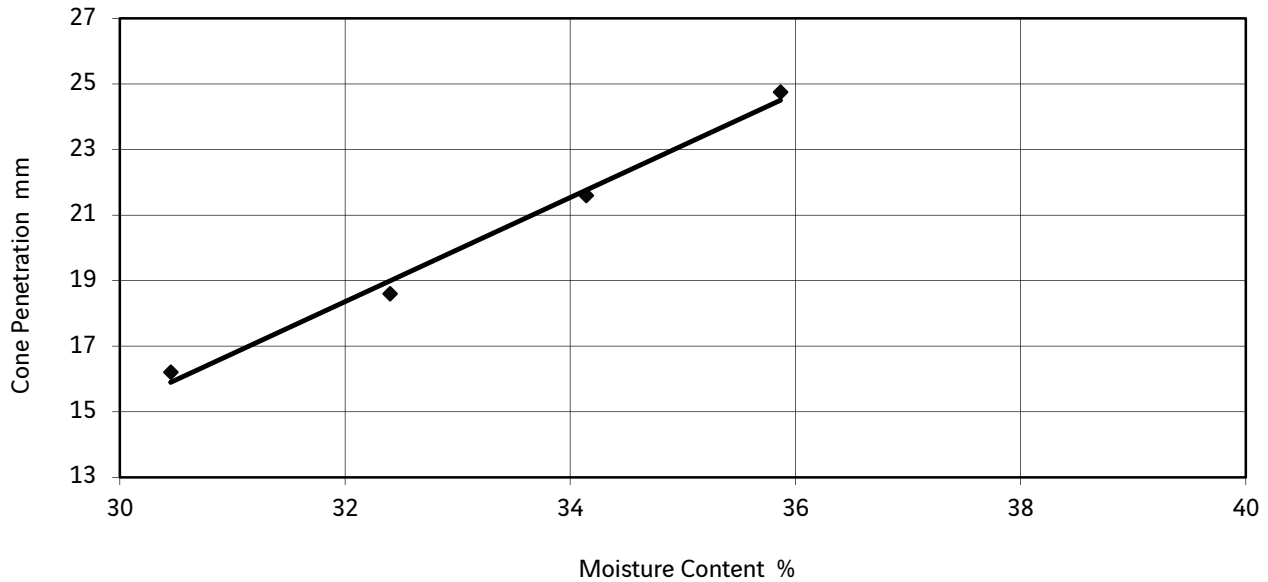


Natural moisture content:	12%	Percentage retained on 425µm sieve:	44%
Liquid limit:	32%	Preparation of sample:	Wet sieve
Plastic limit:	15%	Remarks:	
Plasticity index:	17%		
Moisture content of soil passing 425µm	22%		
Liquidity index:	0.38		

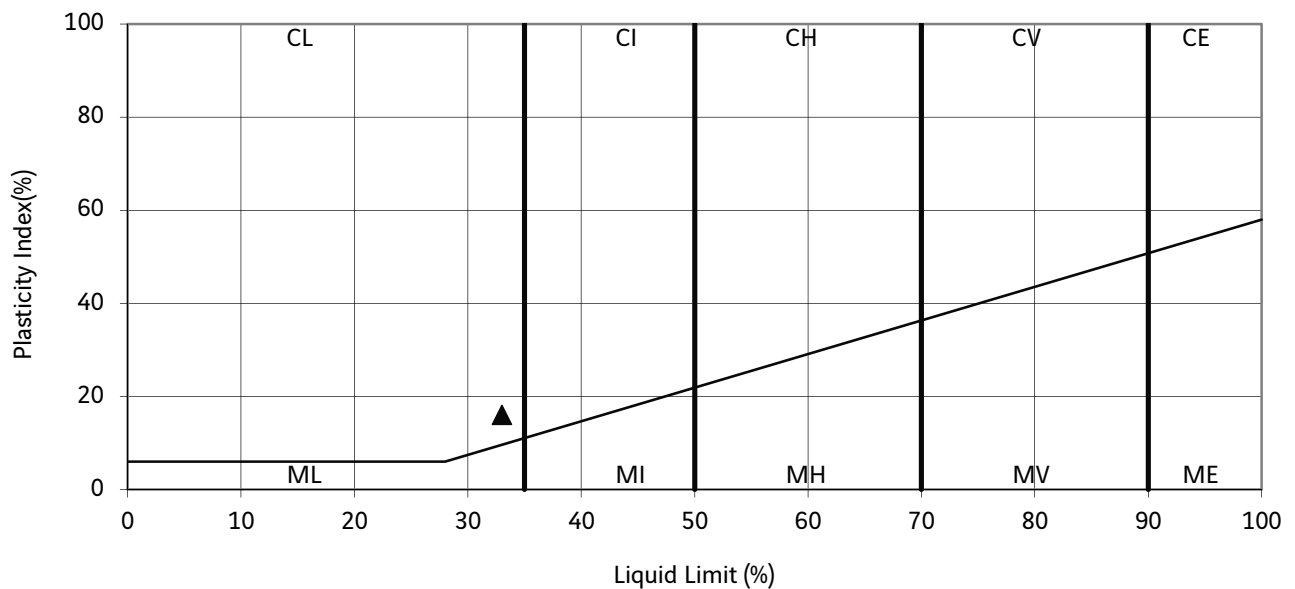



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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Liquid And Plastic Limit Test Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Hole ID C84
		Sample Depth 5.50m
		Sample Number 007
		Sample Type C
Description Brown gravelly sandy CLAY. Gravel is fine to coarse angular		Specimen Depth 5.50m
		Specimen Number 2

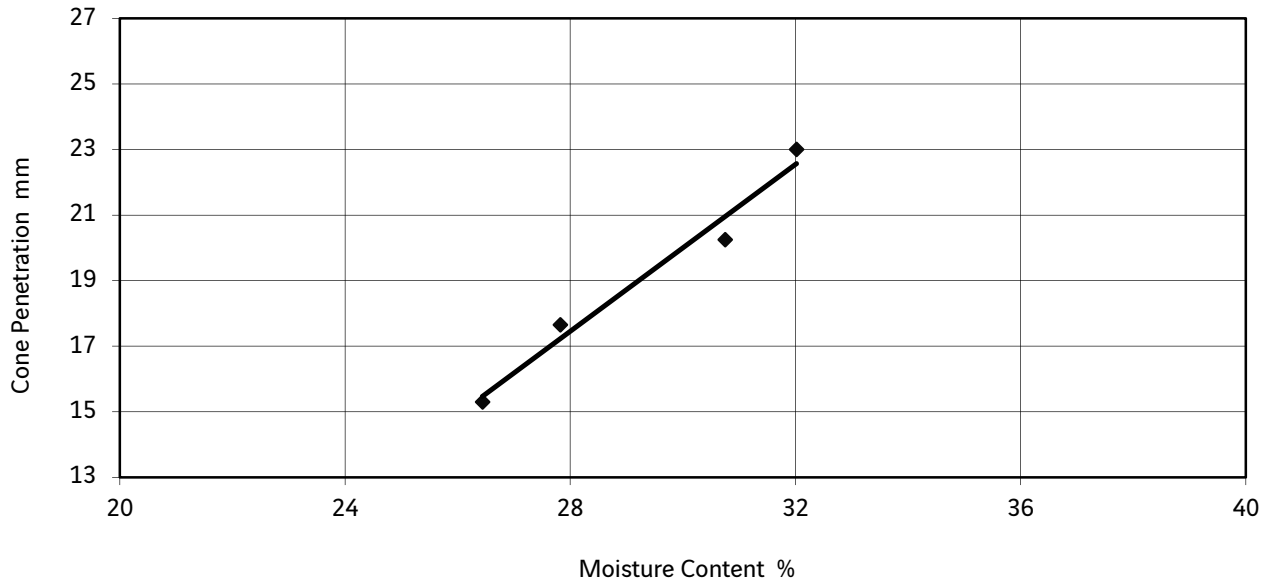


Natural moisture content:	9.4%	Percentage retained on 425µm sieve:	46%
Liquid limit:	33%	Preparation of sample: Wet sieve	
Plastic limit:	17%	Remarks:	
Plasticity index:	16%		
Moisture content of soil passing 425µm	17%		
Liquidity index:	0.01		

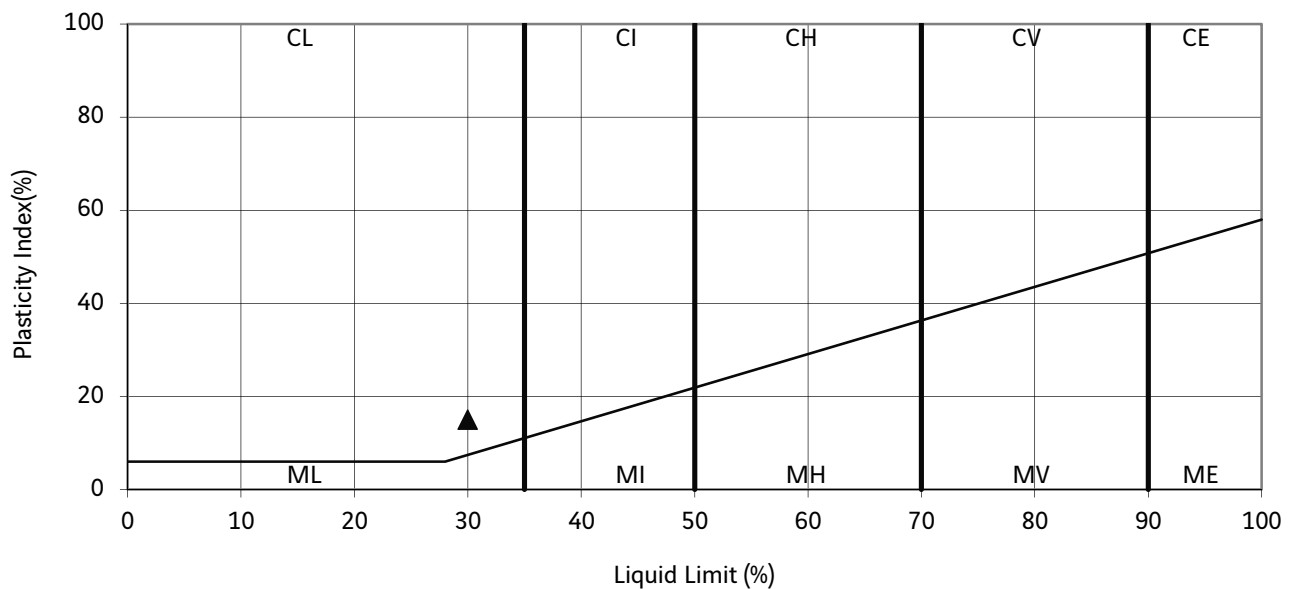



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Revision No. 2.07	Issue Date 19/11/2012	Print date 28/11/2013
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	C84
Project No.	TA7148		Sample Depth	7.10m
Engineer	Arch Henderson LLP		Sample Number	008
Employer	Aberdeen Harbour Board		Sample Type	C
Description		Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Specimen Depth	7.10m
			Specimen Number	2

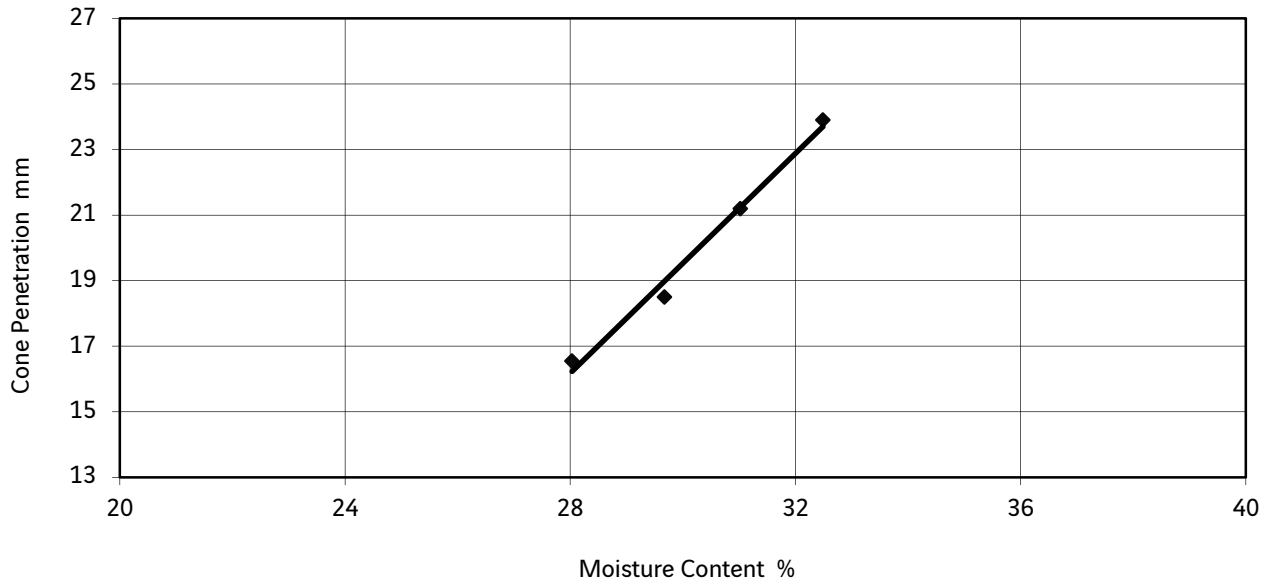


Natural moisture content:	10.0%	Percentage retained on 425µm sieve:	32%
Liquid limit:	30%	Preparation of sample:	Wet sieve
Plastic limit:	15%	Remarks:	
Plasticity index:	15%		
Moisture content of soil passing 425µm	15%		
Liquidity index:	-0.02		

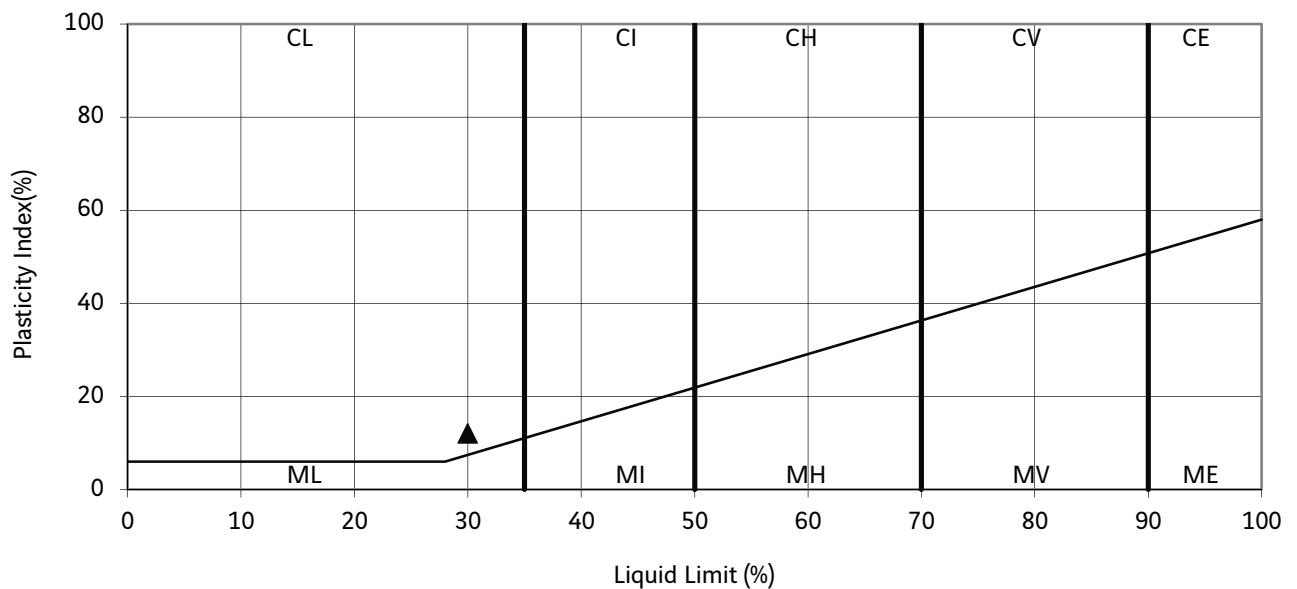



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Revision No.	2.07	Issue Date	19/11/2012	Print date	28/11/2013	Part of the Bachy Soletanche Group

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Liquid And Plastic Limit Test Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Hole ID C88
		Sample Depth 4.30m
		Sample Number 006
		Sample Type C
Description Brown sandy gravelly CLAY. Gravel is medium to coarse subangular.		Specimen Depth 4.30m Specimen Number 1

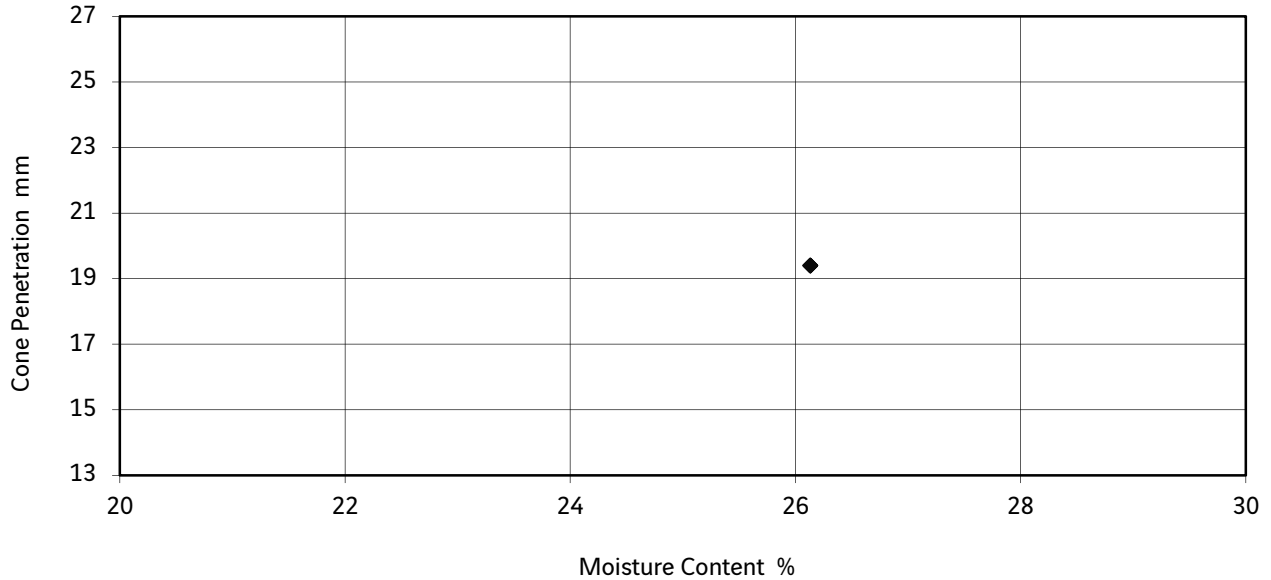


Natural moisture content:	8.9%	Percentage retained on 425µm sieve:	35%
Liquid limit:	30%	Preparation of sample: Wet sieve	
Plastic limit:	18%	Remarks:	
Plasticity index:	12%		
Moisture content of soil passing 425µm	14%		
Liquidity index:	-0.36		

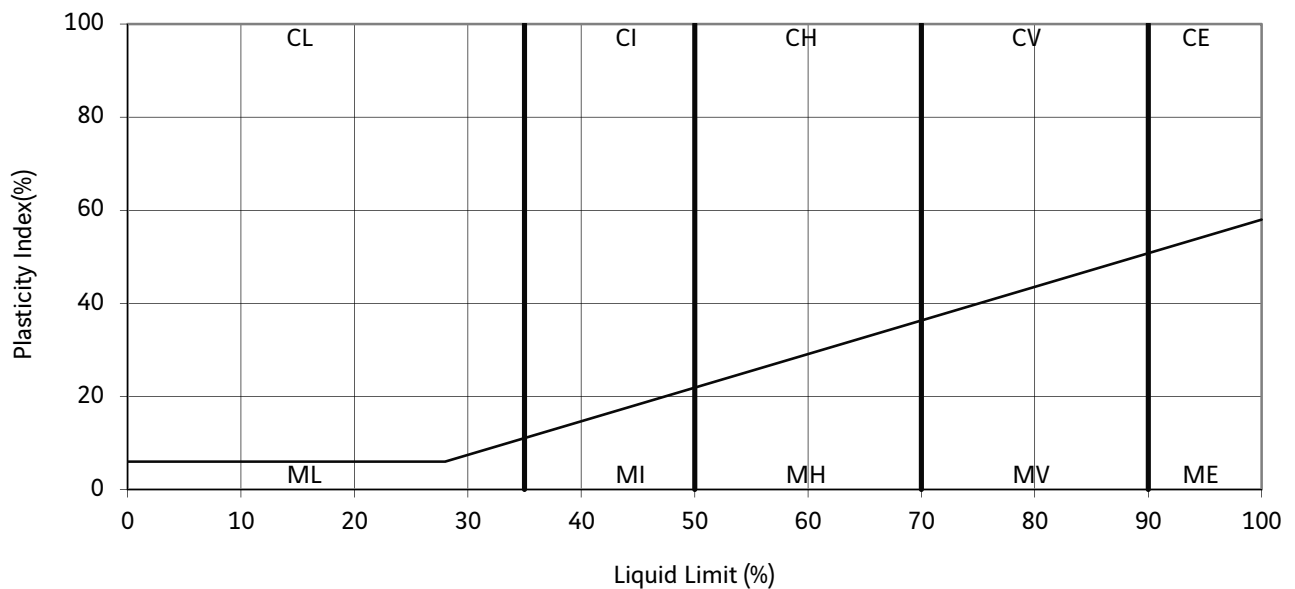



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Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID D100
Project No.	TA7148		Sample Depth 1.50m
Engineer	Arch Henderson LLP		Sample Number 006
Employer	Aberdeen Harbour Board		Sample Type B
Description	Brown SAND.	Test Method: BS1377: Part 2: 1990: Clause 4.4 and 5	Specimen Depth 1.50m
			Specimen Number 1

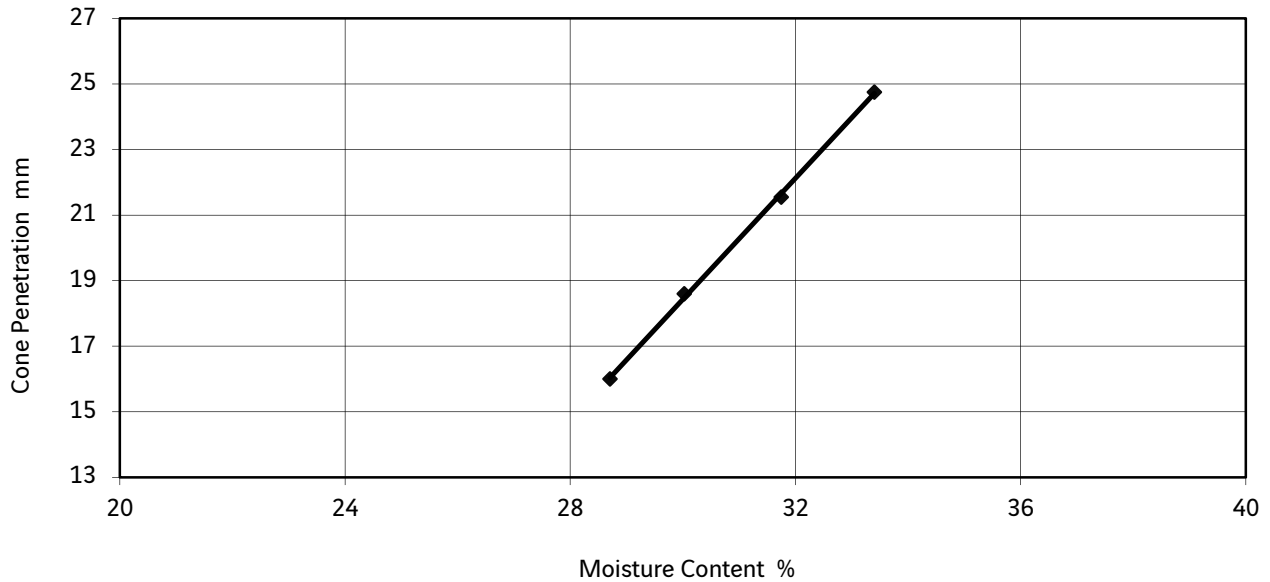


Natural moisture content:	24%	Estimated percentage retained on 425µm sieve:	0%
Liquid limit:	26%	Preparation of sample:	Natural
Plastic limit:	NP	Remarks:	Tested as 1 point Limit Liquid due to the sample being sand and/or silt and it is very difficult to get all four points on a line.
Plasticity index:	NP		
Moisture content of soil passing 425µm	24%		
Liquidity index:			

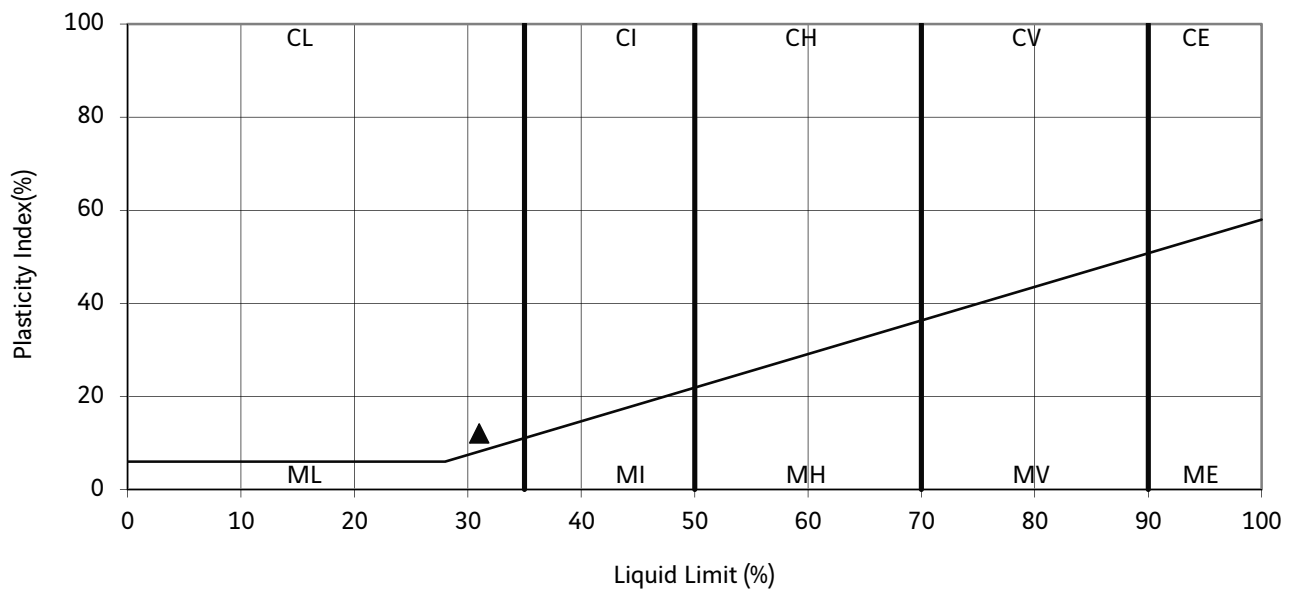



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Sushil Sharda		Print date 28/11/2013	
Revision No.	2.07	Issue Date	19/11/2012

Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	E65
Project No.	TA7148		Sample Depth	9.80m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample Type	C
Description		Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Specimen Depth	9.80m
			Specimen Number	1

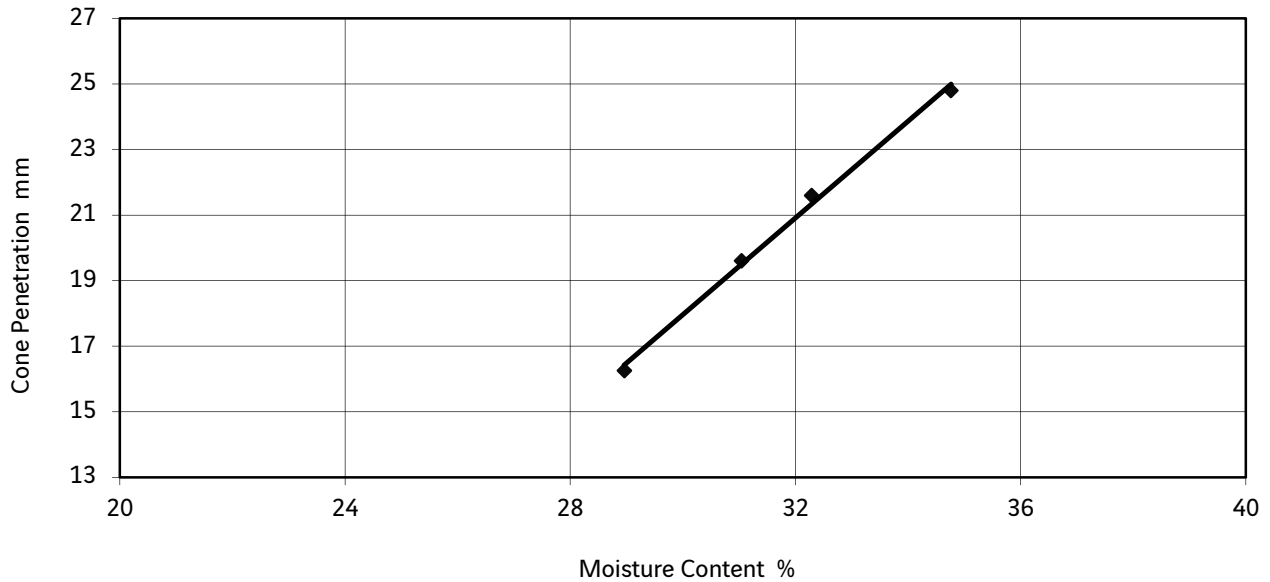


Natural moisture content:	9.6%	Percentage retained on 425µm sieve:	45%
Liquid limit:	31%	Preparation of sample:	Wet sieve
Plastic limit:	19%	Remarks:	
Plasticity index:	12%		
Moisture content of soil passing 425µm	18%		
Liquidity index:	-0.12		

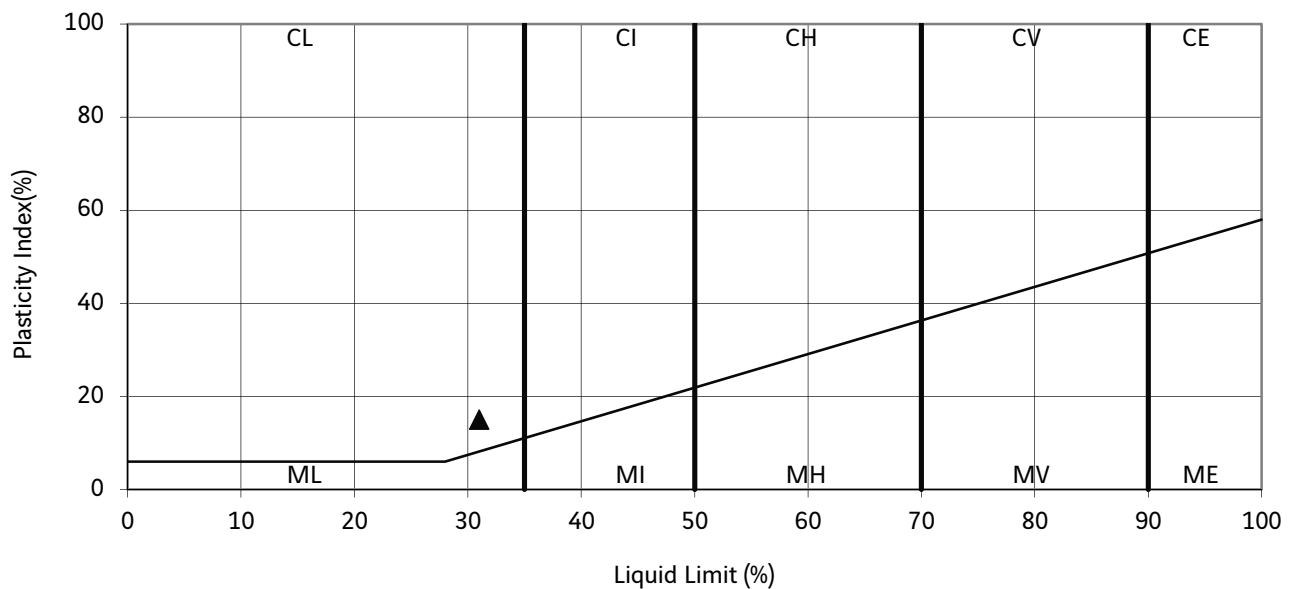


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Revision No.	2.07	Print date 28/11/2013
Issue Date	19/11/2012	Part of the Bachy Soletanche Group

Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	E66
Project No.	TA7148		Sample Depth	12.80m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample Type	C
Description		Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Specimen Depth	12.80m
			Specimen Number	2

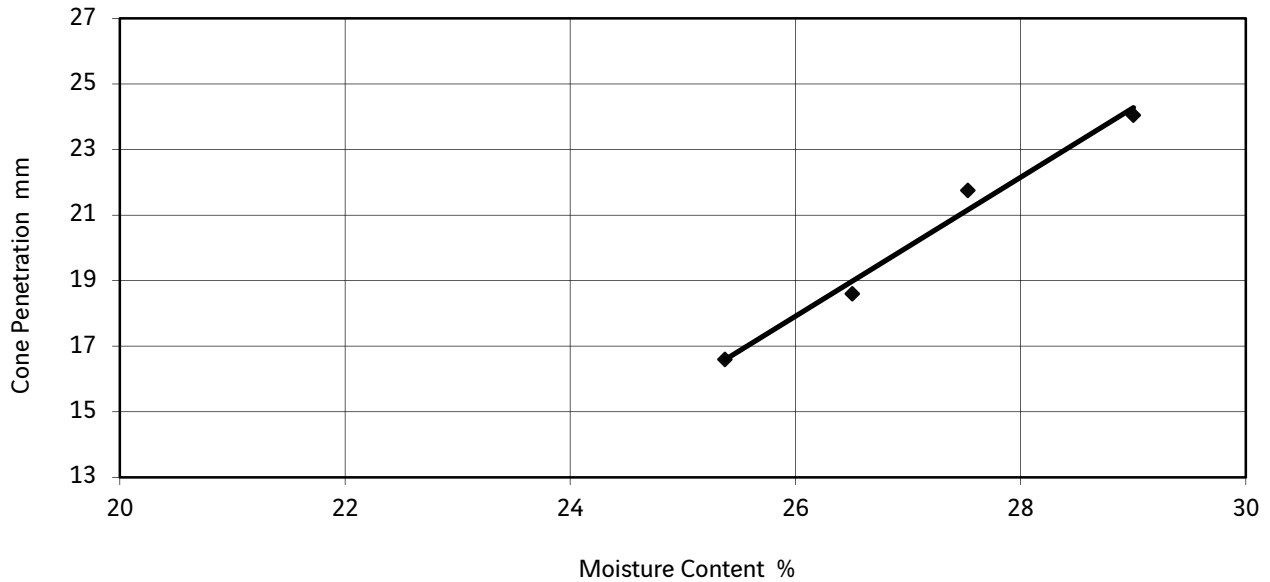


Natural moisture content:	11%	Percentage retained on 425µm sieve:	45%
Liquid limit:	31%	Preparation of sample:	Wet sieve
Plastic limit:	16%	Remarks:	
Plasticity index:	15%		
Moisture content of soil passing 425µm	20%		
Liquidity index:	0.28		

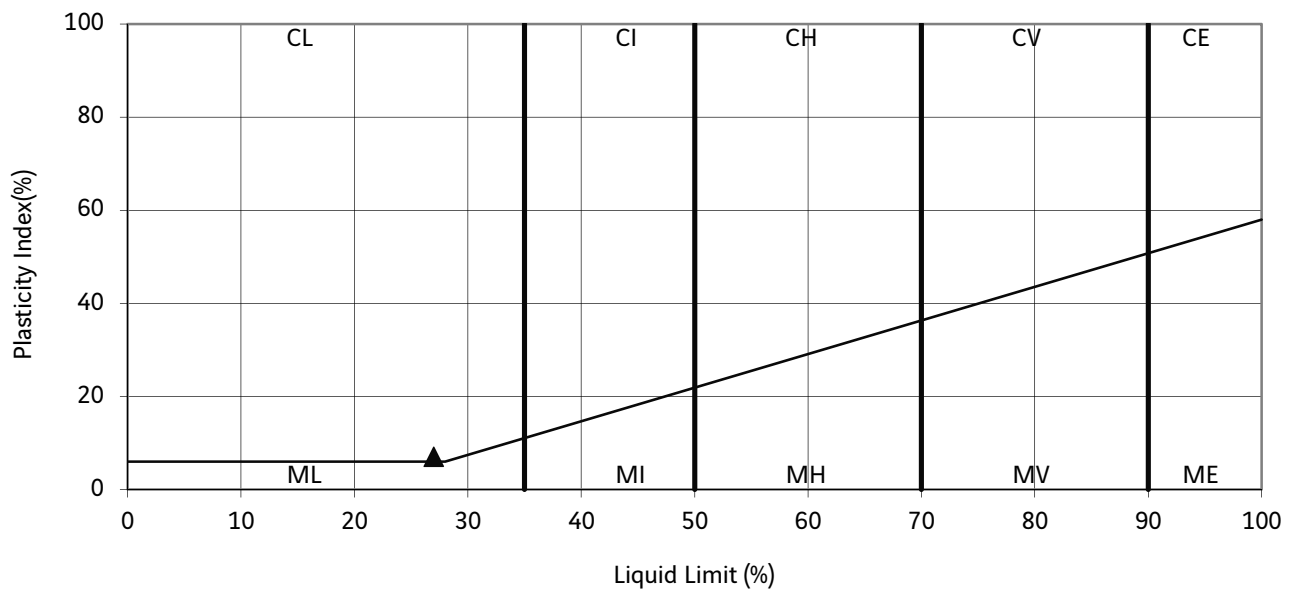


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Revision No.	2.07	Issue Date	19/11/2012	Print date	28/11/2013	Part of the Bachy Soletanche Group

Project Name Investigation Project No. Engineer Employer	Bay of Nigg Harbour Development Ground TA7148 Arch Henderson LLP Aberdeen Harbour Board	Liquid And Plastic Limit Test	Hole ID E69
			Sample Depth 8.80m
			Sample Number
			Sample Type C
Description Brown gravelly slightly sandy CLAY. Gravel is fine to coarse angular.			Specimen Depth 8.80m
			Specimen Number 1

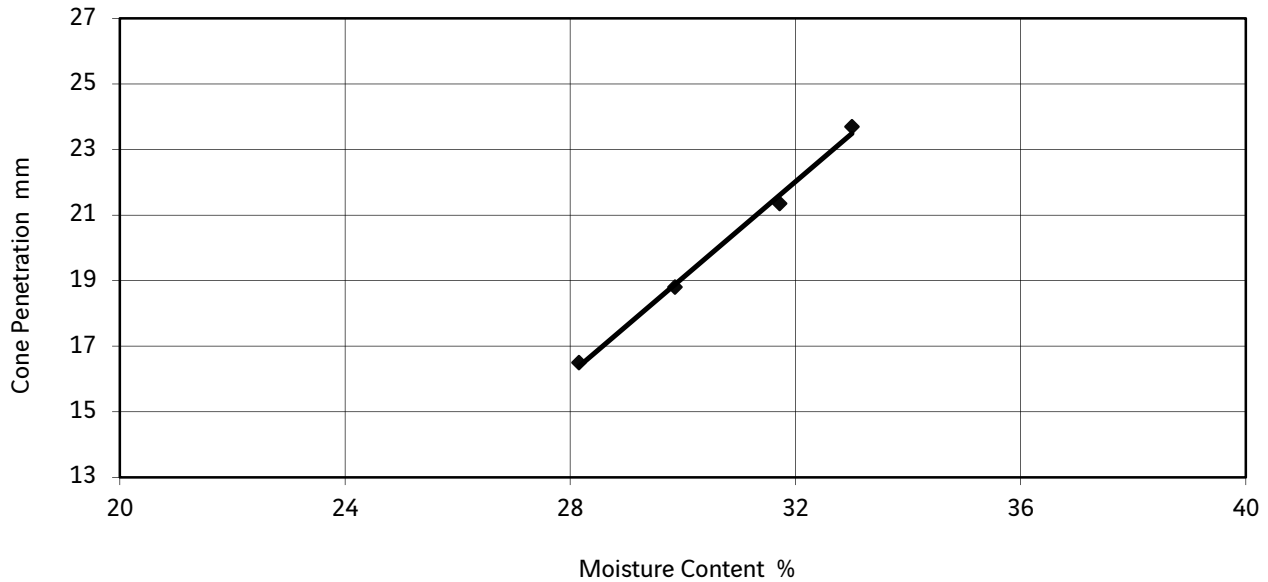


Natural moisture content:	8.0%	Percentage retained on 425µm sieve:	40%
Liquid limit:	27%	Preparation of sample:	Wet sieve
Plastic limit:	20%	Remarks:	
Plasticity index:	7%		
Moisture content of soil passing 425µm	13%		
Liquidity index:	-0.96		

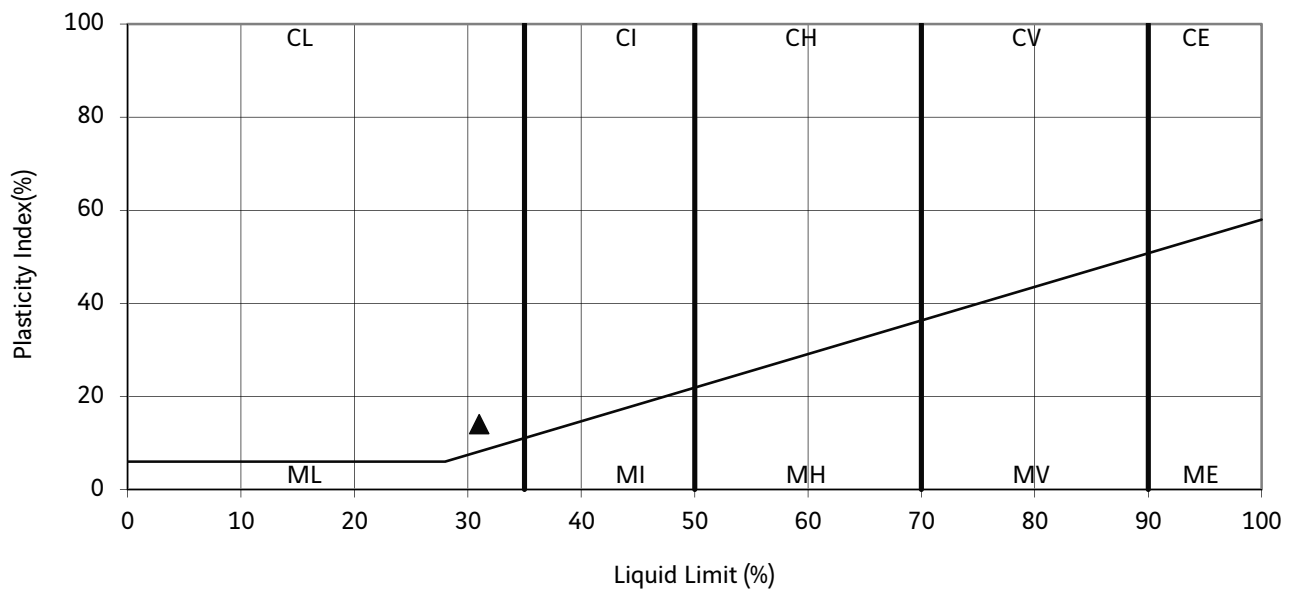



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Revision No. 2.07	Issue Date 19/11/2012		

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Liquid And Plastic Limit Test Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Hole ID E71
		Sample Depth 10.30m
		Sample Number
		Sample Type C
Description Brown gravelly slightly sandy CLAY. Gravel is fine to coarse angular.		Specimen Depth 10.30m Specimen Number 1

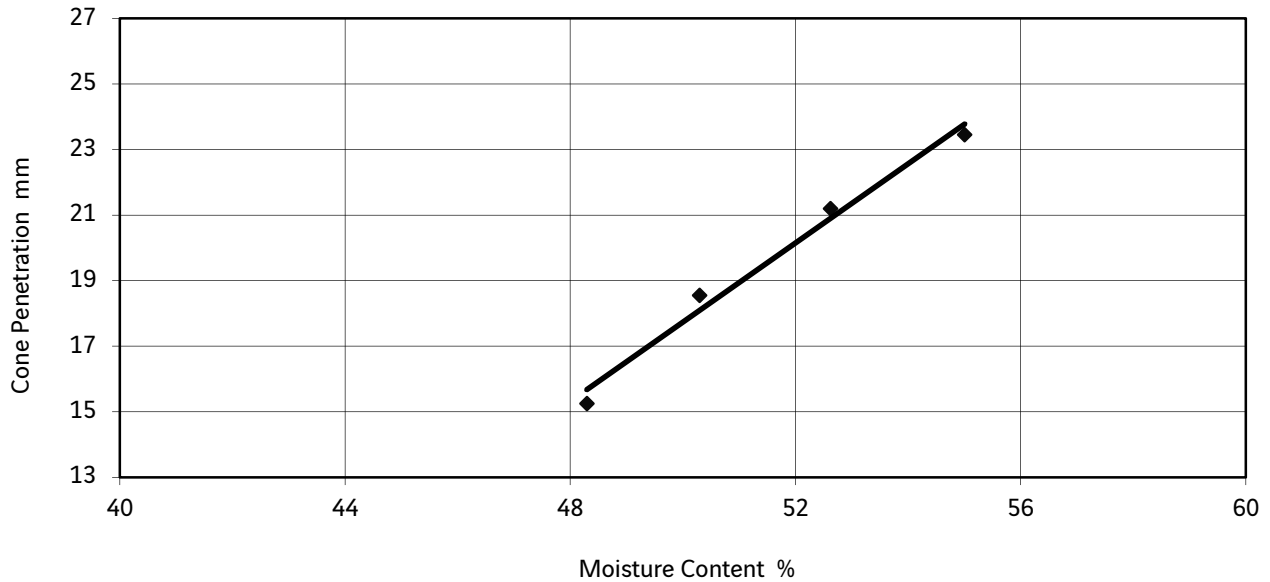


Natural moisture content:	10%	Percentage retained on 425µm sieve:	44%
Liquid limit:	31%	Preparation of sample: Wet sieve	
Plastic limit:	17%	Remarks:	
Plasticity index:	14%		
Moisture content of soil passing 425µm	19%		
Liquidity index:	0.11		

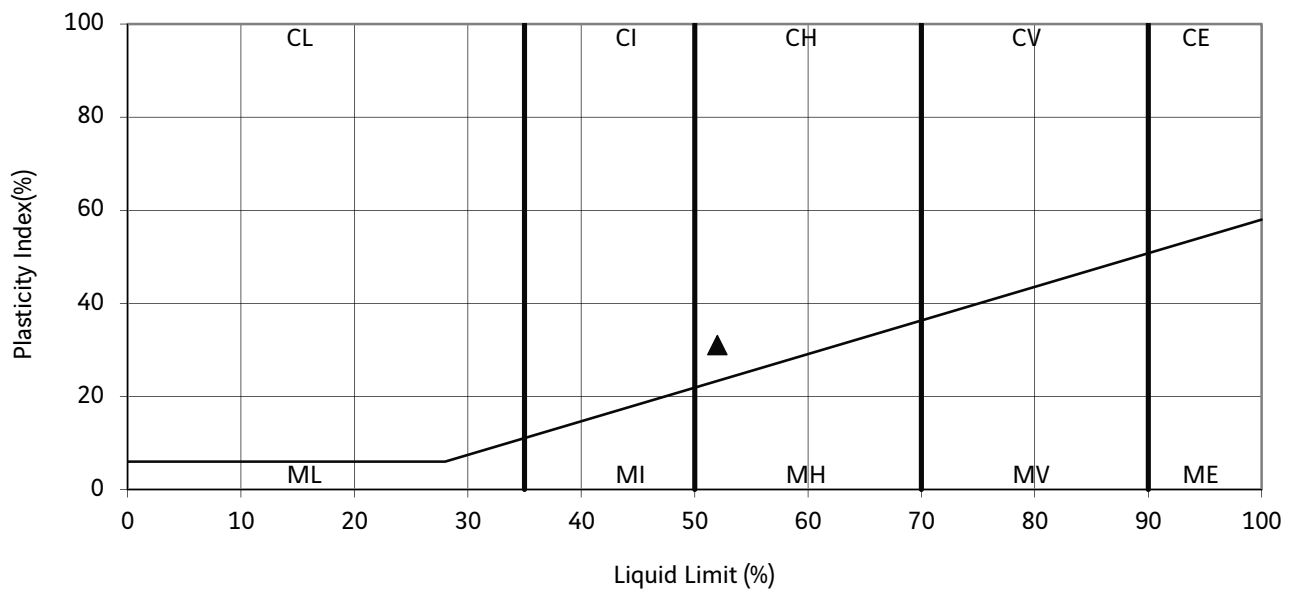



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Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	GS11
Project No.	TA7148		Sample Depth	6.80m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample Type	C
Description		Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Specimen Depth	6.80m
			Specimen Number	1

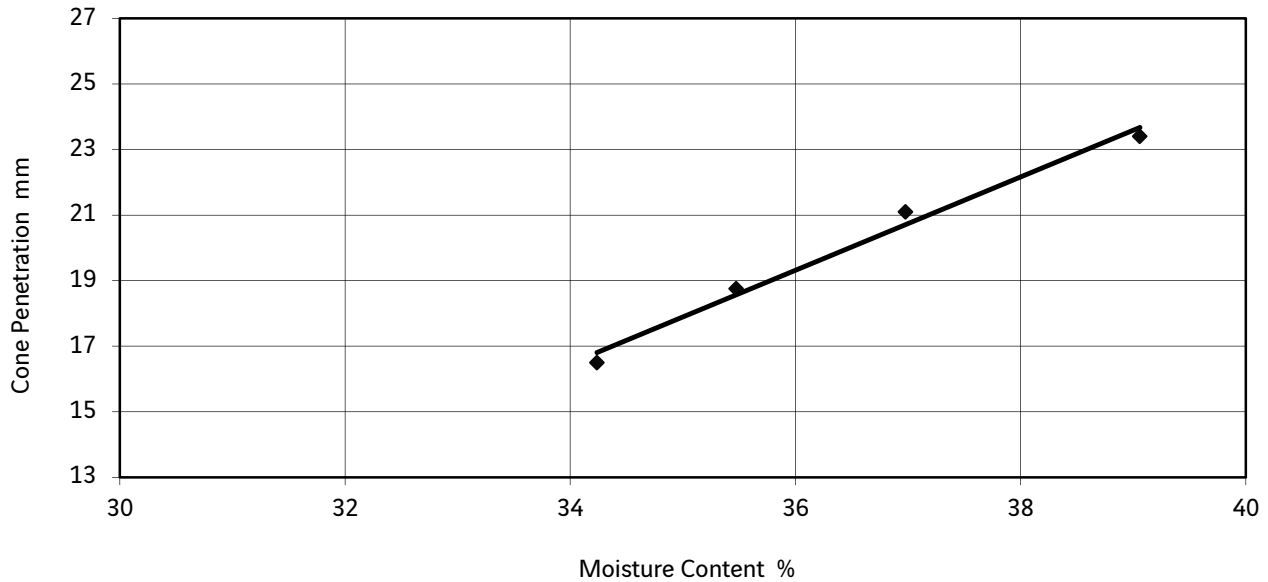


Natural moisture content:	8.0%	Percentage retained on 425µm sieve:	37%
Liquid limit:	52%	Preparation of sample:	Wet sieve
Plastic limit:	21%	Remarks:	
Plasticity index:	31%		
Moisture content of soil passing 425µm	13%		
Liquidity index:	-0.27		

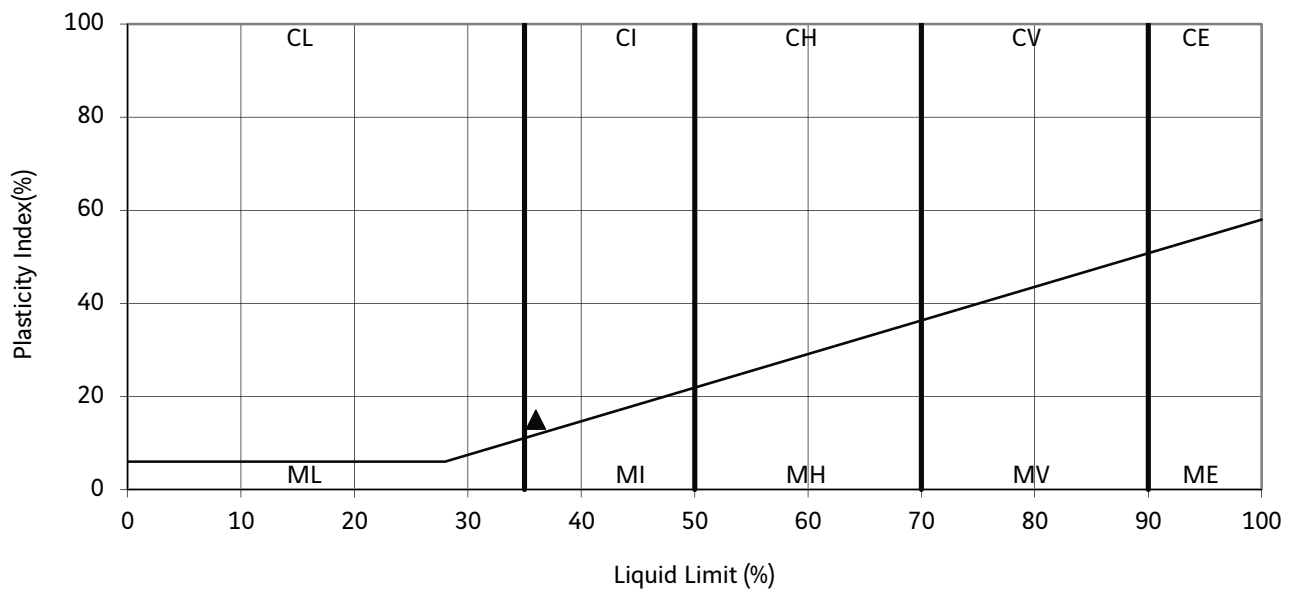


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Sushil Sharda		
Revision No.	2.07	Print date 28/11/2013
Issue Date	19/11/2012	Part of the Bachy Soletanche Group

Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	TP01
Project No.	TA7148		Sample Depth	0.50m
Engineer	Arch Henderson LLP		Sample Number	003
Employer	Aberdeen Harbour Board		Sample Type	B
Description			Brown sandy gravelly CLAY.	Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5
			Specimen Depth	0.50m
			Specimen Number	1

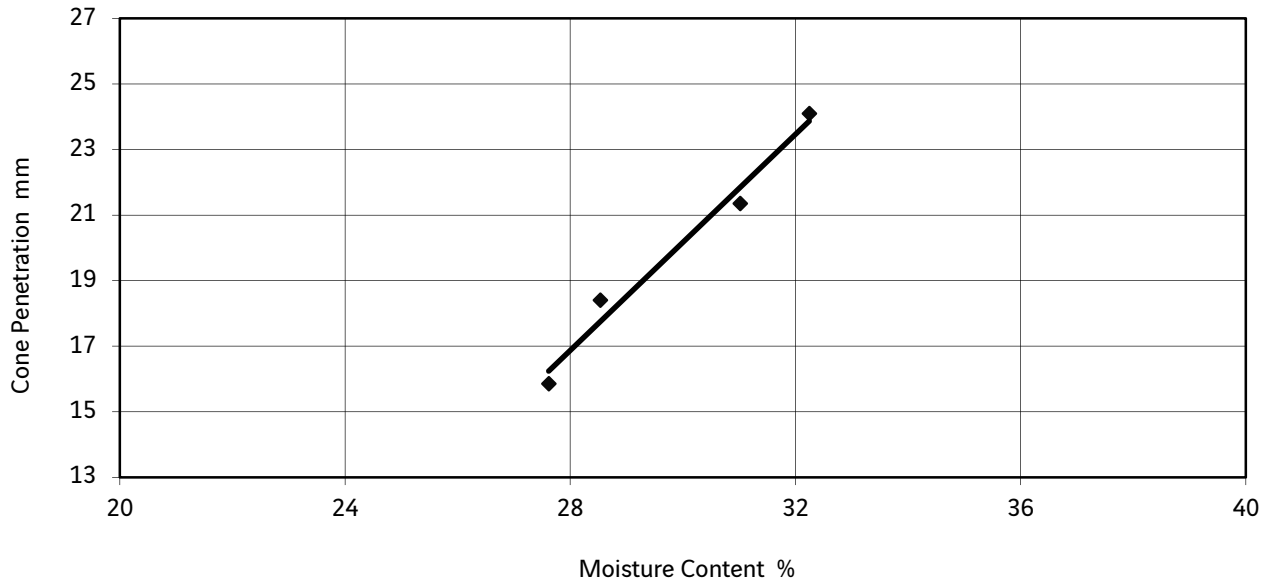


Natural moisture content:	9.4%	Estimated percentage retained on 425µm sieve:	51%
Liquid limit:	36%	Preparation of sample:	
Plastic limit:	21%	Remarks:	
Plasticity index:	15%		
Moisture content of soil passing 425µm	19%		
Liquidity index:	-0.13		

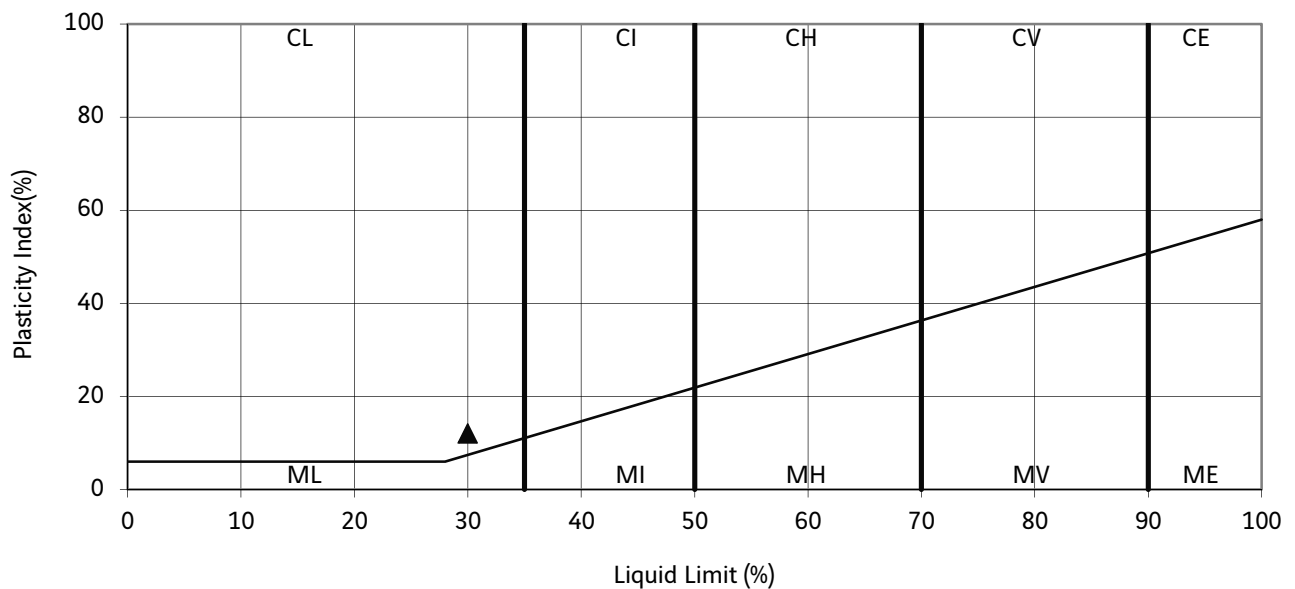



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Revision No.	2.07	Issue Date	19/11/2012	Print date	28/11/2013	Part of the Bachy Soletanche Group

Project Name Investigation Project No. Engineer Employer	Bay of Nigg Harbour Development Ground TA7148 Arch Henderson LLP Aberdeen Harbour Board	Liquid And Plastic Limit Test	Hole ID TP03
			Sample Depth 1.50m
			Sample Number 005
			Sample Type B
Description Brown slightly sandy gravelly CLAY.			Specimen Depth 1.50m
			Specimen Number 1

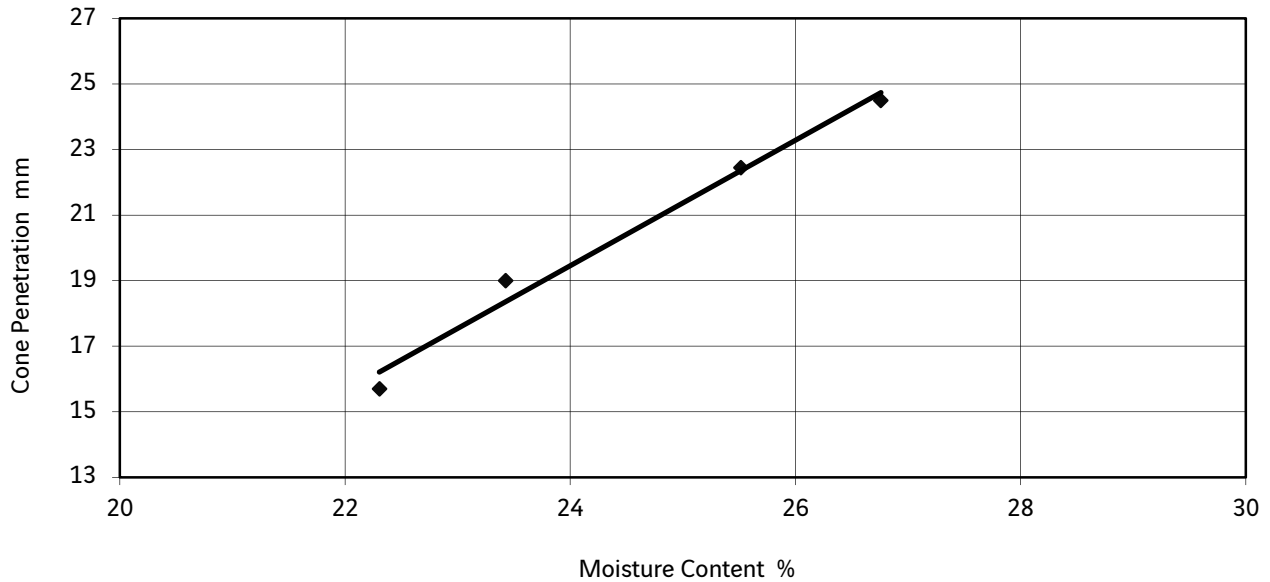


Natural moisture content:	14%	Percentage retained on 425µm sieve:	37%
Liquid limit:	30%	Preparation of sample: Wet sieve	
Plastic limit:	18%	Remarks:	
Plasticity index:	12%		
Moisture content of soil passing 425µm	22%		
Liquidity index:	0.30		

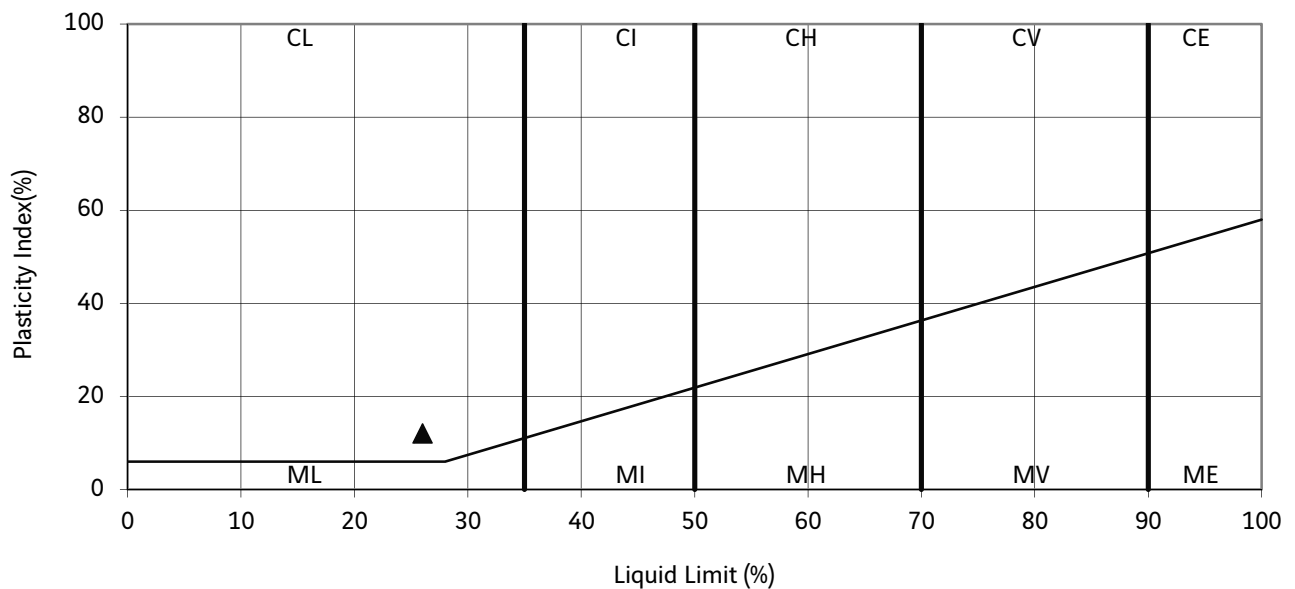



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Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	TP05	
Project No.	TA7148		Sample Depth	1.50m	
Engineer	Arch Henderson LLP		Sample Number	005	
Employer	Aberdeen Harbour Board		Sample Type	B	
Description			Grey mottled brown slightly sandy gravelly CLAY. Gravel is fine to coarse.	Specimen Depth	1.50m
				Specimen Number	1

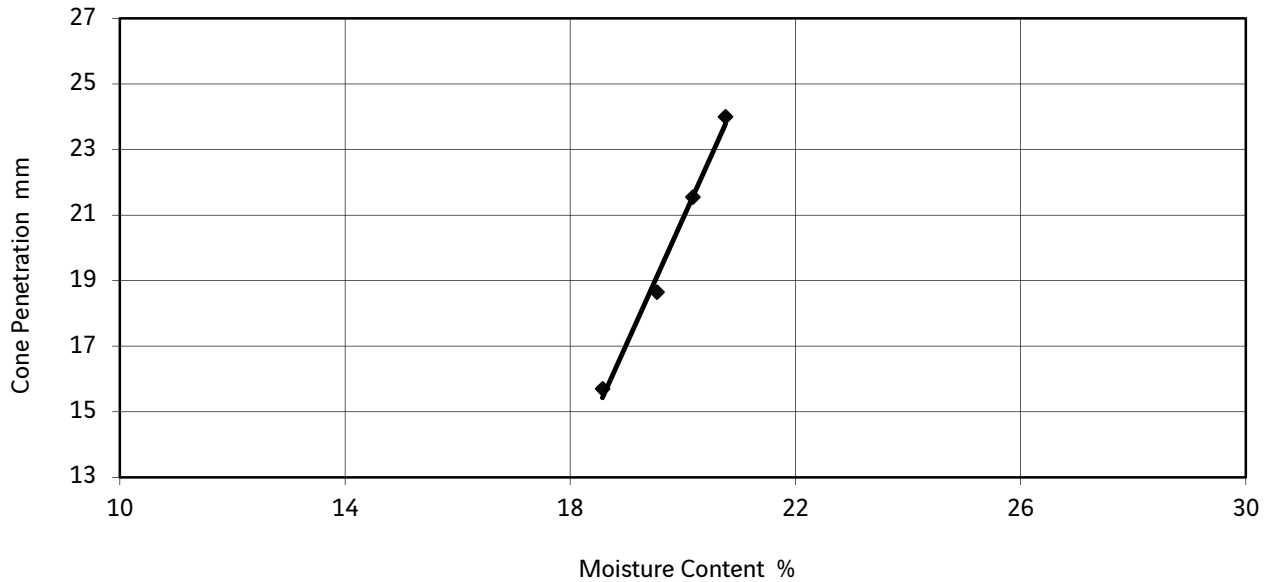


Natural moisture content:	12%	Percentage retained on 425µm sieve:	44%
Liquid limit:	26%	Preparation of sample:	Wet sieve
Plastic limit:	14%	Remarks:	
Plasticity index:	12%		
Moisture content of soil passing 425µm	22%		
Liquidity index:	0.67		

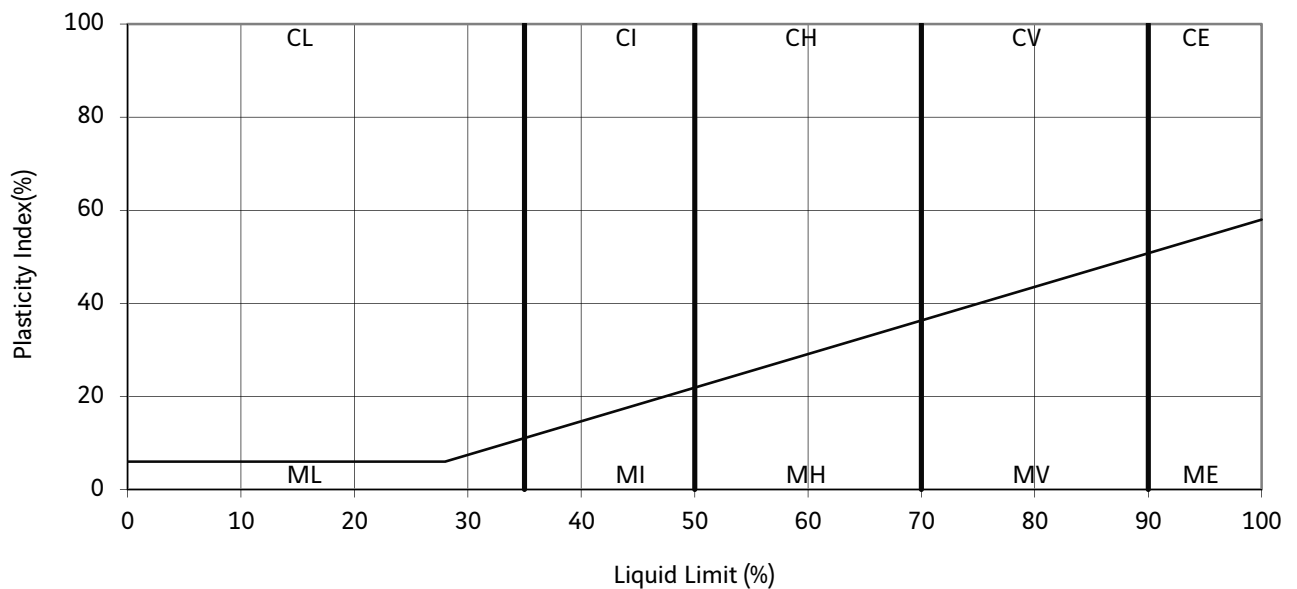


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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Liquid And Plastic Limit Test Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Hole ID TP09
		Sample Depth 2.50m
		Sample Number 008
		Sample Type D
Description Brown slightly gravelly slightly clayey SAND.		Specimen Depth 2.50m
		Specimen Number 1

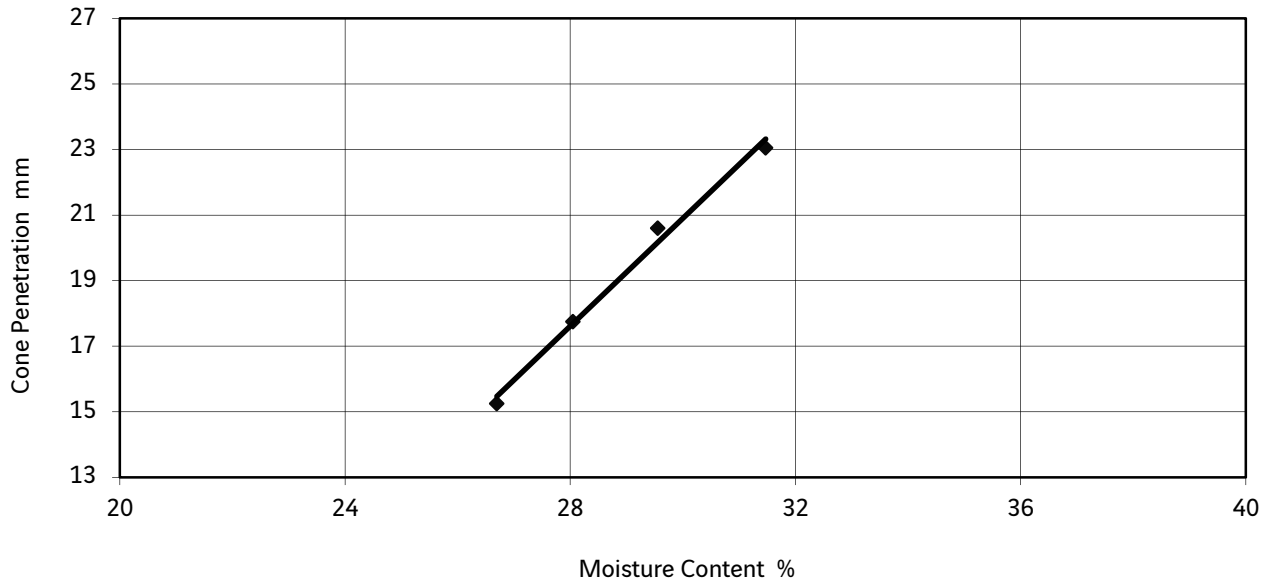


Natural moisture content:	15%	Percentage retained on 425µm sieve:	34%
Liquid limit:	20%	Preparation of sample:	Wet sieve
Plastic limit:	NP	Remarks:	
Plasticity index:	NP		
Moisture content of soil passing 425µm	23%		
Liquidity index:			

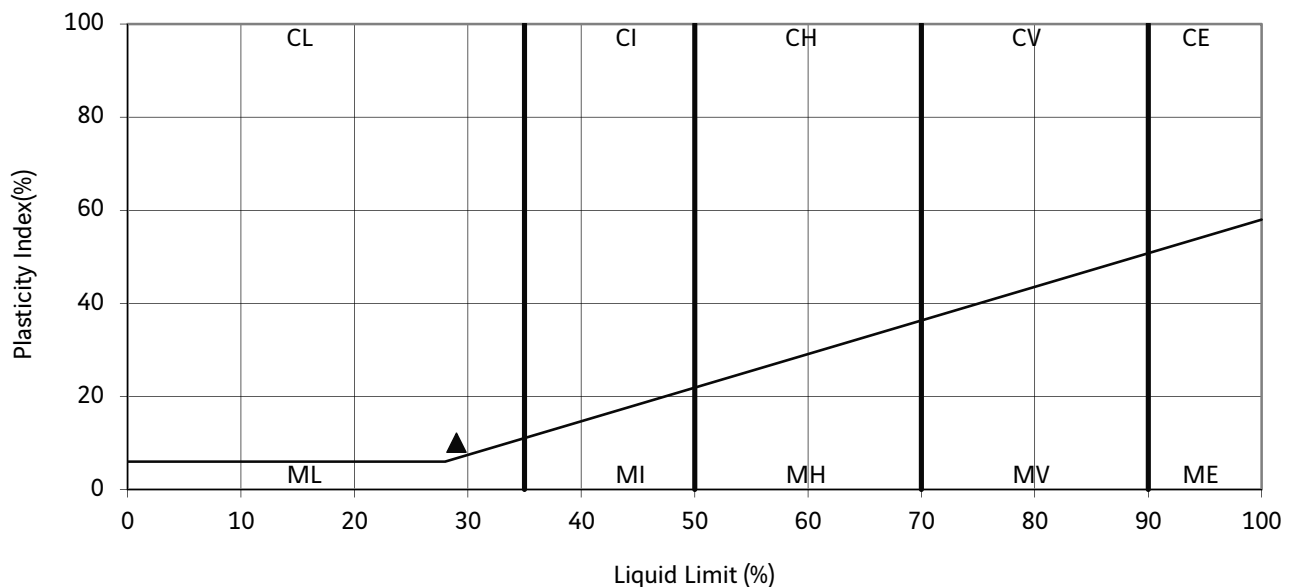


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Revision No. 2.07	Issue Date 19/11/2012		

Project Name Investigation Project No. Engineer Employer	Bay of Nigg Harbour Development Ground TA7148 Arch Henderson LLP Aberdeen Harbour Board	Liquid And Plastic Limit Test	Hole ID TP11
			Sample Depth 2.80m
			Sample Number 007
			Sample Type B
Description Brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular.			Specimen Depth 2.80m
			Specimen Number 1

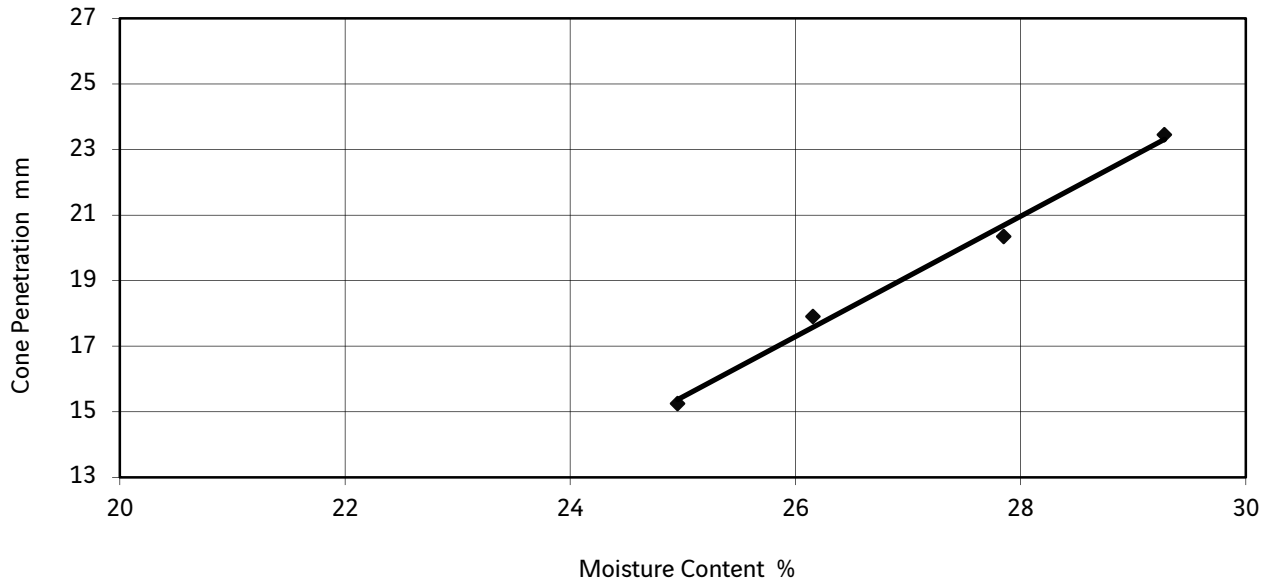


Natural moisture content:	5.9%	Percentage retained on 425µm sieve:	44%
Liquid limit:	29%	Preparation of sample:	Wet sieve
Plastic limit:	19%	Remarks:	
Plasticity index:	10%		
Moisture content of soil passing 425µm	11%		
Liquidity index:	-0.84		

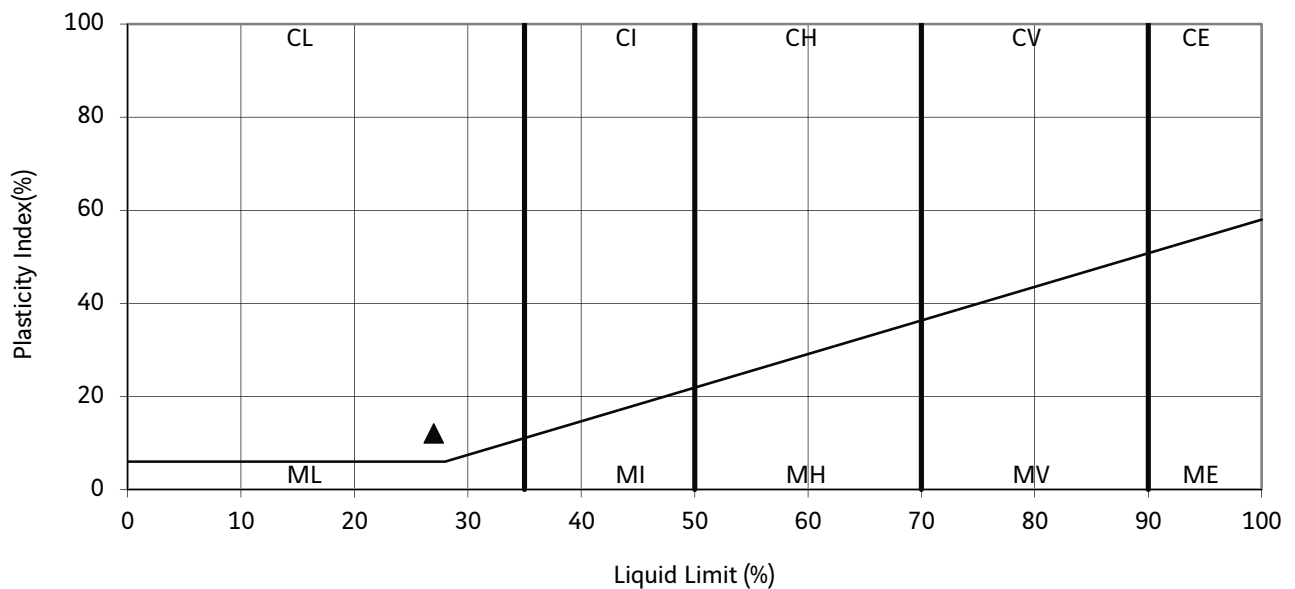



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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Liquid And Plastic Limit Test Test Method: BS1377: Part 2: 1990: Clause 4.3 and 5	Hole ID TP13
		Sample Depth 3.50m
		Sample Number 008
		Sample Type D
Description Brown sandy gravelly CLAY.		Specimen Depth 3.50m
		Specimen Number 1

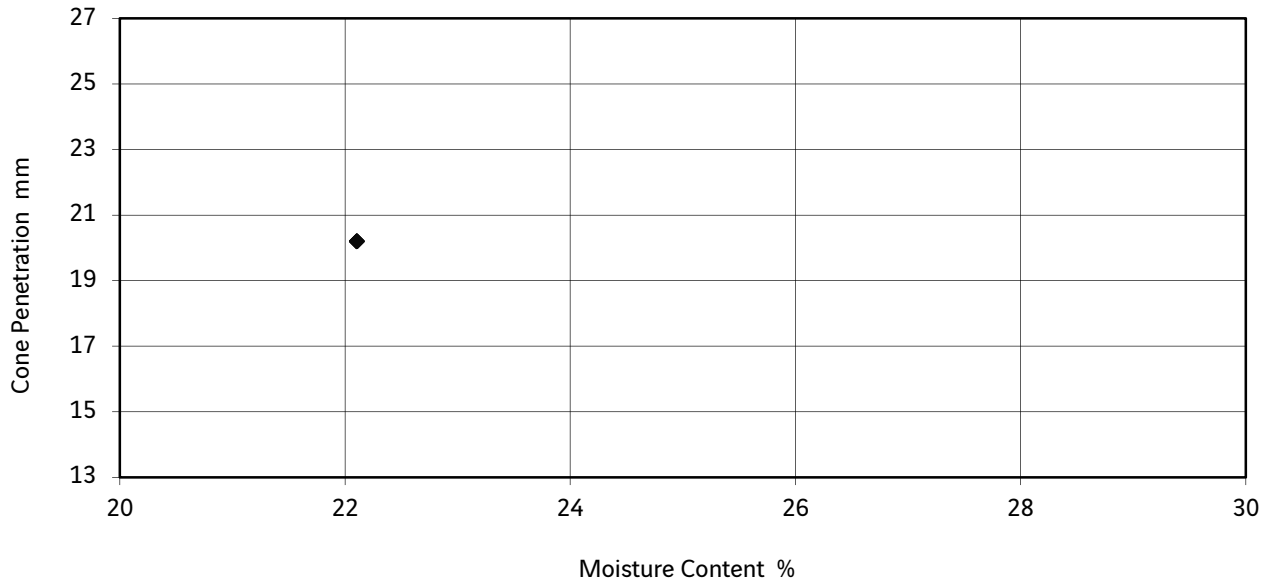


Natural moisture content:	7.0%	Percentage retained on 425µm sieve:	37%
Liquid limit:	27%	Preparation of sample: Wet sieve	
Plastic limit:	15%	Remarks:	
Plasticity index:	12%		
Moisture content of soil passing 425µm	11%		
Liquidity index:	-0.32		

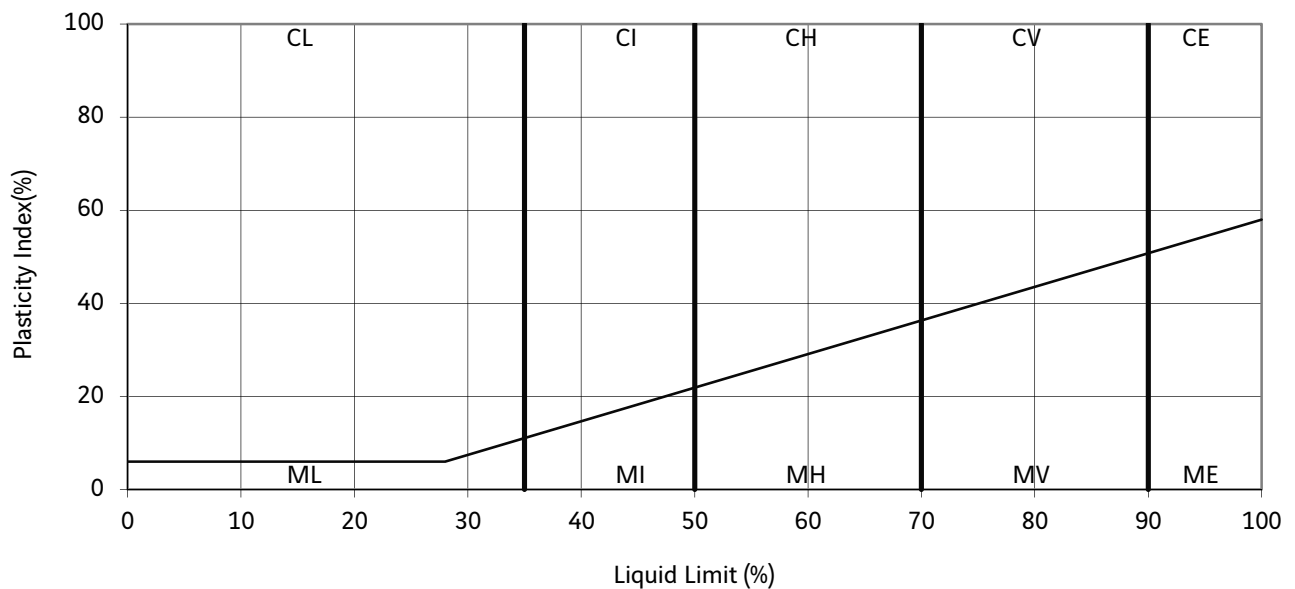



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Project Name	Bay of Nigg Harbour Development Ground Investigation	Liquid And Plastic Limit Test	Hole ID	TP17	
Project No.	TA7148		Sample Depth	1.20m	
Engineer	Arch Henderson LLP		Sample Number	003	
Employer	Aberdeen Harbour Board		Sample Type	D	
Description		Brown slightly clayey SAND.	Test Method: BS1377: Part 2: 1990: Clause 4.4 and 5	Specimen Depth	1.20m
				Specimen Number	1

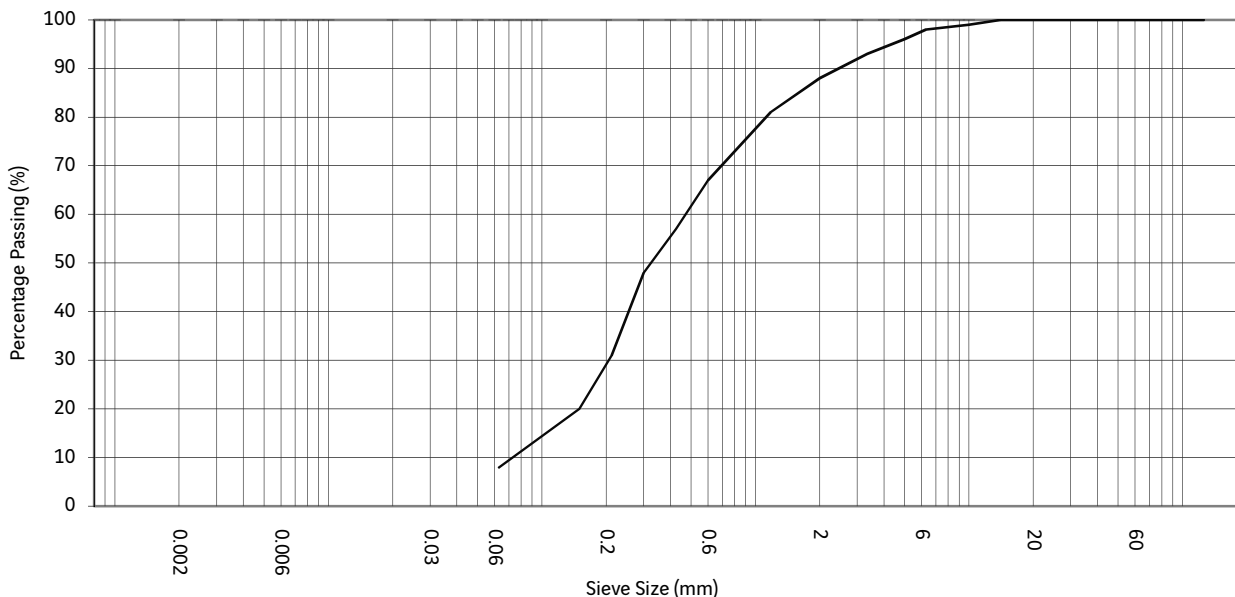


Natural moisture content:	25%	Estimated percentage retained on 425µm sieve:	0%
Liquid limit:	22%	Preparation of sample:	Natural
Plastic limit:	NP	Remarks:	Tested as 1 point Limit Liquid due to the sample being sand and/or silt and it is very difficult to get all four points on a line.
Plasticity index:	NP		
Moisture content of soil passing 425µm	25%		
Liquidity index:			



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Revision No.	2.07	Issue Date	19/11/2012
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID D101
		Sample Depth 1.50m
		Sample Number 004
		Sample type B
Description Brown slightly gravelly SAND.		Specimen Depth 1.50m
		Specimen No. 1



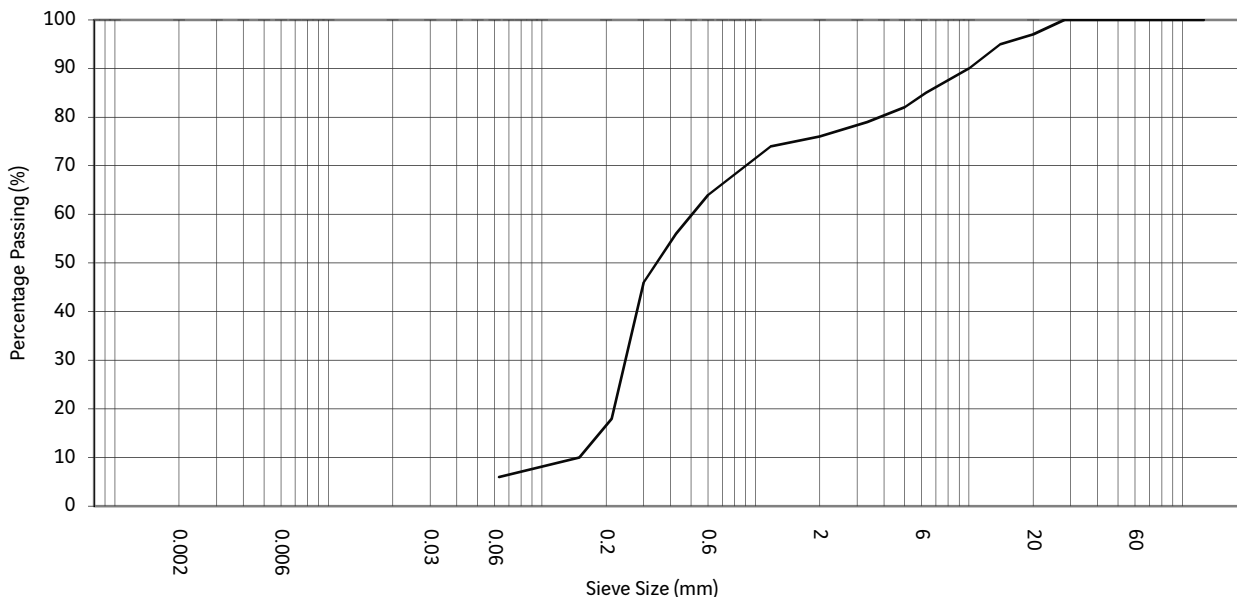
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	8	
Sand:	80	
Gravel:	12	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	99
		6.3	98
		5.0	96
125.0	100	3.35	93
90.0	100	2.00	88
75.0	100	1.18	81
63.0	100	0.600	67
50.0	100	0.425	57
37.5	100	0.300	48
28.0	100	0.212	31
20.0	100	0.150	20
		0.063	8

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Sushil Sharda		Print date 28/11/2013	
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID D101
		Sample Depth 3.50m
		Sample Number 008
		Sample type B
Description Brown slightly gravelly SAND. Gravel is medium to coarse subrounded.		Specimen Depth 3.50m
		Specimen No. 1



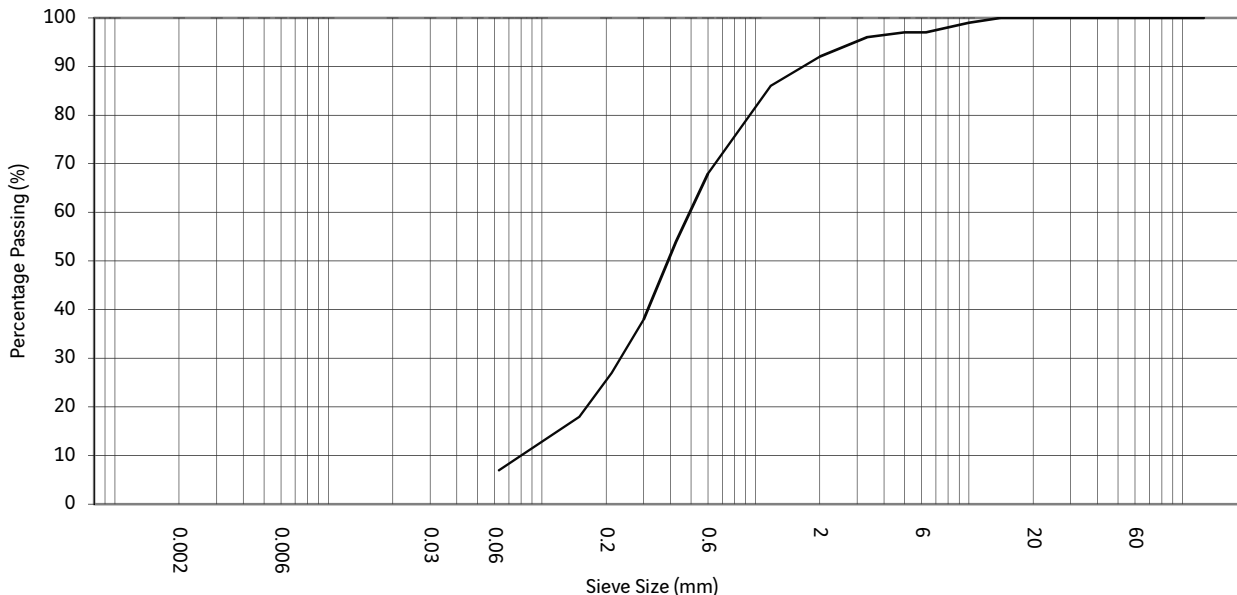
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	6	
Sand:	71	
Gravel:	24	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	95
		10.0	90
		6.3	85
		5.0	82
125.0	100	3.35	79
90.0	100	2.00	76
75.0	100	1.18	74
63.0	100	0.600	64
50.0	100	0.425	56
37.5	100	0.300	46
28.0	100	0.212	18
20.0	97	0.150	10
		0.063	6

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Sushil Sharda		Print date 28/11/2013	
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID L01
		Sample Depth 0.50m
		Sample Number 001
		Sample type B
Description Brown SAND with occasional gravel.		Specimen Depth 0.50m
		Specimen No. 1



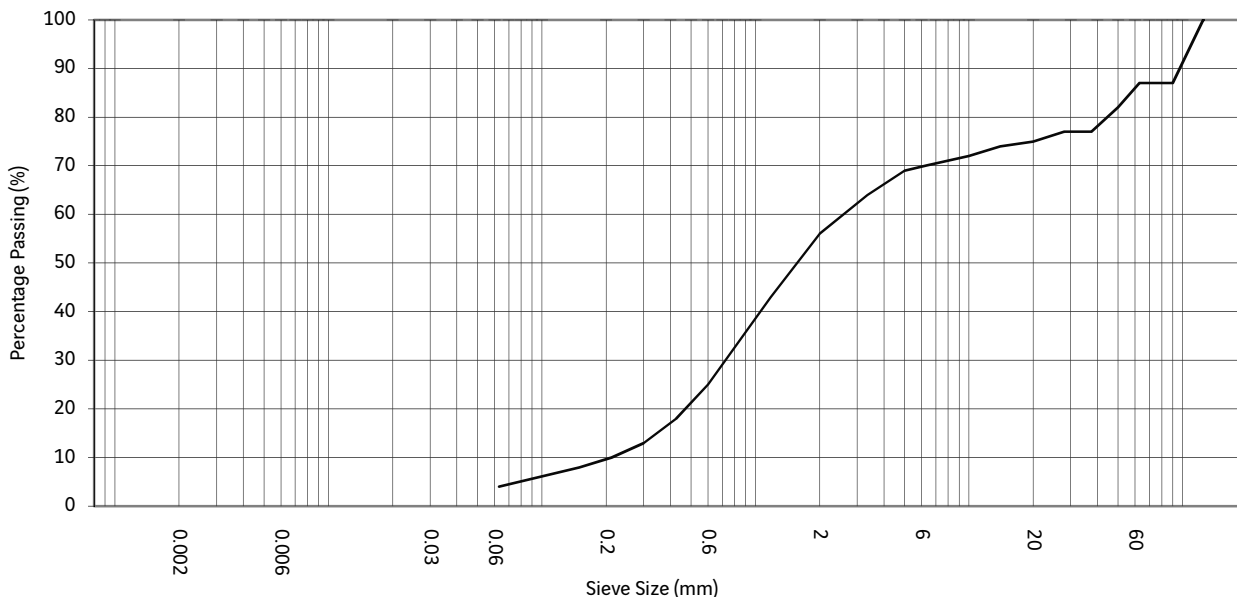
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	7	
Sand:	85	
Gravel:	8	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	99
		6.3	97
125.0	100	5.0	97
90.0	100	3.35	96
75.0	100	2.00	92
63.0	100	1.18	86
50.0	100	0.600	68
37.5	100	0.425	54
28.0	100	0.300	38
20.0	100	0.212	27
		0.150	18
		0.063	7

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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID L01
		Sample Depth 2.50m
		Sample Number 005
		Sample type B
Description Brown gravelly SAND. Gravel is medium to coarse subrounded with cobbles.		Specimen Depth 2.50m
		Specimen No. 1



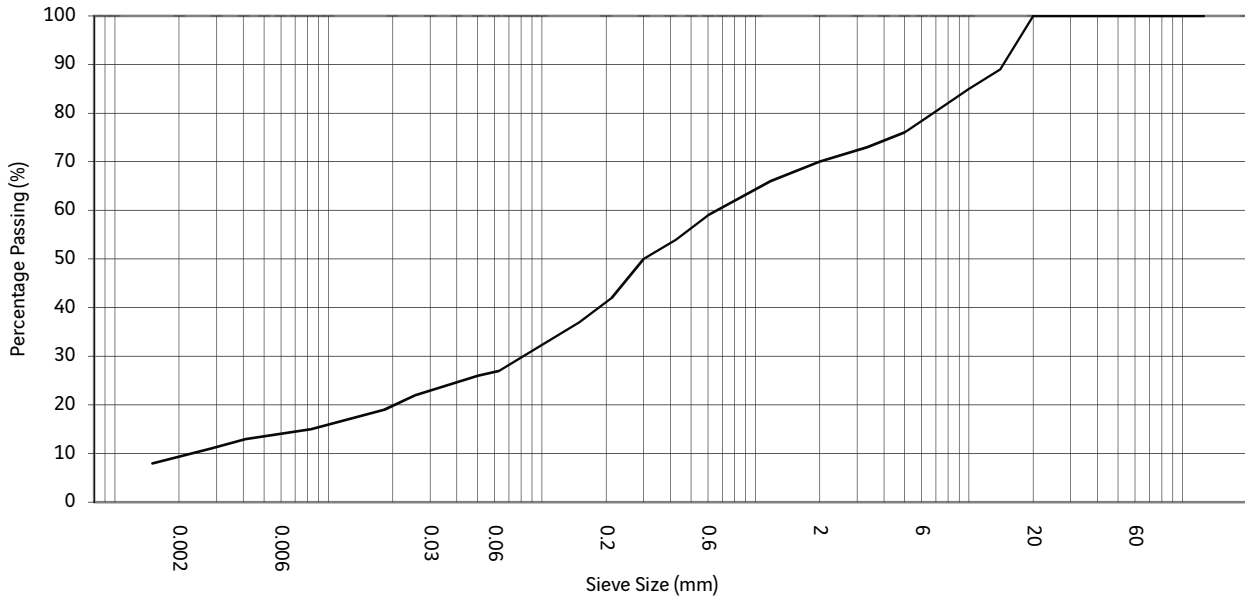
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	4	
Sand:	52	
Gravel:	30	
Cobbles:	14	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	74
		10.0	72
		6.3	70
125.0	100	5.0	69
90.0	87	3.35	64
75.0	87	2.00	56
63.0	87	1.18	43
50.0	82	0.600	25
37.5	77	0.425	18
28.0	77	0.300	13
20.0	75	0.212	10
		0.150	8
		0.063	4

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A05	
Project No.	TA7148		Sample Depth	1.40m	
Engineer	Arch Henderson LLP		Sample Number	001	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Brown slightly clayey slightly gravelly SAND. Gravel is fine to medium.	Specimen Depth	1.40m
				Specimen No.	1



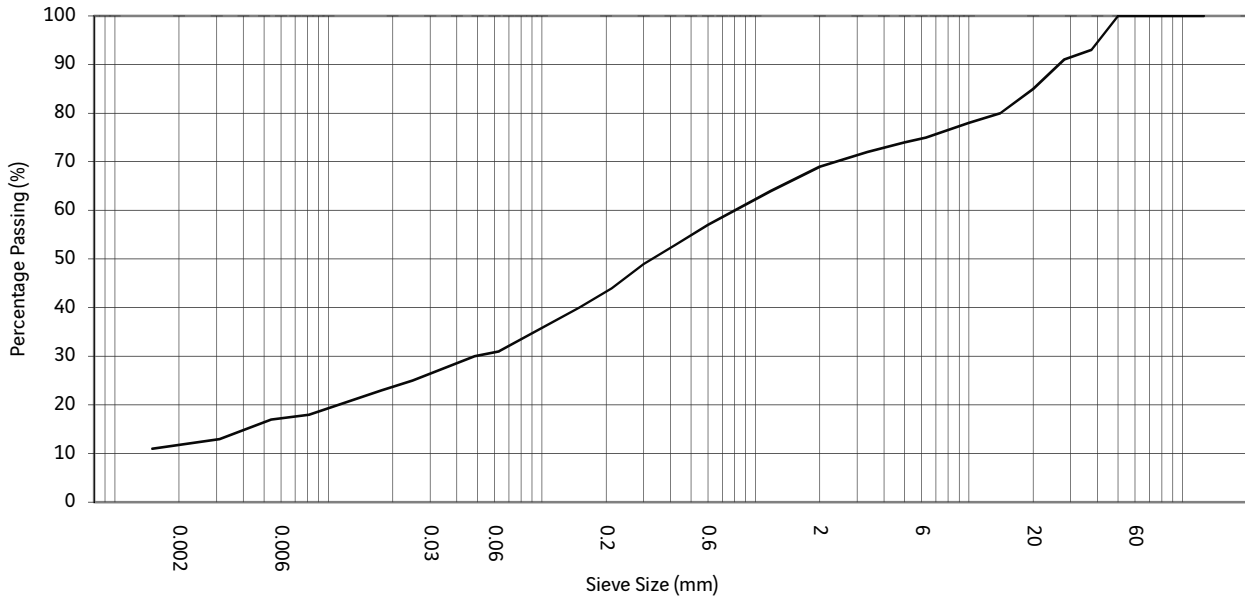
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Clay:	9	
Silt:	18	
Sand:	43	
Gravel:	30	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	89		
		10.0	85	0.0501	26
		6.3	79	0.0255	22
125.0	100	5.0	76	0.0183	19
90.0	100	3.35	73	0.0083	15
75.0	100	2.00	70	0.0041	13
63.0	100	1.18	66	0.0028	11
50.0	100	0.600	59	0.0015	8
37.5	100	0.425	54		
28.0	100	0.300	50		
20.0	100	0.212	42		
		0.150	37		
		0.063	27		

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A05
Project No.	TA7148		Sample Depth	5.98m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample type	C
Description		Brown gravelly sandy CLAY. Gravel is medium to coarse subangular.	Specimen Depth	5.98m
			Specimen No.	3



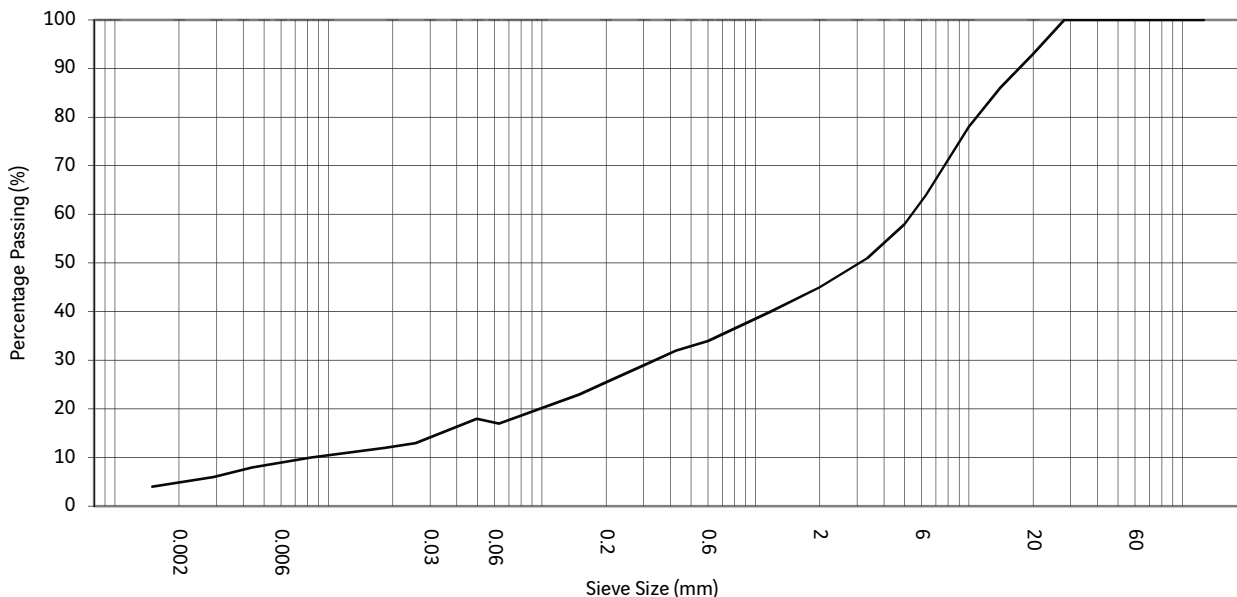
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Clay:	12	
Silt:	19	
Sand:	38	
Gravel:	31	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	80		
		10.0	78	0.0484	30
		6.3	75	0.0248	25
125.0	100	5.0	74	0.0177	23
90.0	100	3.35	72	0.0081	18
75.0	100	2.00	69	0.0054	17
63.0	100	1.18	64	0.0031	13
50.0	100	0.600	57	0.0015	11
37.5	93	0.425	53		
28.0	91	0.300	49		
20.0	85	0.212	44		
		0.150	40		
		0.063	31		

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A08
Project No.	TA7148		Sample Depth	0.50m
Engineer	Arch Henderson LLP		Sample Number	001
Employer	Aberdeen Harbour Board		Sample type	B
Description		Orangish brown mottled grey slightly clayey sandy GRAVEL	Specimen Depth	0.50m
			Specimen No.	1



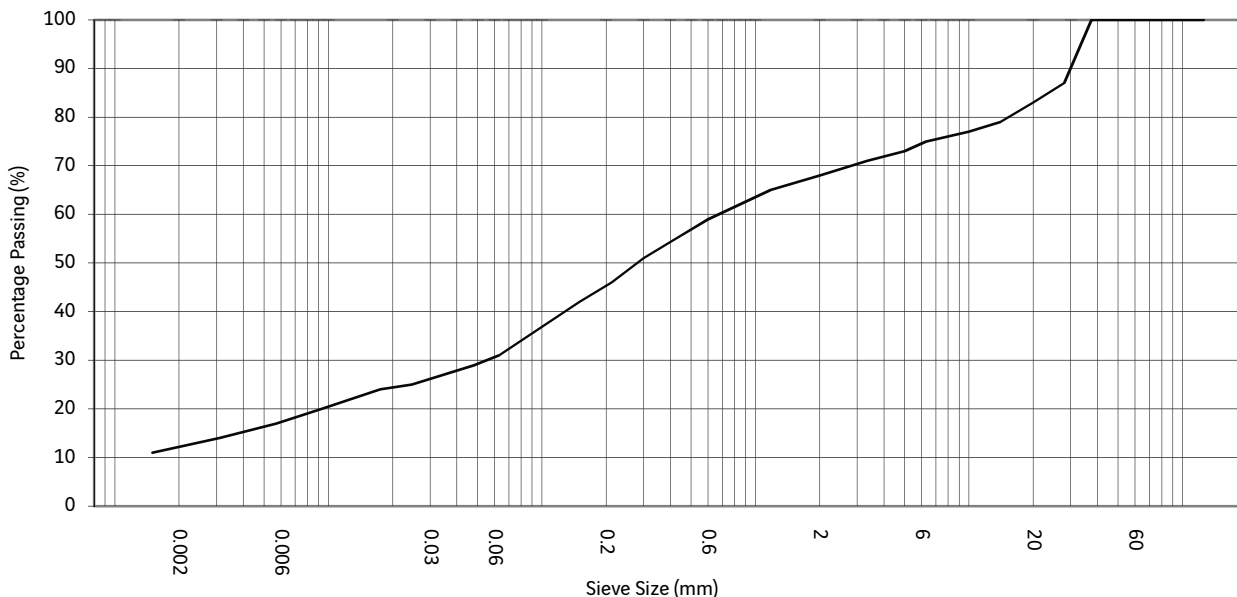
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Clay:	5	
Silt:	13	
Sand:	27	
Gravel:	55	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	86		
		10.0	78	0.0497	18
		6.3	64	0.0257	13
125.0	100	5.0	58	0.0183	12
90.0	100	3.35	51	0.0083	10
75.0	100	2.00	45	0.0044	8
63.0	100	1.18	40	0.0029	6
50.0	100	0.600	34	0.0015	4
37.5	100	0.425	32		
28.0	100	0.300	29		
20.0	93	0.212	26		
		0.150	23		
		0.063	17		

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Stuart Kirk	Print date 28/11/2013	
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A08
Project No.	TA7148		Sample Depth	7.73m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample type	C
Description			Brown gravelly sandy CLAY. Gravel is fine to coarse subangular.	
			Specimen Depth	7.73m
			Specimen No.	3



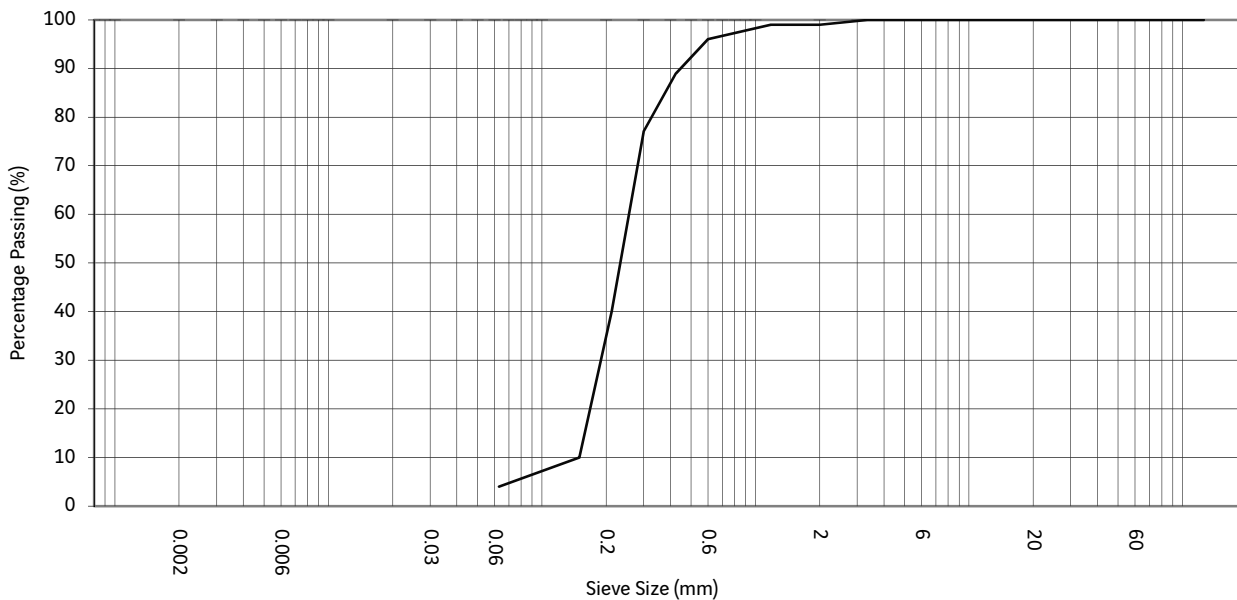
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Clay:	12	
Silt:	19	
Sand:	37	
Gravel:	32	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	79		
		10.0	77	0.0481	29
		6.3	75	0.0246	25
125.0	100	5.0	73	0.0175	24
90.0	100	3.35	71	0.0093	20
75.0	100	2.00	68	0.0057	17
63.0	100	1.18	65	0.0031	14
50.0	100	0.600	59	0.0015	11
37.5	100	0.425	55		
28.0	87	0.300	51		
20.0	83	0.212	46		
		0.150	42		
		0.063	31		

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Stuart Kirk			
Revision No.	3.03	Issue Date	19/11/2012
		Print date	28/11/2013


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A11	
Project No.	TA7148		Sample Depth	0.00m	
Engineer	Arch Henderson LLP		Sample Number	002	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Brown SAND	Specimen Depth	0.00m
				Specimen No.	1



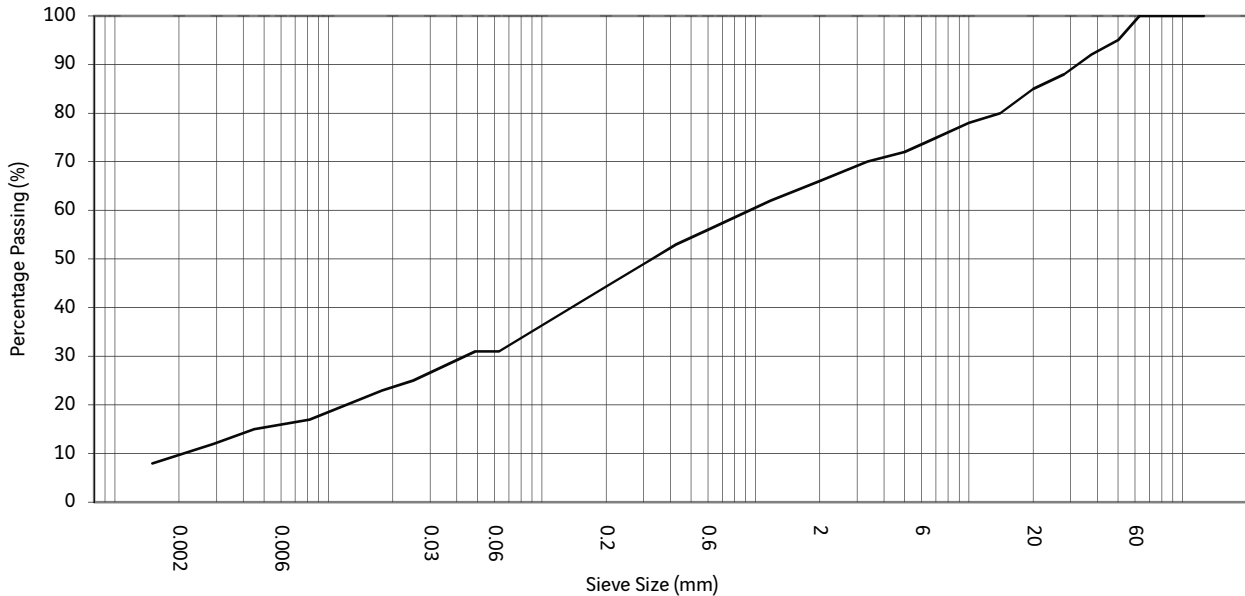
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	4	
Sand:	95	
Gravel:	1	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
90.0	100	3.35	100
75.0	100	2.00	99
63.0	100	1.18	99
50.0	100	0.600	96
37.5	100	0.425	89
28.0	100	0.300	77
20.0	100	0.212	40
		0.150	10
		0.063	4

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk	Print date 28/11/2013	
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution	Hole ID A11
		Sample Depth 8.58m
		Sample Number
		Sample type C
Description Brown gravelly sandy CLAY. Gravel is fine to coarse subangular.		Specimen Depth 8.58m
		Specimen No. 2



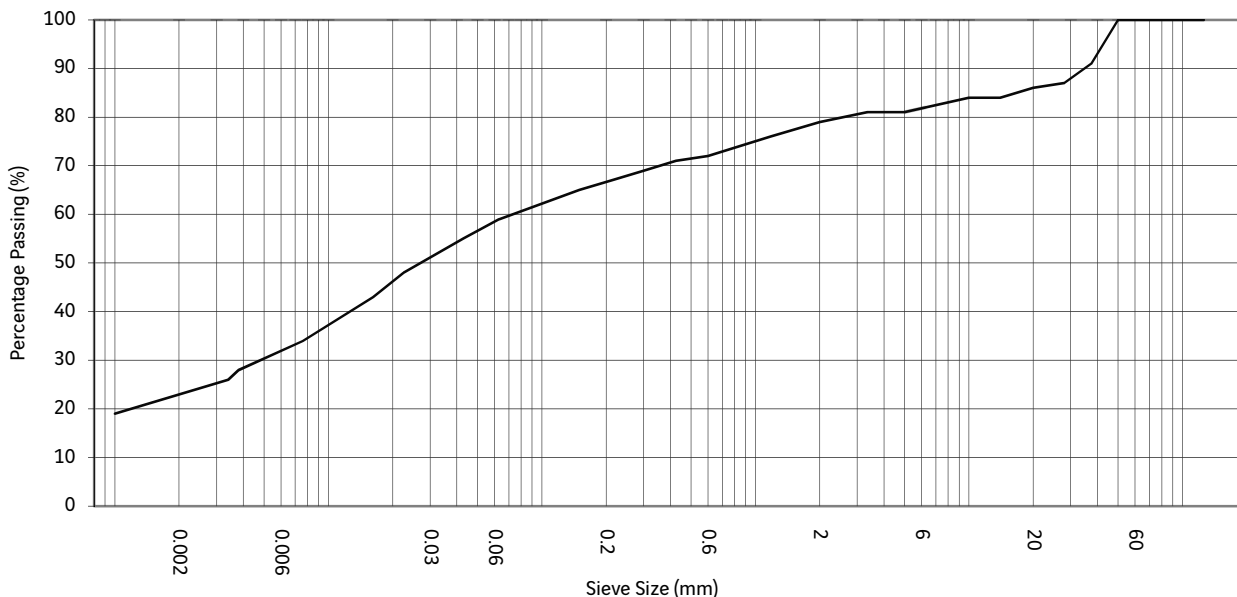
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE % Clay: 9 Silt: 22 Sand: 35 Gravel: 33 Cobbles: 1	General remarks Sample size was insufficient to be representative of particle size Particle density: 2.65Mg/m ³ Assumed
--	--

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	80		
		10.0	78	0.0488	31
		6.3	74	0.0250	25
125.0	100	5.0	72	0.0179	23
90.0	100	3.35	70	0.0082	17
75.0	100	2.00	66	0.0045	15
63.0	100	1.18	62	0.0029	12
50.0	95	0.600	56	0.0015	8
37.5	92	0.425	53		
28.0	88	0.300	49		
20.0	85	0.212	45		
		0.150	41		
		0.063	31		

Approved by: Stuart Kirk	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A11
Project No.	TA7148		Sample Depth	12.78m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample type	C
Description			Brown gravelly sandy CLAY. Gravel is fine to coarse subangular.	
			Specimen Depth	12.78m
			Specimen No.	1



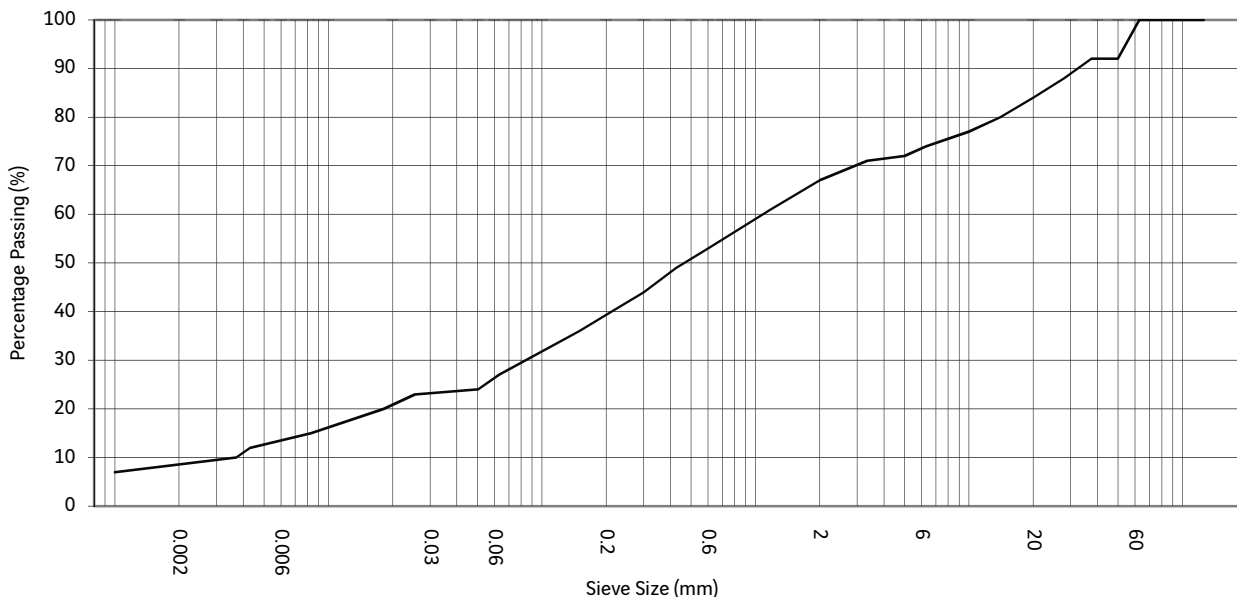
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE		%	General remarks Sample size was insufficient to be representative of particle size
Clay:		22	
Silt:		37	
Sand:		21	
Gravel:		21	
Cobbles:		0	
		Particle density:	2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	84		
		10.0	84	0.0429	55
		6.3	82	0.0225	48
125.0	100	5.0	81	0.0162	43
90.0	100	3.35	81	0.0076	34
75.0	100	2.00	79	0.0038	28
63.0	100	1.18	76	0.0034	26
50.0	100	0.600	72	0.0010	19
37.5	91	0.425	71		
28.0	87	0.300	69		
20.0	86	0.212	67		
		0.150	65		
		0.063	59		

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Stuart Kirk			
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A11
Project No.	TA7148		Sample Depth	25.28m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample type	C
Description		Brown gravelly sandy CLAY. Gravel is fine to coarse subangular	Specimen Depth	25.28m
			Specimen No.	2



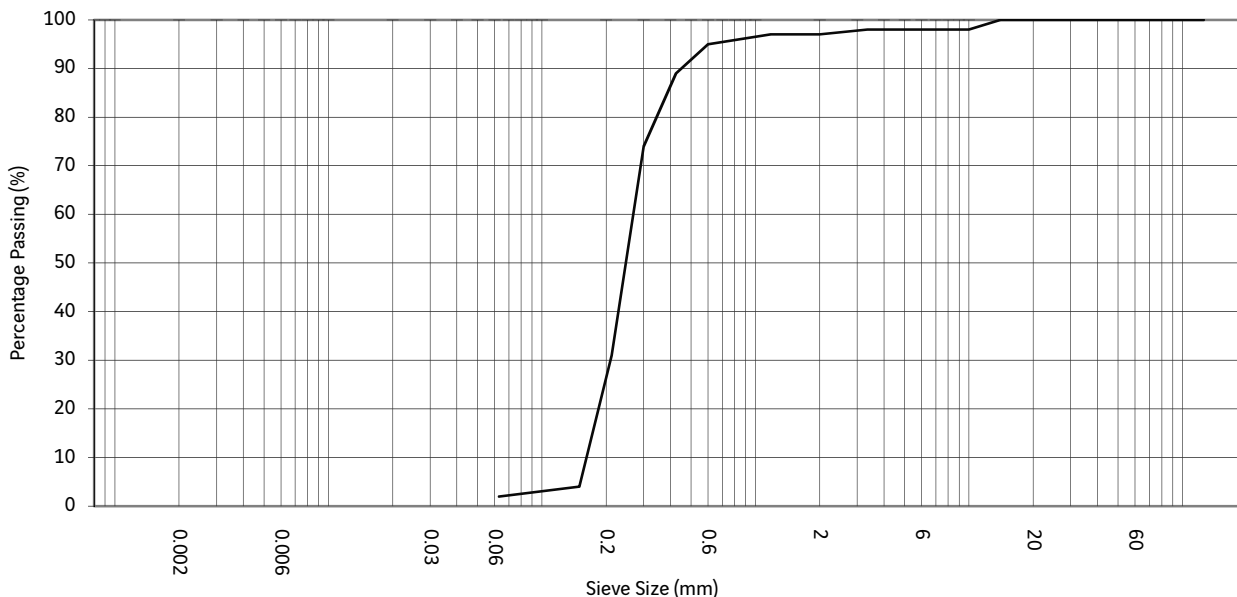
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Clay:	8	
Silt:	19	
Sand:	40	
Gravel:	31	
Cobbles:	2	
Particle density: 2.65Mg/m ³		Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	80		
		10.0	77	0.0503	24
		6.3	74	0.0254	23
125.0	100	5.0	72	0.0182	20
90.0	100	3.35	71	0.0083	15
75.0	100	2.00	67	0.0043	12
63.0	100	1.18	61	0.0037	10
50.0	92	0.600	53	0.0010	7
37.5	92	0.425	49		
28.0	88	0.300	44		
20.0	84	0.212	40		
		0.150	36		
		0.063	27		

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A29
Project No.	TA7148		Sample Depth	0.50m
Engineer	Arch Henderson LLP		Sample Number	003
Employer	Aberdeen Harbour Board		Sample type	B
Description		Brown SAND with rare medium gravel.	Specimen Depth	0.50m
			Specimen No.	1



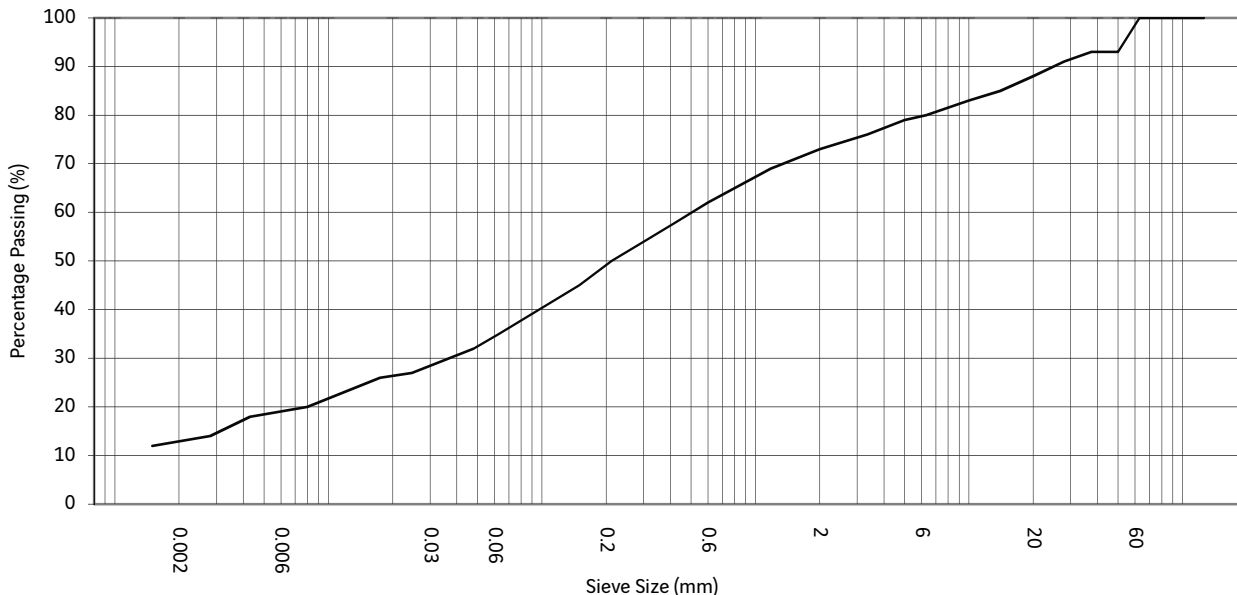
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	2	
Sand:	95	
Gravel:	3	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	98
		6.3	98
125.0	100	5.0	98
100.0	100	3.35	98
75.0	100	2.00	97
63.0	100	1.18	97
50.0	100	0.600	95
37.5	100	0.425	89
28.0	100	0.300	74
20.0	100	0.212	31
		0.150	4
		0.063	2

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A29
Project No.	TA7148		Sample Depth	4.70m
Engineer	Arch Henderson LLP		Sample Number	010
Employer	Aberdeen Harbour Board		Sample type	C
Description		Brown sandy slightly gravelly CLAY. Gravel is fine to coarse subangular.	Specimen Depth	4.70m
			Specimen No.	1



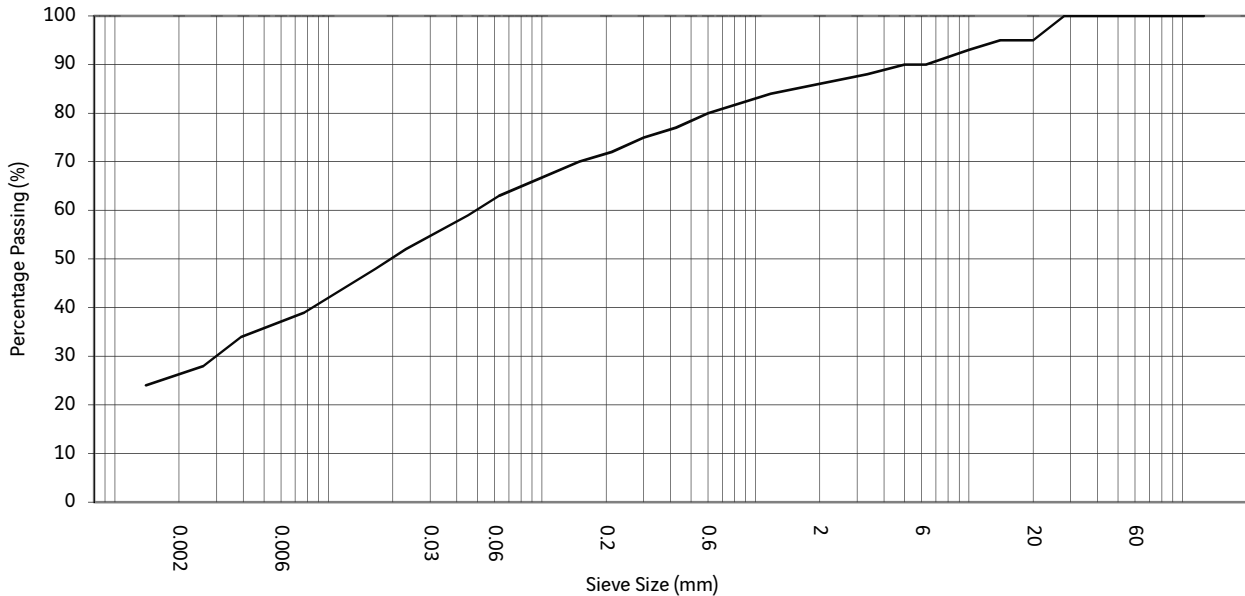
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Dispersant used when soaking specimen.
Clay:	13	
Silt:	22	
Sand:	39	
Gravel:	25	
Cobbles:	2	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	85		
		10.0	83	0.0479	32
		6.3	80	0.0246	27
125.0	100	5.0	79	0.0175	26
100.0	100	3.35	76	0.0080	20
75.0	100	2.00	73	0.0043	18
63.0	100	1.18	69	0.0028	14
50.0	93	0.600	62	0.0015	12
37.5	93	0.425	58		
28.0	91	0.300	54		
20.0	88	0.212	50		
		0.150	45		
		0.063	35		

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID	A29
Project No.	TA7148		Sample Depth	21.50m
Engineer	Arch Henderson LLP		Sample Number	014
Employer	Aberdeen Harbour Board		Sample type	C
Description	Brown sandy slightly gravelly CLAY. Gravel is fine to coarse angular.		Specimen Depth	21.71m
			Specimen No.	1



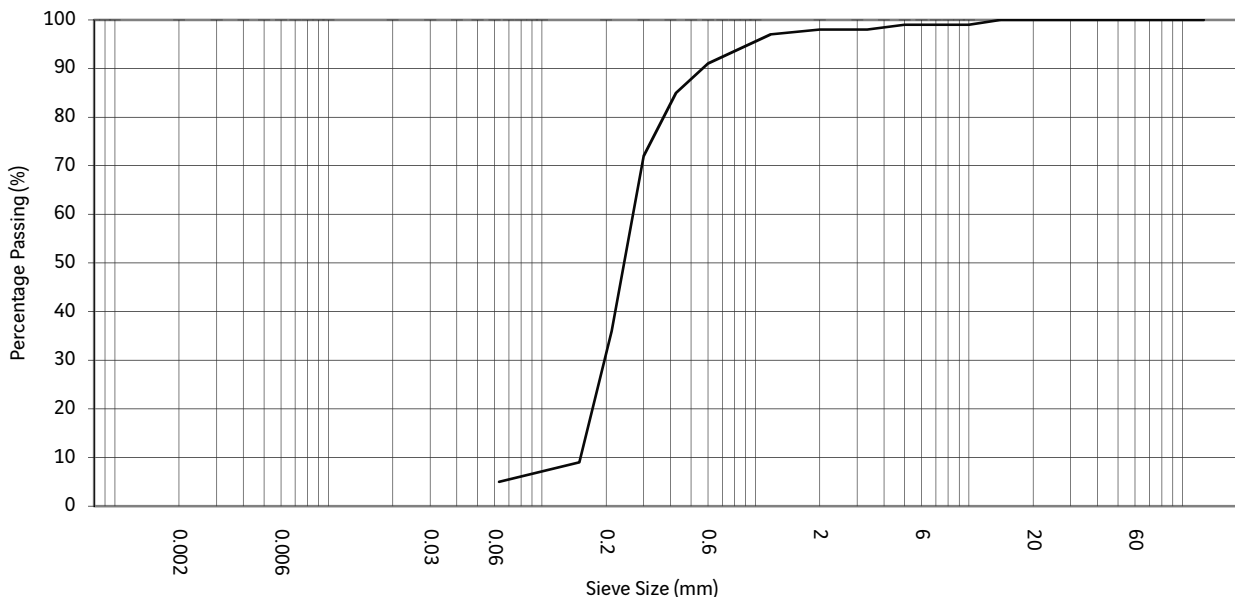
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Dispersant used when soaking specimen. Particle density: 2.65Mg/m ³ Assumed
Clay:	26	
Silt:	36	
Sand:	24	
Gravel:	14	
Cobbles:	0	

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	95		
		10.0	93	0.0450	59
		6.3	90	0.0231	52
125.0	100	5.0	90	0.0166	48
100.0	100	3.35	88	0.0077	39
75.0	100	2.00	86	0.0039	34
63.0	100	1.18	84	0.0026	28
50.0	100	0.600	80	0.0014	24
37.5	100	0.425	77		
28.0	100	0.300	75		
20.0	95	0.212	72		
		0.150	70		
		0.063	63		

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Sushil Sharda	Print date 28/11/2013	
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID A31
		Sample Depth 0.50m
		Sample Number 002
		Sample type B
Description Brownish grey SAND with occasional medium gravel.		Specimen Depth 0.50m
		Specimen No. 1



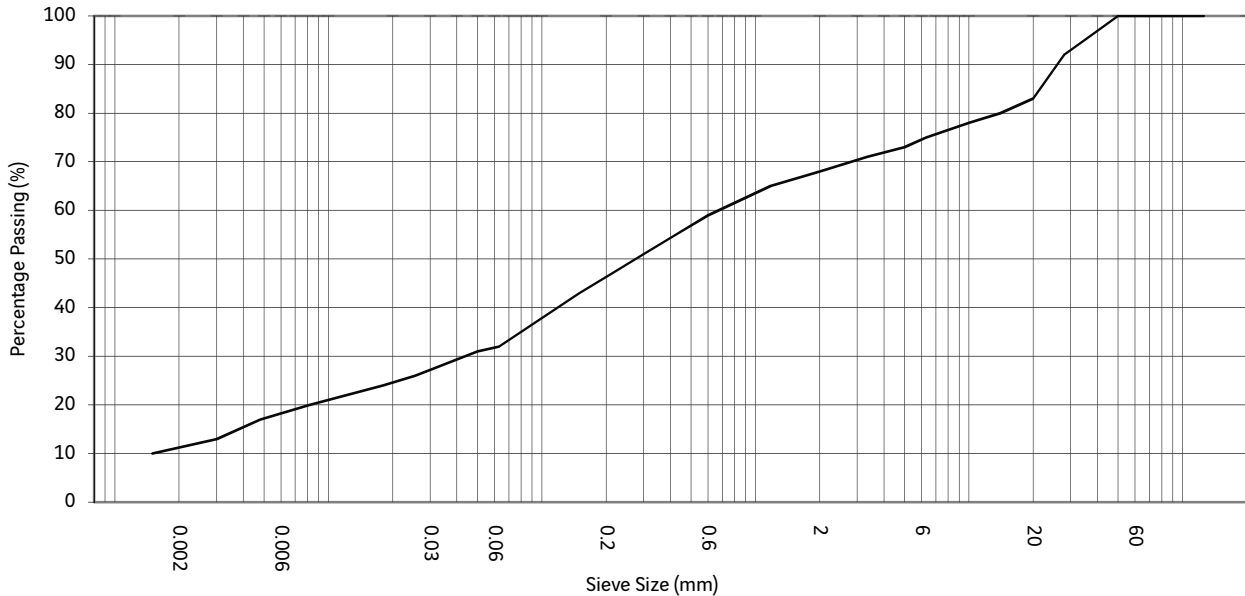
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	5	
Sand:	93	
Gravel:	2	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	99
		6.3	99
		5.0	99
125.0	100	3.35	98
100.0	100	2.00	98
75.0	100	1.18	97
63.0	100	0.600	91
50.0	100	0.425	85
37.5	100	0.300	72
28.0	100	0.212	36
20.0	100	0.150	9
		0.063	5

Approved by:	Leeds Laboratory		
Stuart Kirk		Print date 28/11/2013	SOIL ENGINEERING
Revision No. 3.03	Issue Date 19/11/2012	Part of the Bachy Soletanche Group	


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID A31
		Sample Depth 4.80m
		Sample Number 005
		Sample type C
Description Brown gravelly sandy CLAY. Gravel is fine to coarse subangular	Specimen Depth 4.80m	
	Specimen No. 1	



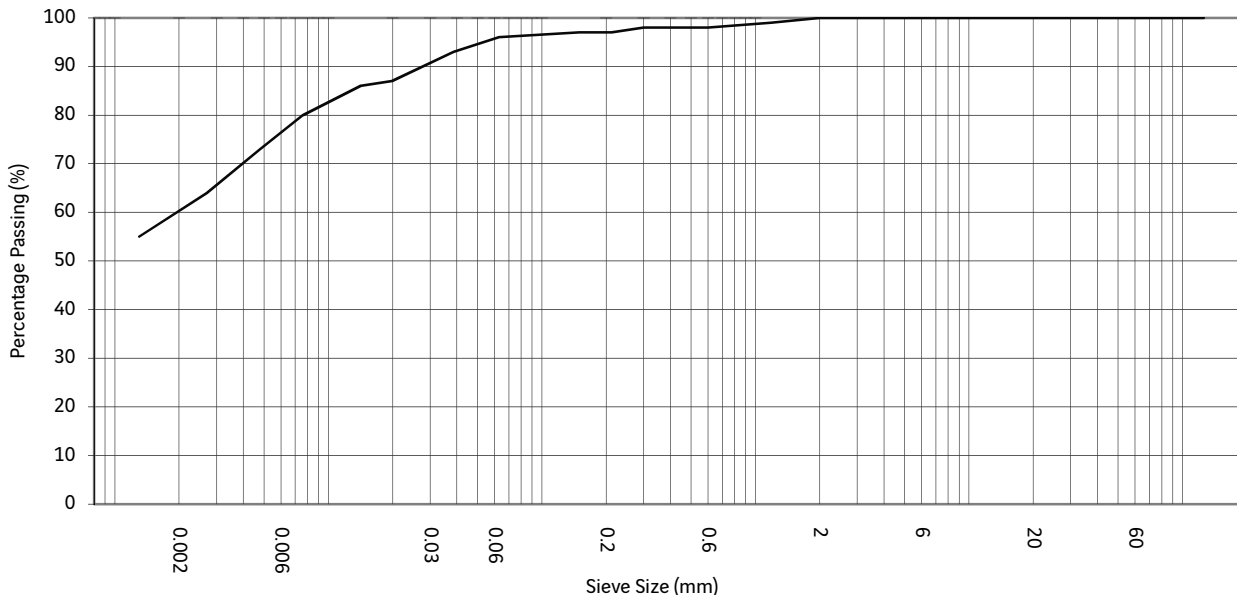
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Clay:	11	
Silt:	21	
Sand:	36	
Gravel:	32	
Cobbles:	0	
Particle density: 2.65Mg/m ³		Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	80		
		10.0	78	0.0500	31
		6.3	75	0.0255	26
125.0	100	5.0	73	0.0181	24
100.0	100	3.35	71	0.0082	20
75.0	100	2.00	68	0.0048	17
63.0	100	1.18	65	0.0030	13
50.0	100	0.600	59	0.0015	10
37.5	96	0.425	55		
28.0	92	0.300	51		
20.0	83	0.212	47		
		0.150	43		
		0.063	32		

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A31	
Project No.	TA7148		Sample Depth	19.30m	
Engineer	Arch Henderson LLP		Sample Number	009	
Employer	Aberdeen Harbour Board		Sample type	C	
Description		Brown CLAY with rare fine angular gravel.	Specimen Depth	19.52m	
				Specimen No.	1



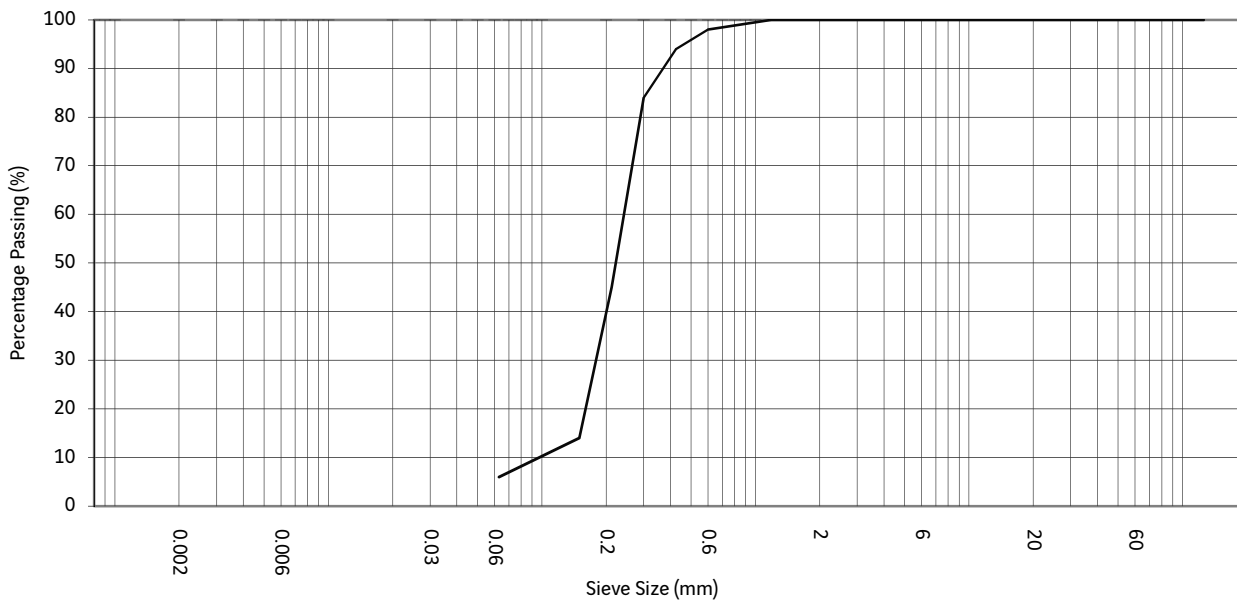
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Clay:	59	
Silt:	36	
Sand:	4	
Gravel:	0	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	100		
		10.0	100	0.0386	93
		6.3	100	0.0199	87
125.0	100	5.0	100	0.0142	86
100.0	100	3.35	100	0.0076	80
75.0	100	2.00	100	0.0048	73
63.0	100	1.18	99	0.0027	64
50.0	100	0.600	98	0.0013	55
37.5	100	0.425	98		
28.0	100	0.300	98		
20.0	100	0.212	97		
		0.150	97		
		0.063	96		

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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID A34
		Sample Depth 0.50m
		Sample Number 002
		Sample type D
Description Greyish brown SAND		Specimen Depth 0.50m
		Specimen No. 1



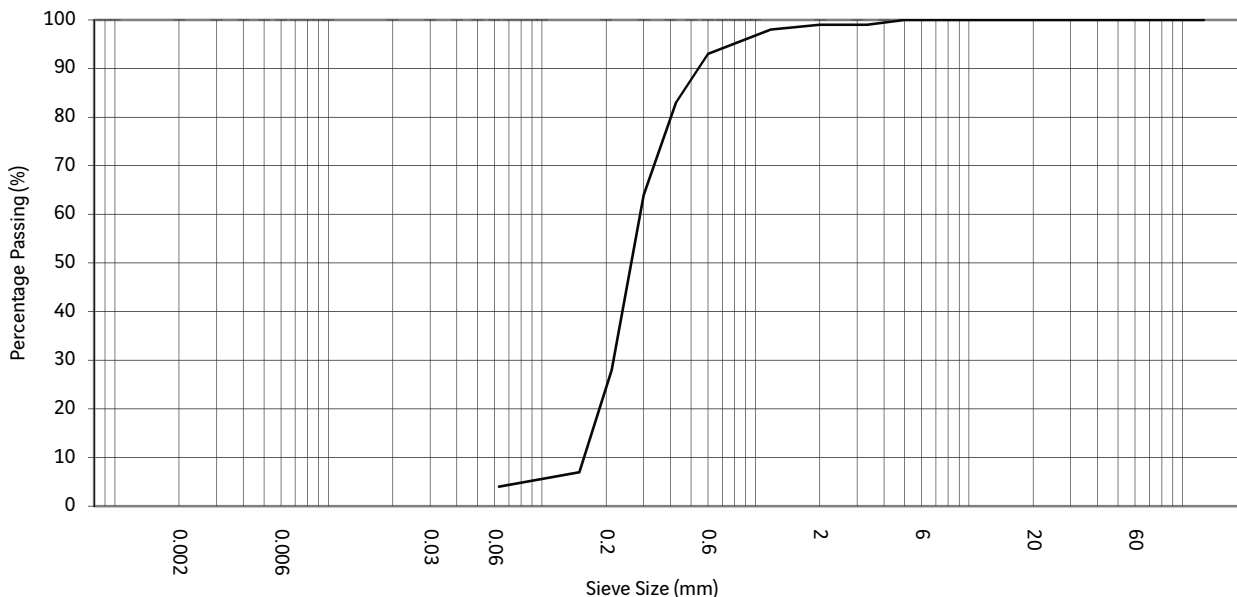
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	6	
Sand:	94	
Gravel:	0	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
90.0	100	3.35	100
75.0	100	2.00	100
63.0	100	1.18	100
50.0	100	0.600	98
37.5	100	0.425	94
28.0	100	0.300	84
20.0	100	0.212	45
		0.150	14
		0.063	6

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Stuart Kirk		Print date 28/11/2013	
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID A34
		Sample Depth 1.50m
		Sample Number 006
		Sample type B
Description Greyish brown SAND.		Specimen Depth 1.50m
		Specimen No. 1



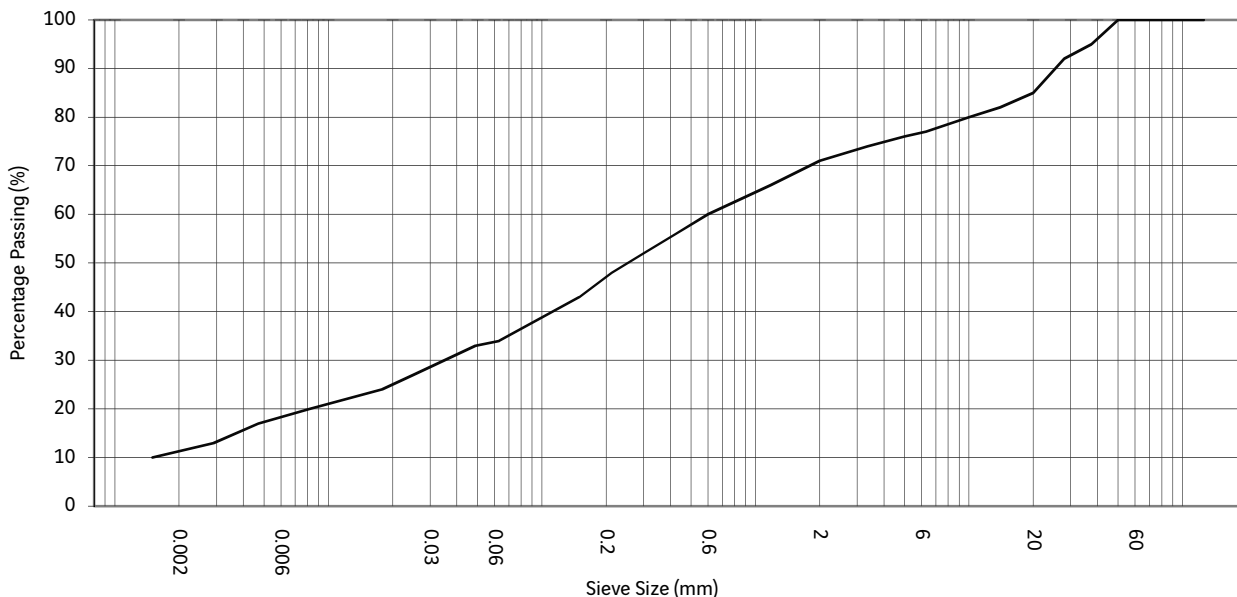
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	4	
Sand:	95	
Gravel:	1	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
		5.0	100
125.0	100	3.35	99
100.0	100	2.00	99
75.0	100	1.18	98
63.0	100	0.600	93
50.0	100	0.425	83
37.5	100	0.300	64
28.0	100	0.212	28
20.0	100	0.150	7
		0.063	4

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Stuart Kirk		Print date 28/11/2013	
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A34
Project No.	TA7148		Sample Depth	4.75m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample type	C
Description			Brown gravelly sandy CLAY. Gravel is fine to coarse subangular.	
			Specimen Depth	4.75m
			Specimen No.	1



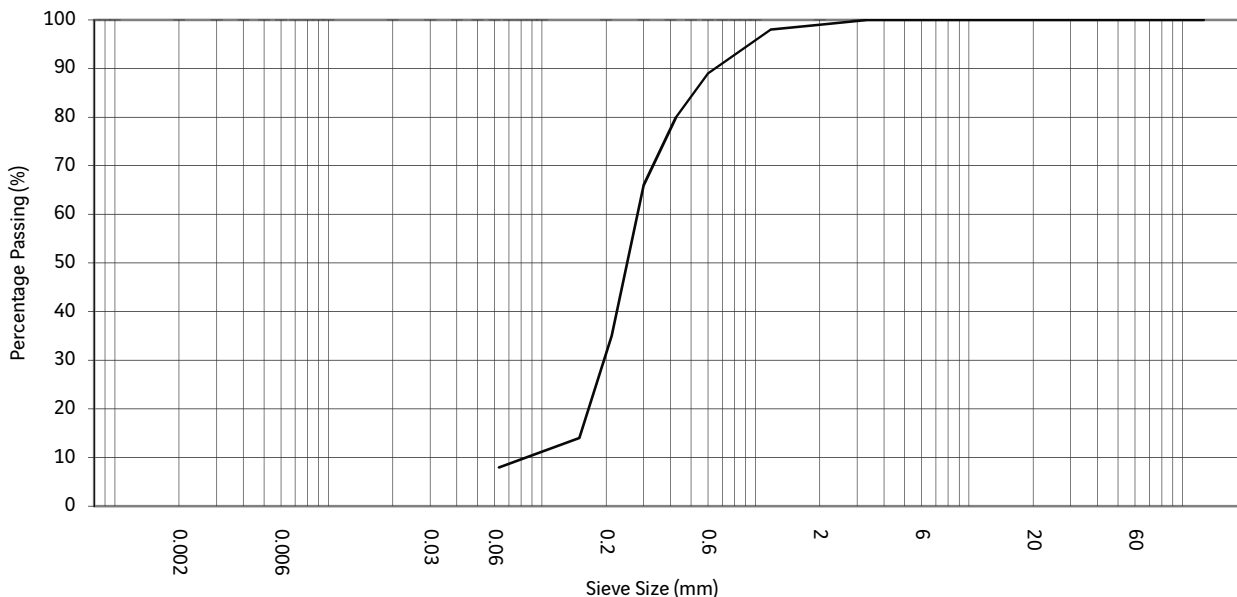
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Clay:	11	
Silt:	23	
Sand:	37	
Gravel:	29	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	82		
		10.0	80	0.0488	33
		6.3	77	0.0250	27
125.0	100	5.0	76	0.0179	24
100.0	100	3.35	74	0.0082	20
75.0	100	2.00	71	0.0047	17
63.0	100	1.18	66	0.0029	13
50.0	100	0.600	60	0.0015	10
37.5	95	0.425	56		
28.0	92	0.300	52		
20.0	85	0.212	48		
		0.150	43		
		0.063	34		

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Stuart Kirk	Print date 28/11/2013	
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A51	
Project No.	TA7148		Sample Depth	0.50m	
Engineer	Arch Henderson LLP		Sample Number	003	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Brown SAND.	Specimen Depth	0.50m
				Specimen No.	1



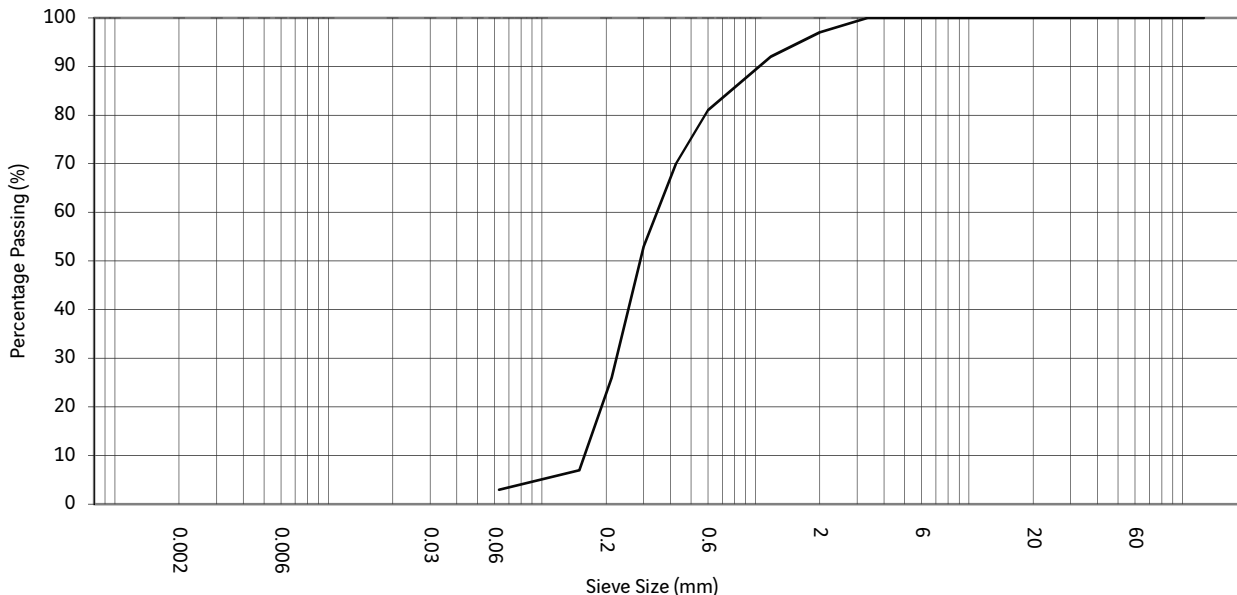
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	8	
Sand:	92	
Gravel:	1	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
100.0	100	3.35	100
75.0	100	2.00	99
63.0	100	1.18	98
50.0	100	0.600	89
37.5	100	0.425	80
28.0	100	0.300	66
20.0	100	0.212	35
		0.150	14
		0.063	8

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Sushil Sharda		
Revision No.	3.03	Issue Date 19/11/2012


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A54	
Project No.	TA7148		Sample Depth	1.50m	
Engineer	Arch Henderson LLP		Sample Number	006	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Grey SAND.	Specimen Depth	1.50m
				Specimen No.	1



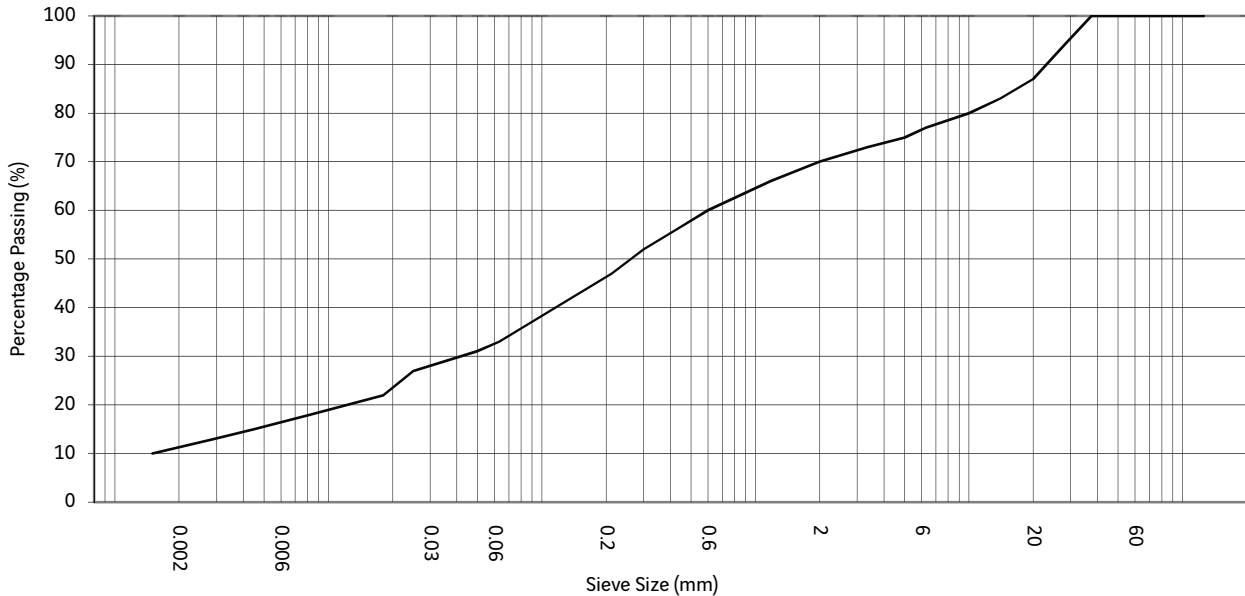
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	4	
Sand:	94	
Gravel:	3	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
100.0	100	3.35	100
75.0	100	2.00	97
63.0	100	1.18	92
50.0	100	0.600	81
37.5	100	0.425	70
28.0	100	0.300	53
20.0	100	0.212	26
		0.150	7
		0.063	3

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Stuart Kirk			Print date 28/11/2013
Revision No.	3.03	Issue Date	19/11/2012


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID	A54
Project No.	TA7148		Sample Depth	6.00m
Engineer	Arch Henderson LLP		Sample Number	014
Employer	Aberdeen Harbour Board		Sample type	C
Description	Brown clayey gravelly SAND. Gravel is medium to coarse subrounded.		Specimen Depth	6.00m
			Specimen No.	2



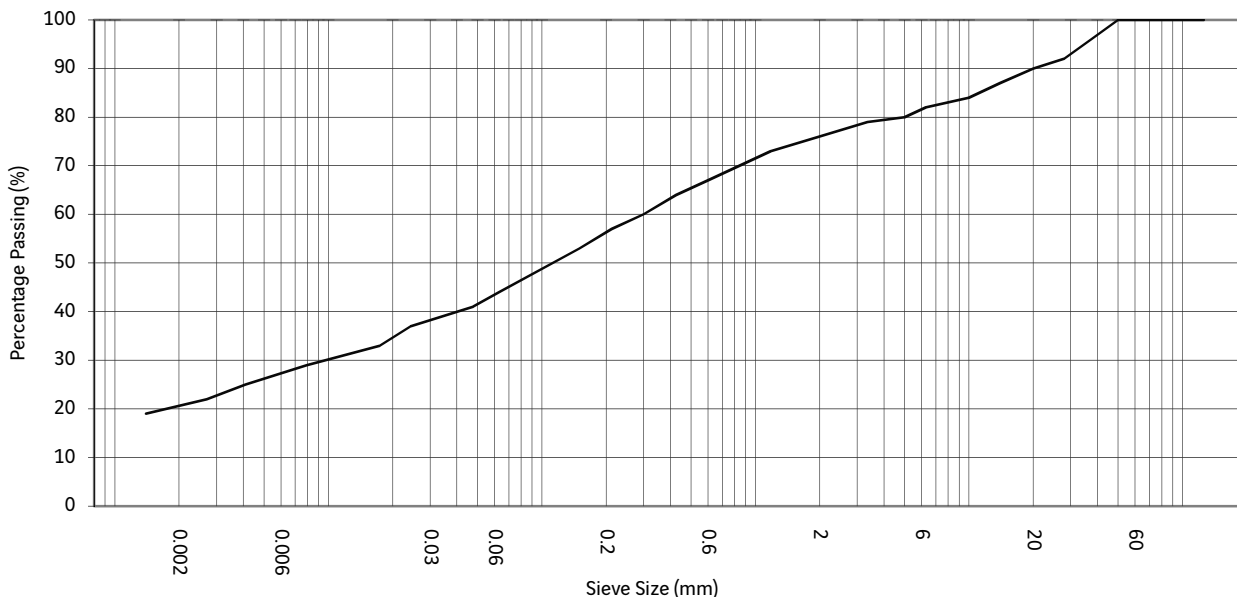
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Clay:	11	
Silt:	22	
Sand:	37	
Gravel:	30	
Cobbles:	0	
Particle density: 2.65Mg/m ³		Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	83		
		10.0	80	0.0494	31
		6.3	77	0.0251	27
125.0	100	5.0	75	0.0181	22
90.0	100	3.35	73	0.0082	18
75.0	100	2.00	70	0.0045	15
63.0	100	1.18	66	0.0029	13
50.0	100	0.600	60	0.0015	10
37.5	100	0.425	56		
28.0	94	0.300	52		
20.0	87	0.212	47		
		0.150	43		
		0.063	33		

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Sushil Sharda			
Revision No.	3.03	Issue Date	19/11/2012


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID	A54
Project No.	TA7148		Sample Depth	10.15m
Engineer	Arch Henderson LLP		Sample Number	016
Employer	Aberdeen Harbour Board		Sample type	C
Description	Brown sandy slightly gravelly CLAY. Gravel is medium to coarse subangular.		Specimen Depth	10.15m
			Specimen No.	2



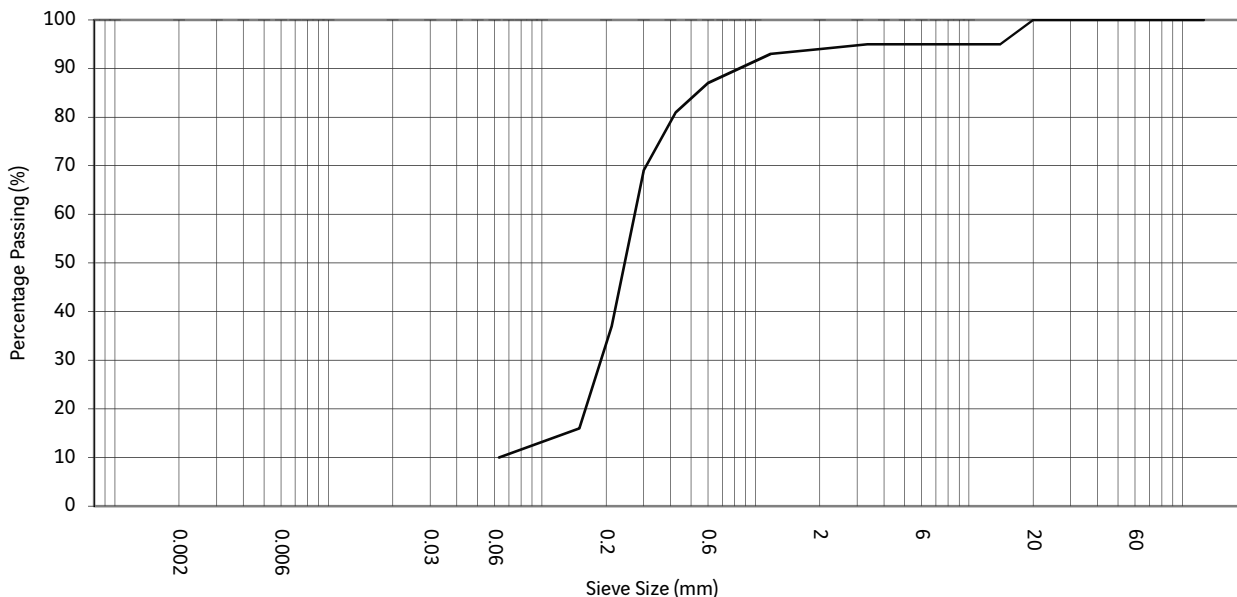
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Clay:	20	
Silt:	23	
Sand:	33	
Gravel:	24	
Cobbles:	0	
Particle density: 2.65Mg/m ³		Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	87		
		10.0	84	0.0476	41
		6.3	82	0.0243	37
125.0	100	5.0	80	0.0174	33
90.0	100	3.35	79	0.0079	29
75.0	100	2.00	76	0.0041	25
63.0	100	1.18	73	0.0027	22
50.0	100	0.600	67	0.0014	19
37.5	96	0.425	64		
28.0	92	0.300	60		
20.0	90	0.212	57		
		0.150	53		
		0.063	44		

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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID A57
		Sample Depth 0.50m
		Sample Number 003
		Sample type B
Description Brown slightly gravelly slightly clayey SAND. Gravel is fine to medium angular.		Specimen Depth 0.50m
		Specimen No. 1



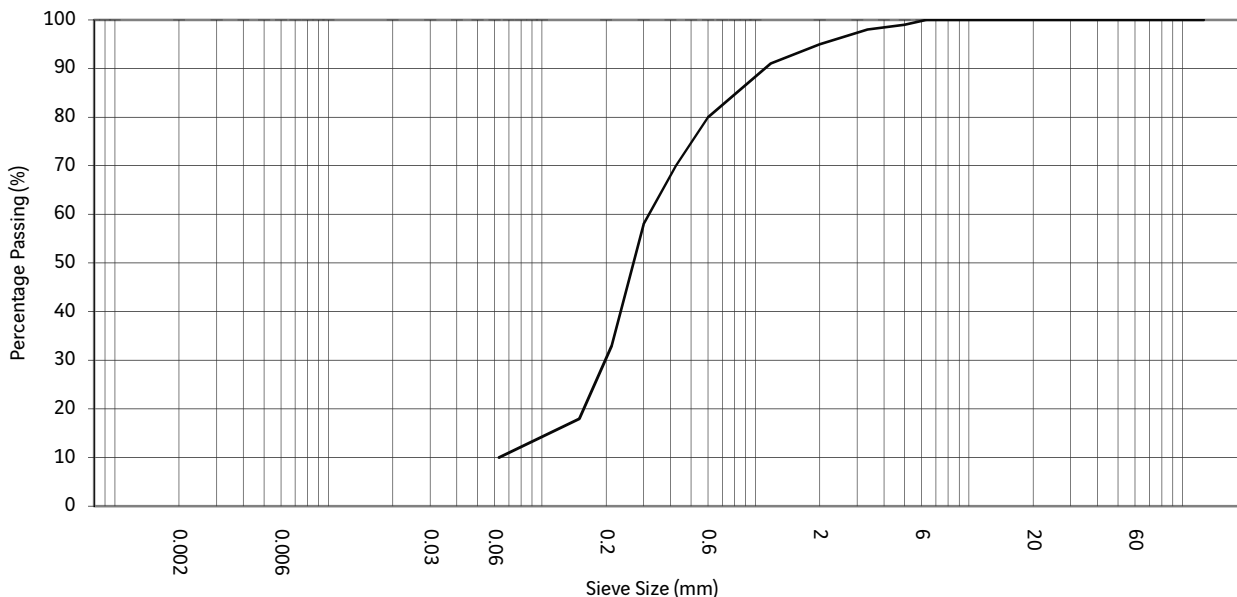
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	10	
Sand:	84	
Gravel:	6	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	95
		10.0	95
		6.3	95
		5.0	95
125.0	100	3.35	95
100.0	100	2.00	94
75.0	100	1.18	93
63.0	100	0.600	87
50.0	100	0.425	81
37.5	100	0.300	69
28.0	100	0.212	37
20.0	100	0.150	16
		0.063	10

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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID A57
		Sample Depth 1.50m
		Sample Number 006
		Sample type B
Description Brown slightly gravelly SAND. Gravel is fine.		Specimen Depth 1.50m
		Specimen No. 1



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

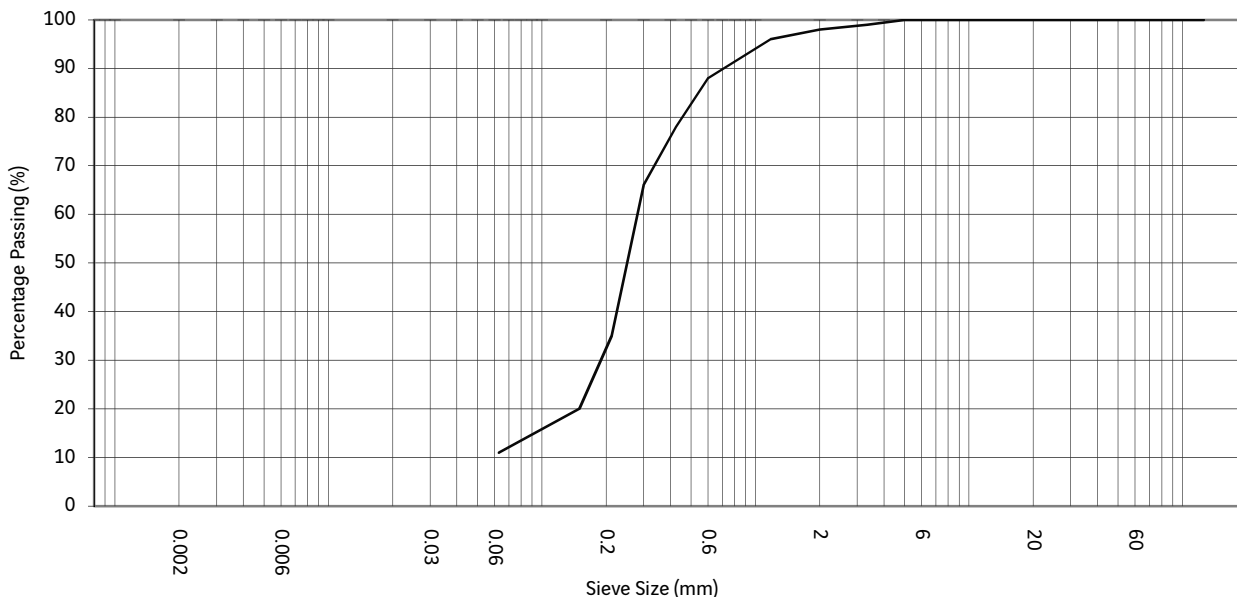
PARTICLE SIZE	%	General remarks
Silt and clay:	10	
Sand:	84	
Gravel:	5	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	99
90.0	100	3.35	98
75.0	100	2.00	95
63.0	100	1.18	91
50.0	100	0.600	80
37.5	100	0.425	70
28.0	100	0.300	58
20.0	100	0.212	33
		0.150	18
		0.063	10

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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID A57
		Sample Depth 4.50m
		Sample Number 015
		Sample type B
Description Brownish grey SAND.		Specimen Depth 4.50m
		Specimen No. 1



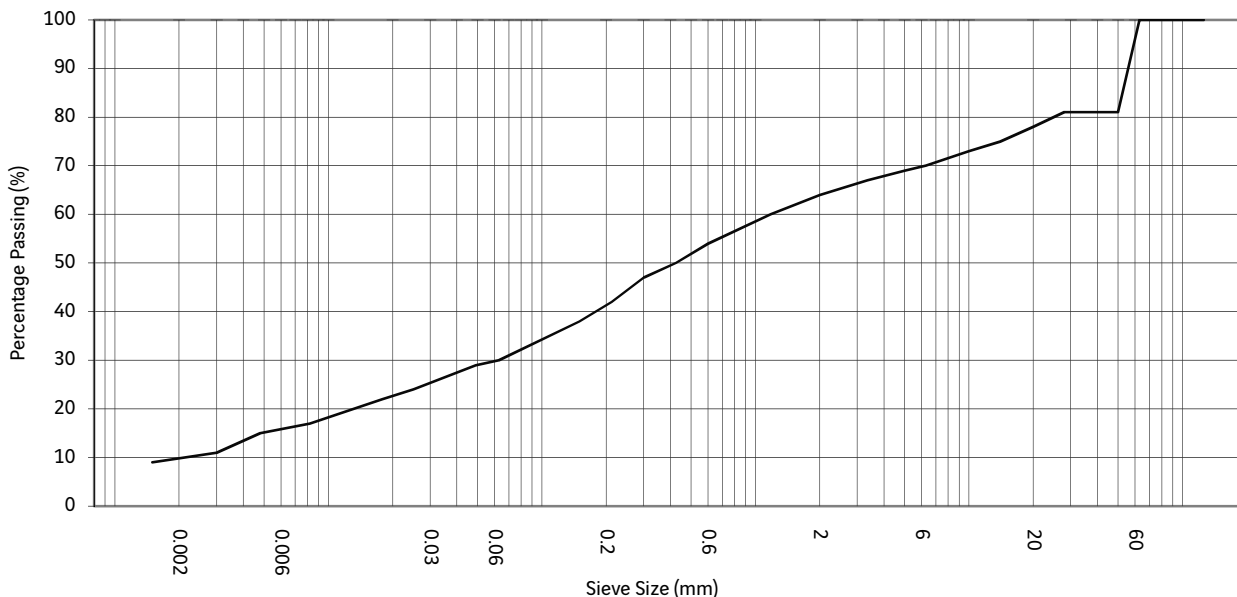
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	11	
Sand:	87	
Gravel:	2	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
100.0	100	3.35	99
75.0	100	2.00	98
63.0	100	1.18	96
50.0	100	0.600	88
37.5	100	0.425	78
28.0	100	0.300	66
20.0	100	0.212	35
		0.150	20
		0.063	11

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A57
Project No.	TA7148		Sample Depth	9.20m
Engineer	Arch Henderson LLP		Sample Number	022
Employer	Aberdeen Harbour Board		Sample type	C
Description		Brown sandy gravelly CLAY. Gravel is fine to coarse.	Specimen Depth	9.20m
			Specimen No.	1



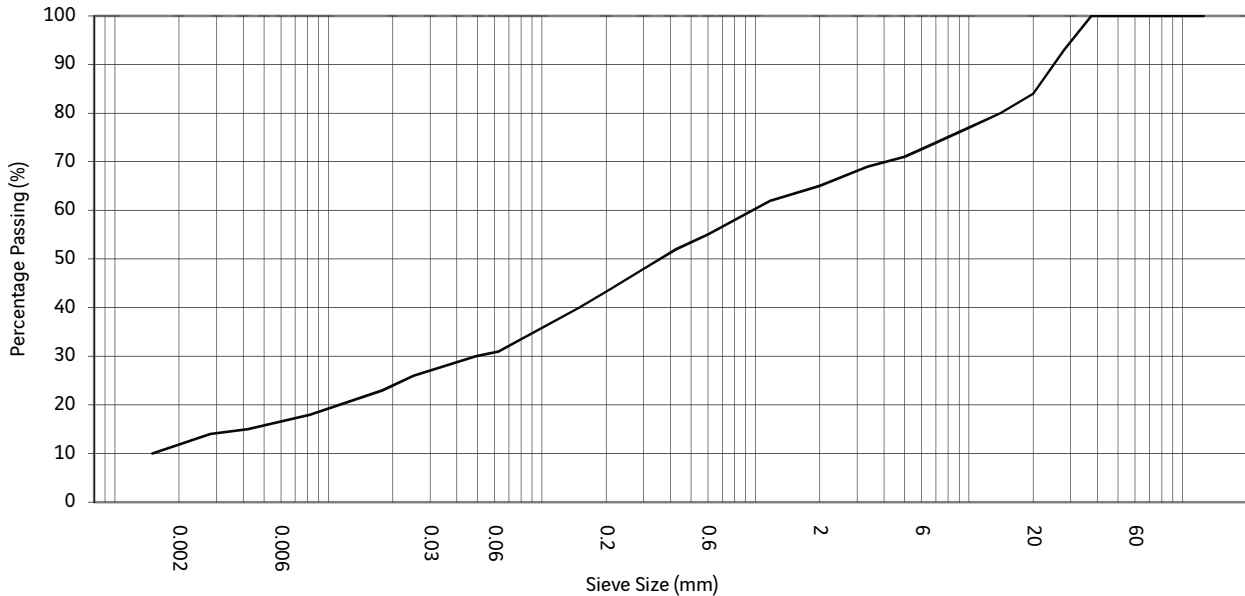
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size Particle density: 2.65Mg/m ³ Assumed
Clay:	10	
Silt:	20	
Sand:	34	
Gravel:	32	
Cobbles:	4	

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	75		
		10.0	73	0.0489	29
		6.3	70	0.0251	24
125.0	100	5.0	69	0.0179	22
100.0	100	3.35	67	0.0082	17
75.0	100	2.00	64	0.0048	15
63.0	100	1.18	60	0.0030	11
50.0	81	0.600	54	0.0015	9
37.5	81	0.425	50		
28.0	81	0.300	47		
20.0	78	0.212	42		
		0.150	38		
		0.063	30		

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A57
Project No.	TA7148		Sample Depth	17.30m
Engineer	Arch Henderson LLP		Sample Number	025
Employer	Aberdeen Harbour Board		Sample type	C
Description			Brown sandy gravelly CLAY. Gravel is medium to coarse subangular.	
			Specimen Depth	17.30m
			Specimen No.	1



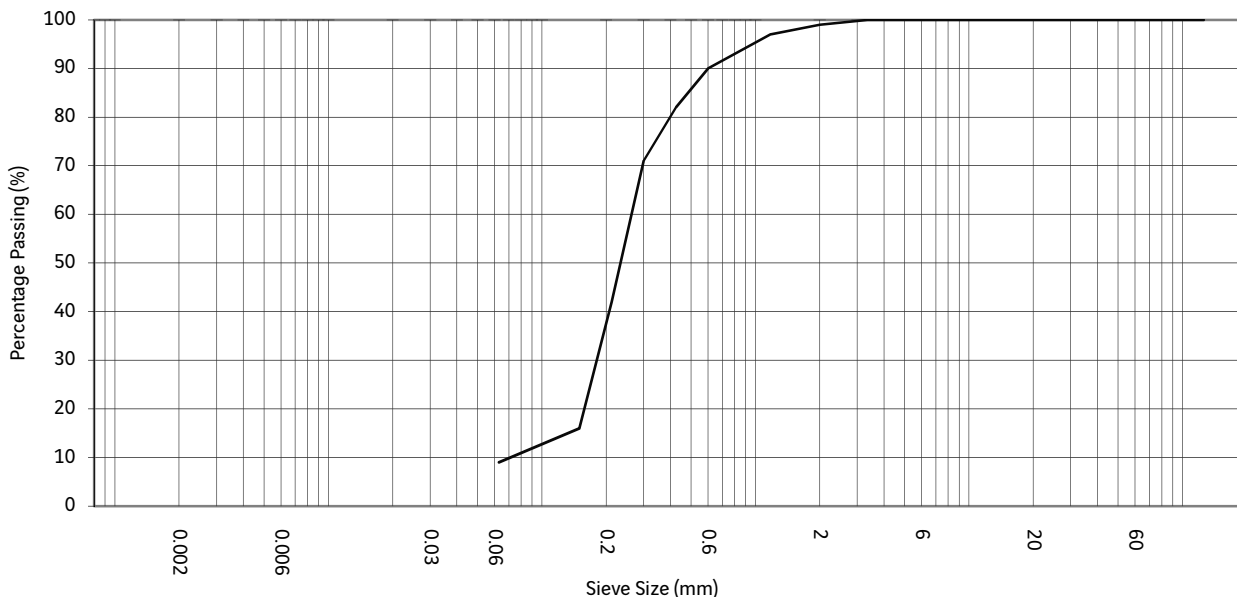
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Clay:	11	
Silt:	19	
Sand:	35	
Gravel:	35	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	80		
		10.0	77	0.0491	30
		6.3	73	0.0251	26
125.0	100	5.0	71	0.0179	23
90.0	100	3.35	69	0.0082	18
75.0	100	2.00	65	0.0042	15
63.0	100	1.18	62	0.0028	14
50.0	100	0.600	55	0.0015	10
37.5	100	0.425	52		
28.0	93	0.300	48		
20.0	84	0.212	44		
		0.150	40		
		0.063	31		

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Revision No.	3.03	Issue Date	19/11/2012


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID A59
		Sample Depth 1.50m
		Sample Number 006
		Sample type B
Description Grey mottled brown SAND		Specimen Depth 1.50m
		Specimen No. 1



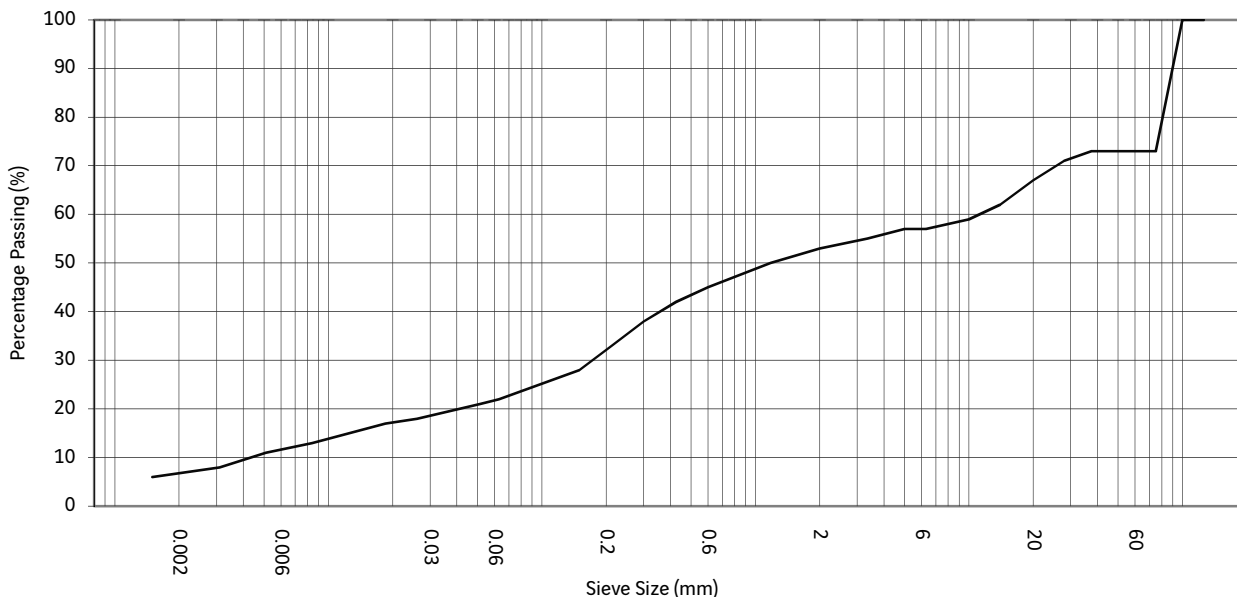
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	9	
Sand:	90	
Gravel:	1	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
90.0	100	3.35	100
75.0	100	2.00	99
63.0	100	1.18	97
50.0	100	0.600	90
37.5	100	0.425	82
28.0	100	0.300	71
20.0	100	0.212	42
		0.150	16
		0.063	9

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID A59
		Sample Depth 5.50m
		Sample Number 016
		Sample type B
Description Brown sandy gravelly CLAY with occasional cobbles. Gravel is fine to coarse angular.	Specimen Depth 5.50m	
	Specimen No. 1	



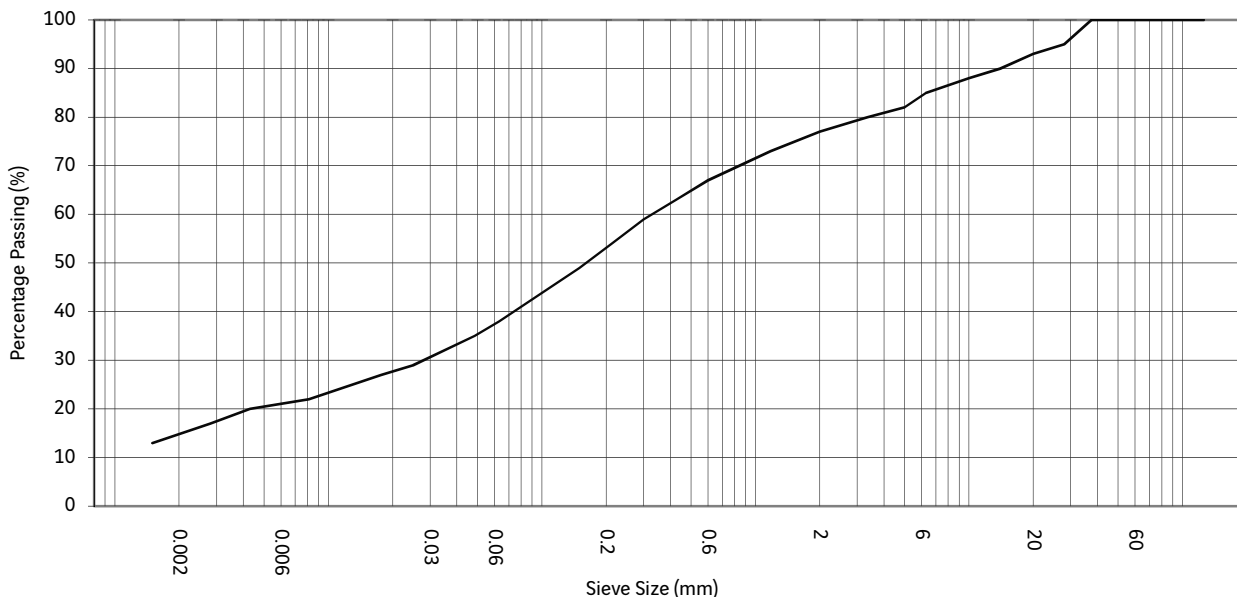
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE % Clay: 6 Silt: 15 Sand: 31 Gravel: 21 Cobbles: 27	General remarks Sample size was insufficient to be representative of particle size Particle density: 2.65Mg/m ³ Assumed
---	--

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	62		
		10.0	59	0.0512	21
		6.3	57	0.0260	18
125.0	100	5.0	57	0.0185	17
100.0	100	3.35	55	0.0084	13
75.0	73	2.00	53	0.0051	11
63.0	73	1.18	50	0.0031	8
50.0	73	0.600	45	0.0015	6
37.5	73	0.425	42		
28.0	71	0.300	38		
20.0	67	0.212	33		
		0.150	28		
		0.063	22		

Approved by: Stuart Kirk	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID	A59
Project No.	TA7148		Sample Depth	10.45m
Engineer	Arch Henderson LLP		Sample Number	024
Employer	Aberdeen Harbour Board		Sample type	C
Description	Brown sandy slightly gravelly CLAY. Gravel is fine to coarse angular.		Specimen Depth	10.72m
			Specimen No.	1



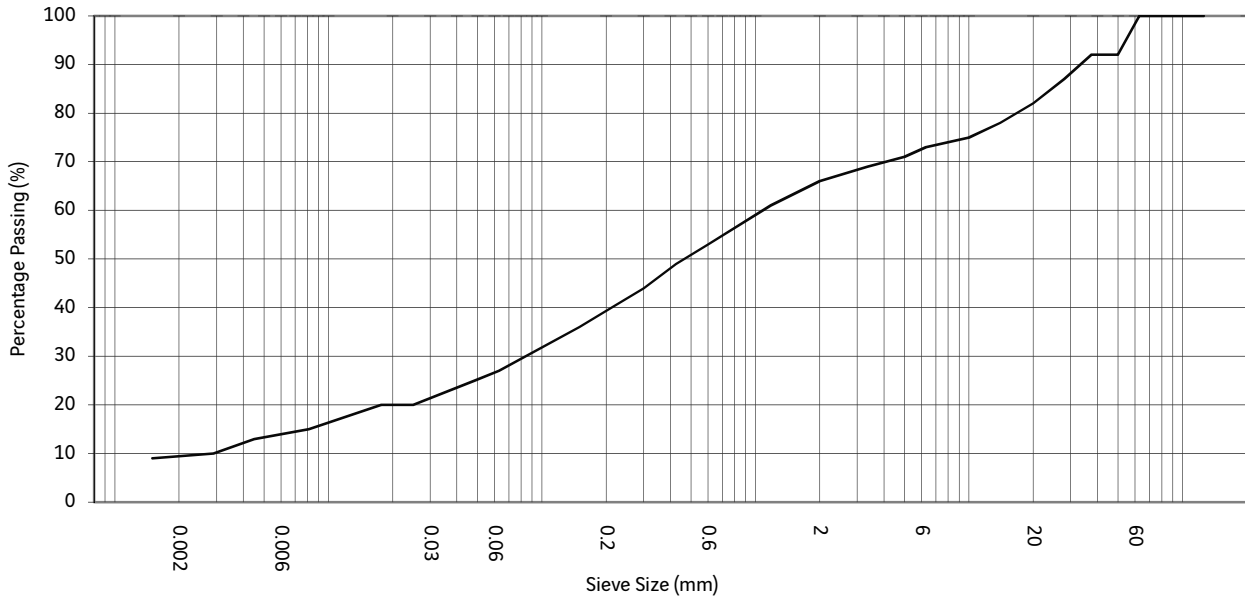
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Clay:	14	
Silt:	23	
Sand:	40	
Gravel:	23	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	90		
		10.0	88	0.0485	35
		6.3	85	0.0249	29
125.0	100	5.0	82	0.0177	27
100.0	100	3.35	80	0.0081	22
75.0	100	2.00	77	0.0043	20
63.0	100	1.18	73	0.0028	17
50.0	100	0.600	67	0.0015	13
37.5	100	0.425	63		
28.0	95	0.300	59		
20.0	93	0.212	54		
		0.150	49		
		0.063	38		

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Sushil Sharda	Print date 28/11/2013	
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID A59
Project No.	TA7148		Sample Depth 21.20m
Engineer	Arch Henderson LLP		Sample Number 027
Employer	Aberdeen Harbour Board		Sample type C
Description	Brown sandy gravelly CLAY. Gravel is fine to coarse angular		Specimen Depth 21.43m
			Specimen No. 1



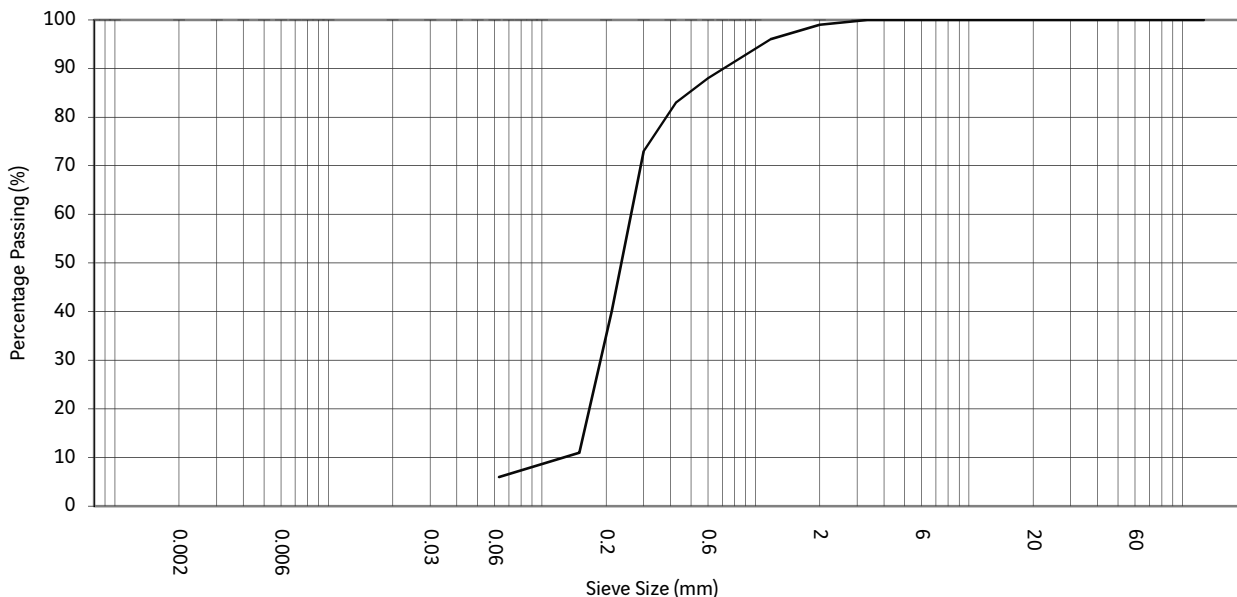
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Clay:	9	
Silt:	17	
Sand:	39	
Gravel:	32	
Cobbles:	2	
Particle density: 2.65Mg/m ³		Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	78		
		10.0	75	0.0487	25
		6.3	73	0.0250	20
125.0	100	5.0	71	0.0177	20
100.0	100	3.35	69	0.0081	15
75.0	100	2.00	66	0.0045	13
63.0	100	1.18	61	0.0029	10
50.0	92	0.600	53	0.0015	9
37.5	92	0.425	49		
28.0	87	0.300	44		
20.0	82	0.212	40		
		0.150	36		
		0.063	27		

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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID A63
		Sample Depth 1.00m
		Sample Number 006
		Sample type B
Description Brown SAND with some shell fragments		Specimen Depth 1.00m
		Specimen No. 1



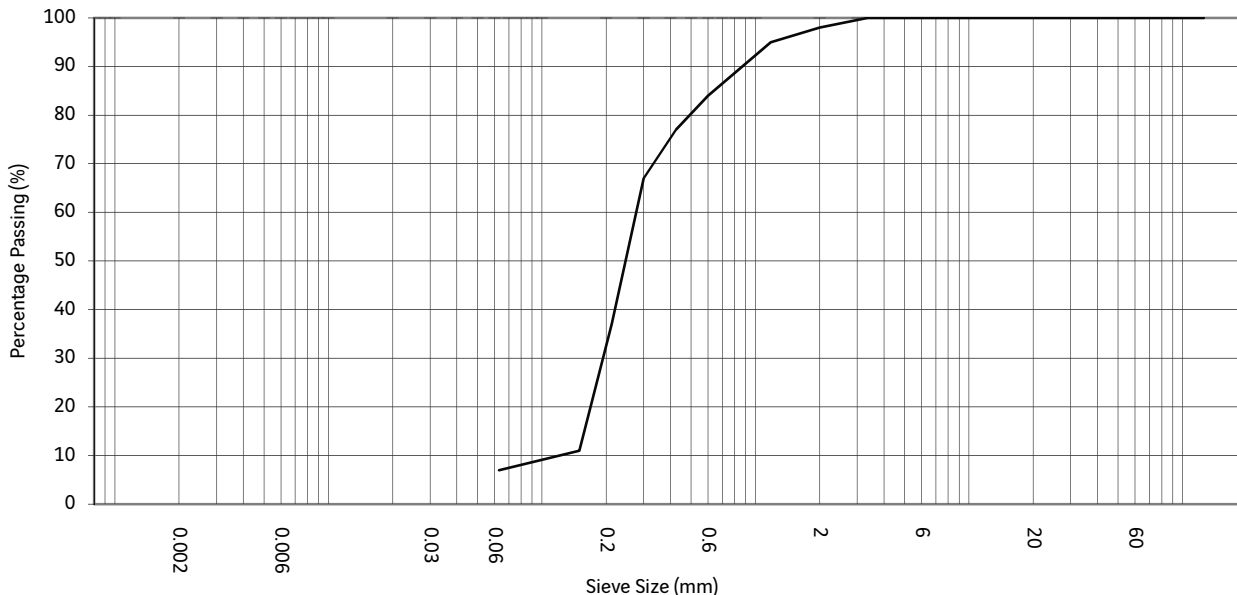
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	6	
Sand:	92	
Gravel:	1	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
90.0	100	3.35	100
75.0	100	2.00	99
63.0	100	1.18	96
50.0	100	0.600	88
37.5	100	0.425	83
28.0	100	0.300	73
20.0	100	0.212	40
		0.150	11
		0.063	6

Approved by: Stuart Kirk	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID A63
		Sample Depth 2.00m
		Sample Number 010
		Sample type B
Description Brown SAND.		Specimen Depth 2.00m
		Specimen No. 1



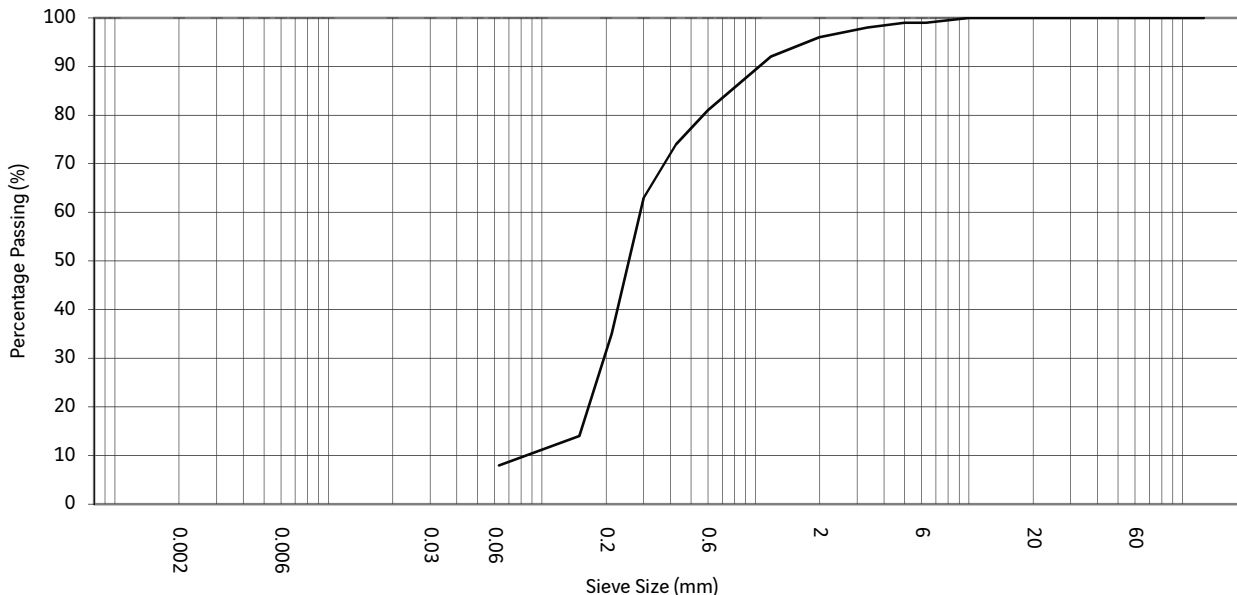
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	7	
Sand:	91	
Gravel:	2	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
90.0	100	3.35	100
75.0	100	2.00	98
63.0	100	1.18	95
50.0	100	0.600	84
37.5	100	0.425	77
28.0	100	0.300	67
20.0	100	0.212	37
		0.150	11
		0.063	7

Approved by: Sushil Sharda	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	A63	
Project No.	TA7148		Sample Depth	3.00m	
Engineer	Arch Henderson LLP		Sample Number	014	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Brown slightly gravelly SAND.	Specimen Depth	3.00m
				Specimen No.	1



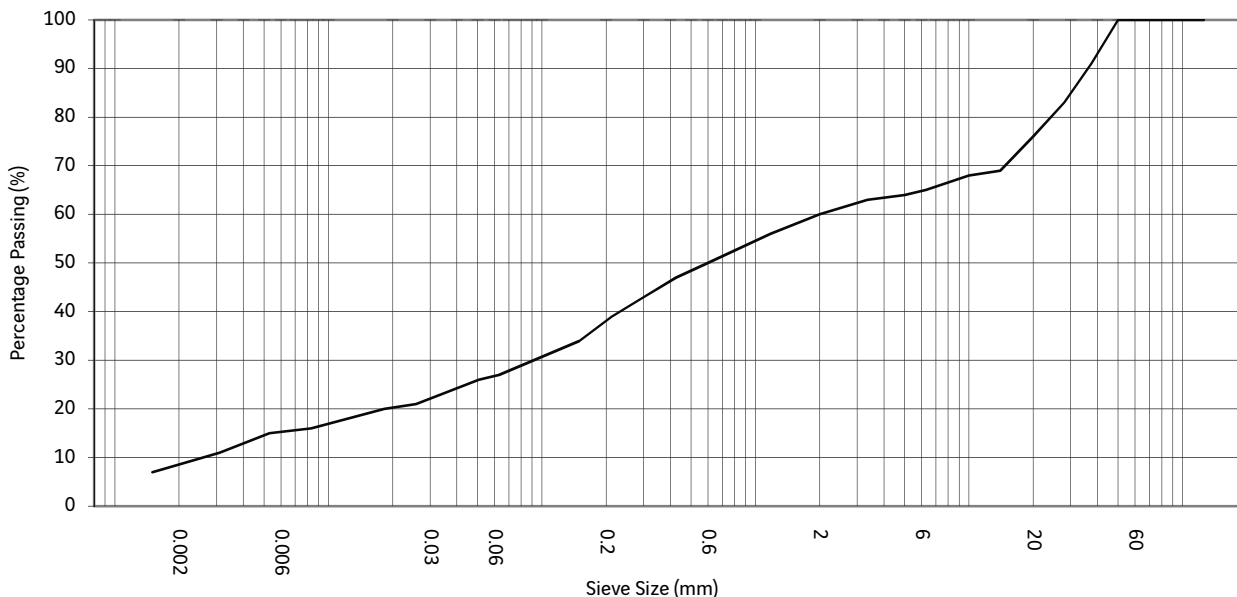
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	8	
Sand:	89	
Gravel:	4	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	99
125.0	100	5.0	99
90.0	100	3.35	98
75.0	100	2.00	96
63.0	100	1.18	92
50.0	100	0.600	81
37.5	100	0.425	74
28.0	100	0.300	63
20.0	100	0.212	35
		0.150	14
		0.063	8

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		
Revision No.	3.03	Issue Date 19/11/2012


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID A63
		Sample Depth 7.50m
		Sample Number 024
		Sample type B
Description Brown sandy gravelly CLAY. Gravel is fine to coarse angular.		Specimen Depth 7.50m
		Specimen No. 1



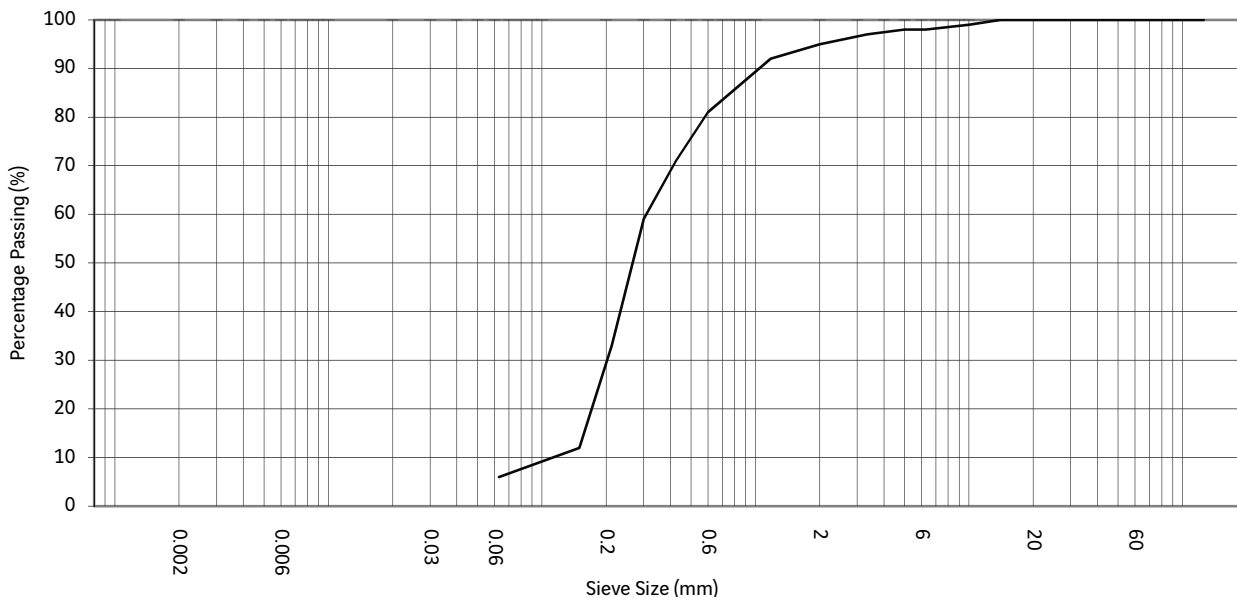
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE % Clay: 9 Silt: 18 Sand: 34 Gravel: 40 Cobbles: 0	General remarks Sample size was insufficient to be representative of particle size Particle density: 2.65Mg/m ³ Assumed
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WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	69		
		10.0	68	0.0507	26
		6.3	65	0.0258	21
125.0	100	5.0	64	0.0183	20
100.0	100	3.35	63	0.0083	16
75.0	100	2.00	60	0.0053	15
63.0	100	1.18	56	0.0031	11
50.0	100	0.600	50	0.0015	7
37.5	91	0.425	47		
28.0	83	0.300	43		
20.0	76	0.212	39		
		0.150	34		
		0.063	27		

Approved by: Stuart Kirk	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID B61
		Sample Depth 1.50m
		Sample Number 007
		Sample type B
Description Grey slightly gravelly SAND		Specimen Depth 1.50m
		Specimen No. 1



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

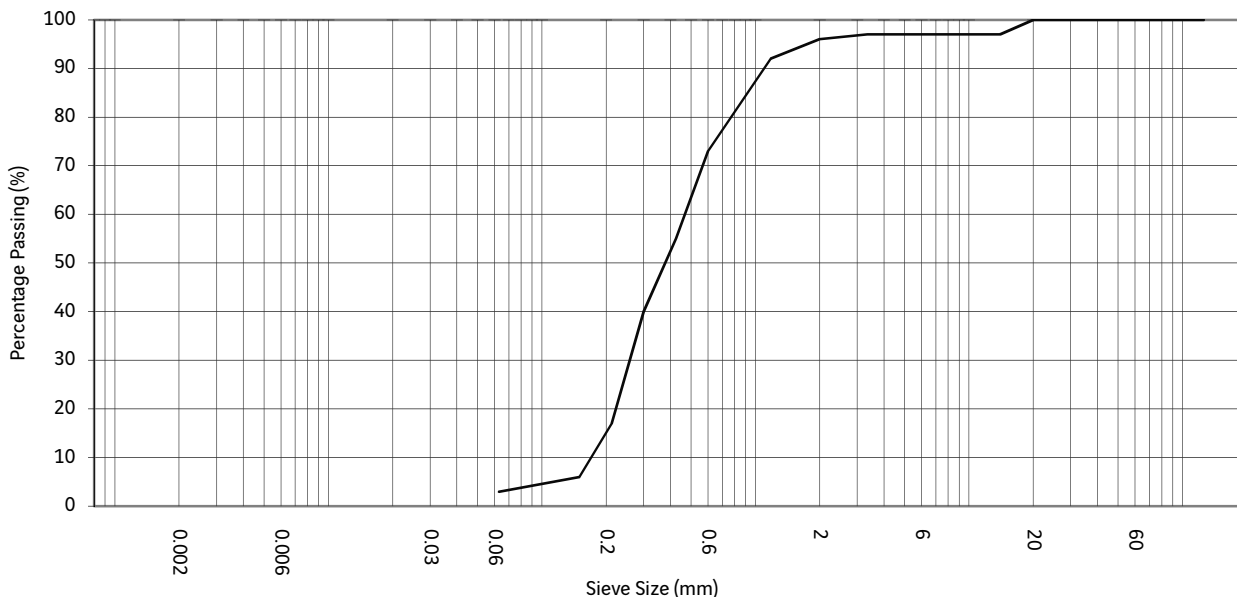
PARTICLE SIZE	%	General remarks
Silt and clay:	6	
Sand:	89	
Gravel:	5	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	99
		6.3	98
		5.0	98
125.0	100	3.35	97
90.0	100	2.00	95
75.0	100	1.18	92
63.0	100	0.600	81
50.0	100	0.425	71
37.5	100	0.300	59
28.0	100	0.212	33
20.0	100	0.150	12
		0.063	6

Approved by:	Leeds Laboratory		
Stuart Kirk		Print date	28/11/2013
Revision No.	3.03	Issue Date	19/11/2012




Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID B61
		Sample Depth 3.50m
		Sample Number 015
		Sample type B
Description Brown slightly gravelly SAND		Specimen Depth 3.50m
		Specimen No. 1



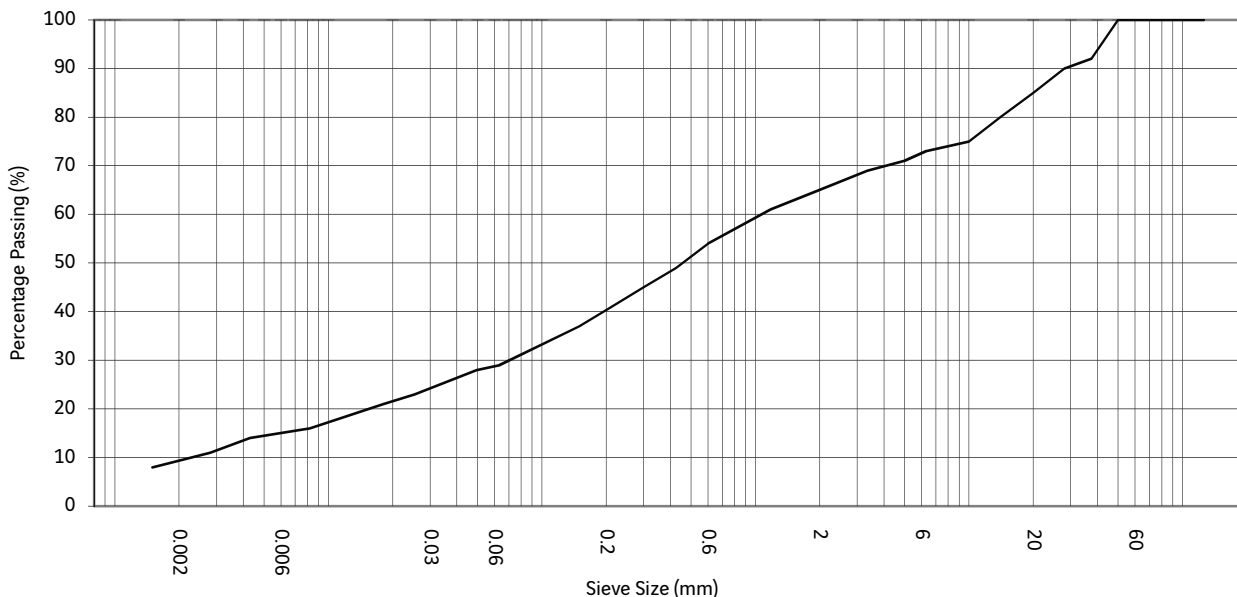
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE % Silt and clay: 3 Sand: 93 Gravel: 4 Cobbles: 0	General remarks
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WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	97
		10.0	97
		6.3	97
		5.0	97
125.0	100	3.35	97
90.0	100	2.00	96
75.0	100	1.18	92
63.0	100	0.600	73
50.0	100	0.425	55
37.5	100	0.300	40
28.0	100	0.212	17
20.0	100	0.150	6
		0.063	3

Approved by: Stuart Kirk	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID B61
		Sample Depth 28.05m
		Sample Number 020
		Sample type C
Description Brown sandy gravelly CLAY.		Specimen Depth 28.10m
		Specimen No. 2



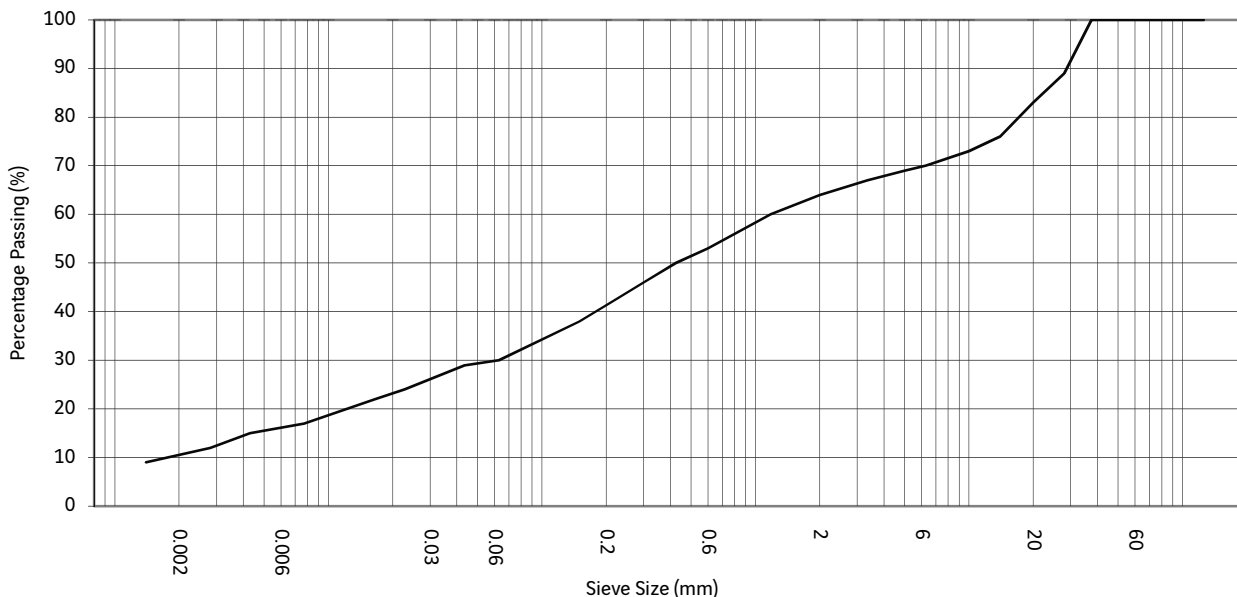
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE % Clay: 9 Silt: 20 Sand: 36 Gravel: 35 Cobbles: 0	General remarks Particle density: 2.65Mg/m ³ Assumed
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WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	80		
		10.0	75	0.0495	28
		6.3	73	0.0253	23
125.0	100	5.0	71	0.0181	21
90.0	100	3.35	69	0.0082	16
75.0	100	2.00	65	0.0043	14
63.0	100	1.18	61	0.0028	11
50.0	100	0.600	54	0.0015	8
37.5	92	0.425	49		
28.0	90	0.300	45		
20.0	85	0.212	41		
		0.150	37		
		0.063	29		

Approved by: Sushil Sharda	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	B61
Project No.	TA7148		Sample Depth	30.30m
Engineer	Arch Henderson LLP		Sample Number	021
Employer	Aberdeen Harbour Board		Sample type	C
Description			Brown sandy gravelly CLAY. Gravel is medium to coarse subangular.	
			Specimen Depth	30.30m
			Specimen No.	2



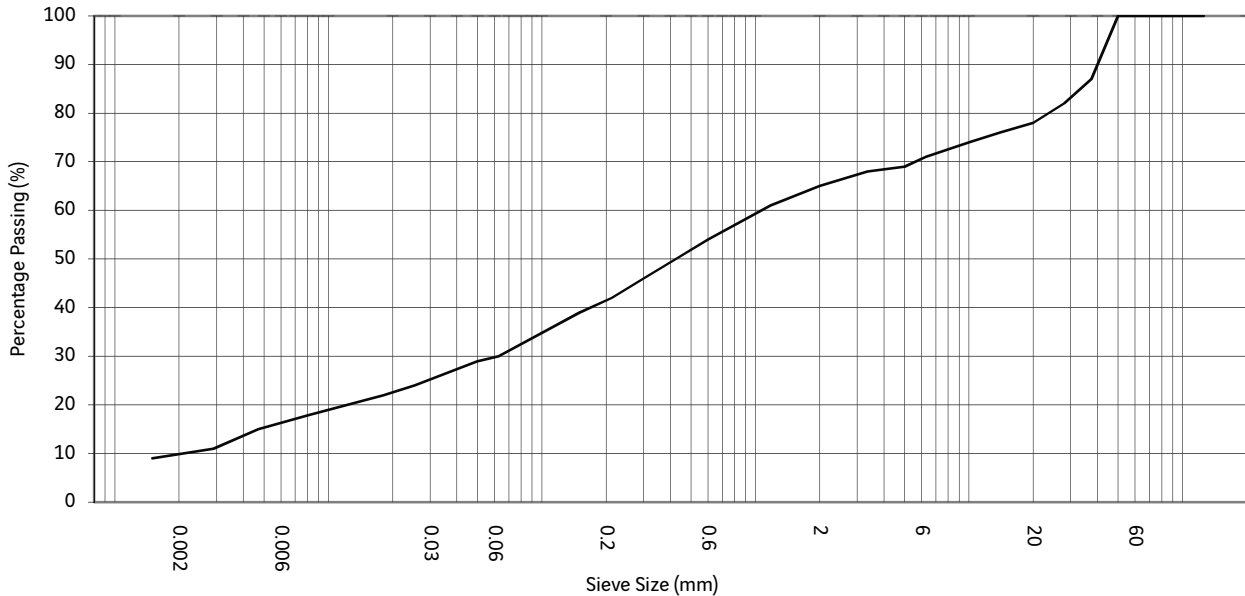
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE		%	General remarks Sample size was insufficient to be representative of particle size
Clay:		10	
Silt:		19	
Sand:		34	
Gravel:		36	
Cobbles:		0	
		Particle density:	2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	76		
		10.0	73	0.0436	29
		6.3	70	0.0228	24
125.0	100	5.0	69	0.0165	22
90.0	100	3.35	67	0.0077	17
75.0	100	2.00	64	0.0043	15
63.0	100	1.18	60	0.0028	12
50.0	100	0.600	53	0.0014	9
37.5	100	0.425	50		
28.0	89	0.300	46		
20.0	83	0.212	42		
		0.150	38		
		0.063	30		

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Sushil Sharda	Print date 28/11/2013	
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID	B61
Project No.	TA7148		Sample Depth	30.80m
Engineer	Arch Henderson LLP		Sample Number	022
Employer	Aberdeen Harbour Board		Sample type	C
Description	Brown sandy gravelly CLAY. Gravel is fine to coarse subrounded.		Specimen Depth	30.80m
			Specimen No.	2



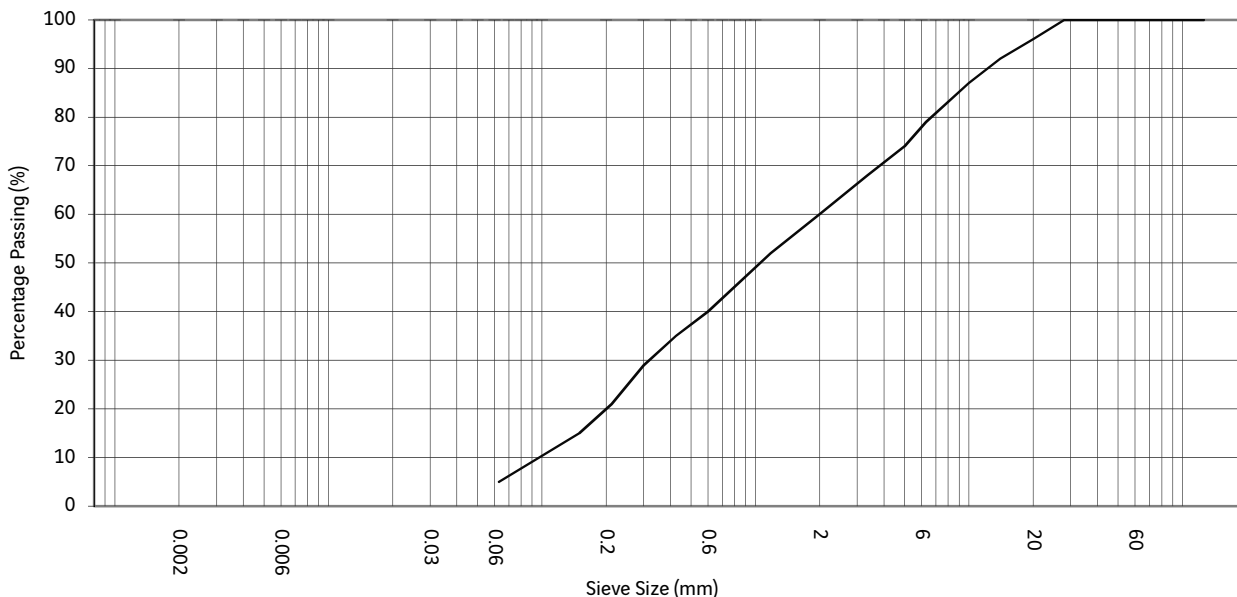
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Clay:	9	
Silt:	20	
Sand:	35	
Gravel:	35	
Cobbles:	0	
Particle density: 2.65Mg/m ³		Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	76		
		10.0	74	0.0498	29
		6.3	71	0.0254	24
125.0	100	5.0	69	0.0181	22
90.0	100	3.35	68	0.0082	18
75.0	100	2.00	65	0.0047	15
63.0	100	1.18	61	0.0029	11
50.0	100	0.600	54	0.0015	9
37.5	87	0.425	50		
28.0	82	0.300	46		
20.0	78	0.212	42		
		0.150	39		
		0.063	30		

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Sushil Sharda	Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012	


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID C79
		Sample Depth 0.50m
		Sample Number 002
		Sample type B
Description Brown gravelly SAND. Gravel is fine to coarse angular.		Specimen Depth 0.50m
		Specimen No. 1



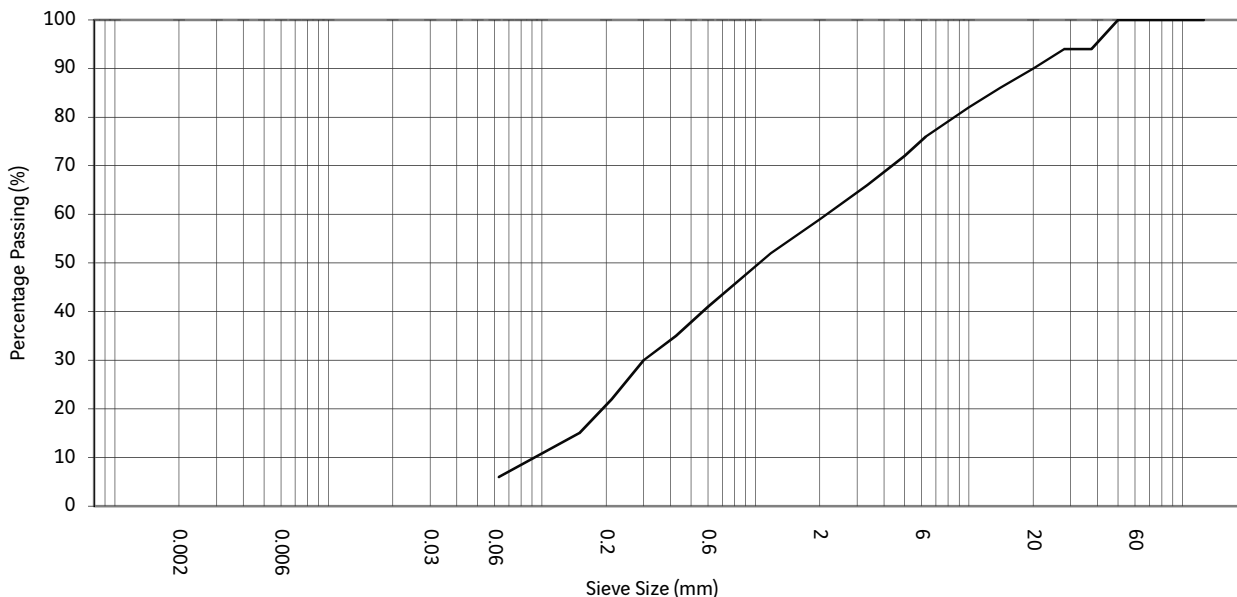
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	5	
Sand:	55	
Gravel:	40	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	92
		10.0	87
		6.3	79
125.0	100	5.0	74
90.0	100	3.35	68
75.0	100	2.00	60
63.0	100	1.18	52
50.0	100	0.600	40
37.5	100	0.425	35
28.0	100	0.300	29
20.0	96	0.212	21
		0.150	15
		0.063	5

Approved by: Sushil Sharda	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Revision No. 3.03	Issue Date 19/11/2012		

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID C81
		Sample Depth 0.50m
		Sample Number 002
		Sample type B
Description Brown mottled grey gravelly SAND. Gravel is fine to coarse subangular.	Specimen Depth 0.50m	Specimen No. 1



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%
Silt and clay:	6
Sand:	53
Gravel:	41
Cobbles:	0

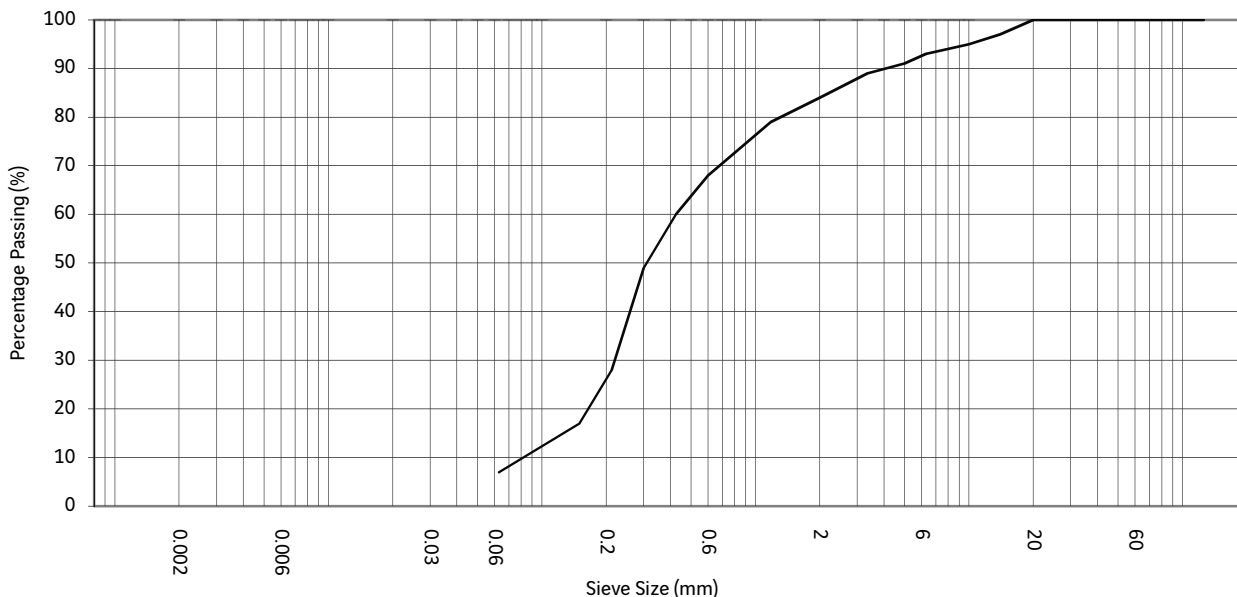
General remarks

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	86
		10.0	82
		6.3	76
		5.0	72
125.0	100	3.35	66
90.0	100	2.00	59
75.0	100	1.18	52
63.0	100	0.600	41
50.0	100	0.425	35
37.5	94	0.300	30
28.0	94	0.212	22
20.0	90	0.150	15
		0.063	6

Approved by: Sushil Sharda	Leeds Laboratory	Print date 28/11/2013
Revision No. 3.03	Issue Date 19/11/2012	


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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	C81	
Project No.	TA7148		Sample Depth	1.50m	
Engineer	Arch Henderson LLP		Sample Number	004	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Brown slightly gravelly SAND. Gravel is fine to medium angular	Specimen Depth	1.50m
				Specimen No.	1



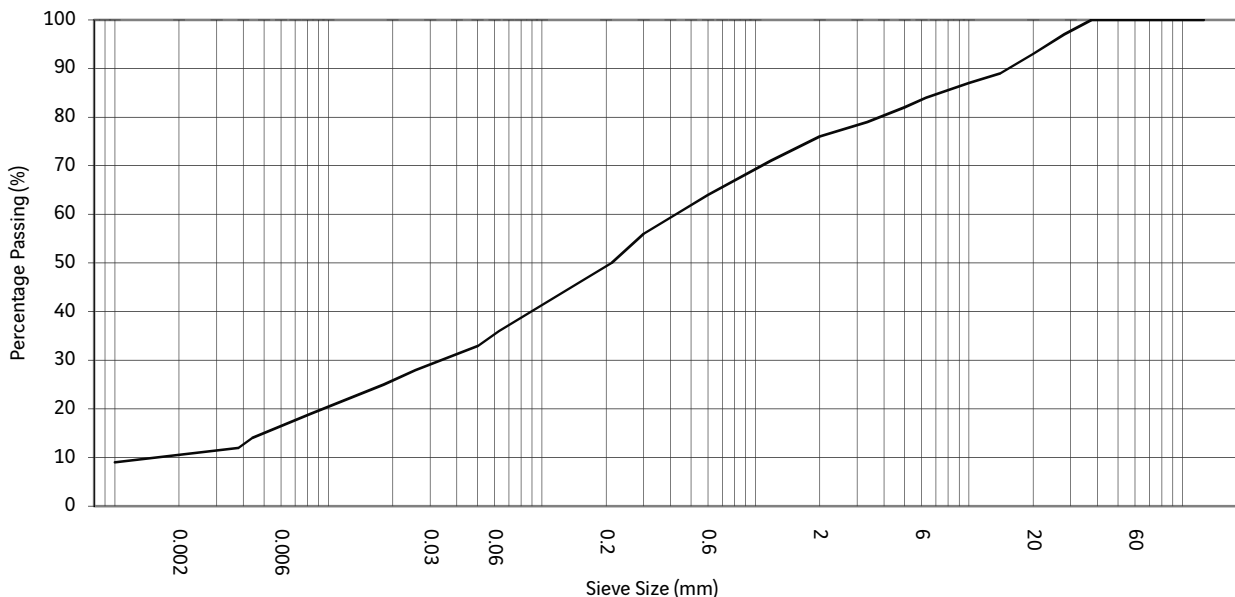
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	7	
Sand:	77	
Gravel:	16	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	97
		10.0	95
		6.3	93
		5.0	91
125.0	100	3.35	89
90.0	100	2.00	84
75.0	100	1.18	79
63.0	100	0.600	68
50.0	100	0.425	60
37.5	100	0.300	49
28.0	100	0.212	28
20.0	100	0.150	17
		0.063	7

Approved by:	Leeds Laboratory			
Stuart Kirk			Print date 28/11/2013	
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution	Hole ID C81
		Sample Depth 6.30m
		Sample Number
		Sample type C
Description Brown gravelly sandy CLAY. Gravel is fine to coarse subangular.		Specimen Depth 6.30m
		Specimen No. 1



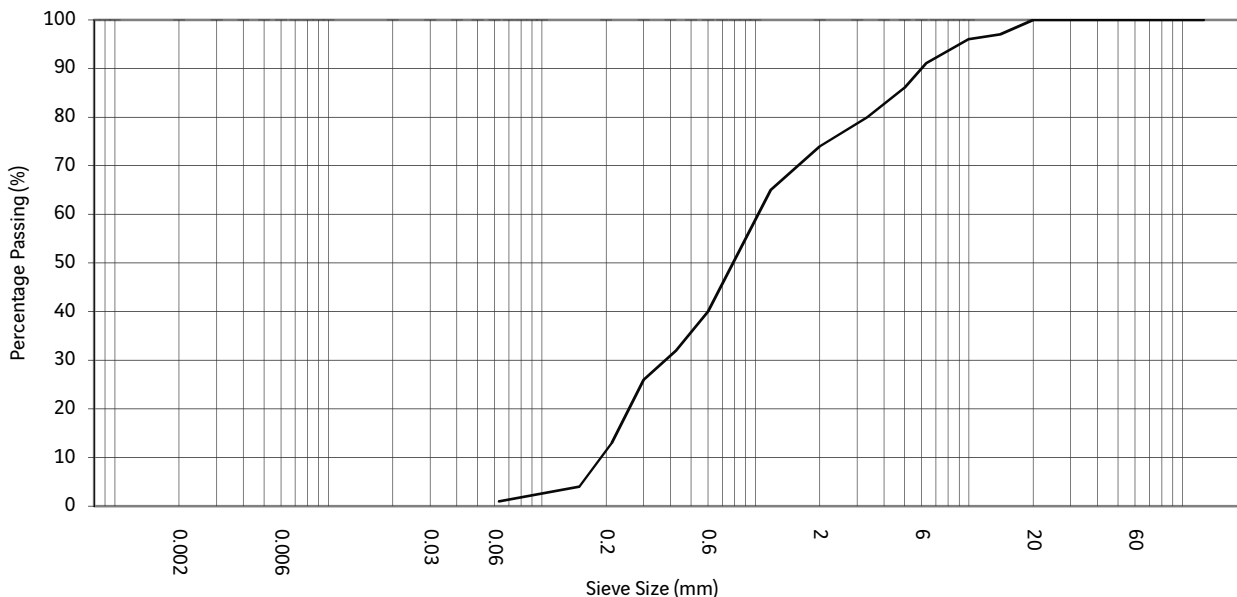
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE Clay: 10 Silt: 25 Sand: 40 Gravel: 25 Cobbles: 0	General remarks Particle density: 2.65Mg/m ³ Assumed
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WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	89		
		10.0	87	0.0503	33
		6.3	84	0.0256	28
125.0	100	5.0	82	0.0182	25
90.0	100	3.35	79	0.0083	19
75.0	100	2.00	76	0.0044	14
63.0	100	1.18	71	0.0038	12
50.0	100	0.600	64	0.0010	9
37.5	100	0.425	60		
28.0	97	0.300	56		
20.0	93	0.212	50		
		0.150	46		
		0.063	36		

Approved by: Stuart Kirk	Leeds Laboratory		Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID C83
		Sample Depth 0.00m
		Sample Number 002
		Sample type B
Description Brown slightly gravelly SAND. Gravel is fine to medium angular		Specimen Depth 0.00m
		Specimen No. 1



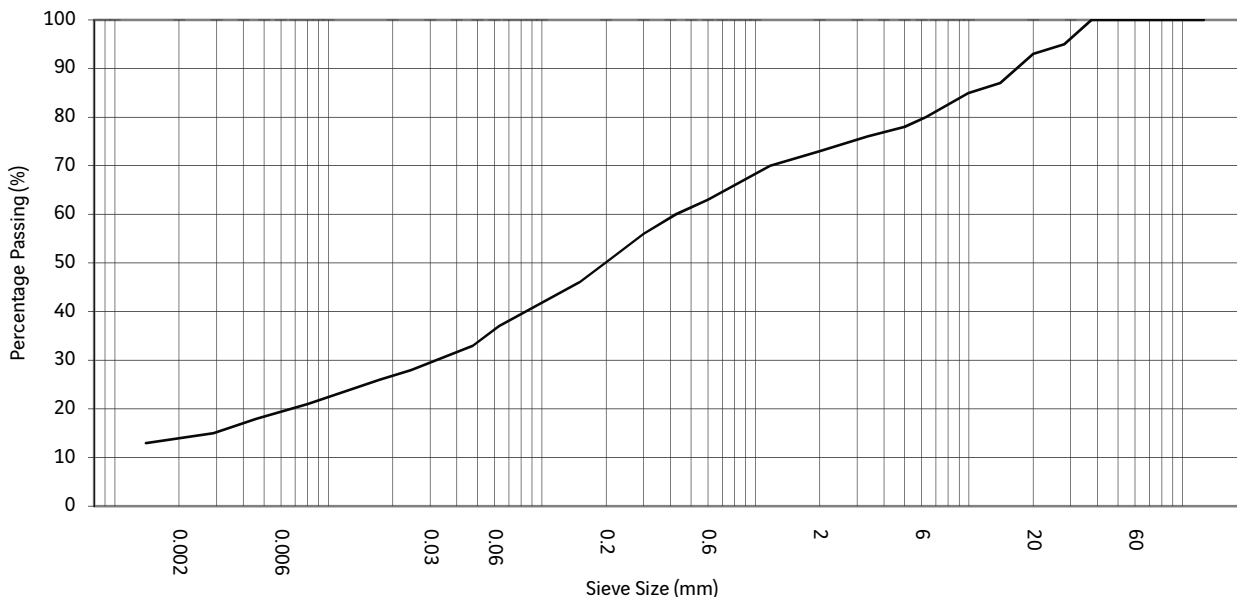
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	2	
Sand:	72	
Gravel:	27	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	97
		10.0	96
		6.3	91
125.0	100	5.0	86
90.0	100	3.35	80
75.0	100	2.00	74
63.0	100	1.18	65
50.0	100	0.600	40
37.5	100	0.425	32
28.0	100	0.300	26
20.0	100	0.212	13
		0.150	4
		0.063	1

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID	C83
Project No.	TA7148		Sample Depth	2.75m
Engineer	Arch Henderson LLP		Sample Number	008
Employer	Aberdeen Harbour Board		Sample type	C
Description	Brown sandy slightly gravelly CLAY. Gravel is fine to coarse angular.		Specimen Depth	2.90m
			Specimen No.	1



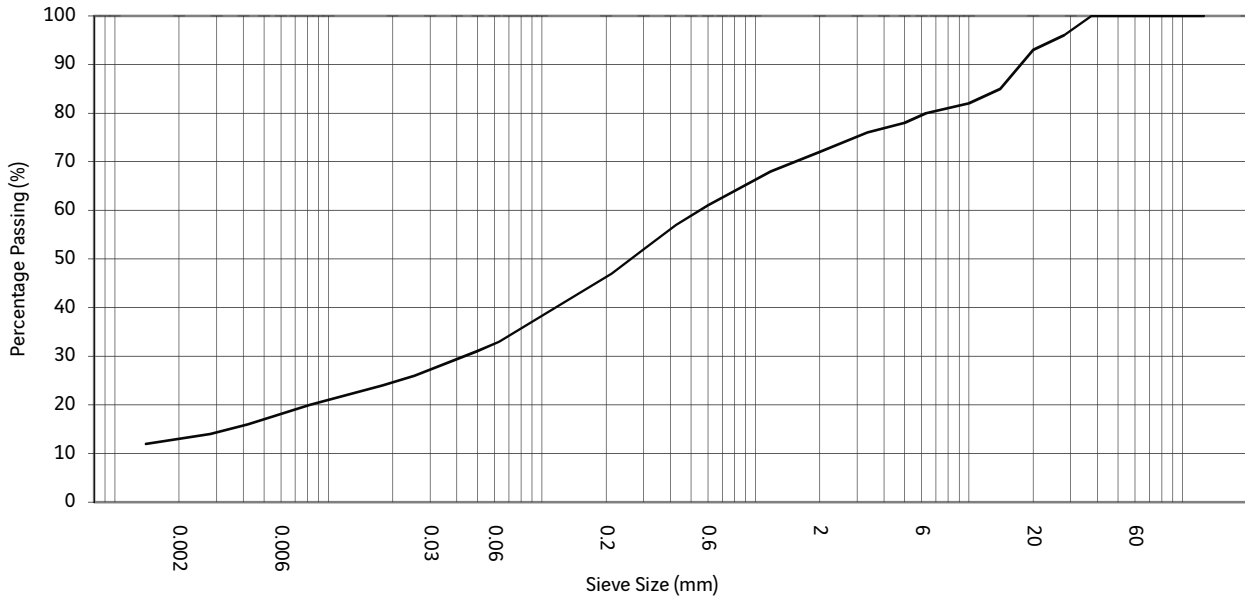
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Clay:	14	
Silt:	22	
Sand:	37	
Gravel:	27	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	87		
		10.0	85	0.0474	33
		6.3	80	0.0244	28
125.0	100	5.0	78	0.0174	26
100.0	100	3.35	76	0.0080	21
75.0	100	2.00	73	0.0046	18
63.0	100	1.18	70	0.0029	15
50.0	100	0.600	63	0.0014	13
37.5	100	0.425	60		
28.0	95	0.300	56		
20.0	93	0.212	51		
		0.150	46		
		0.063	37		

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Sushil Sharda			
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID	C83
Project No.	TA7148		Sample Depth	9.05m
Engineer	Arch Henderson LLP		Sample Number	010
Employer	Aberdeen Harbour Board		Sample type	C
Description	Brown clayey slightly gravelly SAND, Gravel is fine to coarse angular.		Specimen Depth	9.05m
			Specimen No.	1



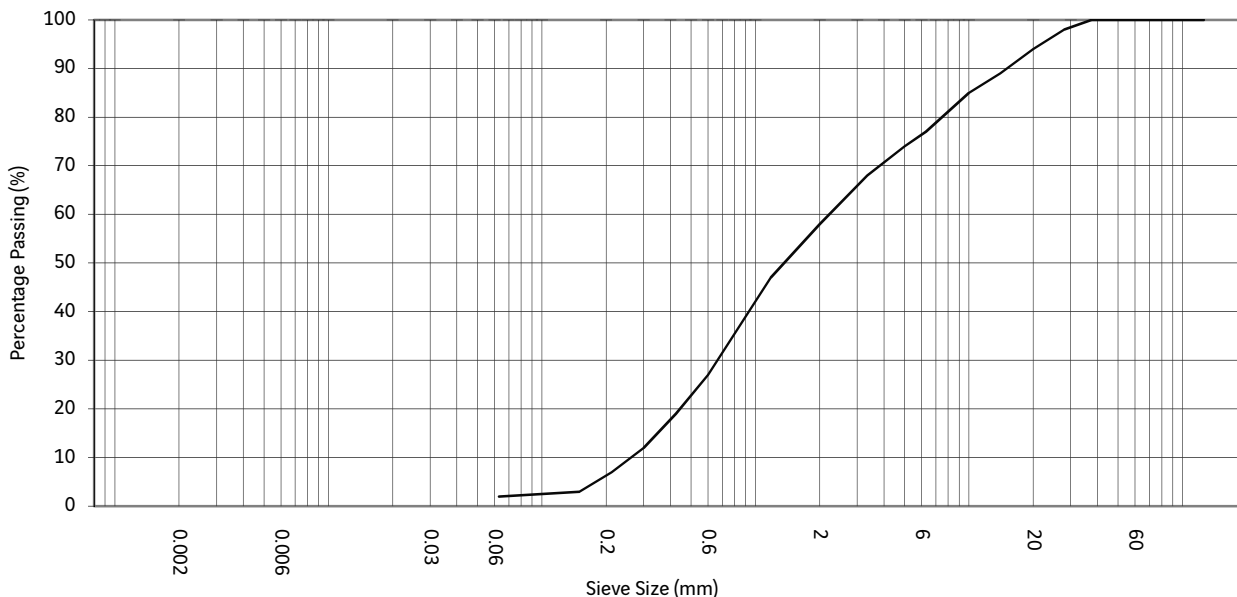
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Dispersant used when soaking specimen. Particle density: 2.65Mg/m ³ Assumed
Clay:	13	
Silt:	19	
Sand:	40	
Gravel:	28	
Cobbles:	0	

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	85		
		10.0	82	0.0494	31
		6.3	80	0.0253	26
125.0	100	5.0	78	0.0180	24
100.0	100	3.35	76	0.0082	20
75.0	100	2.00	72	0.0042	16
63.0	100	1.18	68	0.0028	14
50.0	100	0.600	61	0.0014	12
37.5	100	0.425	57		
28.0	96	0.300	52		
20.0	93	0.212	47		
		0.150	43		
		0.063	33		

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Sushil Sharda	Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012	


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID C84
		Sample Depth 0.30m
		Sample Number 002
		Sample type B
Description Brown gravelly SAND. Gravel is fine to coarse subrounded.		Specimen Depth 0.30m
		Specimen No. 1



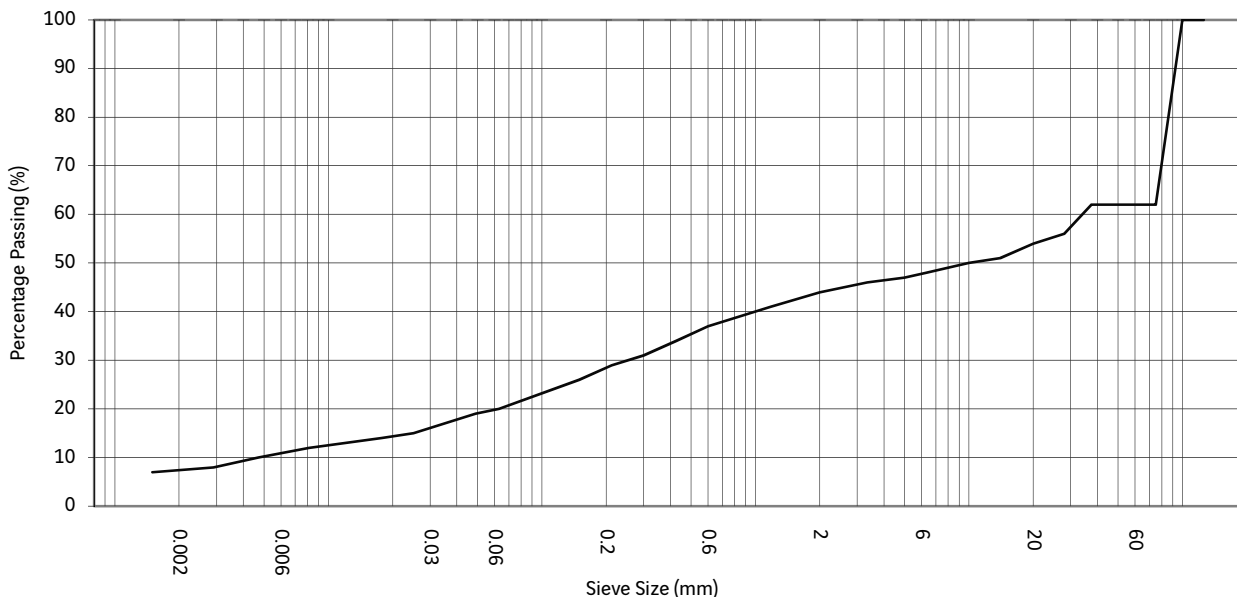
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	2	
Sand:	56	
Gravel:	42	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	89
		10.0	85
		6.3	77
125.0	100	5.0	74
90.0	100	3.35	68
75.0	100	2.00	58
63.0	100	1.18	47
50.0	100	0.600	27
37.5	100	0.425	19
28.0	98	0.300	12
20.0	94	0.212	7
		0.150	3
		0.063	2

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Stuart Kirk		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	C84
Project No.	TA7148		Sample Depth	3.60m
Engineer	Arch Henderson LLP		Sample Number	006
Employer	Aberdeen Harbour Board		Sample type	C
Description		Brown sandy slightly gravelly CLAY. Gravel is fine to coarse angular with cobbles.	Specimen Depth	3.75m
			Specimen No.	1



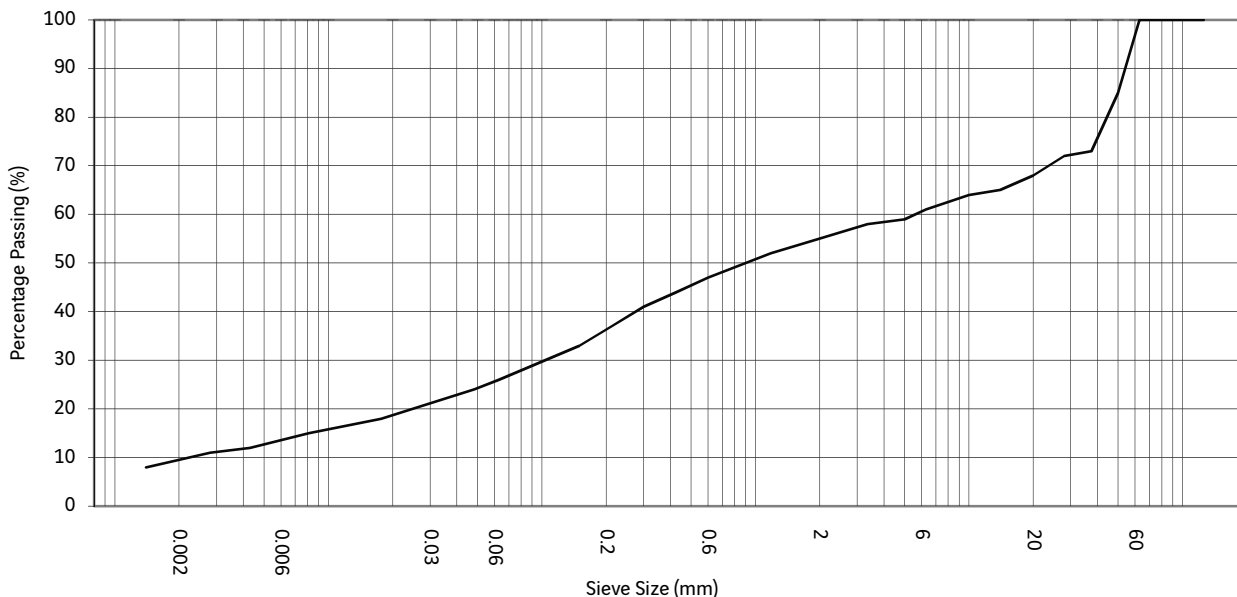
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Clay:	7	
Silt:	12	
Sand:	24	
Gravel:	18	
Cobbles:	38	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	51		
		10.0	50	0.0489	19
		6.3	48	0.0251	15
125.0	100	5.0	47	0.0178	14
100.0	100	3.35	46	0.0081	12
75.0	62	2.00	44	0.0047	10
63.0	62	1.18	41	0.0029	8
50.0	62	0.600	37	0.0015	7
37.5	62	0.425	34		
28.0	56	0.300	31		
20.0	54	0.212	29		
		0.150	26		
		0.063	20		

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Sushil Sharda	Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012	


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	C84
Project No.	TA7148		Sample Depth	7.10m
Engineer	Arch Henderson LLP		Sample Number	008
Employer	Aberdeen Harbour Board		Sample type	C
Description			Brown sandy gravelly CLAY. Gravel is fine to coarse angular.	
			Specimen Depth	7.10m
			Specimen No.	1



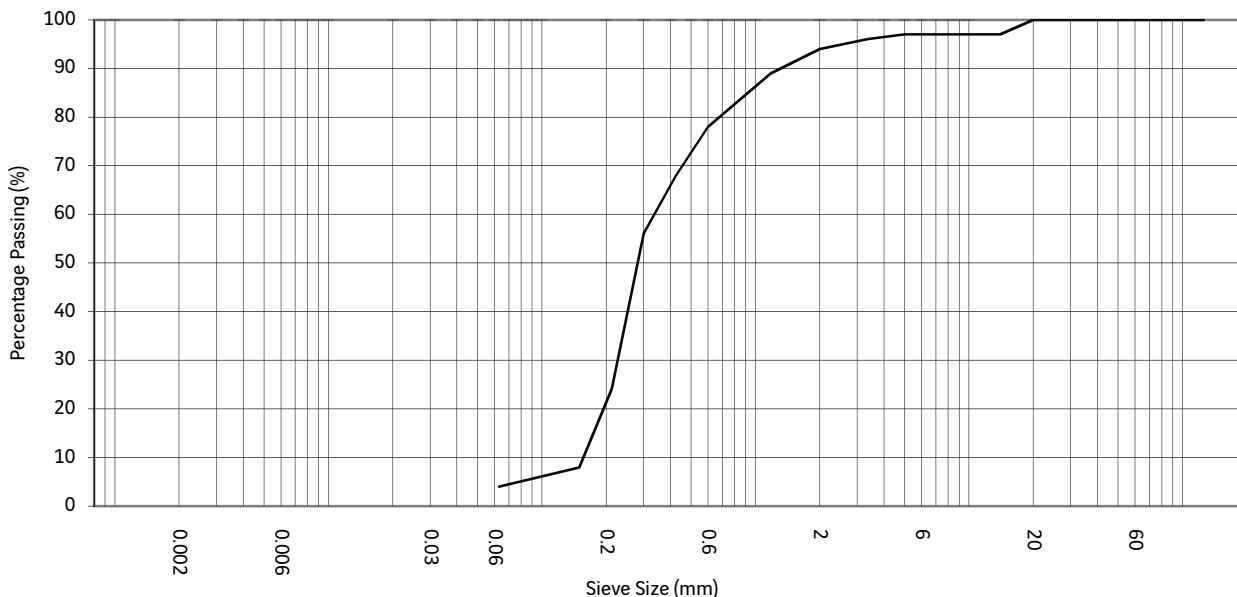
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size Dispersant used when soaking specimen.
Clay:	10	
Silt:	16	
Sand:	29	
Gravel:	42	
Cobbles:	3	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	65		
		10.0	64	0.0483	24
		6.3	61	0.0248	20
125.0	100	5.0	59	0.0177	18
100.0	100	3.35	58	0.0081	15
75.0	100	2.00	55	0.0043	12
63.0	100	1.18	52	0.0028	11
50.0	85	0.600	47	0.0014	8
37.5	73	0.425	44		
28.0	72	0.300	41		
20.0	68	0.212	37		
		0.150	33		
		0.063	26		

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Revision No. 3.03	Issue Date 19/11/2012	

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID C87
		Sample Depth 0.00m
		Sample Number 002
		Sample type B
Description Brown slightly gravelly SAND. Gravel is fine to medium subangular.	Specimen Depth 0.00m	Specimen No. 1



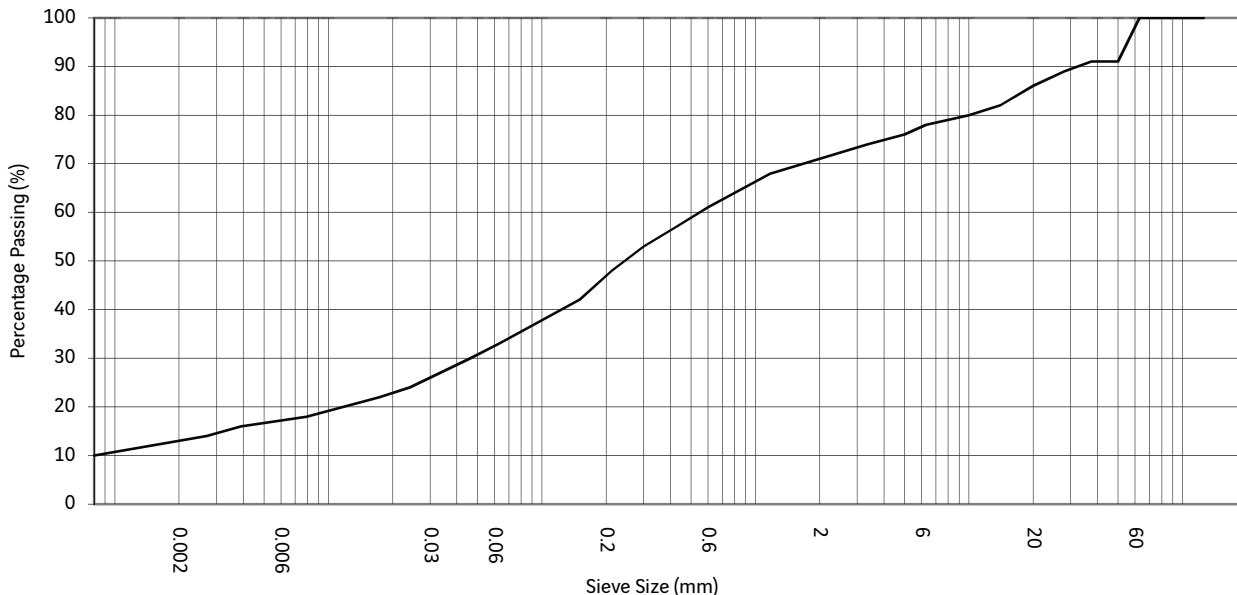
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE % Silt and clay: 4 Sand: 90 Gravel: 6 Cobbles: 0		General remarks
--	--	-----------------

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	97
		10.0	97
		6.3	97
		5.0	97
125.0	100	3.35	96
100.0	100	2.00	94
75.0	100	1.18	89
63.0	100	0.600	78
50.0	100	0.425	68
37.5	100	0.300	56
28.0	100	0.212	24
20.0	100	0.150	8
		0.063	4

Approved by: Stuart Kirk	Leeds Laboratory	Print date 28/11/2013	 Part of the Bachy Soletanche Group
Revision No. 3.03	Issue Date 19/11/2012		


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	C87
Project No.	TA7148		Sample Depth	4.15m
Engineer	Arch Henderson LLP		Sample Number	005
Employer	Aberdeen Harbour Board		Sample type	C
Description		Brown sandy slightly gravelly CLAY. Gravel is fine to coarse subangular.	Specimen Depth	4.37m
			Specimen No.	1



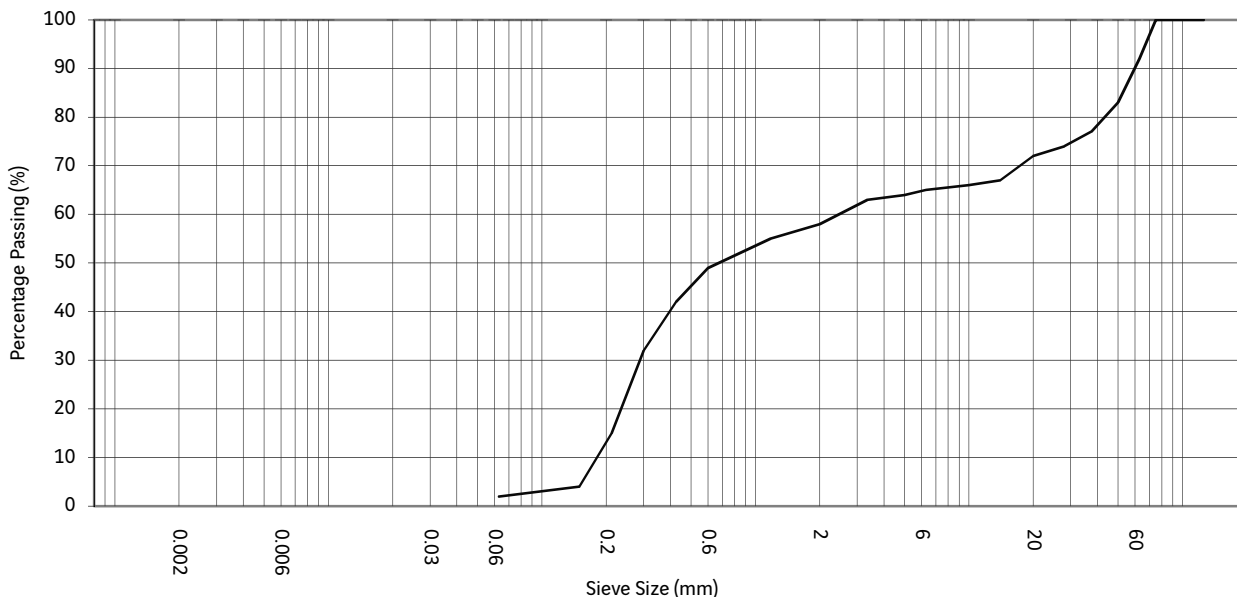
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Clay:	13	
Silt:	20	
Sand:	39	
Gravel:	27	
Cobbles:	2	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	82		
		10.0	80	0.0463	30
		6.3	78	0.0241	24
125.0	100	5.0	76	0.0173	22
100.0	100	3.35	74	0.0079	18
75.0	100	2.00	71	0.0039	16
63.0	100	1.18	68	0.0027	14
50.0	91	0.600	61	0.0008	10
37.5	91	0.425	57		
28.0	89	0.300	53		
20.0	86	0.212	48		
		0.150	42		
		0.063	33		

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Sushil Sharda	Print date 28/11/2013	
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	C88	
Project No.	TA7148		Sample Depth	0.00m	
Engineer	Arch Henderson LLP		Sample Number	002	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Brown gravelly SAND with cobbles. Gravel is fine to coarse sunagular to rounded.	Specimen Depth	0.00m
				Specimen No.	1



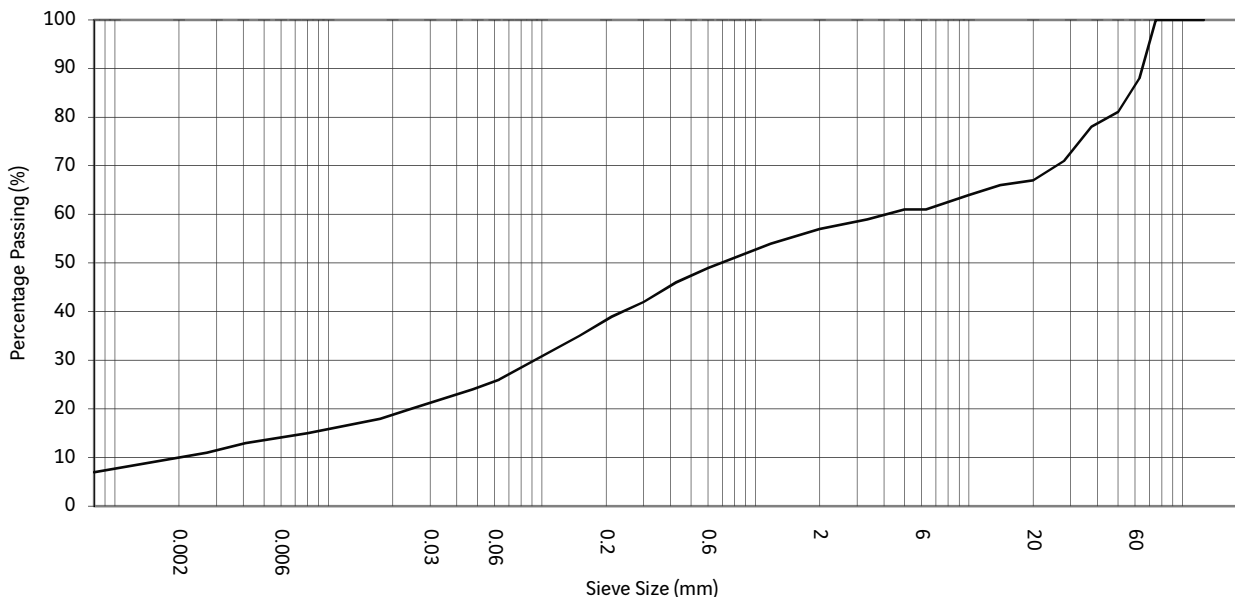
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	2	
Sand:	56	
Gravel:	32	
Cobbles:	10	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	67
		10.0	66
		6.3	65
125.0	100	5.0	64
90.0	100	3.35	63
75.0	100	2.00	58
63.0	92	1.18	55
50.0	83	0.600	49
37.5	77	0.425	42
28.0	74	0.300	32
20.0	72	0.212	15
		0.150	4
		0.063	2

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk	Print date 28/11/2013	
Revision No.	3.03	Issue Date 19/11/2012

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID C88
		Sample Depth 2.05m
		Sample Number 005
		Sample type C
Description Brown sandy gravelly CLAY. Gravel is fine to coarse angular.		Specimen Depth 2.05m
		Specimen No. 1



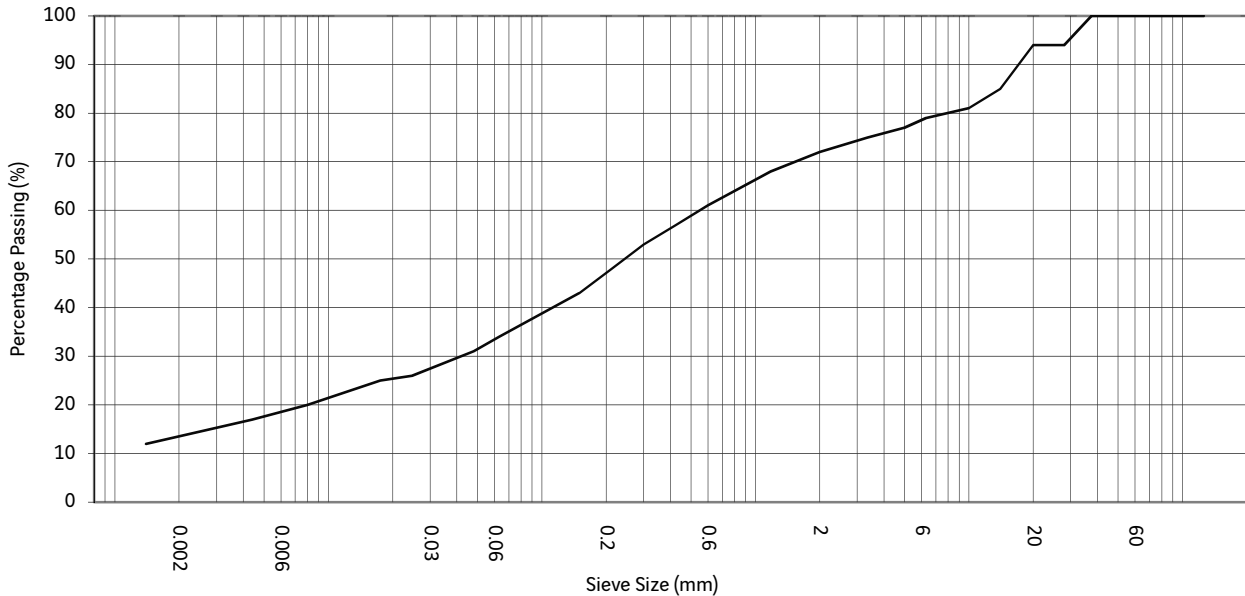
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size Particle density: 2.65Mg/m ³ Assumed
Clay:	10	
Silt:	16	
Sand:	31	
Gravel:	29	
Cobbles:	14	

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	66		
		10.0	64	0.0475	24
		6.3	61	0.0244	20
125.0	100	5.0	61	0.0175	18
100.0	100	3.35	59	0.0080	15
75.0	100	2.00	57	0.0041	13
63.0	88	1.18	54	0.0027	11
50.0	81	0.600	49	0.0008	7
37.5	78	0.425	46		
28.0	71	0.300	42		
20.0	67	0.212	39		
		0.150	35		
		0.063	26		

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Sushil Sharda					
Revision No.	3.03	Issue Date	19/11/2012	Print date	28/11/2013


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	C88
Project No.	TA7148		Sample Depth	6.20m
Engineer	Arch Henderson LLP		Sample Number	007
Employer	Aberdeen Harbour Board		Sample type	C
Description		Brown sandy slightly gravelly CLAY.	Specimen Depth	6.20m
			Specimen No.	1



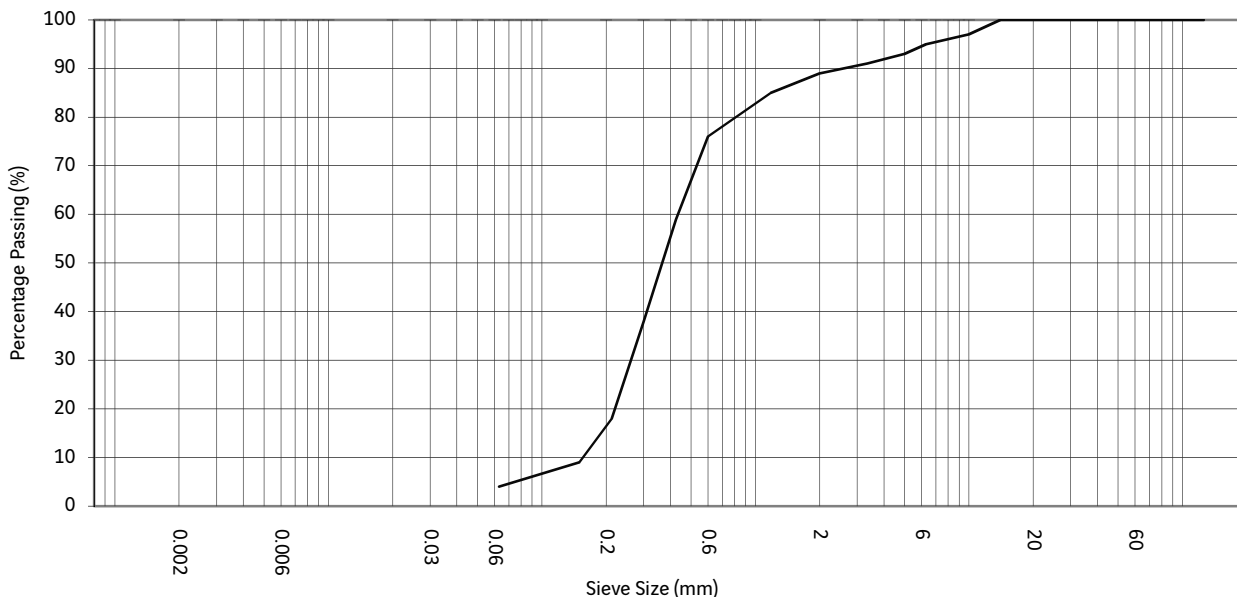
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Dispersant used when soaking specimen.
Clay:	13	
Silt:	20	
Sand:	38	
Gravel:	28	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	85		
		10.0	81	0.0480	31
		6.3	79	0.0247	26
125.0	100	5.0	77	0.0175	25
100.0	100	3.35	75	0.0080	20
75.0	100	2.00	72	0.0044	17
63.0	100	1.18	68	0.0028	15
50.0	100	0.600	61	0.0014	12
37.5	100	0.425	57		
28.0	94	0.300	53		
20.0	94	0.212	48		
		0.150	43		
		0.063	34		

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Sushil Sharda	Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012	

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID C96
		Sample Depth 0.50m
		Sample Number 003
		Sample type B
Description Brown slightly gravelly SAND		Specimen Depth 0.50m
		Specimen No. 1



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

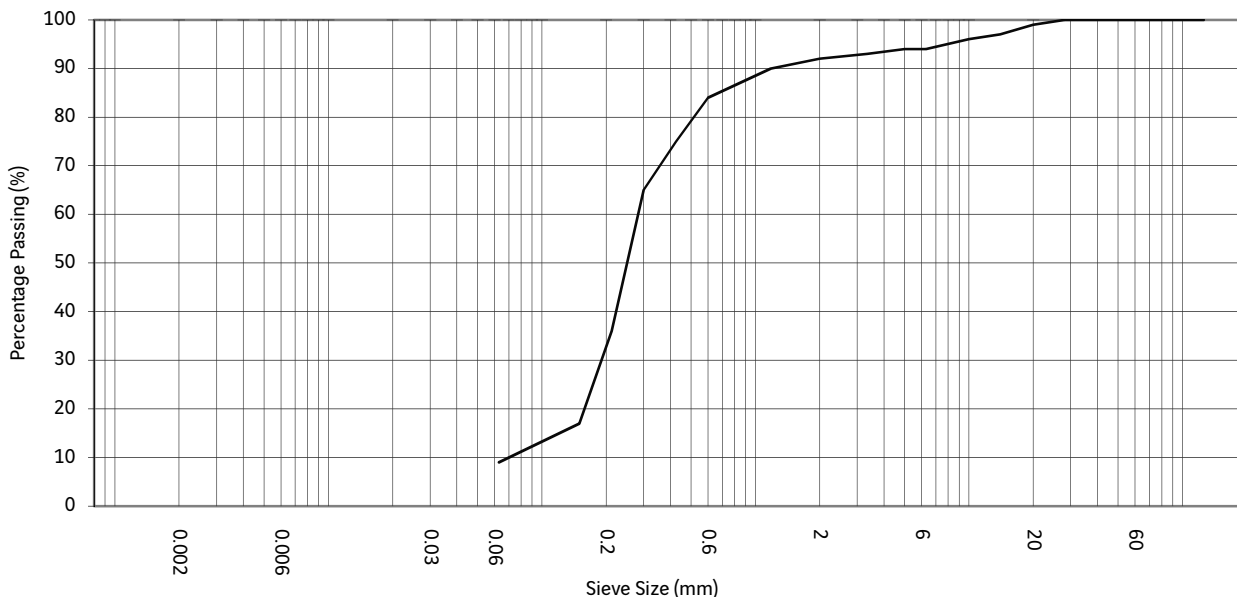
PARTICLE SIZE	%	General remarks
Silt and clay:	4	
Sand:	85	
Gravel:	11	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	97
		6.3	95
		5.0	93
125.0	100	3.35	91
90.0	100	2.00	89
75.0	100	1.18	85
63.0	100	0.600	76
50.0	100	0.425	59
37.5	100	0.300	38
28.0	100	0.212	18
20.0	100	0.150	9
		0.063	4

Approved by:	Leeds Laboratory		
Stuart Kirk		Print date	28/11/2013
Revision No.	3.03	Issue Date	19/11/2012




Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID C96
		Sample Depth 3.50m
		Sample Number 012
		Sample type B
Description Brown gravelly SAND. Gravel is fine to medium subrounded		Specimen Depth 3.50m
		Specimen No. 1



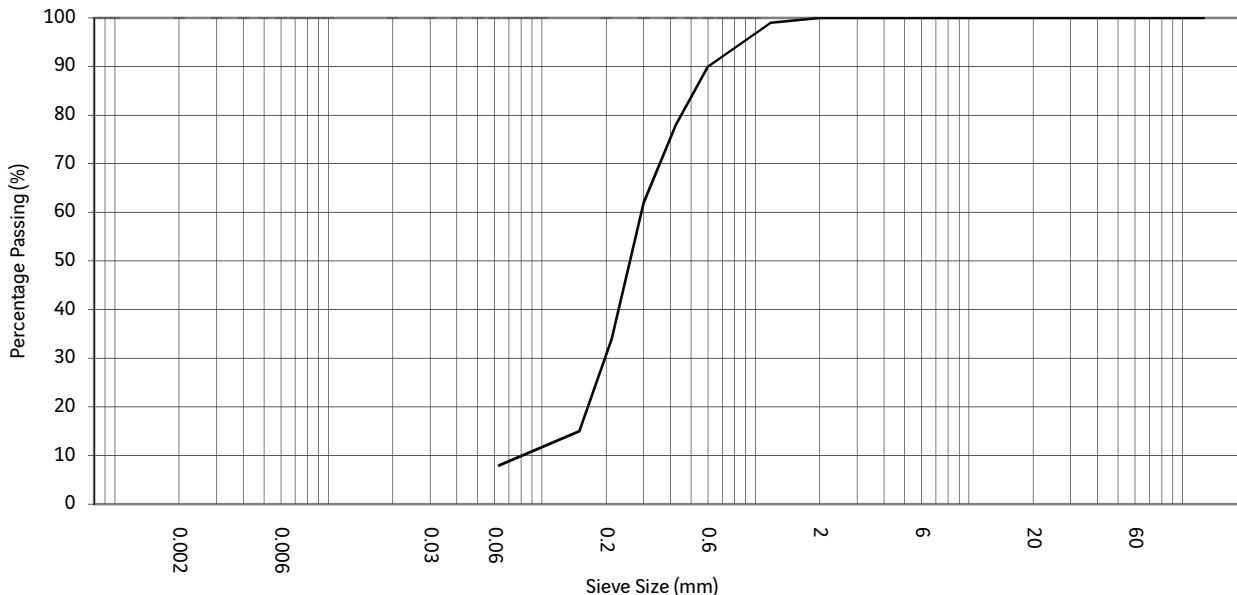
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	9	
Sand:	83	
Gravel:	8	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	97
		10.0	96
		6.3	94
125.0	100	5.0	94
90.0	100	3.35	93
75.0	100	2.00	92
63.0	100	1.18	90
50.0	100	0.600	84
37.5	100	0.425	75
28.0	100	0.300	65
20.0	99	0.212	36
		0.150	17
		0.063	9

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Stuart Kirk		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	D98	
Project No.	TA7148		Sample Depth	0.00m	
Engineer	Arch Henderson LLP		Sample Number	001	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Brown SAND	Specimen Depth	0.00m
				Specimen No.	1



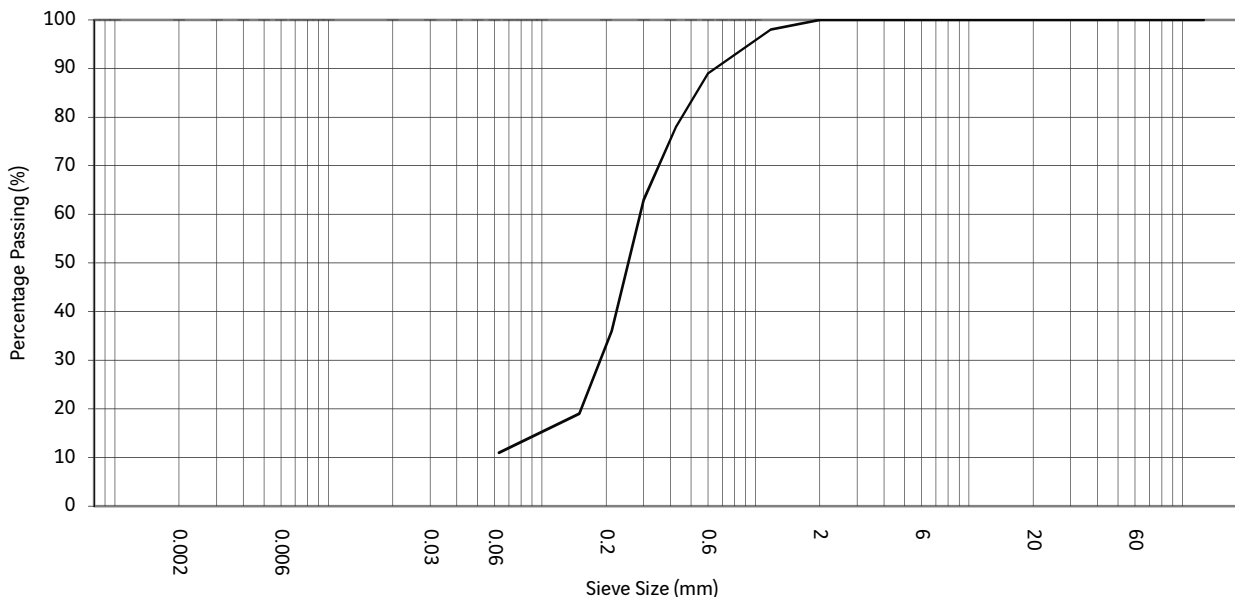
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	8	
Sand:	92	
Gravel:	0	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
90.0	100	3.35	100
75.0	100	2.00	100
63.0	100	1.18	99
50.0	100	0.600	90
37.5	100	0.425	78
28.0	100	0.300	62
20.0	100	0.212	34
		0.150	15
		0.063	8

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group	
Stuart Kirk			Print date 28/11/2013
Revision No.	3.03	Issue Date	19/11/2012


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution	Hole ID D98
		Sample Depth 1.50m
		Sample Number 006
		Sample type B
Description Brown SAND		Specimen Depth 1.50m
		Specimen No. 1



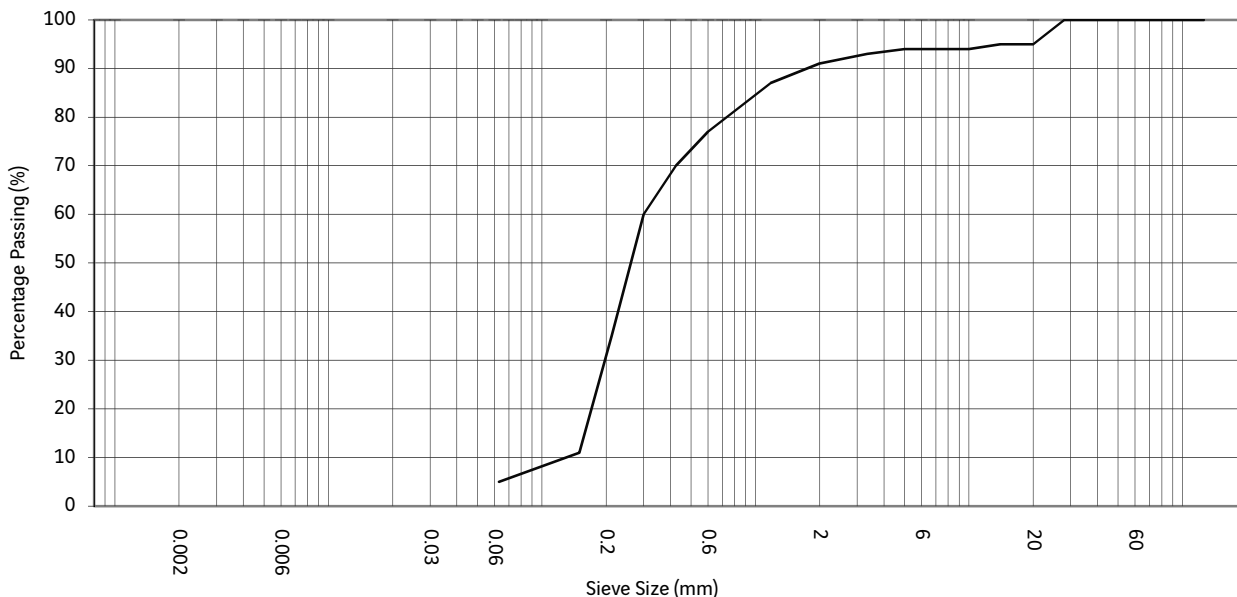
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	11	
Sand:	89	
Gravel:	0	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
90.0	100	3.35	100
75.0	100	2.00	100
63.0	100	1.18	98
50.0	100	0.600	89
37.5	100	0.425	78
28.0	100	0.300	63
20.0	100	0.212	36
		0.150	19
		0.063	11

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk	Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012	


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	D99
Project No.	TA7148		Sample Depth	0.50m
Engineer	Arch Henderson LLP		Sample Number	003
Employer	Aberdeen Harbour Board		Sample type	B
Description		Greyish brown SAND with occasional fine to coarse gravel	Specimen Depth	0.50m
			Specimen No.	1



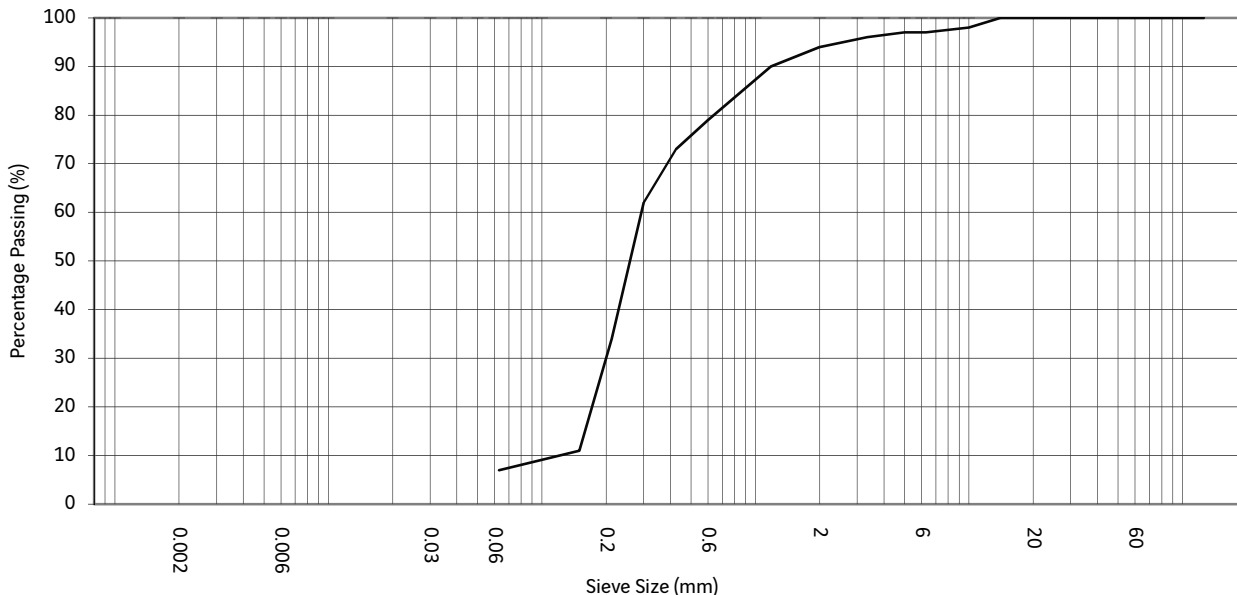
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	5	
Sand:	86	
Gravel:	9	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	95
		10.0	94
		6.3	94
		5.0	94
125.0	100	3.35	93
90.0	100	2.00	91
75.0	100	1.18	87
63.0	100	0.600	77
50.0	100	0.425	70
37.5	100	0.300	60
28.0	100	0.212	35
20.0	95	0.150	11
		0.063	5

Approved by:	Leeds Laboratory	 SOIL ENGINEERING
Stuart Kirk		
Revision No.	3.03	Print date 28/11/2013
	Issue Date	19/11/2012
		Part of the Bachy Soletanche Group


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID D99
		Sample Depth 1.50m
		Sample Number 006
		Sample type B
Description Greyish brown SAND with occasional medium gravel.		Specimen Depth 1.50m
		Specimen No. 1



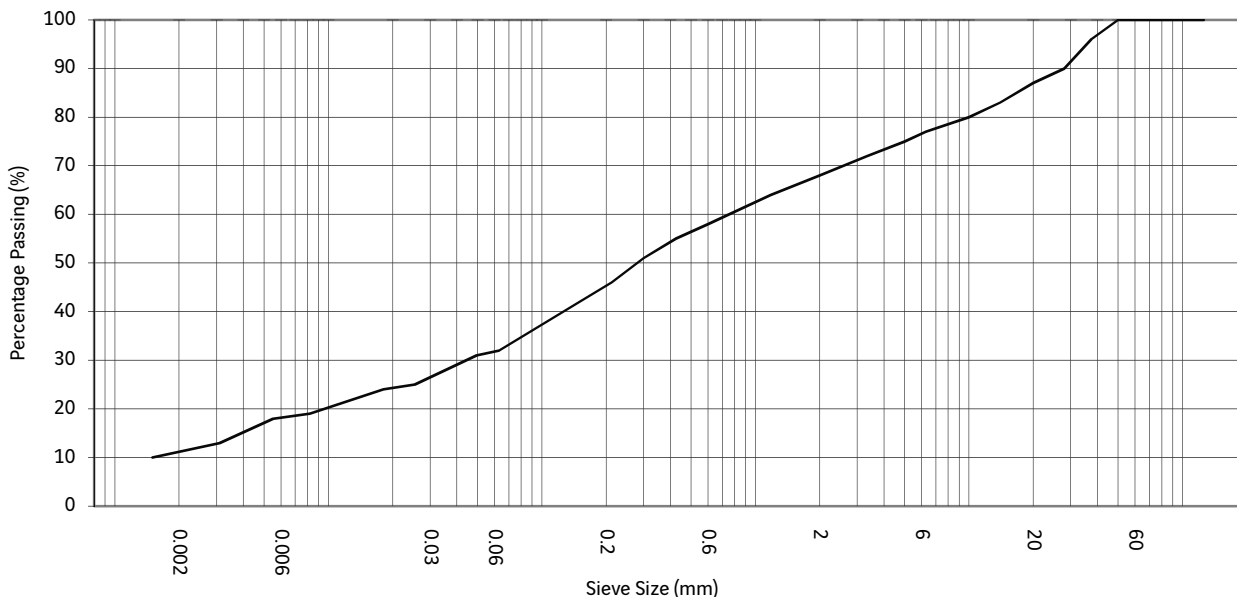
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	7	
Sand:	88	
Gravel:	6	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	98
		6.3	97
125.0	100	5.0	97
100.0	100	3.35	96
75.0	100	2.00	94
63.0	100	1.18	90
50.0	100	0.600	79
37.5	100	0.425	73
28.0	100	0.300	62
20.0	100	0.212	34
		0.150	11
		0.063	7

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	D99
Project No.	TA7148		Sample Depth	6.00m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample type	C
Description			Brown gravelly sandy CLAY. Gravel is fine to coarse subangular.	
			Specimen Depth	6.00m
			Specimen No.	1



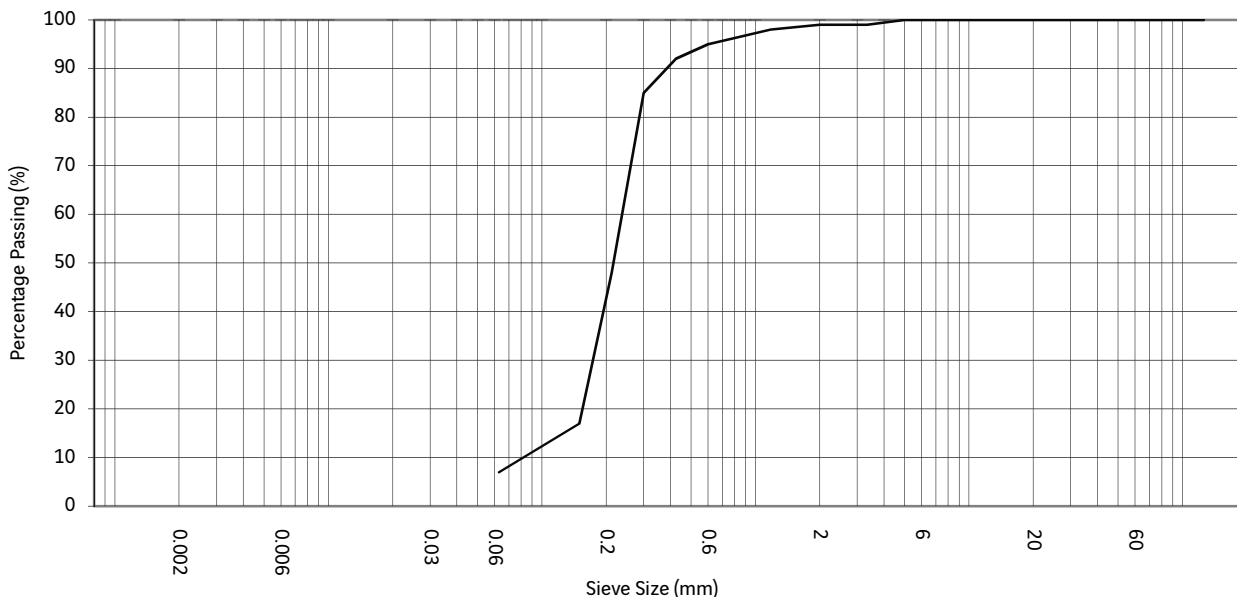
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Clay:	11	
Silt:	21	
Sand:	36	
Gravel:	32	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	83		
		10.0	80	0.0495	31
		6.3	77	0.0254	25
125.0	100	5.0	75	0.0181	24
90.0	100	3.35	72	0.0082	19
75.0	100	2.00	68	0.0055	18
63.0	100	1.18	64	0.0031	13
50.0	100	0.600	58	0.0015	10
37.5	96	0.425	55		
28.0	90	0.300	51		
20.0	87	0.212	46		
		0.150	42		
		0.063	32		

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk	Print date 28/11/2013	
Revision No.	3.03	Issue Date 19/11/2012


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID D100
		Sample Depth 0.50m
		Sample Number 003
		Sample type B
Description Greyish brown mottled black fine to medium SAND.		Specimen Depth 0.50m
		Specimen No. 1



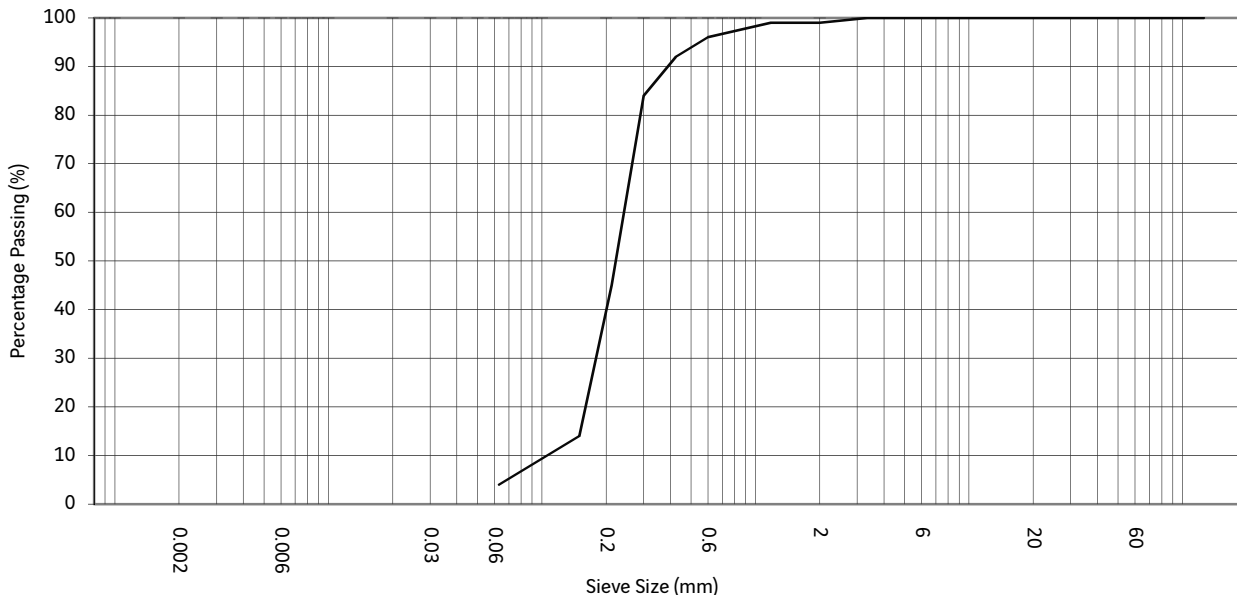
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	7	
Sand:	92	
Gravel:	1	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
		5.0	100
125.0	100	3.35	99
100.0	100	2.00	99
75.0	100	1.18	98
63.0	100	0.600	95
50.0	100	0.425	92
37.5	100	0.300	85
28.0	100	0.212	48
20.0	100	0.150	17
		0.063	7

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Sushil Sharda		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		

Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	D100		
Project No.	TA7148		Sample Depth	2.50m		
Engineer	Arch Henderson LLP		Sample Number	009		
Employer	Aberdeen Harbour Board		Sample type	B		
			BS 1377: Part 2: 1990: 9.2			
Description	Greyish brown SAND.	Specimen Depth			2.50m	
					Specimen No.	1



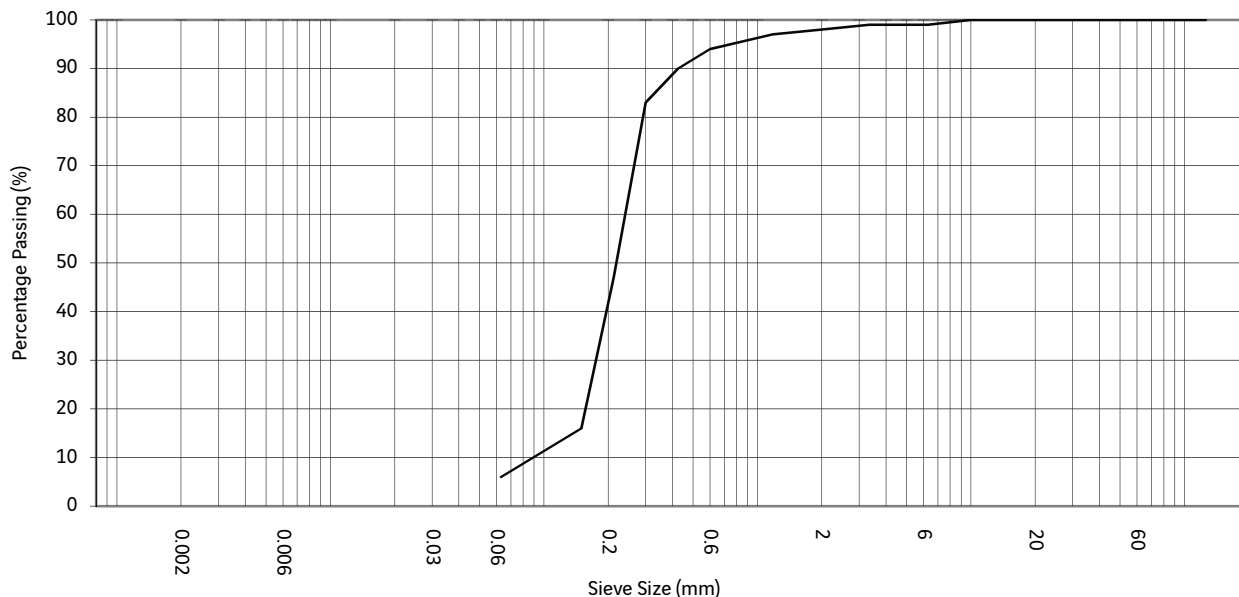
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	5	
Sand:	95	
Gravel:	1	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
100.0	100	3.35	100
75.0	100	2.00	99
63.0	100	1.18	99
50.0	100	0.600	96
37.5	100	0.425	92
28.0	100	0.300	84
20.0	100	0.212	45
		0.150	14
		0.063	4

Approved by:	Leeds Laboratory		SOIL ENGINEERING <small>Part of the Bachy Soletanche Group</small>
Sushil Sharda		Print date 28/11/2013	
Revision No.	3.03	Issue Date	19/11/2012

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID D102
		Sample Depth 0.50m
		Sample Number 003
		Sample type B
Description Brownish grey SAND.		Specimen Depth 0.50m
		Specimen No. 1




CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

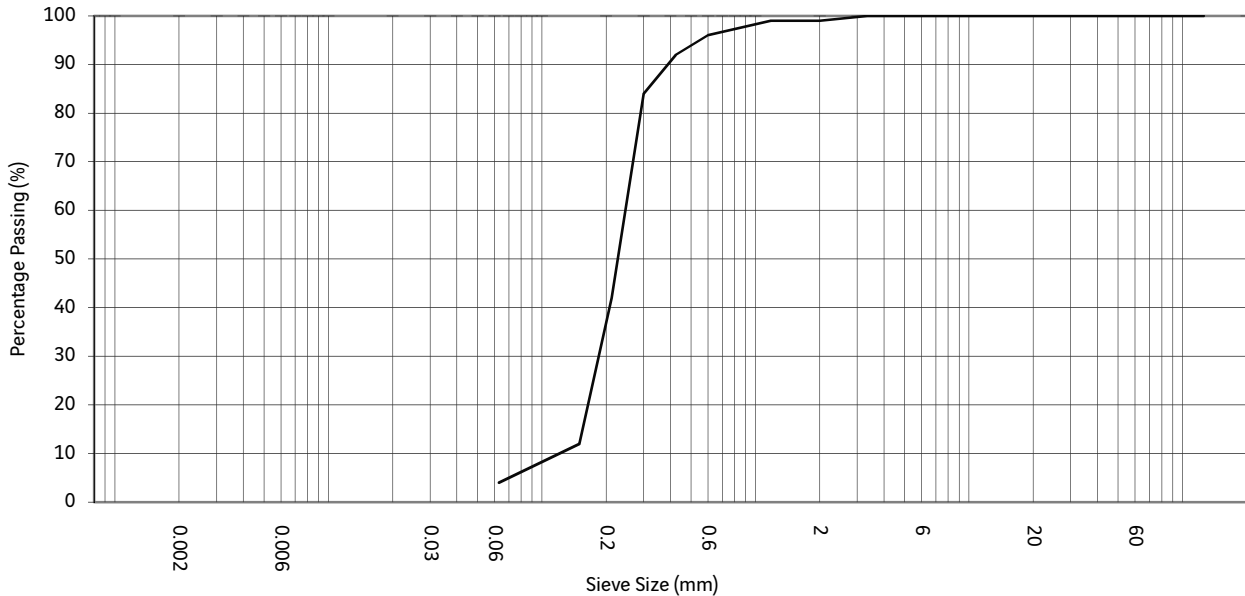
PARTICLE SIZE	%	General remarks
Silt and clay:	6	
Sand:	92	
Gravel:	2	
Cobbles:	0	

WET SIEVE DATA

Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	99
125.0	100	5.0	99
100.0	100	3.35	99
75.0	100	2.00	98
63.0	100	1.18	97
50.0	100	0.600	94
37.5	100	0.425	90
28.0	100	0.300	83
20.0	100	0.212	47
		0.150	16
		0.063	6

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk	Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012	


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID D102
		Sample Depth 2.50m
		Sample Number 009
		Sample type B
Description Brown SAND		Specimen Depth 2.50m Specimen No. 1



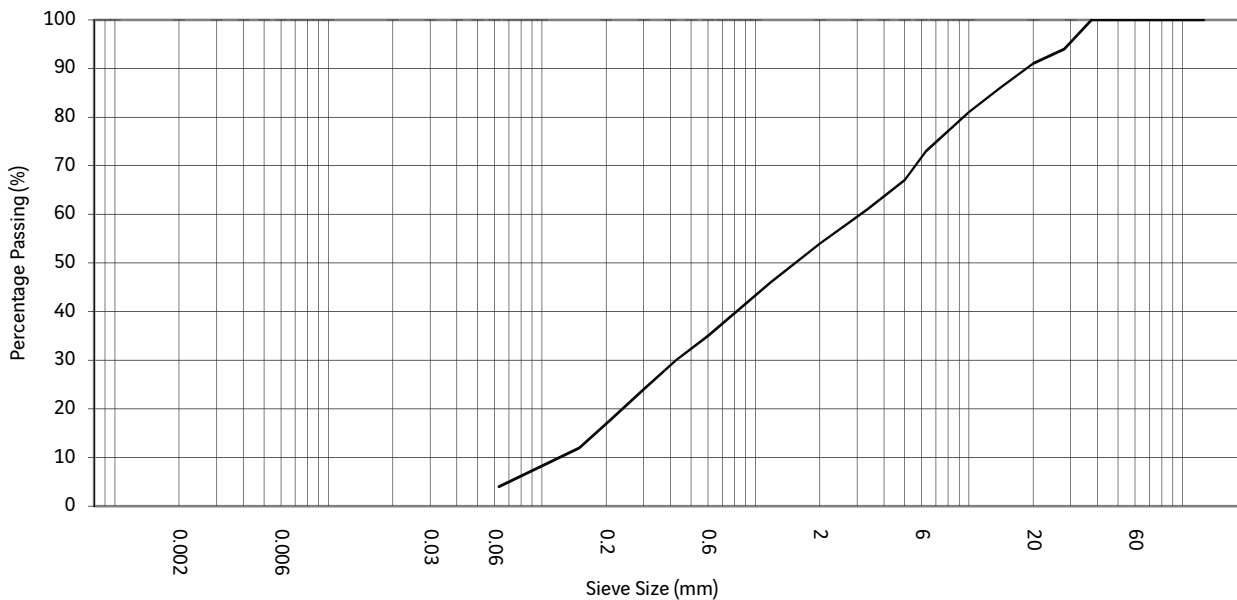
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE % Silt and clay: 4 Sand: 95 Gravel: 1 Cobbles: 0	General remarks
---	------------------------

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
90.0	100	3.35	100
75.0	100	2.00	99
63.0	100	1.18	99
50.0	100	0.600	96
37.5	100	0.425	92
28.0	100	0.300	84
20.0	100	0.212	42
		0.150	12
		0.063	4

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID D104
		Sample Depth 1.50m
		Sample Number 004
		Sample type B
Description Brown SAND and GRAVEL. Gravel is fine to coarse angular	Specimen Depth 1.50m	Specimen No. 1



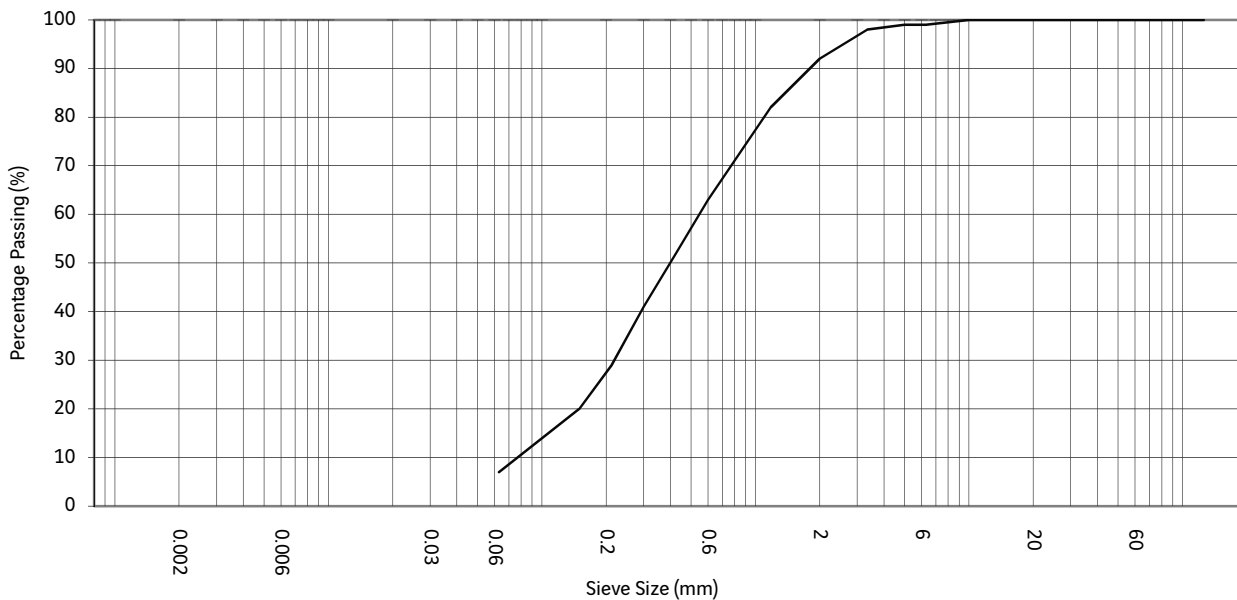
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	4	
Sand:	50	
Gravel:	46	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	86
		10.0	81
		6.3	73
125.0	100	5.0	67
90.0	100	3.35	61
75.0	100	2.00	54
63.0	100	1.18	46
50.0	100	0.600	35
37.5	100	0.425	30
28.0	94	0.300	24
20.0	91	0.212	18
		0.150	12
		0.063	4

Approved by: Stuart Kirk	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Revision No. 3.03	Issue Date 19/11/2012		

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID D104
		Sample Depth 5.50m
		Sample Number 012
		Sample type B
Description Brown SAND		Specimen Depth 5.50m
		Specimen No. 1



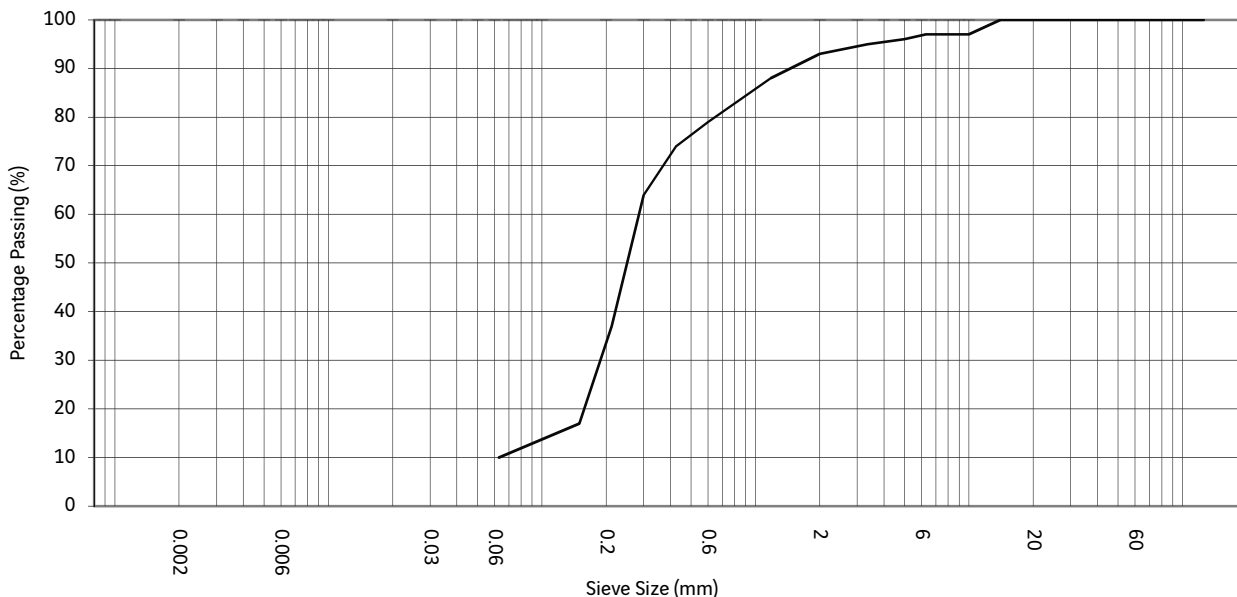
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	7	
Sand:	85	
Gravel:	8	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	99
125.0	100	5.0	99
90.0	100	3.35	98
75.0	100	2.00	92
63.0	100	1.18	82
50.0	100	0.600	63
37.5	100	0.425	52
28.0	100	0.300	41
20.0	100	0.212	29
		0.150	20
		0.063	7

Approved by: Stuart Kirk	Leeds Laboratory	Print date 28/11/2013	 Part of the Bachy Soletanche Group
Revision No. 3.03	Issue Date 19/11/2012		


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E65
		Sample Depth 0.50m
		Sample Number 003
		Sample type B
Description Brown slightly gravelly SAND		Specimen Depth 0.50m
		Specimen No. 1



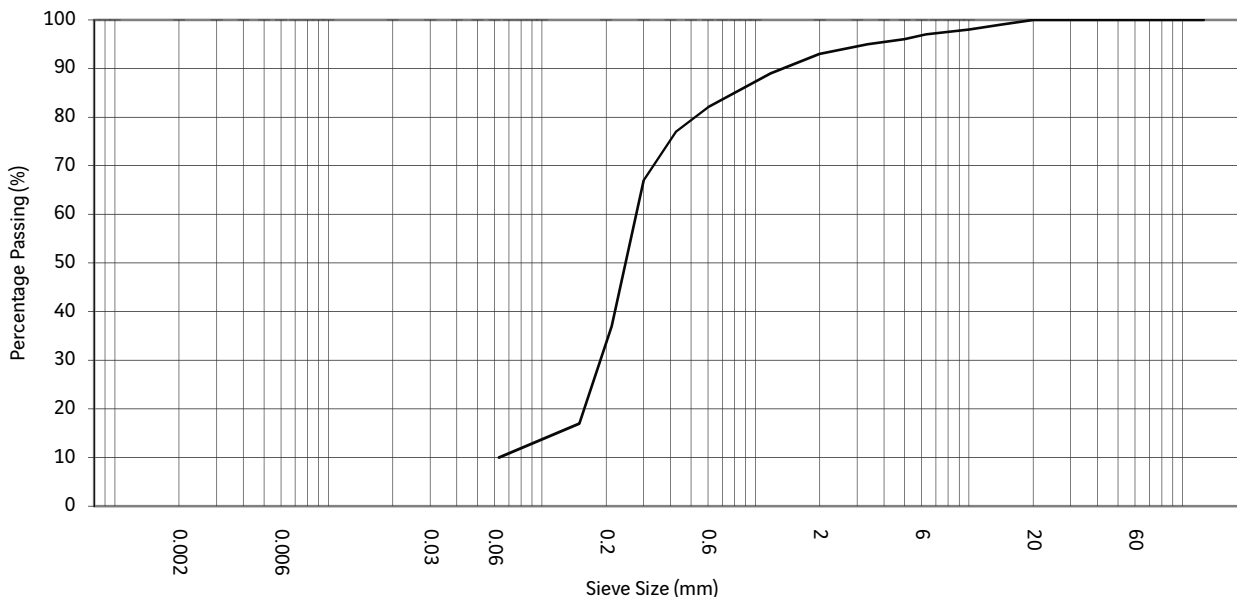
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	10	
Sand:	83	
Gravel:	7	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	97
		6.3	97
		5.0	96
125.0	100	3.35	95
90.0	100	2.00	93
75.0	100	1.18	88
63.0	100	0.600	79
50.0	100	0.425	74
37.5	100	0.300	64
28.0	100	0.212	37
20.0	100	0.150	17
		0.063	10

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		Print date 28/11/2013	
Revision No.	3.03	Issue Date	19/11/2012


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E65
		Sample Depth 2.50m
		Sample Number 009
		Sample type B
Description Brown slightly gravelly SAND. Gravel is fine to medium subangular		Specimen Depth 2.50m
		Specimen No. 1



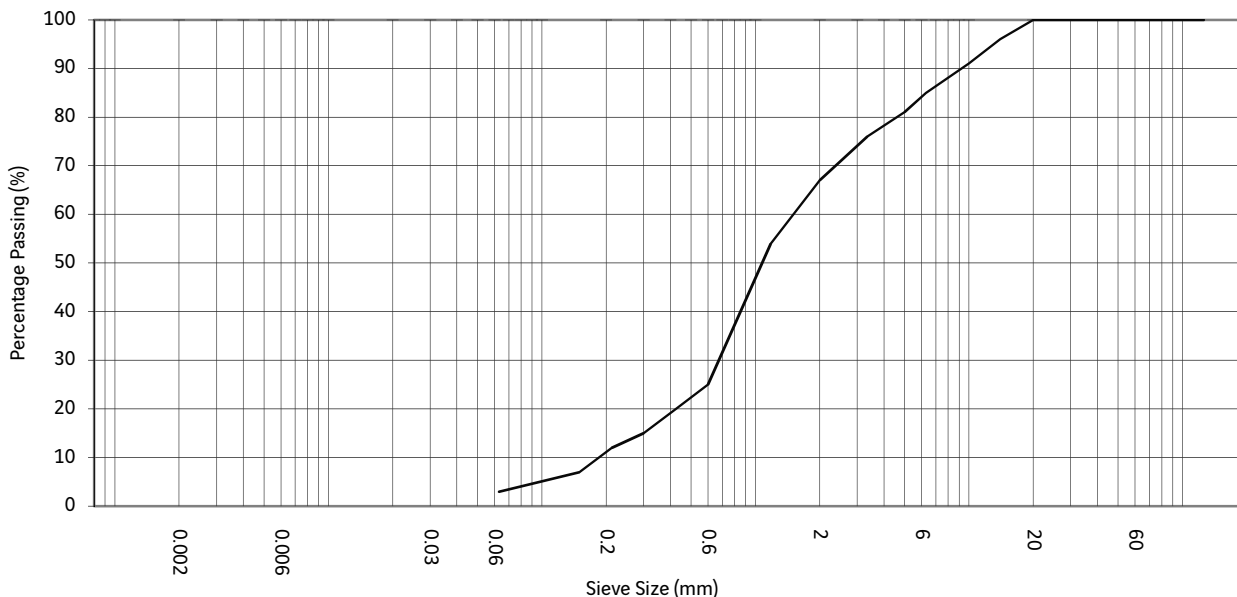
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	10	
Sand:	83	
Gravel:	8	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	99
		10.0	98
		6.3	97
		5.0	96
125.0	100	3.35	95
90.0	100	2.00	93
75.0	100	1.18	89
63.0	100	0.600	82
50.0	100	0.425	77
37.5	100	0.300	67
28.0	100	0.212	37
20.0	100	0.150	17
		0.063	10

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		Print date 28/11/2013	
Revision No.	3.03	Issue Date	19/11/2012


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	E65
Project No.	TA7148		Sample Depth	4.50m
Engineer	Arch Henderson LLP		Sample Number	015
Employer	Aberdeen Harbour Board		Sample type	B
Description		BS 1377: Part 2: 1990: 9.2	Specimen Depth	4.50m
			Specimen No.	1



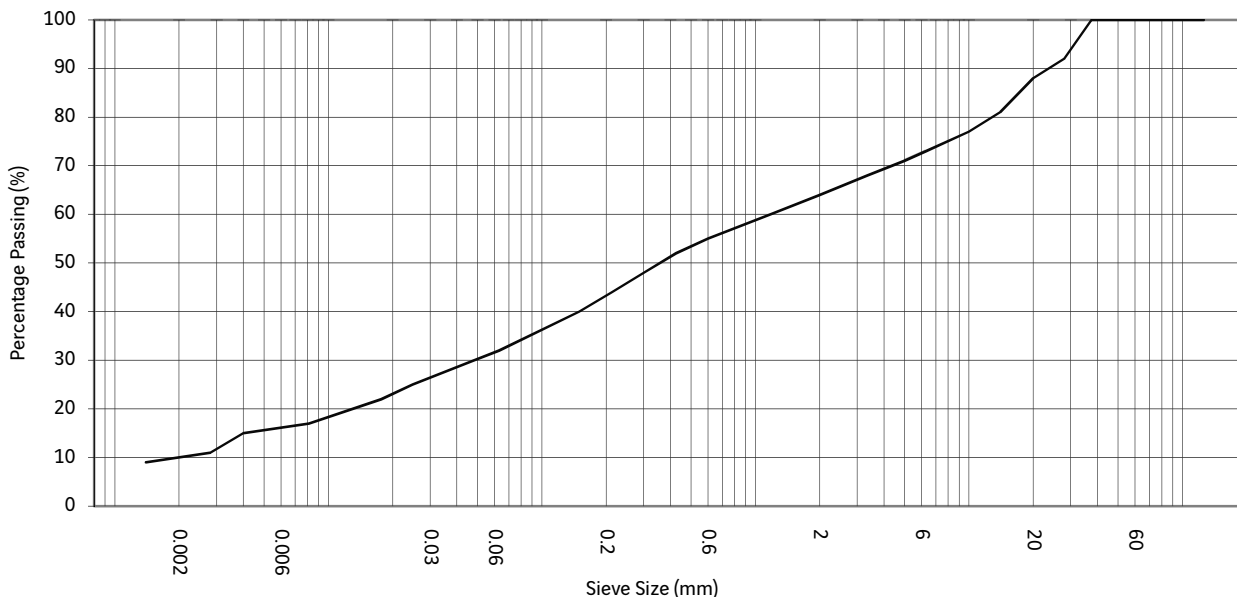
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	3	
Sand:	63	
Gravel:	34	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	96
		10.0	91
		6.3	85
		5.0	81
125.0	100	3.35	76
90.0	100	2.00	67
75.0	100	1.18	54
63.0	100	0.600	25
50.0	100	0.425	20
37.5	100	0.300	15
28.0	100	0.212	12
20.0	100	0.150	7
		0.063	3

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk	Print date 28/11/2013	
Revision No.	3.03	Issue Date 19/11/2012


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID E65
Project No.	TA7148		Sample Depth 8.00m
Engineer	Arch Henderson LLP		Sample Number
Employer	Aberdeen Harbour Board		Sample type C
Description	Brown sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded.		Specimen Depth 8.24m
			Specimen No. 1



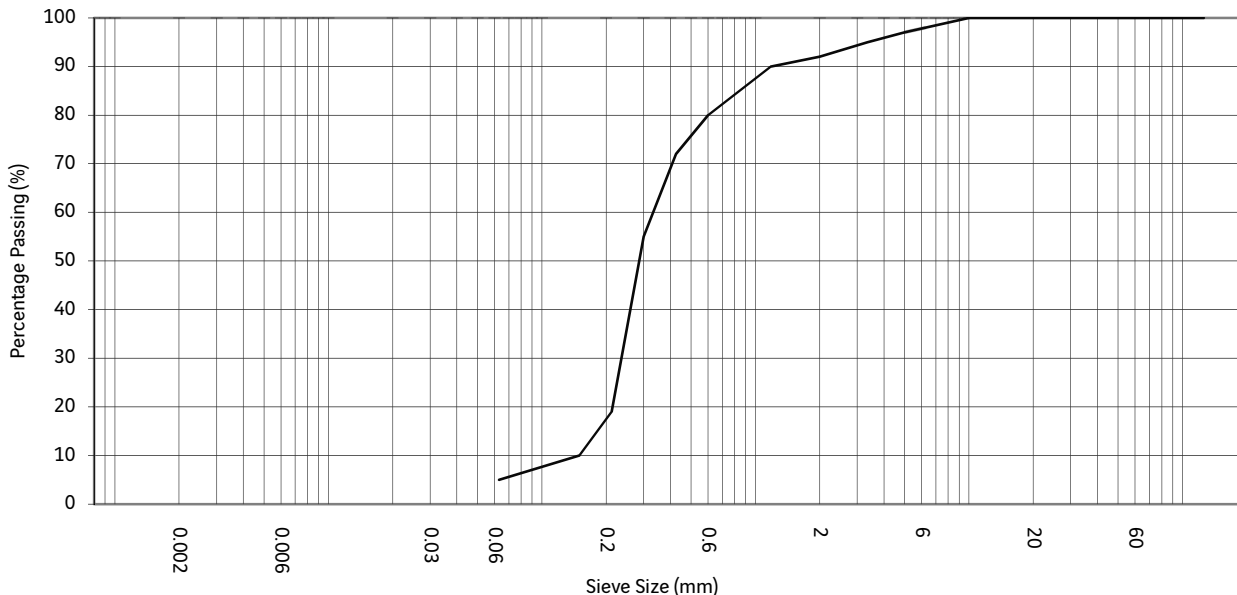
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE % Clay: 10 Silt: 22 Sand: 33 Gravel: 36 Cobbles: 0		General remarks Particle density: 2.65Mg/m ³ Assumed
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WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	81		
		10.0	77	0.0483	30
		6.3	73	0.0248	25
125.0	100	5.0	71	0.0177	22
90.0	100	3.35	68	0.0081	17
75.0	100	2.00	64	0.0040	15
63.0	100	1.18	60	0.0028	11
50.0	100	0.600	55	0.0014	9
37.5	100	0.425	52		
28.0	92	0.300	48		
20.0	88	0.212	44		
		0.150	40		
		0.063	32		

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Sushil Sharda	Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012	


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	E66	
Project No.	TA7148		Sample Depth	1.50m	
Engineer	Arch Henderson LLP		Sample Number	004	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Brown slightly gravelly SAND.	Specimen Depth	1.50m
				Specimen No.	1



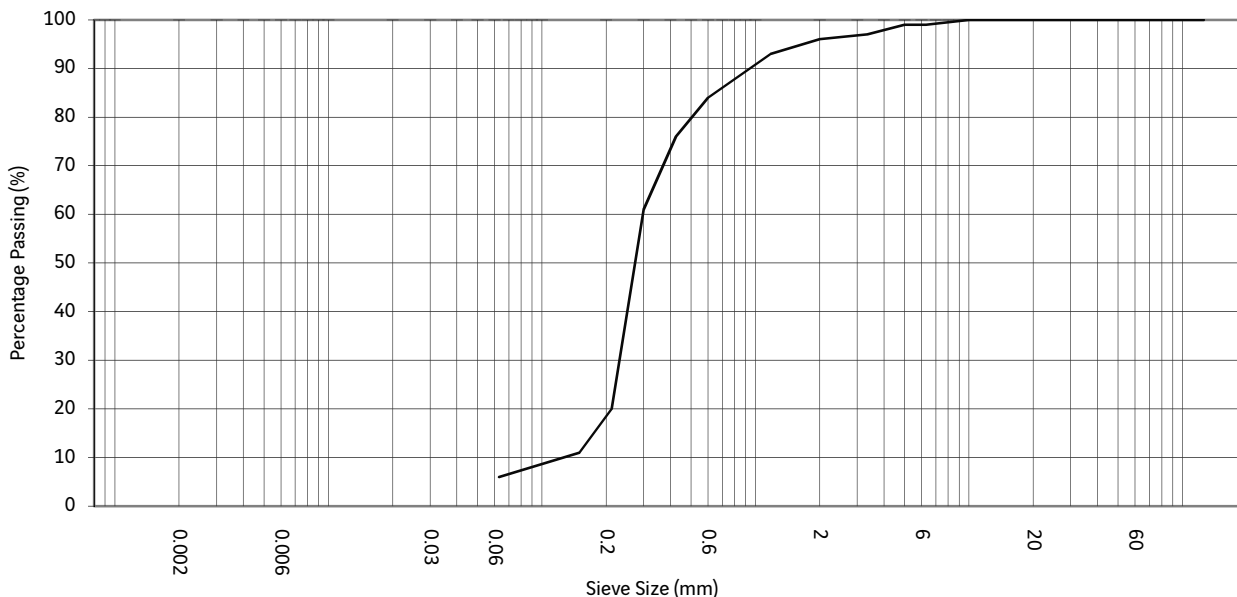
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	5	
Sand:	87	
Gravel:	8	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	98
125.0	100	5.0	97
90.0	100	3.35	95
75.0	100	2.00	92
63.0	100	1.18	90
50.0	100	0.600	80
37.5	100	0.425	72
28.0	100	0.300	55
20.0	100	0.212	19
		0.150	10
		0.063	5

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk	Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012	


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E66
		Sample Depth 3.50m
		Sample Number 008
		Sample type B
Description Brown slightly gravelly SAND		Specimen Depth 3.50m
		Specimen No. 1



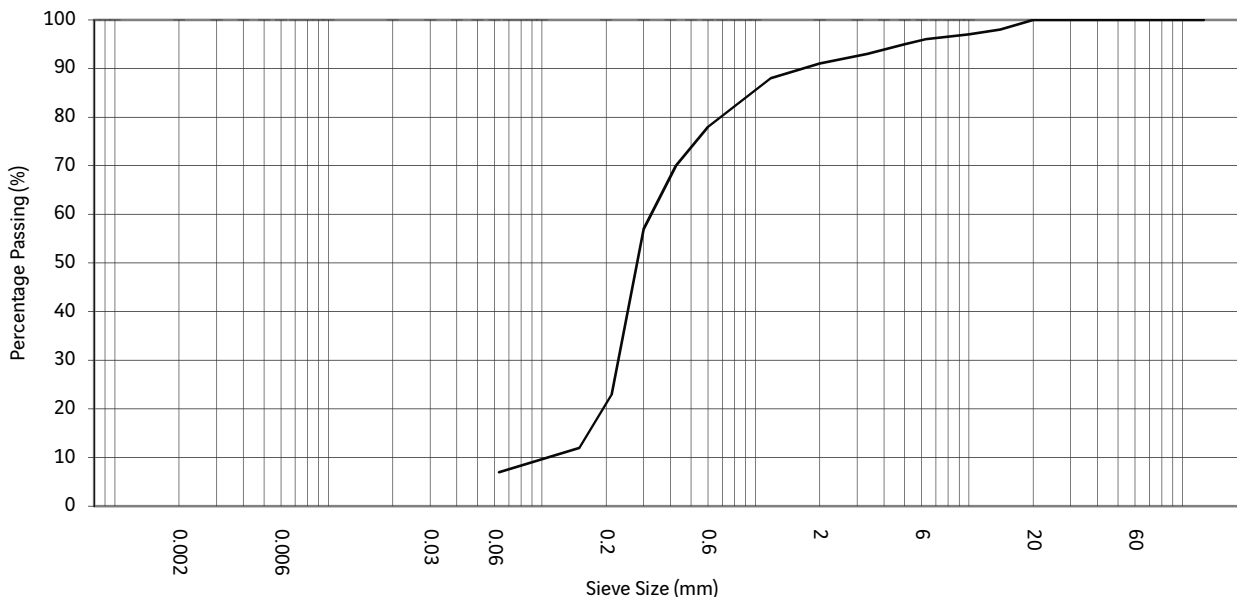
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	6	
Sand:	89	
Gravel:	4	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	99
125.0	100	5.0	99
90.0	100	3.35	97
75.0	100	2.00	96
63.0	100	1.18	93
50.0	100	0.600	84
37.5	100	0.425	76
28.0	100	0.300	61
20.0	100	0.212	20
		0.150	11
		0.063	6

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E66
		Sample Depth 6.50m
		Sample Number 014
		Sample type B
Description Brown slightly gravelly SAND		Specimen Depth 6.50m
		Specimen No. 1



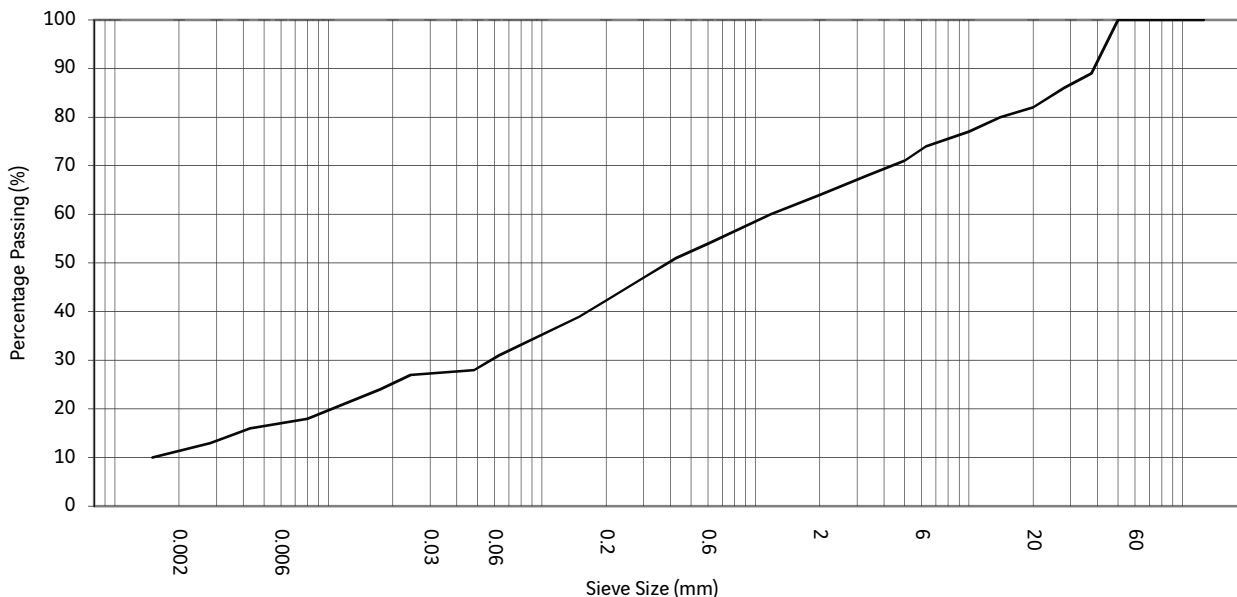
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	7	
Sand:	84	
Gravel:	9	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	98
		10.0	97
		6.3	96
		5.0	95
125.0	100	3.35	93
90.0	100	2.00	91
75.0	100	1.18	88
63.0	100	0.600	78
50.0	100	0.425	70
37.5	100	0.300	57
28.0	100	0.212	23
20.0	100	0.150	12
		0.063	7

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	E66
Project No.	TA7148		Sample Depth	11.60m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample type	C
Description			Brown sandy gravelly CLAY. Gravel is fine to coarse angular.	
			Specimen Depth	11.60m
			Specimen No.	1



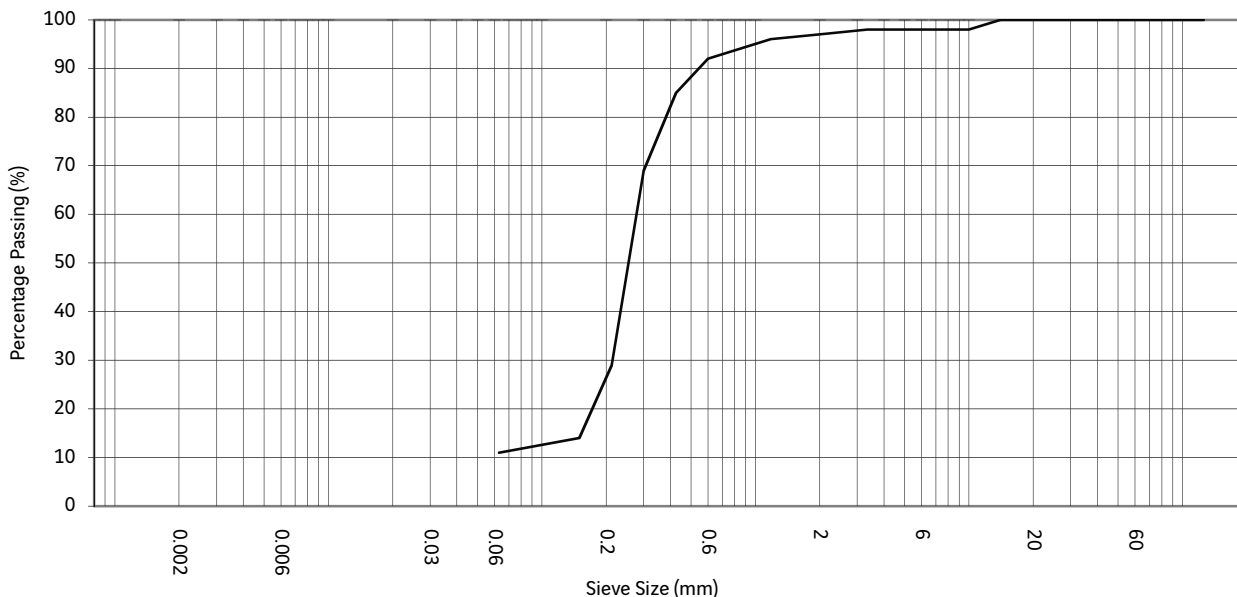
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Clay:	11	
Silt:	19	
Sand:	34	
Gravel:	36	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	80		
		10.0	77	0.0481	28
		6.3	74	0.0243	27
125.0	100	5.0	71	0.0175	24
90.0	100	3.35	68	0.0080	18
75.0	100	2.00	64	0.0043	16
63.0	100	1.18	60	0.0028	13
50.0	100	0.600	54	0.0015	10
37.5	89	0.425	51		
28.0	86	0.300	47		
20.0	82	0.212	43		
		0.150	39		
		0.063	31		

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group	
Sushil Sharda			
Revision No.	3.03	Issue Date	19/11/2012
		Print date	28/11/2013


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	E69	
Project No.	TA7148		Sample Depth	1.50m	
Engineer	Arch Henderson LLP		Sample Number	004	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Brown SAND	Specimen Depth	1.50m
				Specimen No.	1



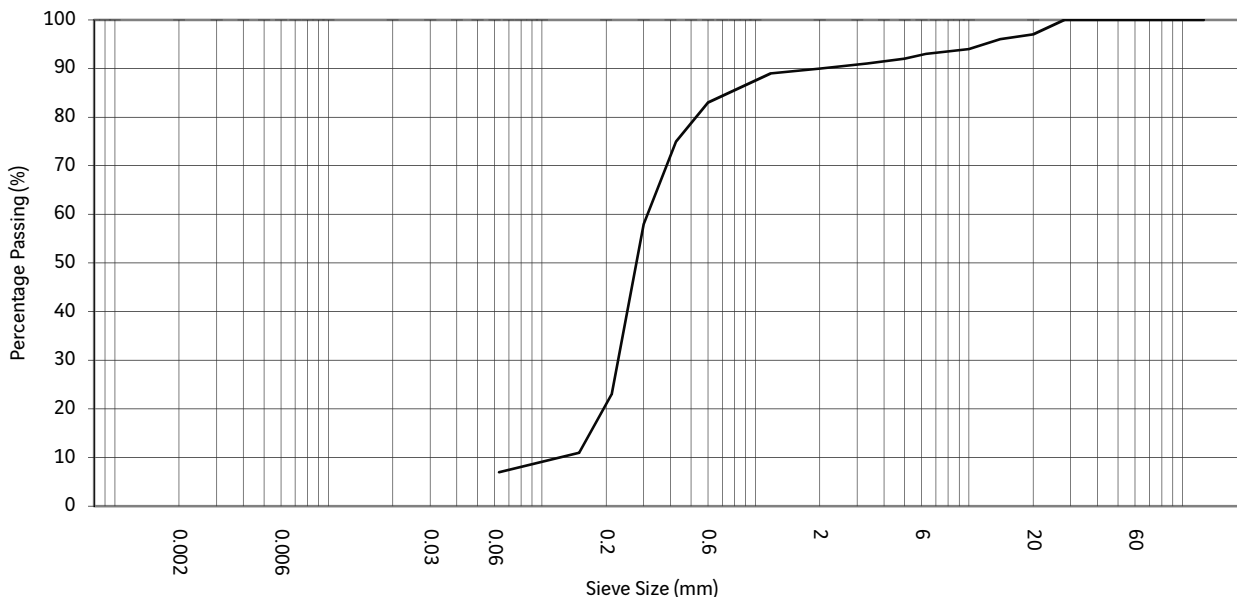
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	11	
Sand:	87	
Gravel:	3	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	98
		6.3	98
125.0	100	5.0	98
90.0	100	3.35	98
75.0	100	2.00	97
63.0	100	1.18	96
50.0	100	0.600	92
37.5	100	0.425	85
28.0	100	0.300	69
20.0	100	0.212	29
		0.150	14
		0.063	11

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk	Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012	


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E69
		Sample Depth 3.50m
		Sample Number 008
		Sample type B
Description Brown slightly gravelly SAND. Gravel is fine to coarse subangular		Specimen Depth 3.50m
		Specimen No. 1



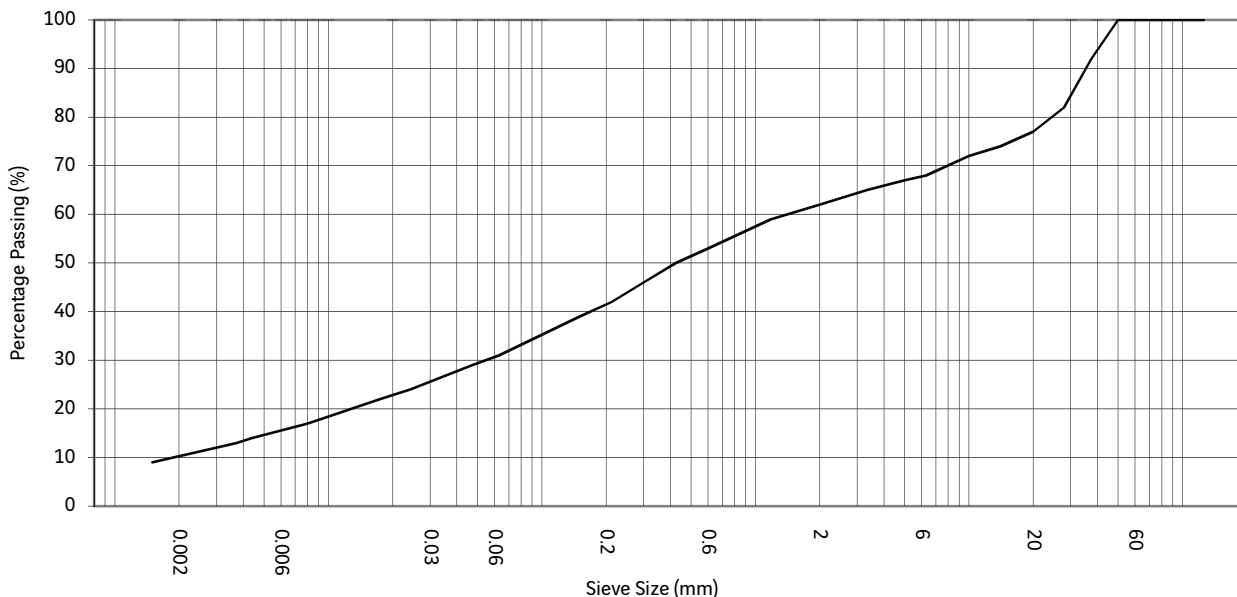
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	8	
Sand:	83	
Gravel:	10	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	96
		10.0	94
		6.3	93
125.0	100	5.0	92
90.0	100	3.35	91
75.0	100	2.00	90
63.0	100	1.18	89
50.0	100	0.600	83
37.5	100	0.425	75
28.0	100	0.300	58
20.0	97	0.212	23
		0.150	11
		0.063	7

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	E69
Project No.	TA7148		Sample Depth	8.10m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample type	C
Description		Brown sandy gravelly CLAY.	Specimen Depth	8.10m
			Specimen No.	1



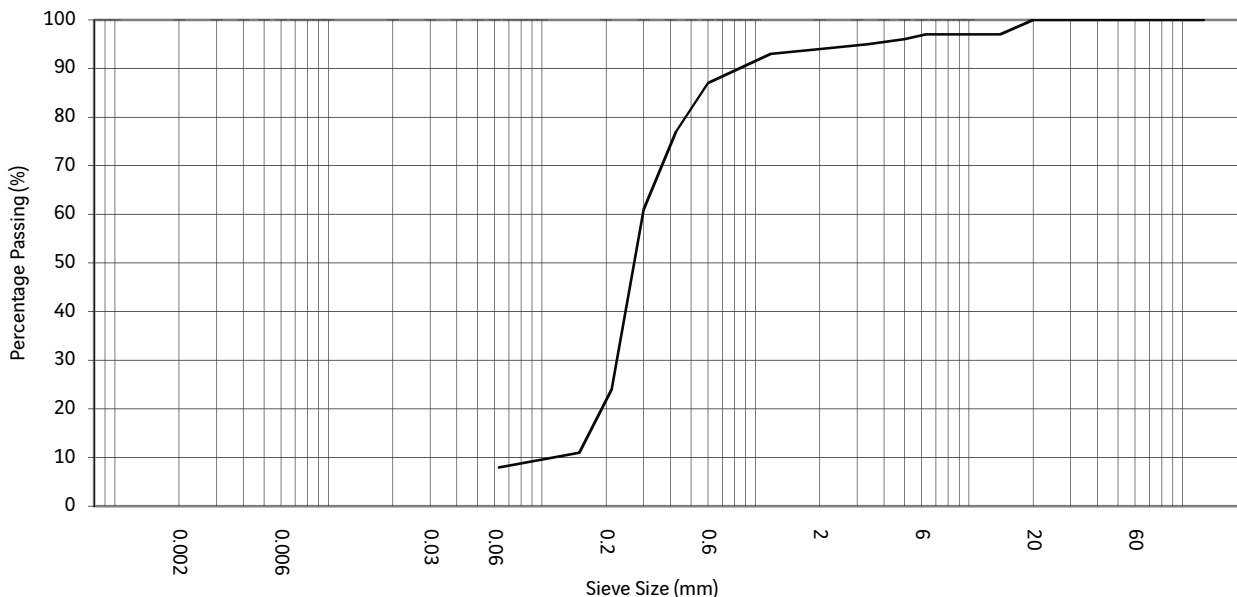
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Clay:	10	
Silt:	21	
Sand:	32	
Gravel:	38	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	74		
		10.0	72	0.0470	29
		6.3	68	0.0243	24
125.0	100	5.0	67	0.0174	22
90.0	100	3.35	65	0.0080	17
75.0	100	2.00	62	0.0044	14
63.0	100	1.18	59	0.0037	13
50.0	100	0.600	53	0.0015	9
37.5	92	0.425	50		
28.0	82	0.300	46		
20.0	77	0.212	42		
		0.150	39		
		0.063	31		

Approved by:	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Sushil Sharda			
Revision No.	3.03	Issue Date	19/11/2012


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E71
		Sample Depth 1.50m
		Sample Number 004
		Sample type B
Description Brown slightly gravelly SAND. Gravel is fine to medium angular		Specimen Depth 1.50m
		Specimen No. 1



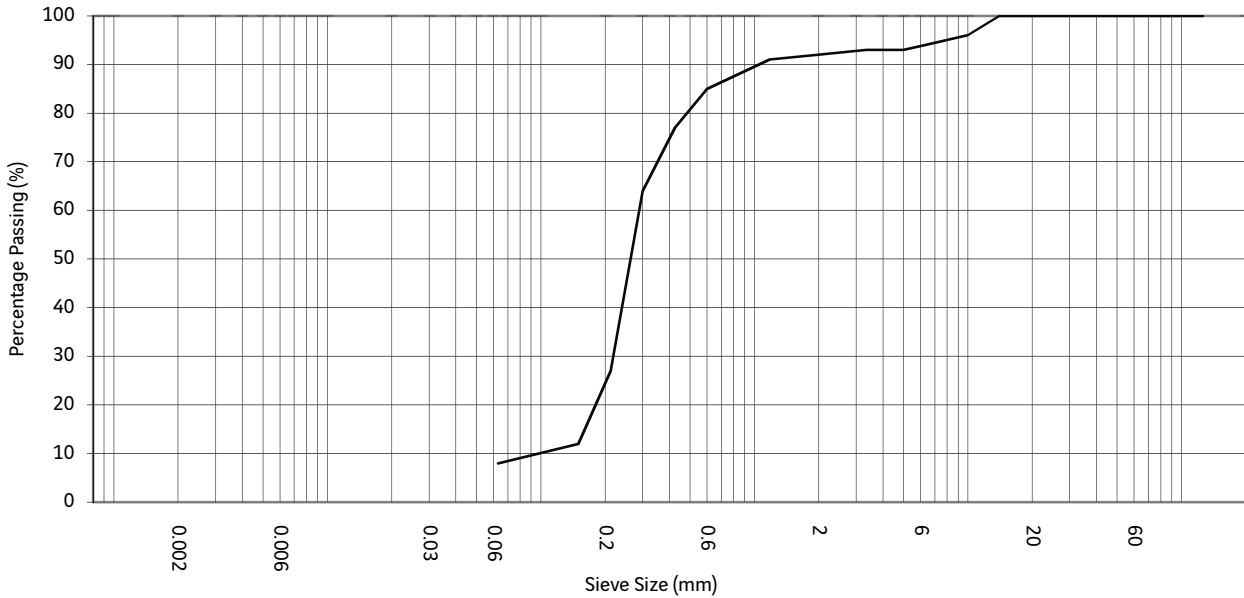
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	8	
Sand:	86	
Gravel:	6	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	97
		10.0	97
		6.3	97
125.0	100	5.0	96
90.0	100	3.35	95
75.0	100	2.00	94
63.0	100	1.18	93
50.0	100	0.600	87
37.5	100	0.425	77
28.0	100	0.300	61
20.0	100	0.212	24
		0.150	11
		0.063	8

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Revision No.	3.03	Issue Date	19/11/2012


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	E71
Project No.	TA7148		Sample Depth	4.50m
Engineer	Arch Henderson LLP		Sample Number	010
Employer	Aberdeen Harbour Board		Sample type	B
Description		Brown slightly gravelly SAND	Specimen Depth	4.50m
			Specimen No.	1



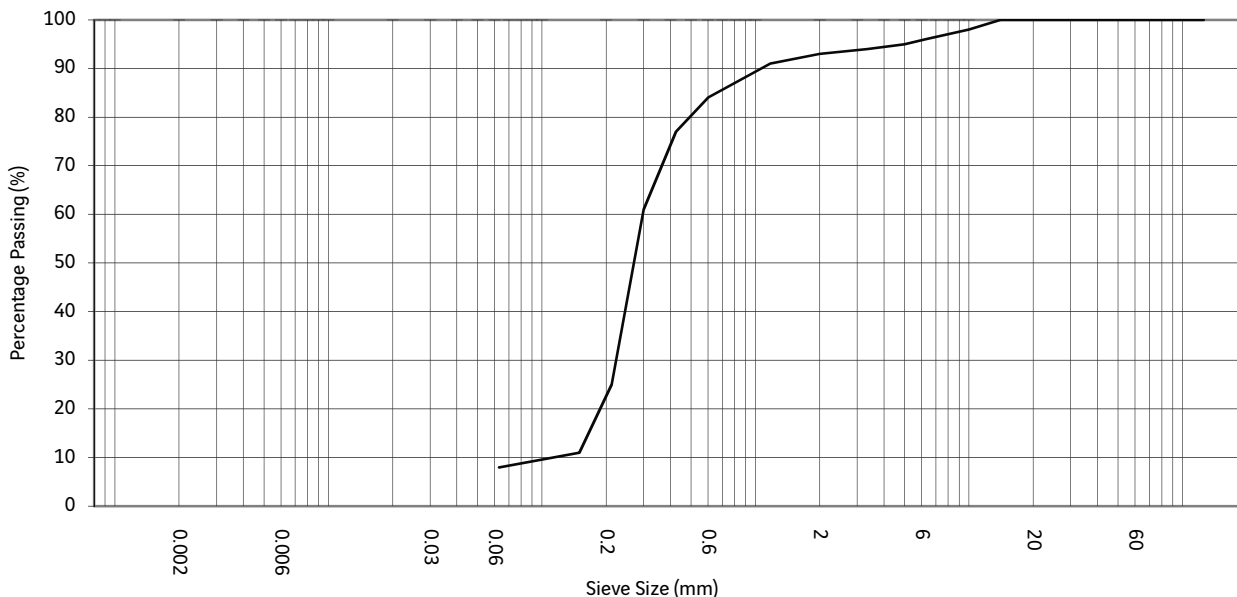
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	8	
Sand:	84	
Gravel:	8	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	96
		6.3	94
		5.0	93
125.0	100	3.35	93
90.0	100	2.00	92
75.0	100	1.18	91
63.0	100	0.600	85
50.0	100	0.425	77
37.5	100	0.300	64
28.0	100	0.212	27
20.0	100	0.150	12
		0.063	8

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Stuart Kirk		
Revision No.	3.03	Print date 28/11/2013
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID	E71
Project No.	TA7148		Sample Depth	9.00m
Engineer	Arch Henderson LLP		Sample Number	016
Employer	Aberdeen Harbour Board		Sample type	B
Description	Brown slightly gravelly SAND.		Specimen Depth	9.00m
			Specimen No.	1



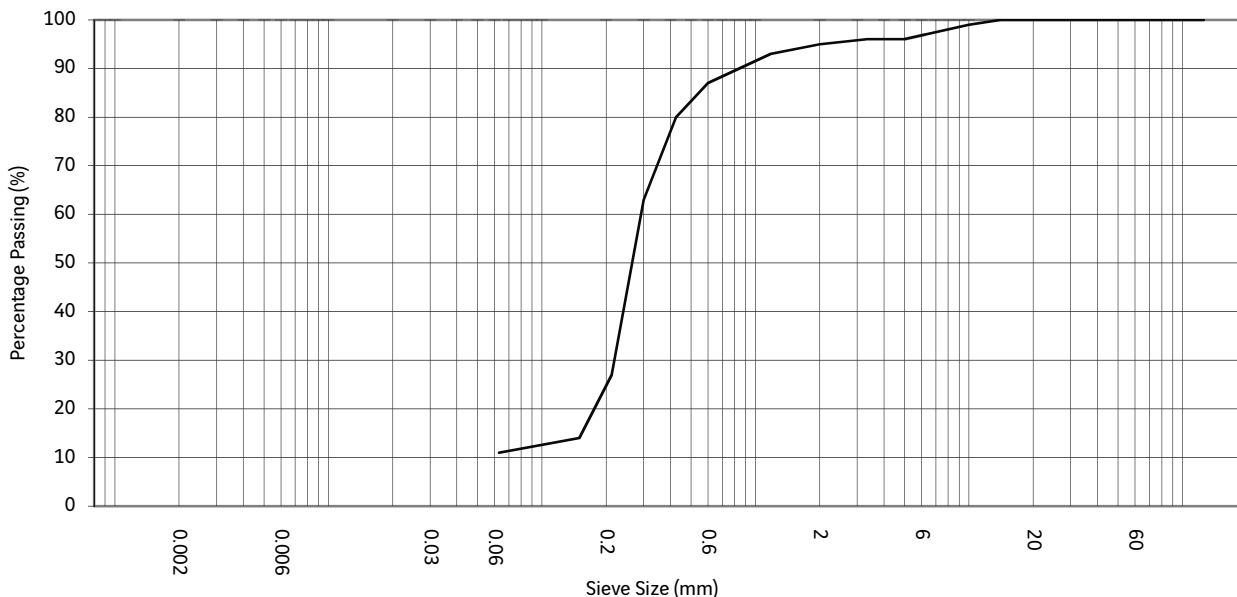
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	8	
Sand:	85	
Gravel:	7	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	98
		6.3	96
125.0	100	5.0	95
90.0	100	3.35	94
75.0	100	2.00	93
63.0	100	1.18	91
50.0	100	0.600	84
37.5	100	0.425	77
28.0	100	0.300	61
20.0	100	0.212	25
		0.150	11
		0.063	8

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E72
		Sample Depth 1.50m
		Sample Number 004
		Sample type B
Description Brownish grey SAND		Specimen Depth 1.50m
		Specimen No. 1



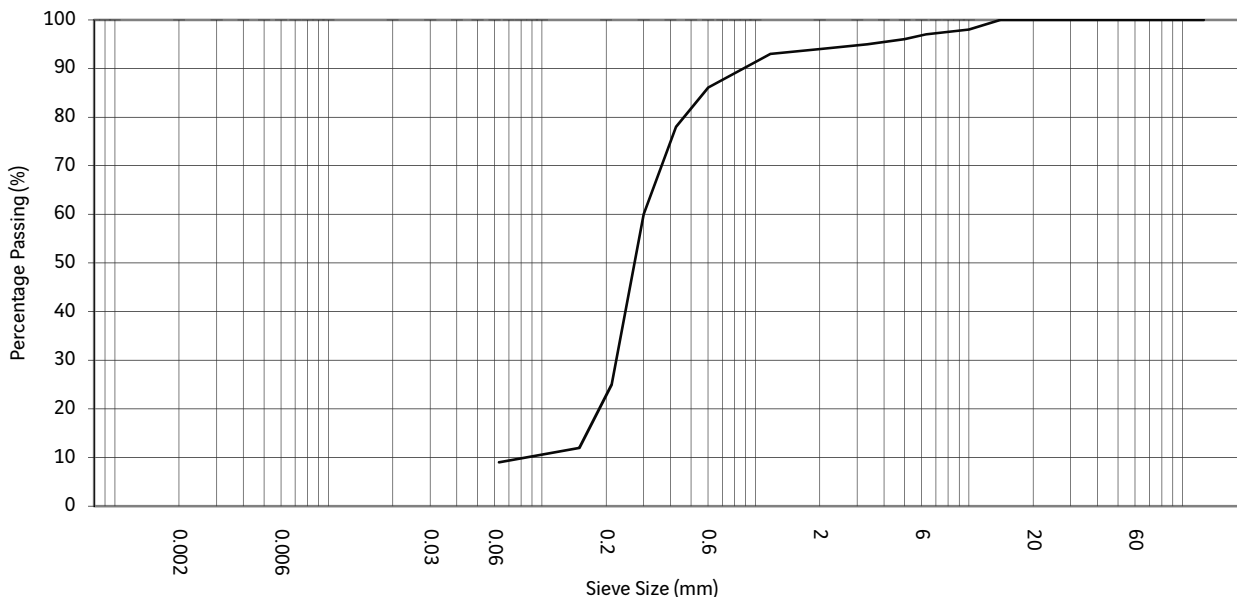
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	11	
Sand:	84	
Gravel:	5	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	99
		6.3	97
		5.0	96
125.0	100	3.35	96
90.0	100	2.00	95
75.0	100	1.18	93
63.0	100	0.600	87
50.0	100	0.425	80
37.5	100	0.300	63
28.0	100	0.212	27
20.0	100	0.150	14
		0.063	11

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E72
		Sample Depth 3.50m
		Sample Number 008
		Sample type B
Description Brown slightly gravelly SAND. Gravel is fine to medium.		Specimen Depth 3.50m
		Specimen No. 1



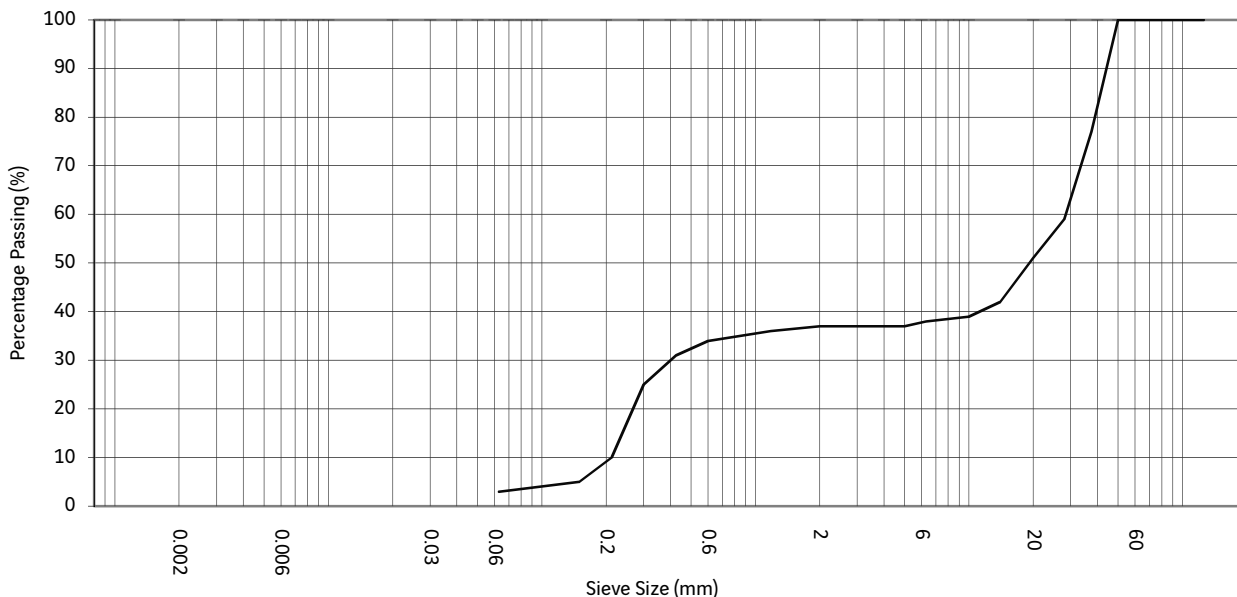
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	9	
Sand:	86	
Gravel:	6	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	98
		6.3	97
		5.0	96
125.0	100	3.35	95
90.0	100	2.00	94
75.0	100	1.18	93
63.0	100	0.600	86
50.0	100	0.425	78
37.5	100	0.300	60
28.0	100	0.212	25
20.0	100	0.150	12
		0.063	9

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Sushil Sharda		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E75
		Sample Depth 0.50m
		Sample Number 002
		Sample type B
Description Brown sandy GRAVEL. Gravel is fine to coarse angular.		Specimen Depth 0.50m
		Specimen No. 1



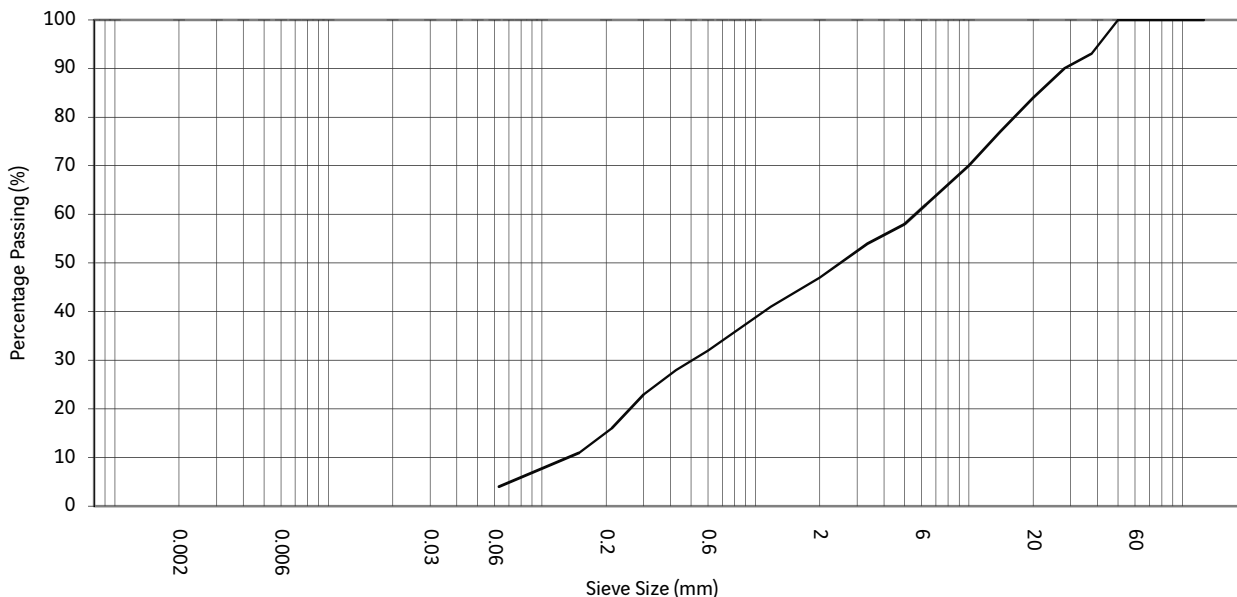
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	3	
Sand:	33	
Gravel:	63	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	42
		10.0	39
		6.3	38
		5.0	37
125.0	100	3.35	37
90.0	100	2.00	37
75.0	100	1.18	36
63.0	100	0.600	34
50.0	100	0.425	31
37.5	77	0.300	25
28.0	59	0.212	10
20.0	51	0.150	5
		0.063	3

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Sushil Sharda		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		

Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	E75
Project No.	TA7148		Sample Depth	2.50m
Engineer	Arch Henderson LLP		Sample Number	006
Employer	Aberdeen Harbour Board		Sample type	B
Description			Brown gravelly SAND. Gravel is fine to coarse subrounded and angular.	
			Specimen Depth	2.50m
			Specimen No.	1



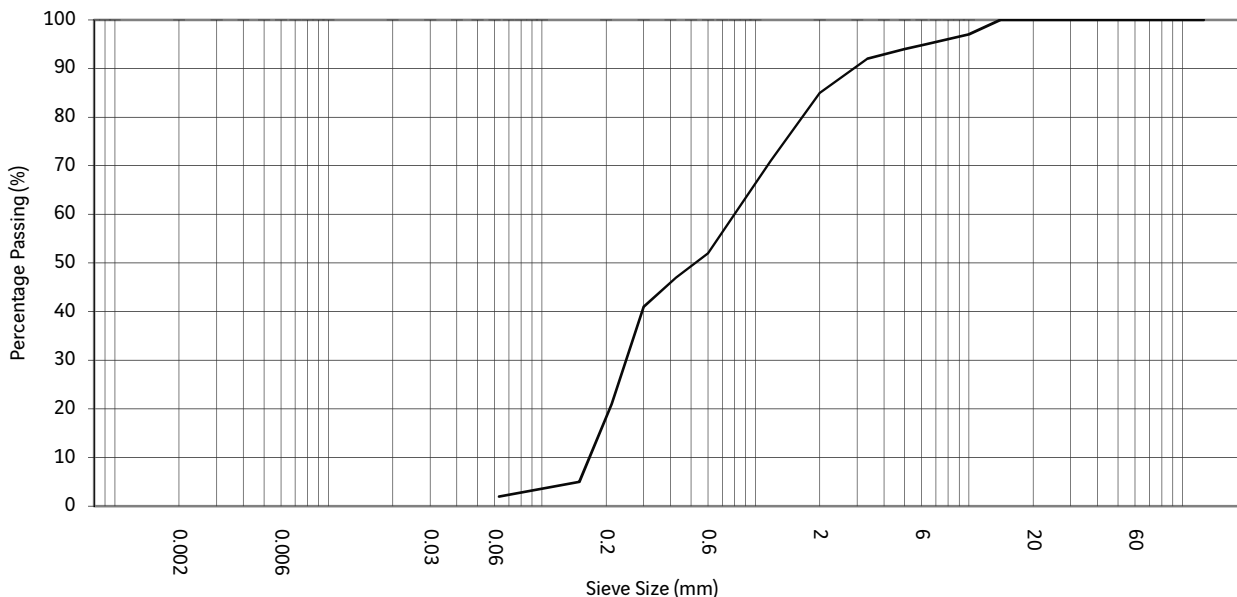
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	4	
Sand:	43	
Gravel:	53	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	77
		10.0	70
		6.3	62
		5.0	58
125.0	100	3.35	54
90.0	100	2.00	47
75.0	100	1.18	41
63.0	100	0.600	32
50.0	100	0.425	28
37.5	93	0.300	23
28.0	90	0.212	16
20.0	84	0.150	11
		0.063	4

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Sushil Sharda		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID	E105
Project No.	TA7148		Sample Depth	0.00m
Engineer	Arch Henderson LLP		Sample Number	002
Employer	Aberdeen Harbour Board		Sample type	B
Description	Brown slightly gravelly SAND		Specimen Depth	0.00m
			Specimen No.	1



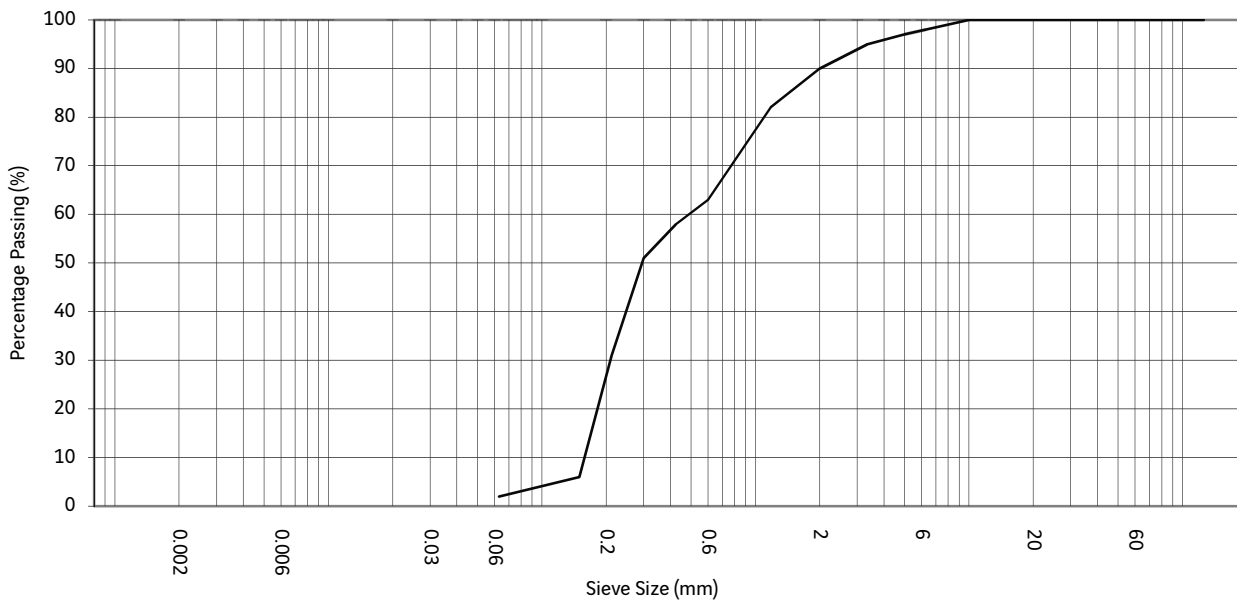
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	2	
Sand:	83	
Gravel:	15	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	97
		6.3	95
125.0	100	5.0	94
90.0	100	3.35	92
75.0	100	2.00	85
63.0	100	1.18	71
50.0	100	0.600	52
37.5	100	0.425	47
28.0	100	0.300	41
20.0	100	0.212	21
		0.150	5
		0.063	2

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk	Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012	


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E105
		Sample Depth 3.50m
		Sample Number 014
		Sample type B
Description Greyish brown slightly gravelly SAND	Specimen Depth 3.50m	Specimen No. 1



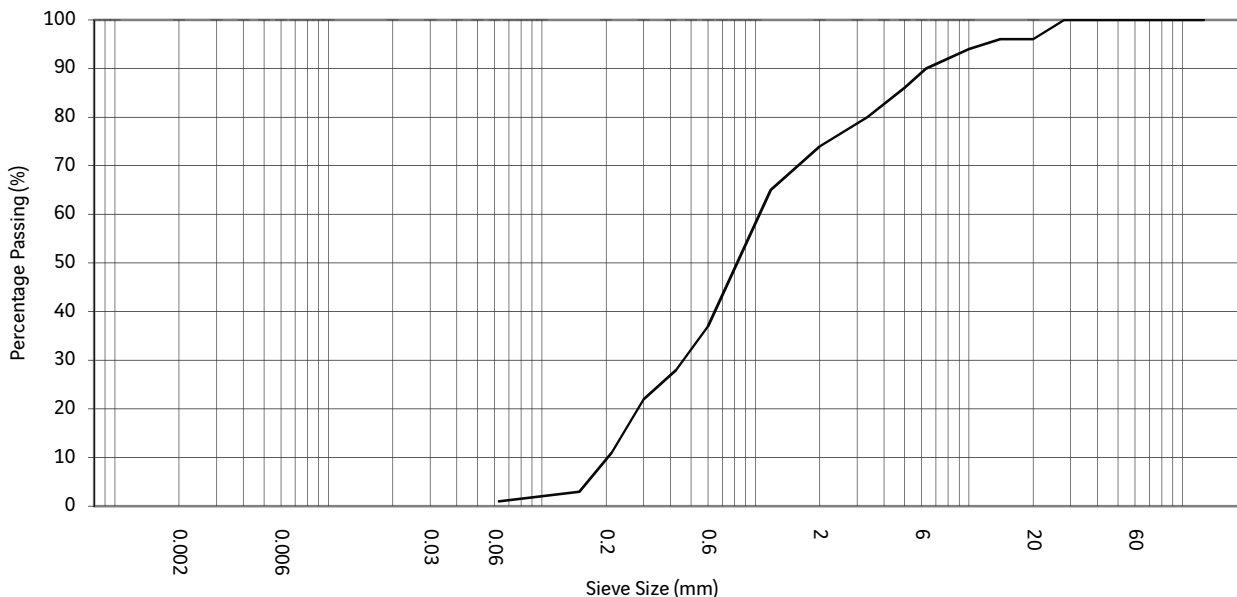
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	2	
Sand:	88	
Gravel:	10	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	98
125.0	100	5.0	97
90.0	100	3.35	95
75.0	100	2.00	90
63.0	100	1.18	82
50.0	100	0.600	63
37.5	100	0.425	58
28.0	100	0.300	51
20.0	100	0.212	31
		0.150	6
		0.063	2

Approved by: Stuart Kirk	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E105
		Sample Depth 5.50m
		Sample Number 022
		Sample type B
Description Brown gravelly SAND. Gravel is fine to coarse subrounded		Specimen Depth 5.50m
		Specimen No. 1



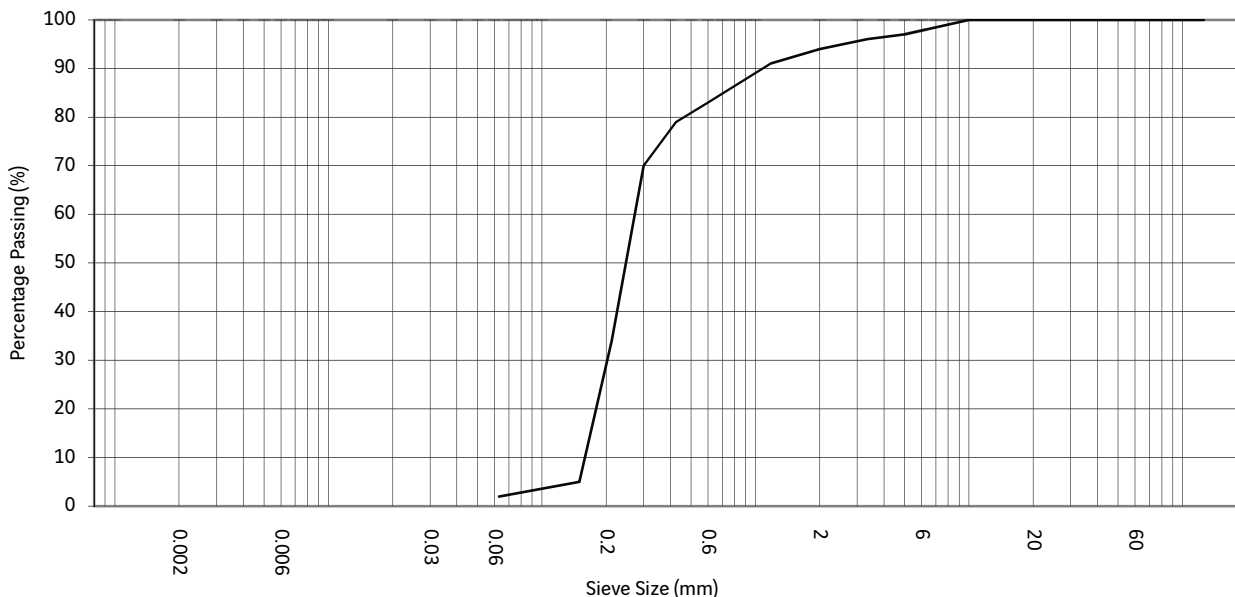
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	1	
Sand:	73	
Gravel:	26	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	96
		10.0	94
		6.3	90
125.0	100	5.0	86
90.0	100	3.35	80
75.0	100	2.00	74
63.0	100	1.18	65
50.0	100	0.600	37
37.5	100	0.425	28
28.0	100	0.300	22
20.0	96	0.212	11
		0.150	3
		0.063	1

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E106
		Sample Depth 0.00m
		Sample Number 002
		Sample type B
Description Brownish grey slightly gravelly SAND	Specimen Depth 0.00m	Specimen No. 1



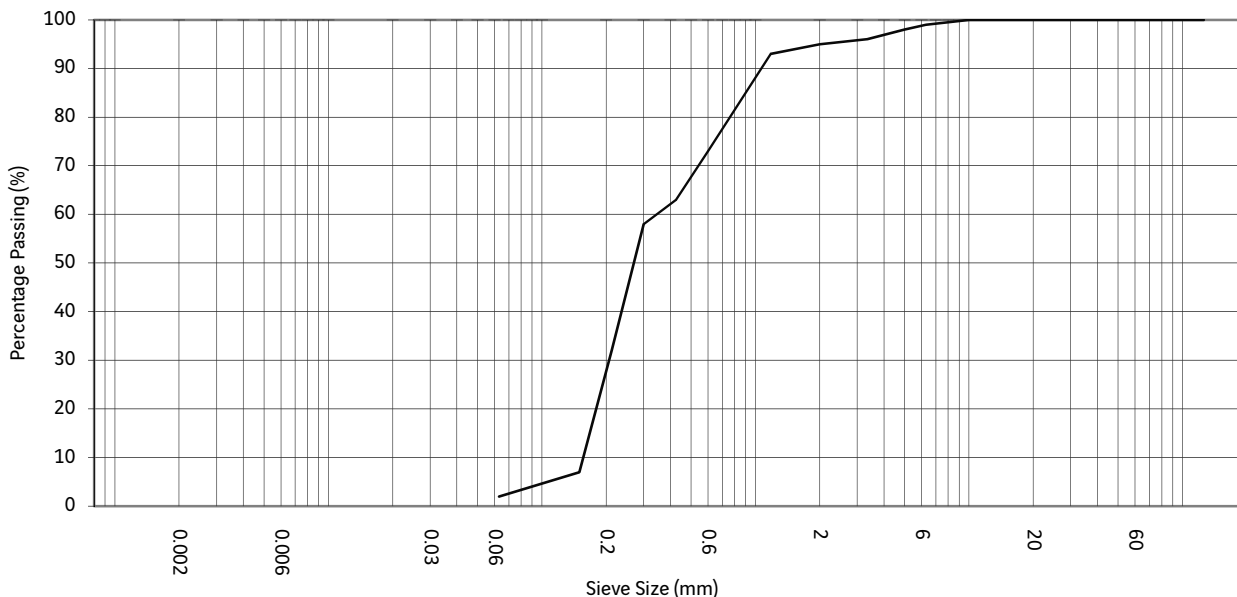
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	2	
Sand:	92	
Gravel:	6	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	98
125.0	100	5.0	97
90.0	100	3.35	96
75.0	100	2.00	94
63.0	100	1.18	91
50.0	100	0.600	83
37.5	100	0.425	79
28.0	100	0.300	70
20.0	100	0.212	34
		0.150	5
		0.063	2

Approved by: Stuart Kirk	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID	E106
Project No.	TA7148		Sample Depth	4.50m
Engineer	Arch Henderson LLP		Sample Number	018
Employer	Aberdeen Harbour Board		Sample type	B
Description	Brown SAND		Specimen Depth	4.50m
			Specimen No.	1



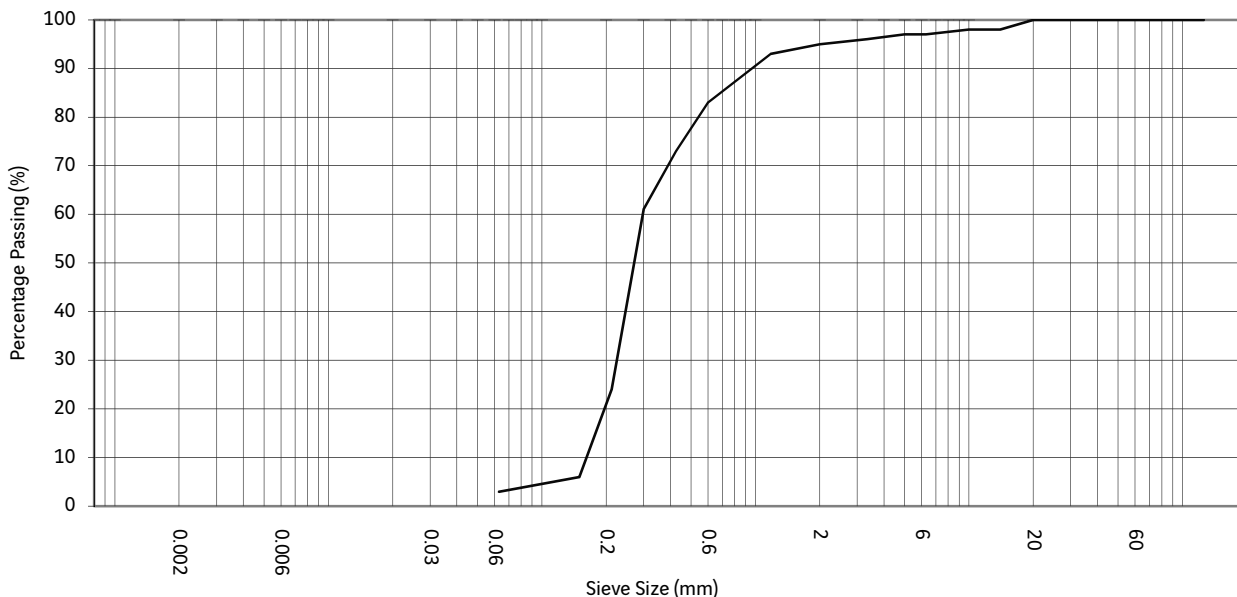
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	2	
Sand:	93	
Gravel:	5	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	99
125.0	100	5.0	98
90.0	100	3.35	96
75.0	100	2.00	95
63.0	100	1.18	93
50.0	100	0.600	73
37.5	100	0.425	63
28.0	100	0.300	58
20.0	100	0.212	32
		0.150	7
		0.063	2

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk	Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012	


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	E107	
Project No.	TA7148		Sample Depth	0.50m	
Engineer	Arch Henderson LLP		Sample Number	003	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Brown slightly gravelly SAND	Specimen Depth	0.50m
				Specimen No.	1



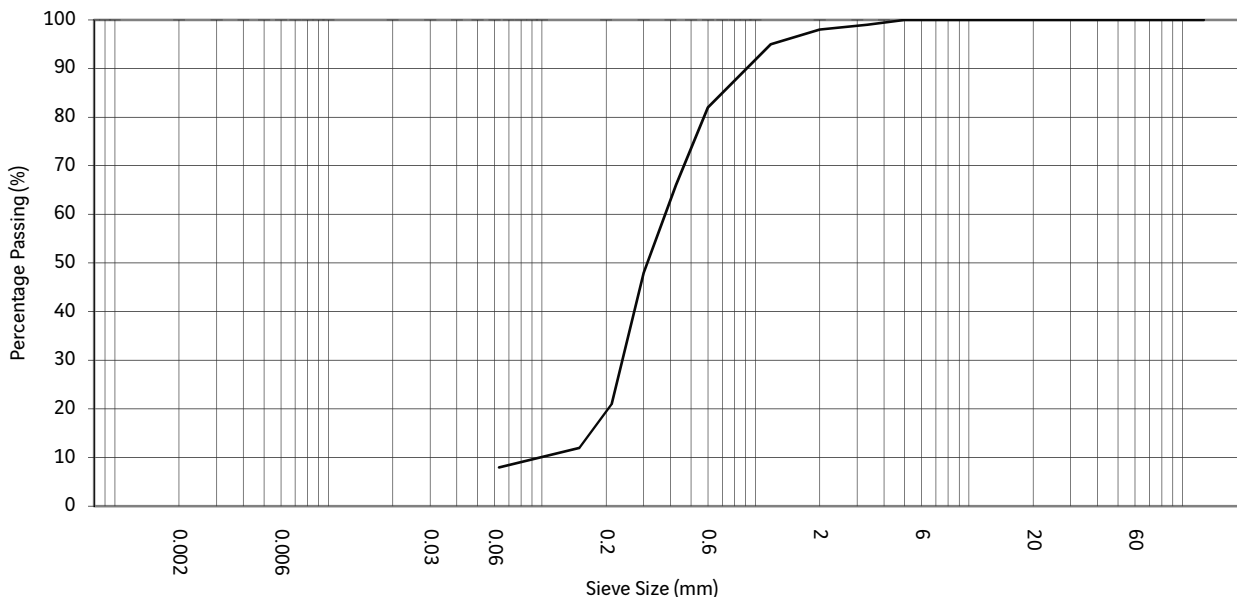
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	3	
Sand:	93	
Gravel:	5	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	98
		10.0	98
		6.3	97
		5.0	97
125.0	100	3.35	96
90.0	100	2.00	95
75.0	100	1.18	93
63.0	100	0.600	83
50.0	100	0.425	73
37.5	100	0.300	61
28.0	100	0.212	24
20.0	100	0.150	6
		0.063	3

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk	Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012	


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E107
		Sample Depth 4.50m
		Sample Number 011
		Sample type B
Description Grey SAND.		Specimen Depth 4.50m
		Specimen No. 1



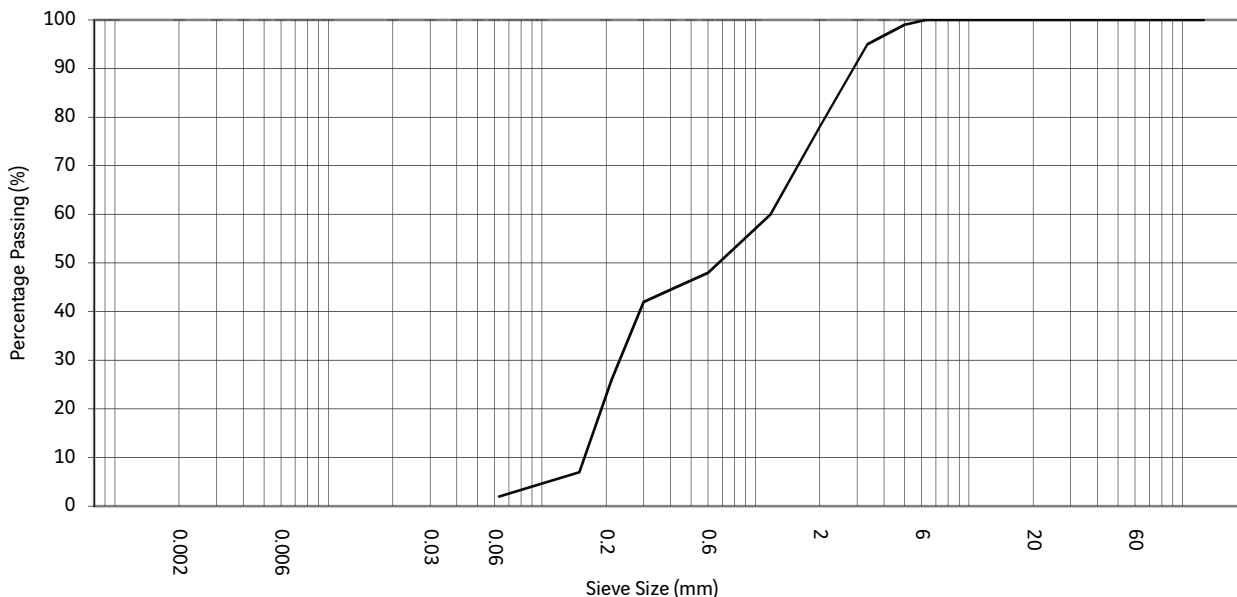
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	8	
Sand:	90	
Gravel:	3	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
100.0	100	3.35	99
75.0	100	2.00	98
63.0	100	1.18	95
50.0	100	0.600	82
37.5	100	0.425	66
28.0	100	0.300	48
20.0	100	0.212	21
		0.150	12
		0.063	8

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Sushil Sharda		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID E108
Project No.	TA7148		Sample Depth 0.00m
Engineer	Arch Henderson LLP		Sample Number 001
Employer	Aberdeen Harbour Board		Sample type B
Description			Brown gravelly SAND.
			Specimen Depth 0.00m
			Specimen No. 1



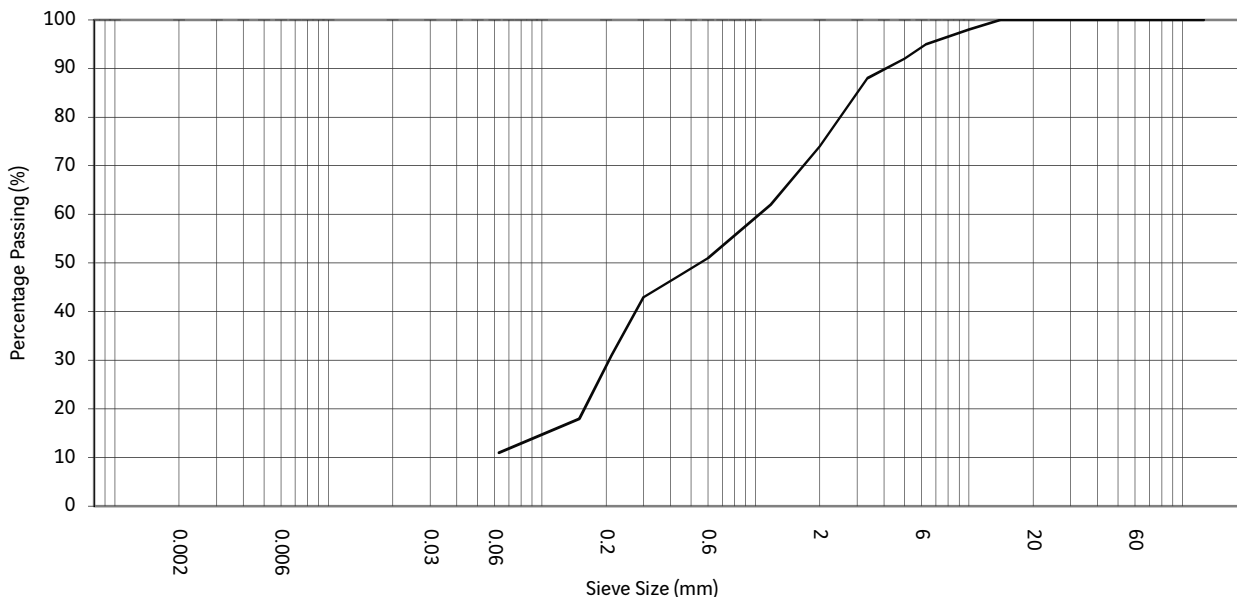
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	2	
Sand:	75	
Gravel:	22	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	99
90.0	100	3.35	95
75.0	100	2.00	78
63.0	100	1.18	60
50.0	100	0.600	48
37.5	100	0.425	45
28.0	100	0.300	42
20.0	100	0.212	26
		0.150	7
		0.063	2

Approved by:	Leeds Laboratory		 SOIL ENGINEERING <small>Part of the Bachy Soletanche Group</small>
Stuart Kirk		Print date 28/11/2013	
Revision No. 3.03		Issue Date 19/11/2012	


Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	E108	
Project No.	TA7148		Sample Depth	2.00m	
Engineer	Arch Henderson LLP		Sample Number	008	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Grey slightly clayey gravelly SAND. Gravel is fine to medium rounded	Specimen Depth	2.00m
				Specimen No.	1



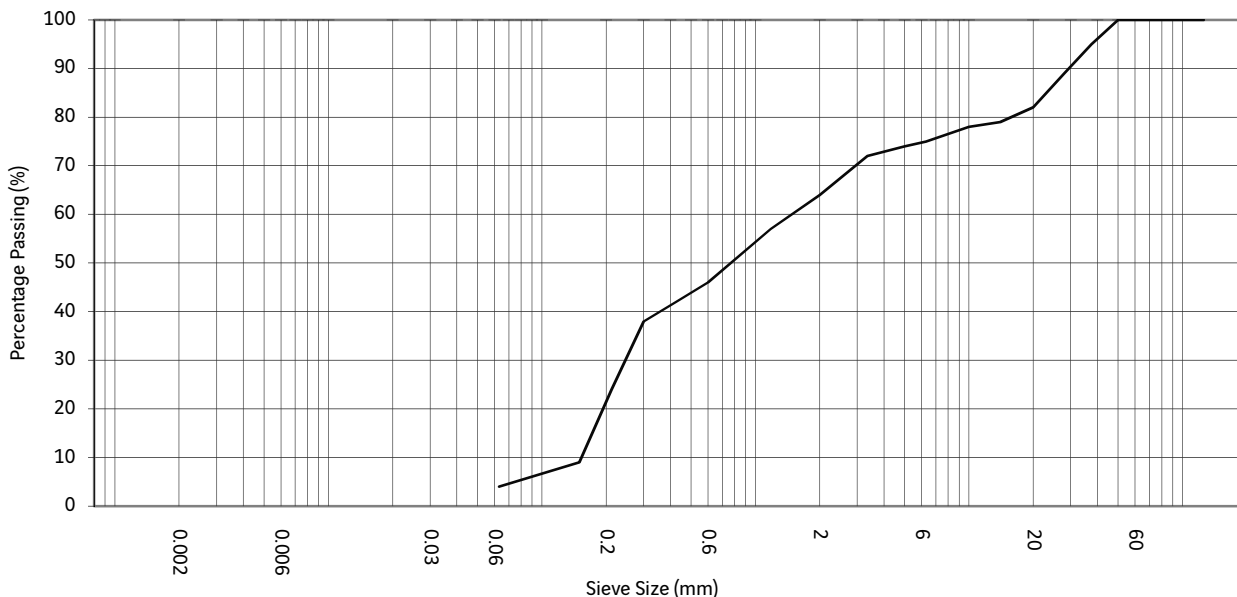
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	11	
Sand:	63	
Gravel:	26	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	98
		6.3	95
		5.0	92
125.0	100	3.35	88
90.0	100	2.00	74
75.0	100	1.18	62
63.0	100	0.600	51
50.0	100	0.425	47
37.5	100	0.300	43
28.0	100	0.212	31
20.0	100	0.150	18
		0.063	11

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk	Print date 28/11/2013	
Revision No.	3.03	Issue Date 19/11/2012

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution	Hole ID E108
		Sample Depth 3.00m
		Sample Number 011
		Sample type B
Description Greyish brown gravelly SAND. Gravel is fine to coarse well rounded.		Specimen Depth 3.00m
		Specimen No. 1




CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

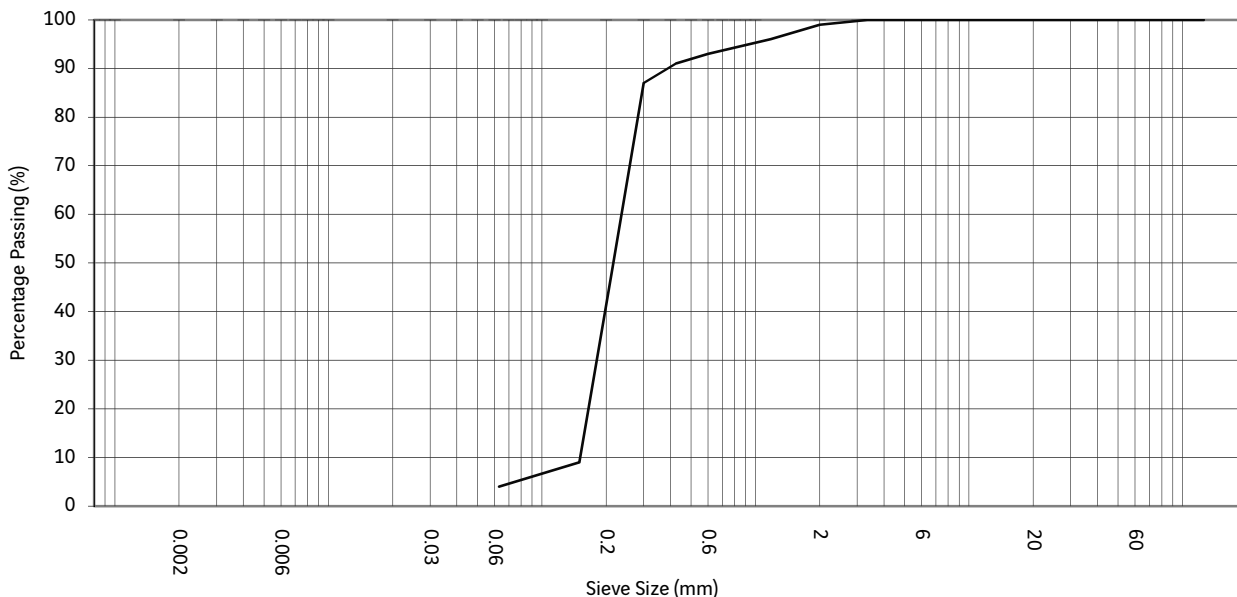
PARTICLE SIZE	%
Silt and clay:	4
Sand:	60
Gravel:	36
Cobbles:	0

General remarks
Sample size was insufficient to be representative of particle size

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	79
		10.0	78
		6.3	75
125.0	100	5.0	74
100.0	100	3.35	72
75.0	100	2.00	64
63.0	100	1.18	57
50.0	100	0.600	46
37.5	95	0.425	42
28.0	89	0.300	38
20.0	82	0.212	24
		0.150	9
		0.063	4

Approved by: Stuart Kirk	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Revision No. 3.03	Issue Date 19/11/2012		


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E109
		Sample Depth 0.00m
		Sample Number 002
		Sample type B
Description Greyish brown SAND		Specimen Depth 0.00m
		Specimen No. 1



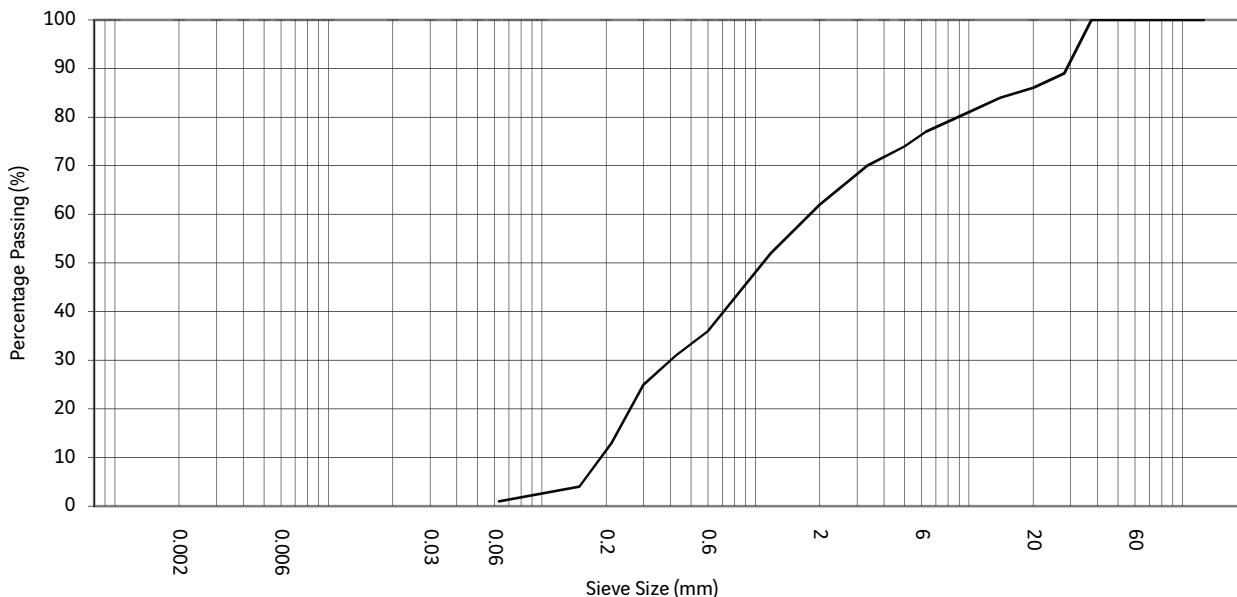
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	4	
Sand:	95	
Gravel:	1	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
90.0	100	3.35	100
75.0	100	2.00	99
63.0	100	1.18	96
50.0	100	0.600	93
37.5	100	0.425	91
28.0	100	0.300	87
20.0	100	0.212	48
		0.150	9
		0.063	4

Approved by: Stuart Kirk	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Revision No. 3.03	Issue Date 19/11/2012		


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E109
		Sample Depth 2.50m
		Sample Number 010
		Sample type B
Description Brwon gravelly SAND. Gravel is fine to coarse rounded		Specimen Depth 2.50m
		Specimen No. 1



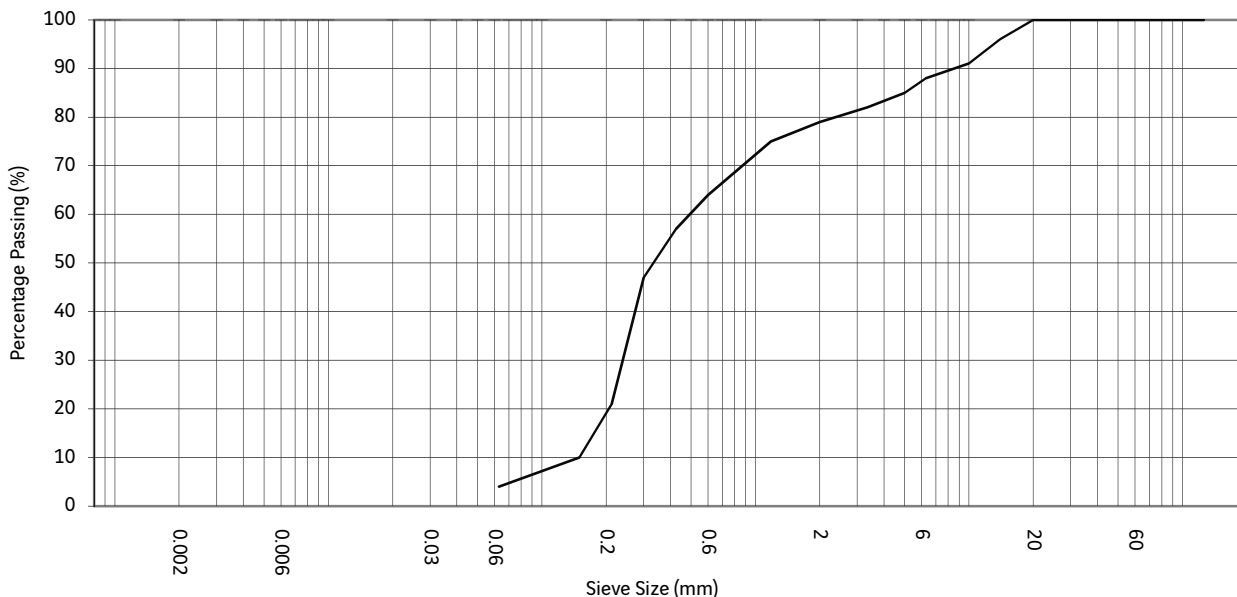
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	1	
Sand:	61	
Gravel:	38	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	84
		10.0	81
		6.3	77
125.0	100	5.0	74
90.0	100	3.35	70
75.0	100	2.00	62
63.0	100	1.18	52
50.0	100	0.600	36
37.5	100	0.425	31
28.0	89	0.300	25
20.0	86	0.212	13
		0.150	4
		0.063	1

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E109
		Sample Depth 5.00m
		Sample Number 019
		Sample type B
Description Brown gravelly SAND. Gravel is fine to medium rounded	Specimen Depth 5.00m	Specimen No. 1




CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

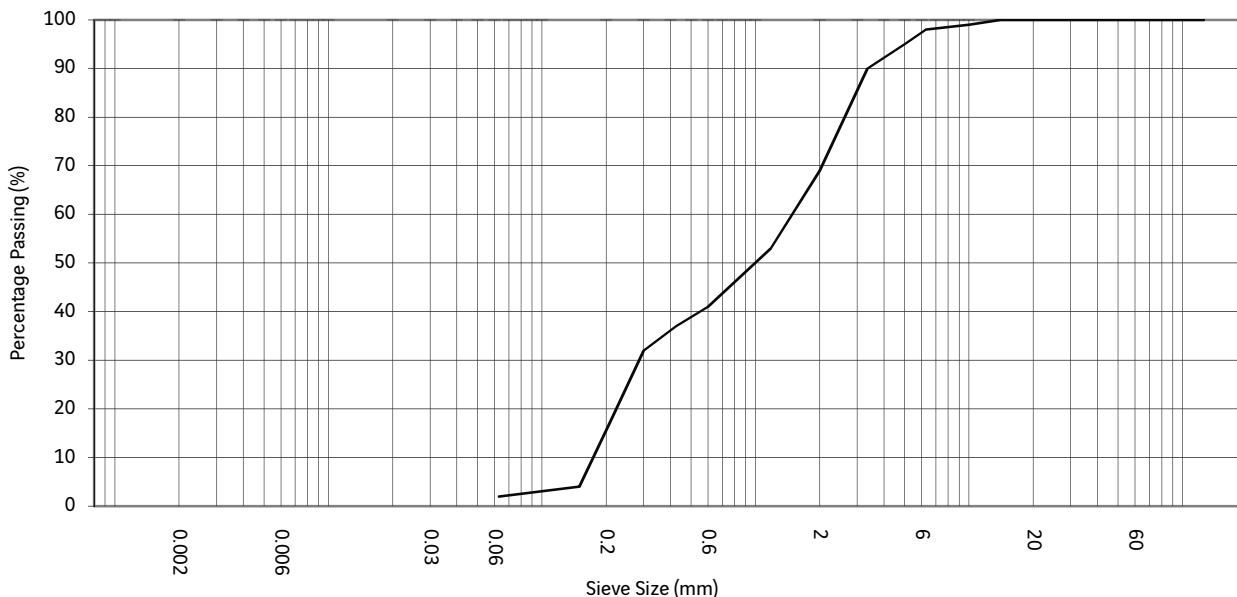
PARTICLE SIZE	%
Silt and clay:	4
Sand:	75
Gravel:	21
Cobbles:	0

General remarks

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	96
		10.0	91
		6.3	88
125.0	100	5.0	85
90.0	100	3.35	82
75.0	100	2.00	79
63.0	100	1.18	75
50.0	100	0.600	64
37.5	100	0.425	57
28.0	100	0.300	47
20.0	100	0.212	21
		0.150	10
		0.063	4

Approved by:	Leeds Laboratory	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk	Print date 28/11/2013	
Revision No.	3.03	Issue Date 19/11/2012

Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E110
		Sample Depth 1.50m
		Sample Number 005
		Sample type B
Description Brown slightly gravelly SAND with shell fragments		Specimen Depth 1.50m
		Specimen No. 1



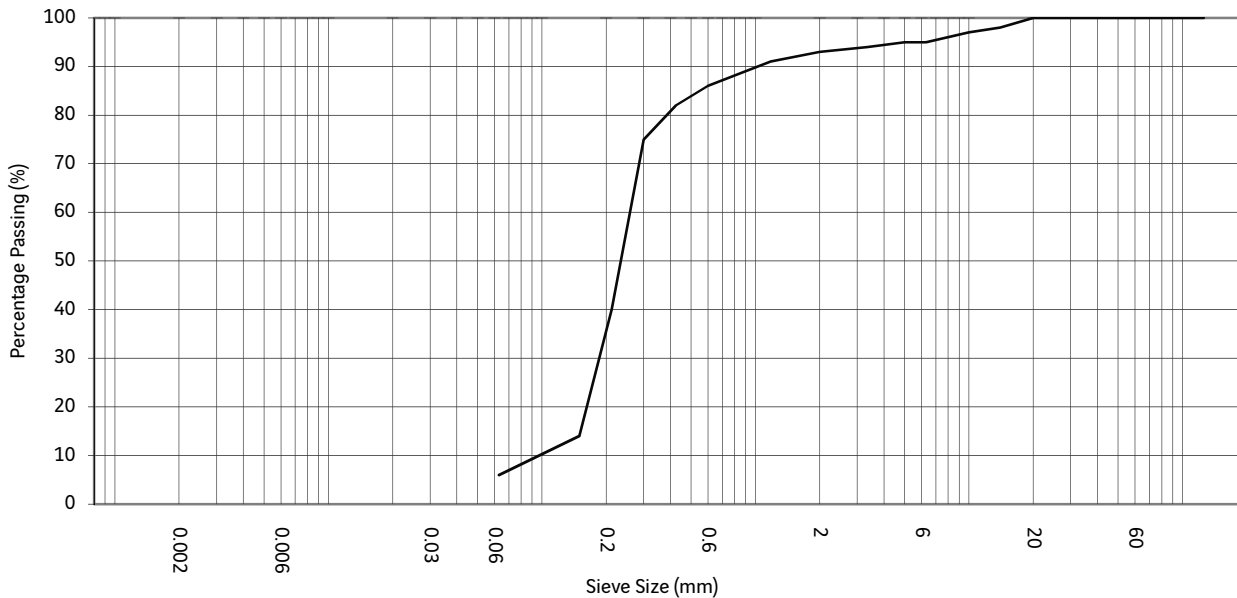
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	2	
Sand:	67	
Gravel:	31	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	99
		6.3	98
125.0	100	5.0	95
100.0	100	3.35	90
75.0	100	2.00	69
63.0	100	1.18	53
50.0	100	0.600	41
37.5	100	0.425	37
28.0	100	0.300	32
20.0	100	0.212	18
		0.150	4
		0.063	2

Approved by: Stuart Kirk	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Revision No. 3.03	Issue Date 19/11/2012		


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E111
		Sample Depth 0.50m
		Sample Number 003
		Sample type B
Description Brown slightly gravelly SAND. Gravel is fine to medium subangular.		Specimen Depth 0.50m
		Specimen No. 1



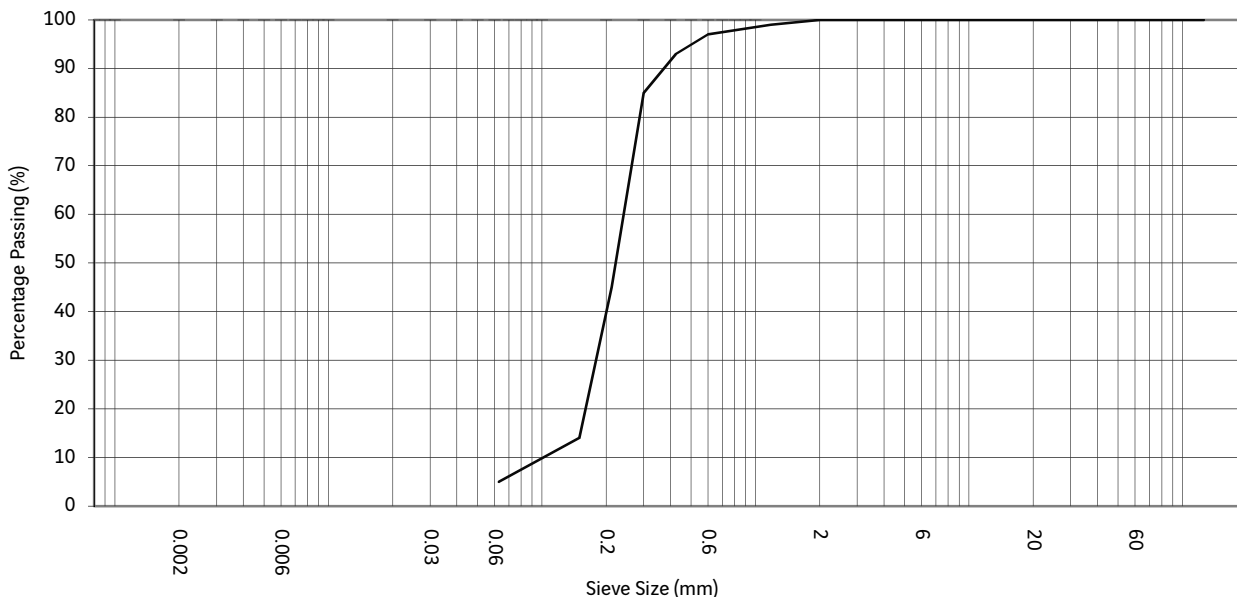
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	6	
Sand:	87	
Gravel:	7	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	98
		10.0	97
		6.3	95
125.0	100	5.0	95
100.0	100	3.35	94
75.0	100	2.00	93
63.0	100	1.18	91
50.0	100	0.600	86
37.5	100	0.425	82
28.0	100	0.300	75
20.0	100	0.212	40
		0.150	14
		0.063	6

Approved by: Stuart Kirk	Leeds Laboratory						 SOIL ENGINEERING Part of the Bachy Soletanche Group
	Revision No. 3.03	Issue Date	19/11/2012	Print date	28/11/2013		


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E111
		Sample Depth 2.50m
		Sample Number 009
		Sample type B
Description Brown SAND		Specimen Depth 2.50m
		Specimen No. 1



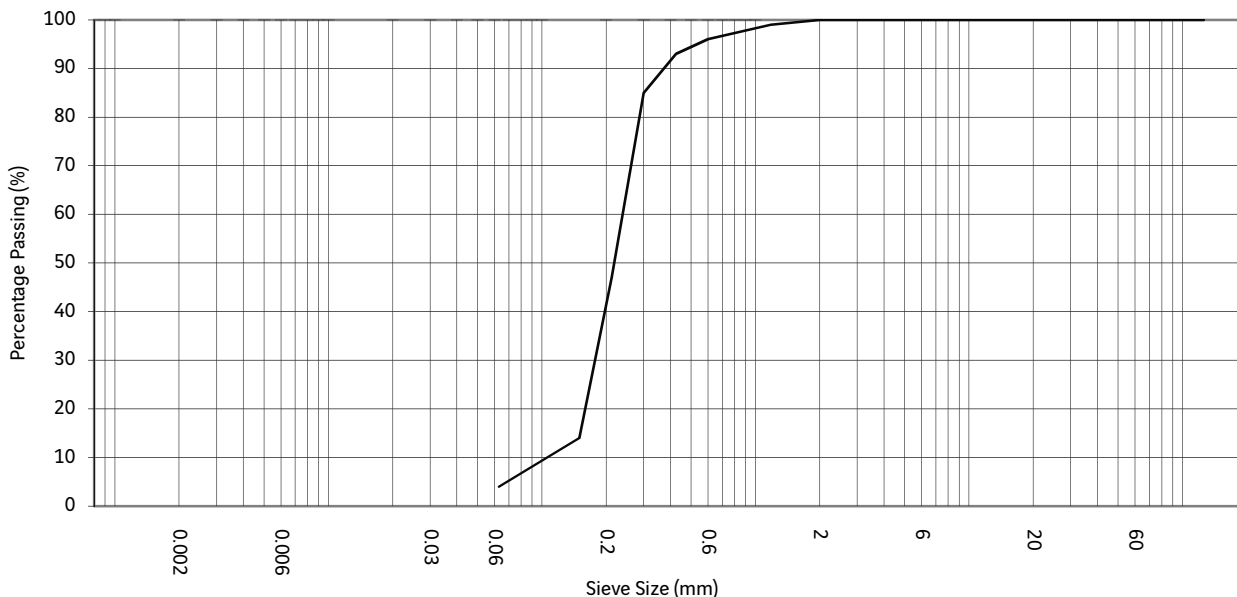
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	5	
Sand:	94	
Gravel:	0	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
		5.0	100
125.0	100	3.35	100
100.0	100	2.00	100
75.0	100	1.18	99
63.0	100	0.600	97
50.0	100	0.425	93
37.5	100	0.300	85
28.0	100	0.212	45
20.0	100	0.150	14
		0.063	5

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E112
		Sample Depth 2.00m
		Sample Number 006
		Sample type B
Description Brown SAND		Specimen Depth 2.00m Specimen No. 1



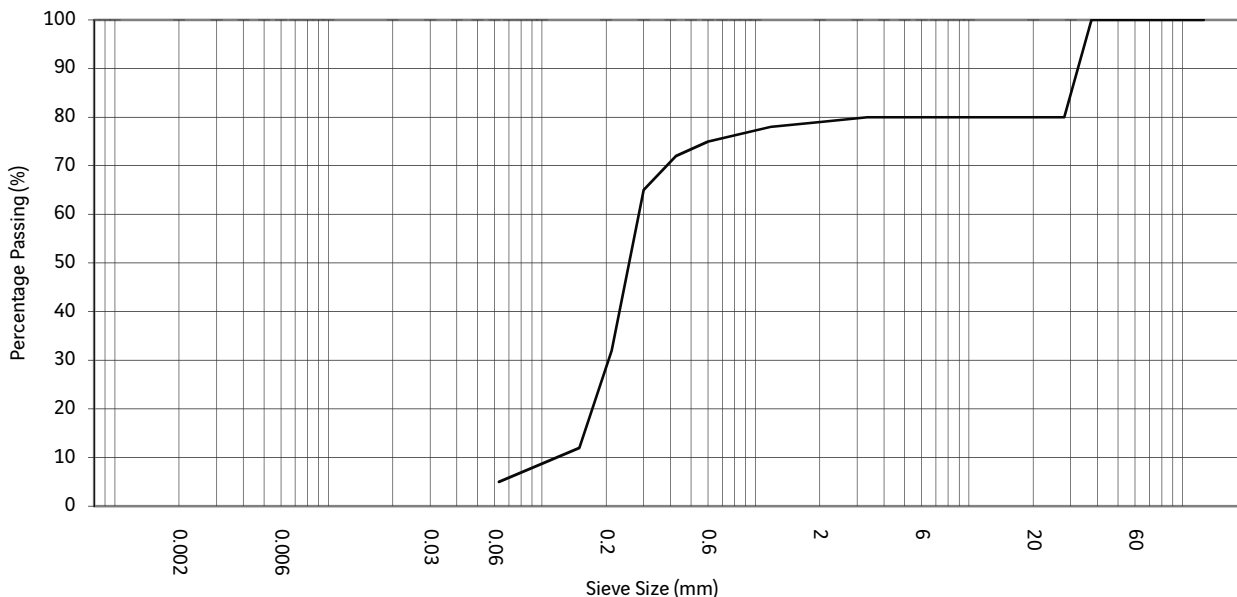
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE % Silt and clay: 4 Sand: 96 Gravel: 0 Cobbles: 0	General remarks
---	-----------------

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	100
		10.0	100
		6.3	100
125.0	100	5.0	100
90.0	100	3.35	100
75.0	100	2.00	100
63.0	100	1.18	99
50.0	100	0.600	96
37.5	100	0.425	93
28.0	100	0.300	85
20.0	100	0.212	47
		0.150	14
		0.063	4

Approved by: Stuart Kirk	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Revision No. 3.03	Issue Date 19/11/2012		


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E115
		Sample Depth 0.50m
		Sample Number 003
		Sample type B
Description Brown slightly gravelly SAND. Gravel is fine to coarse angular. (Diesel odour)		Specimen Depth 0.50m
		Specimen No. 1



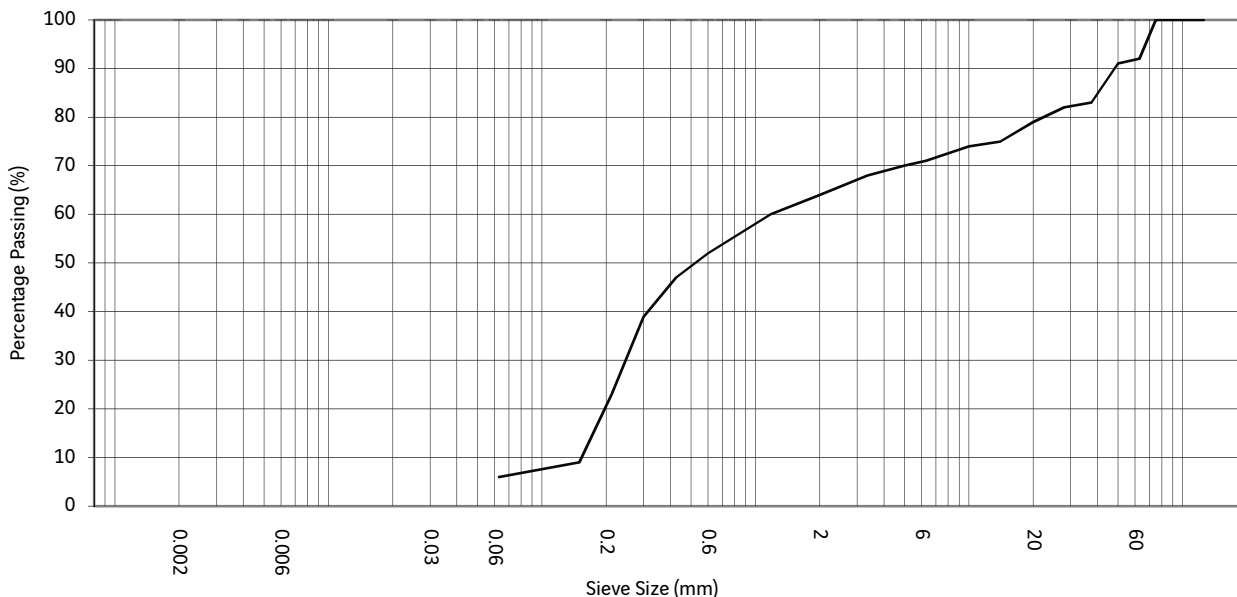
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	5	
Sand:	74	
Gravel:	21	
Cobbles:	0	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	80
		10.0	80
		6.3	80
		5.0	80
125.0	100	3.35	80
100.0	100	2.00	79
75.0	100	1.18	78
63.0	100	0.600	75
50.0	100	0.425	72
37.5	100	0.300	65
28.0	80	0.212	32
20.0	80	0.150	12
		0.063	5

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		Print date 28/11/2013	
Revision No. 3.03	Issue Date 19/11/2012		


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID E116
		Sample Depth 0.50m
		Sample Number 002
		Sample type B
Description Brown gravelly SAND. Gravel is fine to coarse angular.	Specimen Depth 0.50m	Specimen No. 1



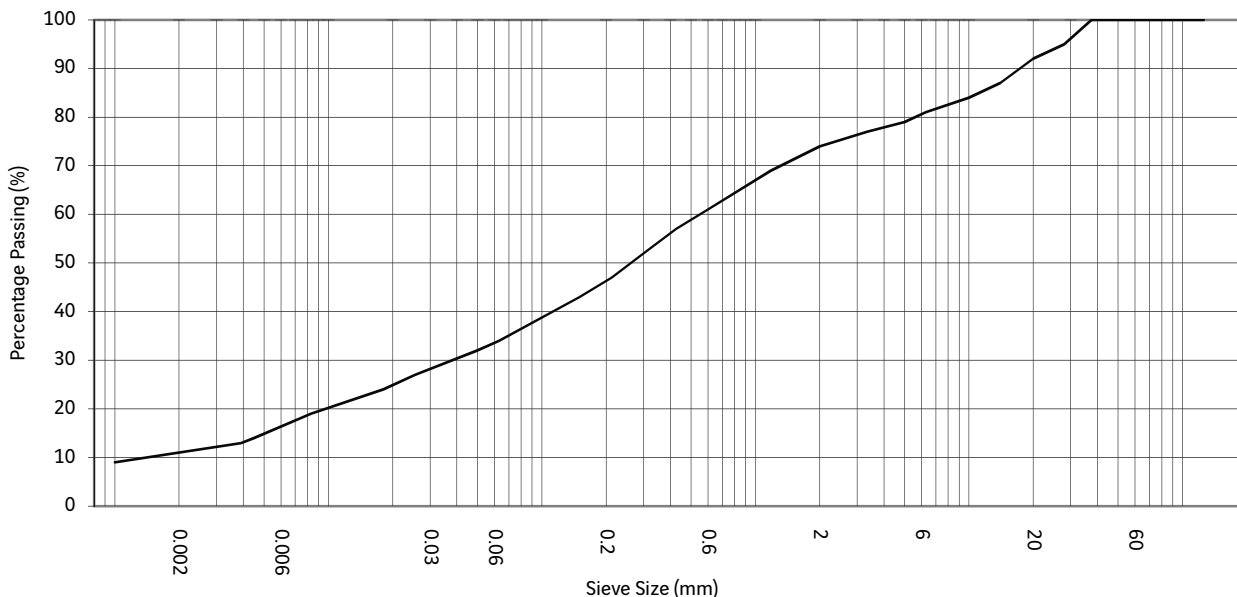
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	7	
Sand:	58	
Gravel:	27	
Cobbles:	8	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	75
		10.0	74
		6.3	71
		5.0	70
125.0	100	3.35	68
100.0	100	2.00	64
75.0	100	1.18	60
63.0	92	0.600	52
50.0	91	0.425	47
37.5	83	0.300	39
28.0	82	0.212	23
20.0	79	0.150	9
		0.063	6

Approved by: Sushil Sharda	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
Revision No. 3.03	Issue Date 19/11/2012		

Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	GS11
Project No.	TA7148		Sample Depth	6.80m
Engineer	Arch Henderson LLP		Sample Number	
Employer	Aberdeen Harbour Board		Sample type	C
Description		BS 1377: Part 2: 1990: 9.2, 9.5	Specimen Depth	6.80m
			Specimen No.	2



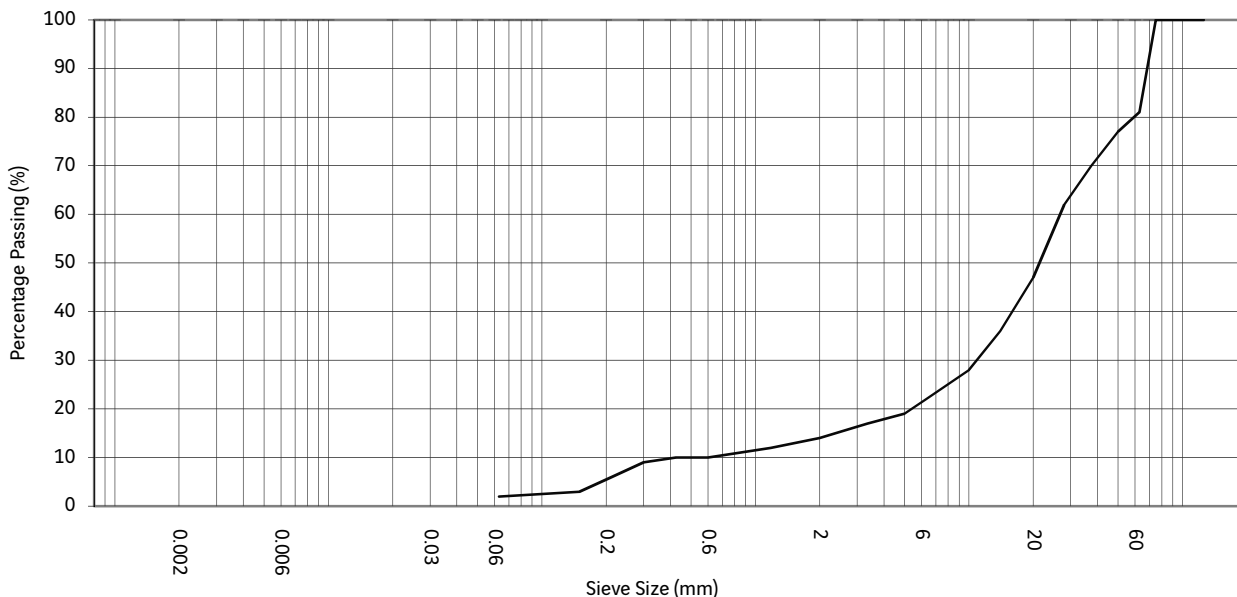
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Clay:	10	
Silt:	23	
Sand:	40	
Gravel:	27	
Cobbles:	0	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	87		
		10.0	84	0.0497	32
		6.3	81	0.0254	27
125.0	100	5.0	79	0.0181	24
100.0	100	3.35	77	0.0083	19
75.0	100	2.00	74	0.0045	14
63.0	100	1.18	69	0.0039	13
50.0	100	0.600	61	0.0010	9
37.5	100	0.425	57		
28.0	95	0.300	52		
20.0	92	0.212	47		
		0.150	43		
		0.063	34		

Approved by:	Leeds Laboratory	Print date 28/11/2013	
Stuart Kirk			
Revision No.	3.03	Issue Date	19/11/2012
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID TP01
		Sample Depth 0.10m
		Sample Number 001
		Sample type B
Description Brown sandy GRAVEL with cobbles. Gravel is fine to coarse rounded and subangular.		Specimen Depth 0.10m
		Specimen No. 1



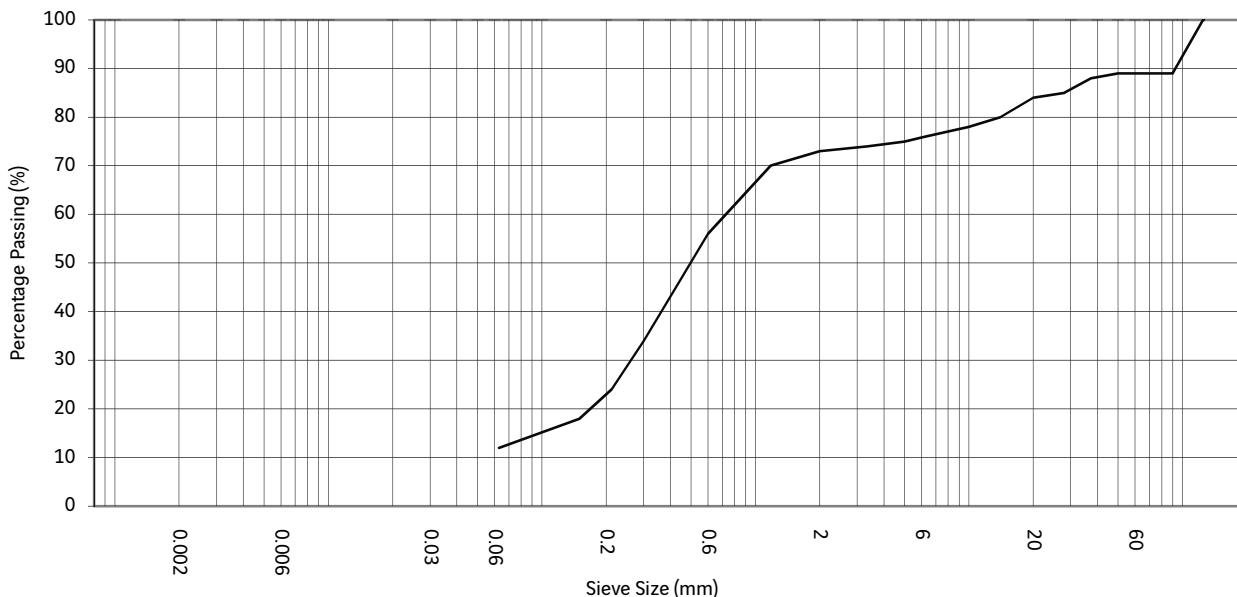
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	2	
Sand:	11	
Gravel:	67	
Cobbles:	20	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	36
		10.0	28
		6.3	22
		5.0	19
125.0	100	3.35	17
90.0	100	2.00	14
75.0	100	1.18	12
63.0	81	0.600	10
50.0	77	0.425	10
37.5	70	0.300	9
28.0	62	0.212	6
20.0	47	0.150	3
		0.063	2

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Stuart Kirk		Print date 28/11/2013	
Revision No.	3.03	Issue Date	19/11/2012


Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID TP03
		Sample Depth 0.00m
		Sample Number 001
		Sample type B
Description Brown gravelly SAND. Gravel is fine to coarse with cobbles.		Specimen Depth 0.00m
		Specimen No. 1



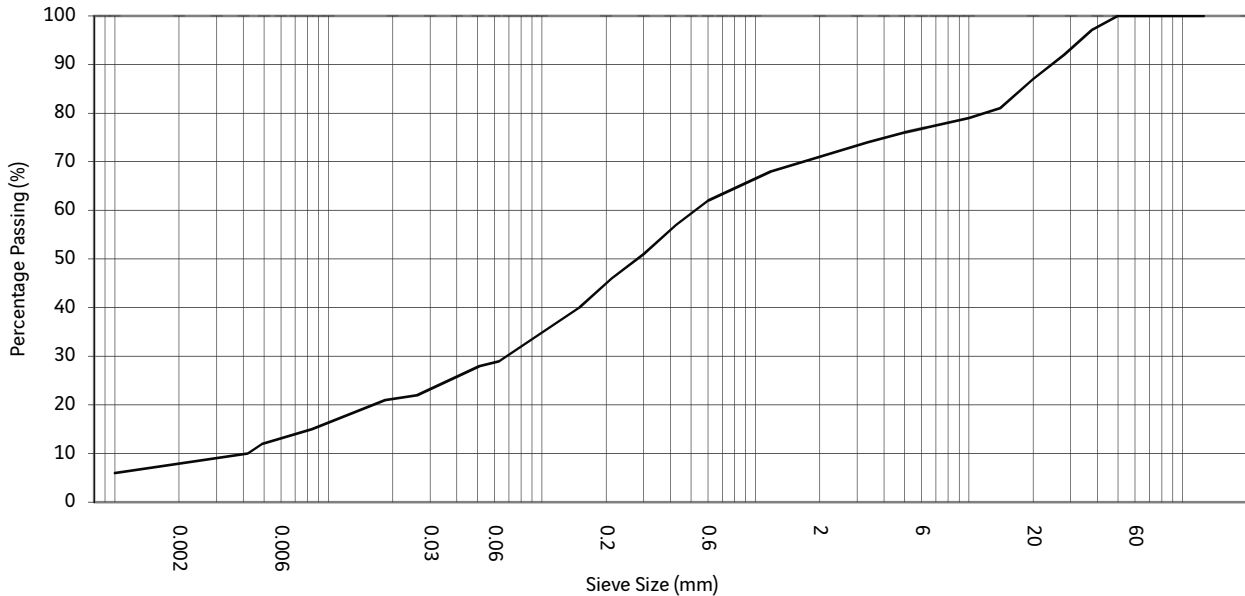
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	12	
Sand:	61	
Gravel:	16	
Cobbles:	11	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	80
		10.0	78
		6.3	76
125.0	100	5.0	75
90.0	89	3.35	74
75.0	89	2.00	73
63.0	89	1.18	70
50.0	89	0.600	56
37.5	88	0.425	45
28.0	85	0.300	34
20.0	84	0.212	24
		0.150	18
		0.063	12

Approved by:	Leeds Laboratory		 SOIL ENGINEERING Part of the Bachy Soletanche Group
Sushil Sharda		Print date 28/11/2013	
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	TP04	
Project No.	TA7148		Sample Depth	2.00m	
Engineer	Arch Henderson LLP		Sample Number	005	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Orangish brown slightly gravelly sandy CLAY. Gravel is fine to coarse.	Specimen Depth	2.00m
				Specimen No.	1



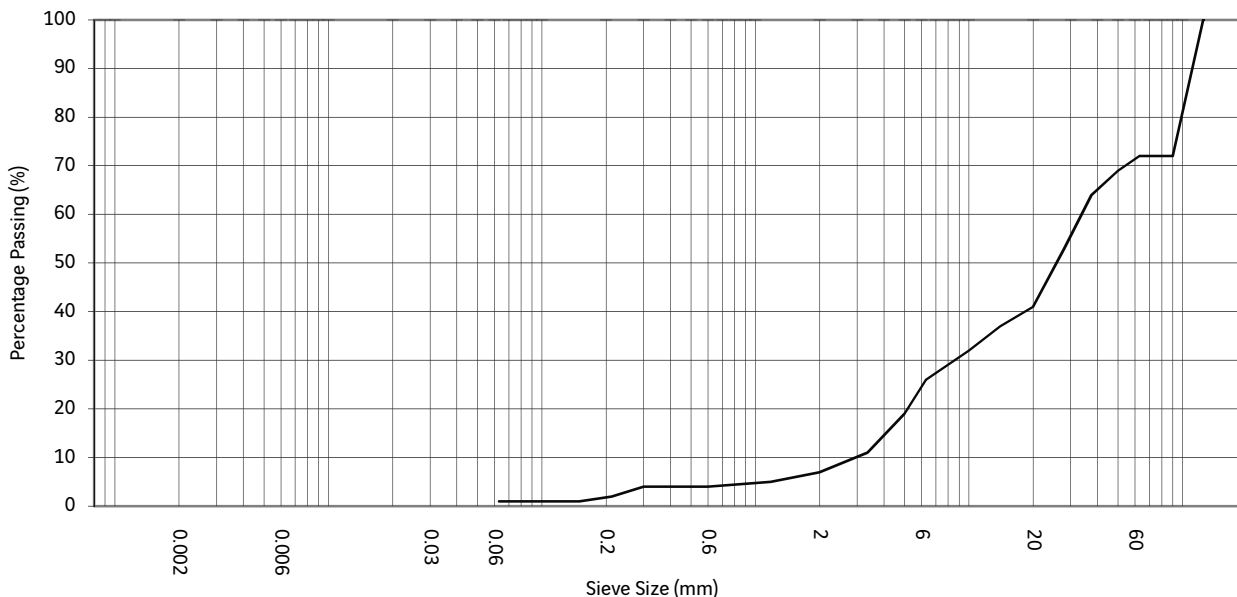
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE		%	General remarks
Clay:		7	
Silt:		21	
Sand:		43	
Gravel:		29	
Cobbles:		0	
Particle density:		2.65Mg/m ³	Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	81		
		10.0	79	0.0510	28
		6.3	77	0.0260	22
125.0	100	5.0	76	0.0185	21
90.0	100	3.35	74	0.0084	15
75.0	100	2.00	71	0.0049	12
63.0	100	1.18	68	0.0042	10
50.0	100	0.600	62	0.0010	6
37.5	97	0.425	57		
28.0	92	0.300	51		
20.0	87	0.212	46		
		0.150	40		
		0.063	29		

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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID TP05
		Sample Depth 0.50m
		Sample Number 003
		Sample type B
Description Brown slightly sandy GRAVEL with occasional cobbles.		Specimen Depth 0.50m
		Specimen No. 2



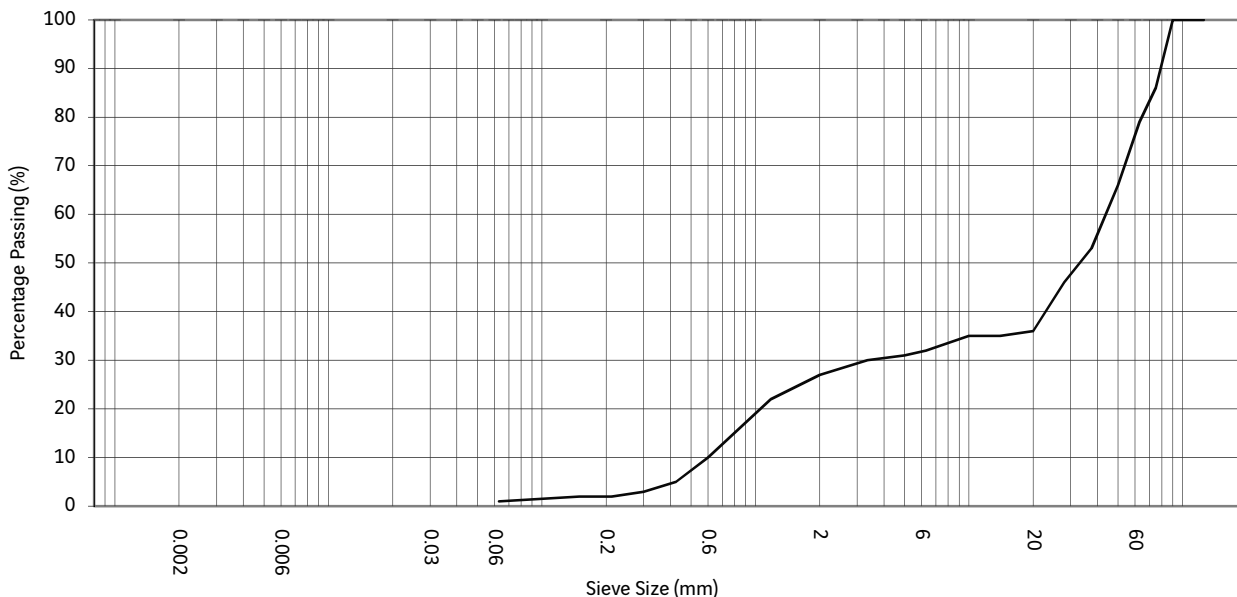
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks #N/A
Silt and clay:	0	
Sand:	6	
Gravel:	65	
Cobbles:	29	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	37
		10.0	32
		6.3	26
125.0	100	5.0	19
90.0	72	3.35	11
75.0	72	2.00	7
63.0	72	1.18	5
50.0	69	0.600	4
37.5	64	0.425	4
28.0	53	0.300	4
20.0	41	0.212	2
		0.150	1
		0.063	1

Approved by: Sushil Sharda	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID TP06
		Sample Depth 2.50m
		Sample Number 006
		Sample type B
Description Brown sandy fine to coarse GRAVEL with occasional cobbles.		Specimen Depth 2.50m
		Specimen No. 1



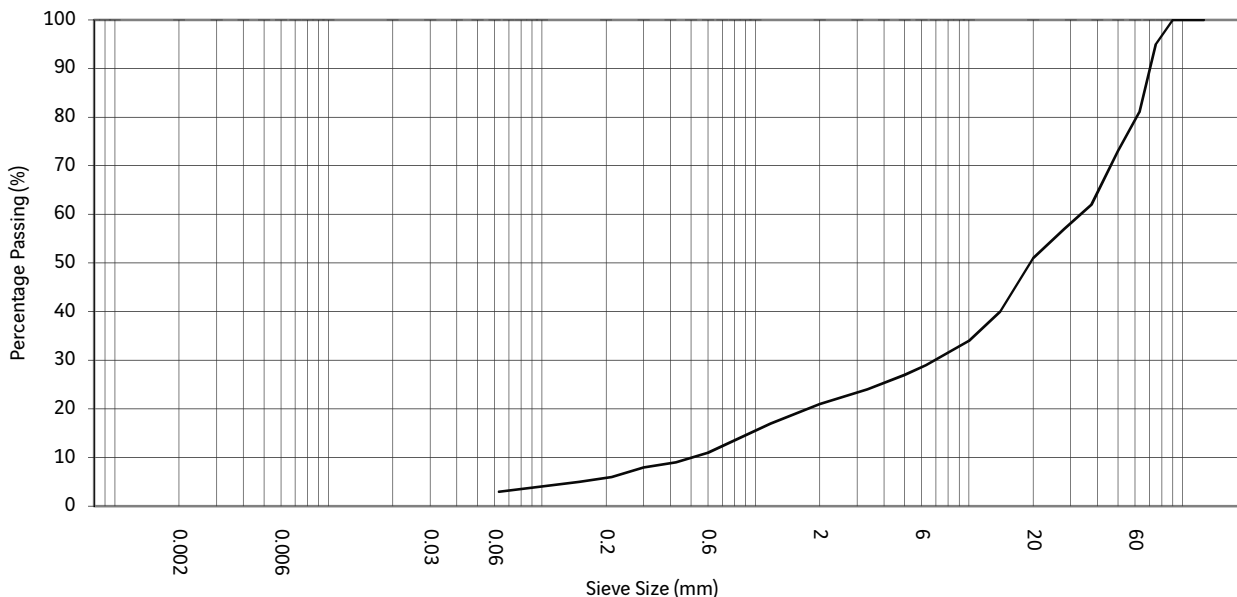
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE % Silt and clay: 1 Sand: 26 Gravel: 49 Cobbles: 24	General remarks Sample size was insufficient to be representative of particle size
---	--

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	35
		10.0	35
		6.3	32
		5.0	31
125.0	100	3.35	30
90.0	100	2.00	27
75.0	86	1.18	22
63.0	79	0.600	10
50.0	66	0.425	5
37.5	53	0.300	3
28.0	46	0.212	2
20.0	36	0.150	2
		0.063	1

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	TP08
Project No.	TA7148		Sample Depth	1.50m
Engineer	Arch Henderson LLP		Sample Number	003
Employer	Aberdeen Harbour Board		Sample type	B
Description		Dark brown sandy fine to coarse well rounded to rounded GRAVEL with cobbles	Specimen Depth	1.50m
			Specimen No.	1



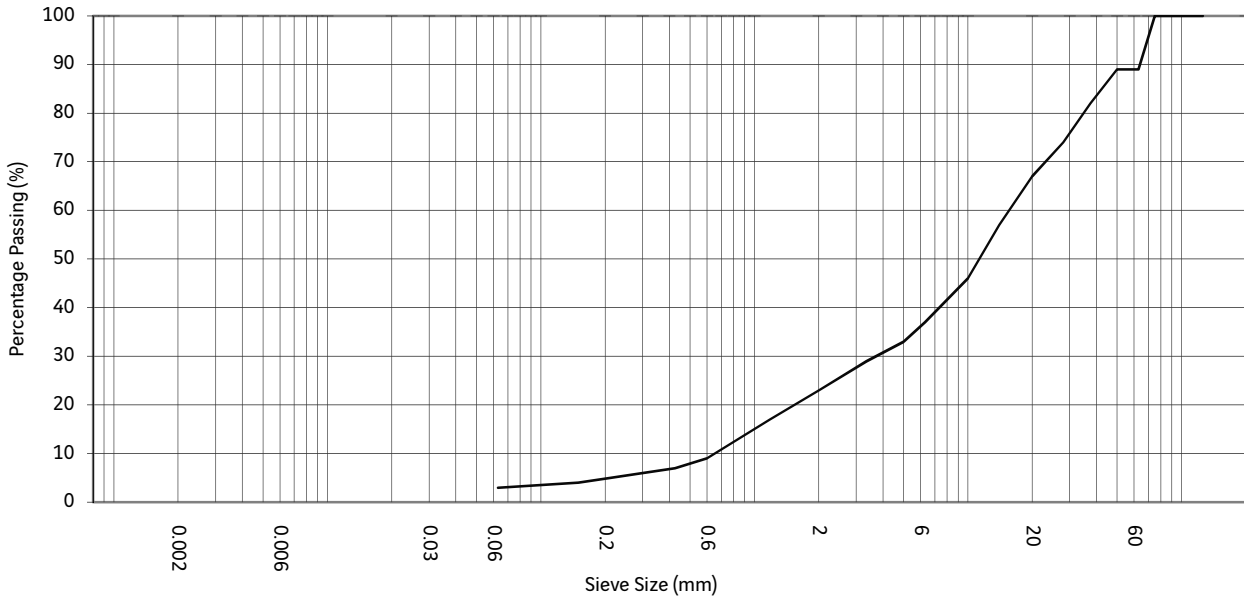
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	3	
Sand:	18	
Gravel:	58	
Cobbles:	21	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	40
		10.0	34
		6.3	29
125.0	100	5.0	27
90.0	100	3.35	24
75.0	95	2.00	21
63.0	81	1.18	17
50.0	73	0.600	11
37.5	62	0.425	9
28.0	57	0.300	8
20.0	51	0.212	6
		0.150	5
		0.063	3

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	TP09
Project No.	TA7148		Sample Depth	0.60m
Engineer	Arch Henderson LLP		Sample Number	003
Employer	Aberdeen Harbour Board		Sample type	B
Description		BS 1377: Part 2: 1990: 9.2	Specimen Depth	0.60m
			Specimen No.	1



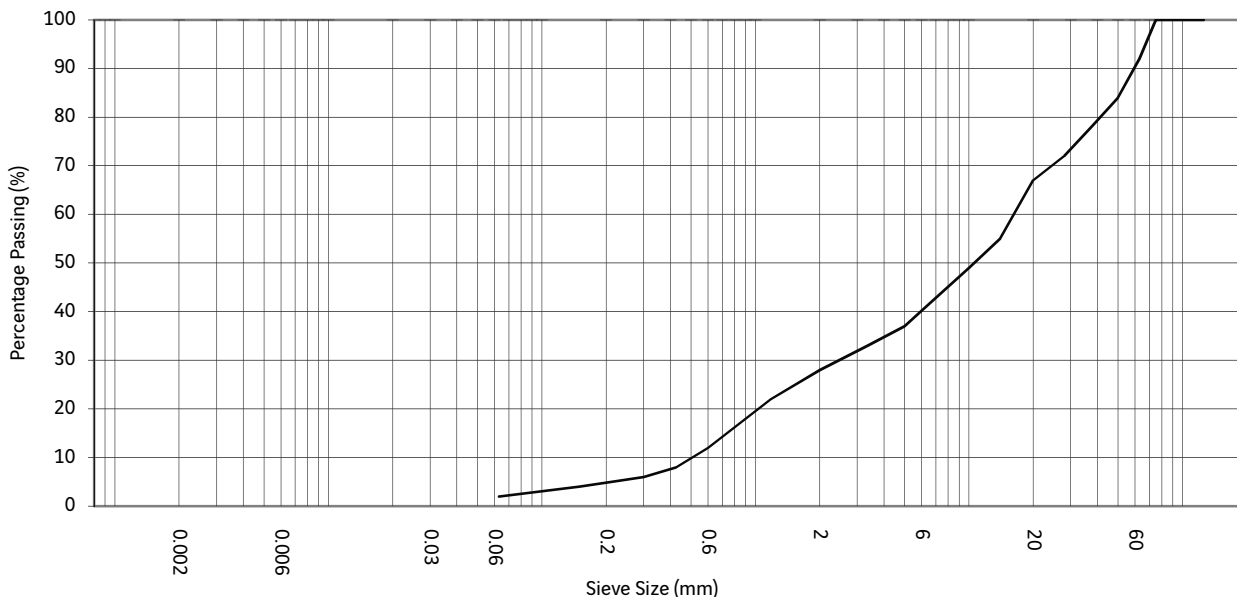
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	3	
Sand:	21	
Gravel:	66	
Cobbles:	11	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	57
		10.0	46
		6.3	37
125.0	100	5.0	33
90.0	100	3.35	29
75.0	100	2.00	23
63.0	89	1.18	17
50.0	89	0.600	9
37.5	82	0.425	7
28.0	74	0.300	6
20.0	67	0.212	5
		0.150	4
		0.063	3

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Stuart Kirk		Print date 28/11/2013	
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID TP10
		Sample Depth 0.50m
		Sample Number 001
		Sample type B
Description Brown slightly sandy GRAVEL. Gravel is medium to coarse subangular with cobbles.		Specimen Depth 0.50m
		Specimen No. 1



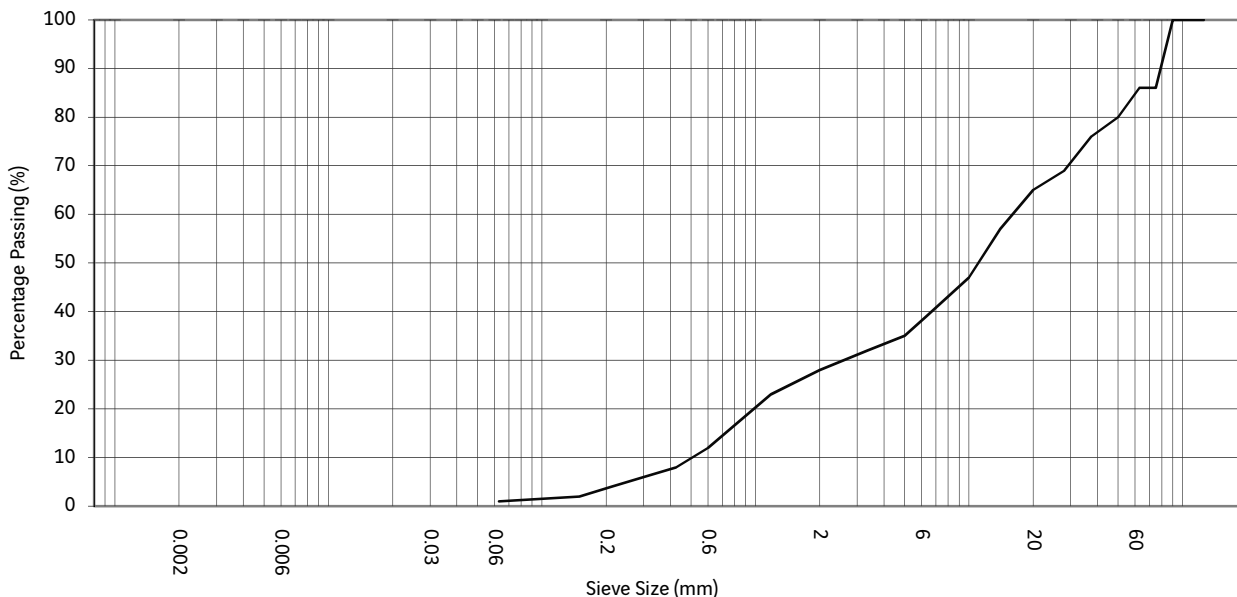
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	2	
Sand:	26	
Gravel:	62	
Cobbles:	10	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	55
		10.0	49
		6.3	41
		5.0	37
125.0	100	3.35	33
90.0	100	2.00	28
75.0	100	1.18	22
63.0	92	0.600	12
50.0	84	0.425	8
37.5	78	0.300	6
28.0	72	0.212	5
20.0	67	0.150	4
		0.063	2

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	TP11	
Project No.	TA7148		Sample Depth	1.50m	
Engineer	Arch Henderson LLP		Sample Number	003	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Brown sandy GRAVEL with cobbles.	Specimen Depth	1.50m
				Specimen No.	1



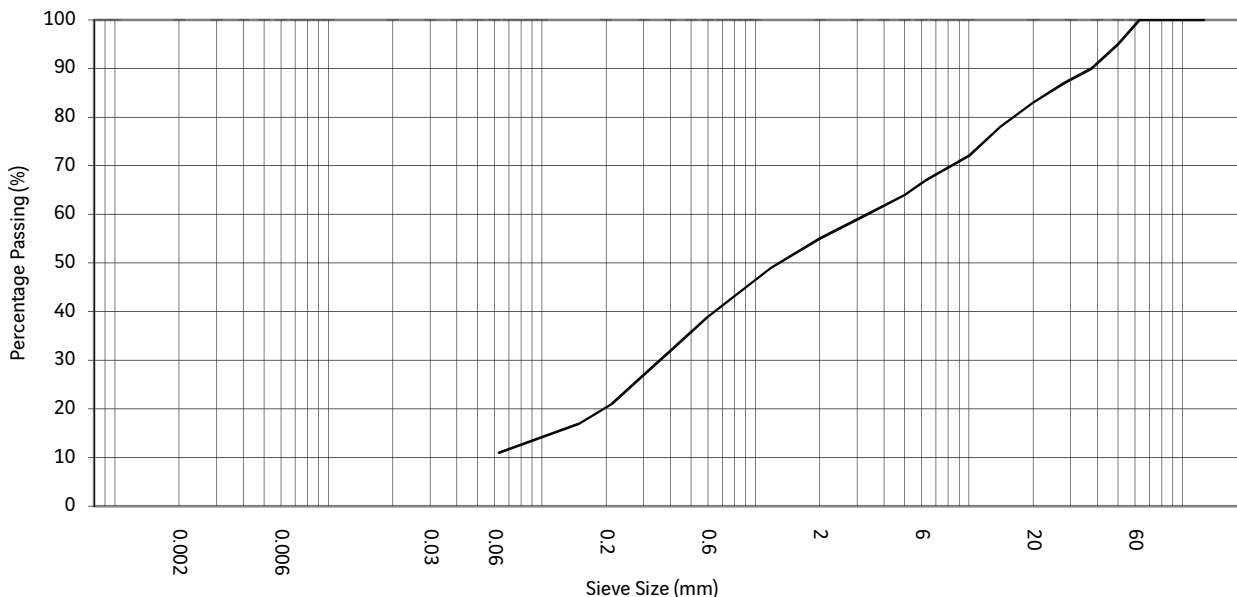
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	1	Sample size was insufficient to be representative of particle size
Sand:	27	
Gravel:	57	
Cobbles:	15	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	57
		10.0	47
		6.3	39
125.0	100	5.0	35
90.0	100	3.35	32
75.0	86	2.00	28
63.0	86	1.18	23
50.0	80	0.600	12
37.5	76	0.425	8
28.0	69	0.300	6
20.0	65	0.212	4
		0.150	2
		0.063	1

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Sushil Sharda	Print date 28/11/2013	
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID TP12
		Sample Depth 1.50m
		Sample Number 004
		Sample type B
Description MADE GROUND: Dark brown slightly clayey sand and gravel with some concrete and tarmac fragments. Gravel is angular.	Specimen Depth 1.50m	
	Specimen No. 1	



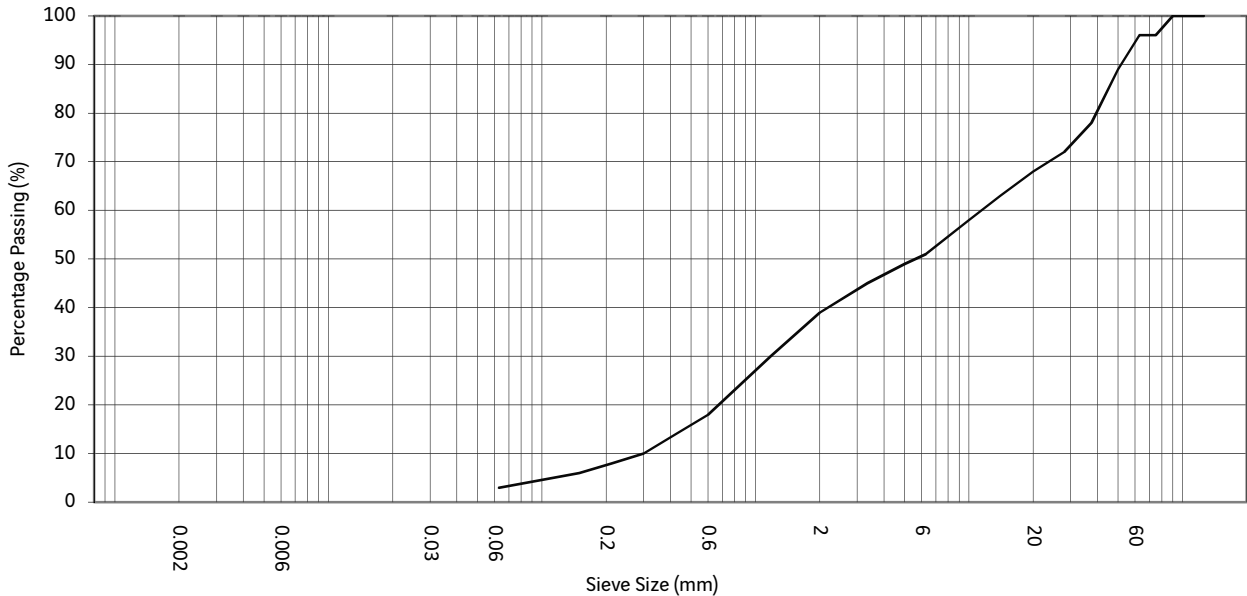
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	11	
Sand:	44	
Gravel:	44	
Cobbles:	1	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	78
		10.0	72
		6.3	67
125.0	100	5.0	64
90.0	100	3.35	60
75.0	100	2.00	55
63.0	100	1.18	49
50.0	95	0.600	39
37.5	90	0.425	33
28.0	87	0.300	27
20.0	83	0.212	21
		0.150	17
		0.063	11

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Stuart Kirk		Print date 28/11/2013	
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID TP13
		Sample Depth 1.50m
		Sample Number 003
		Sample type B
Description Brown sandy GRAVEL with occasional cobbles. Gravel is fine to coarse subangular to angular.	Specimen Depth 1.50m	
	Specimen No. 1	



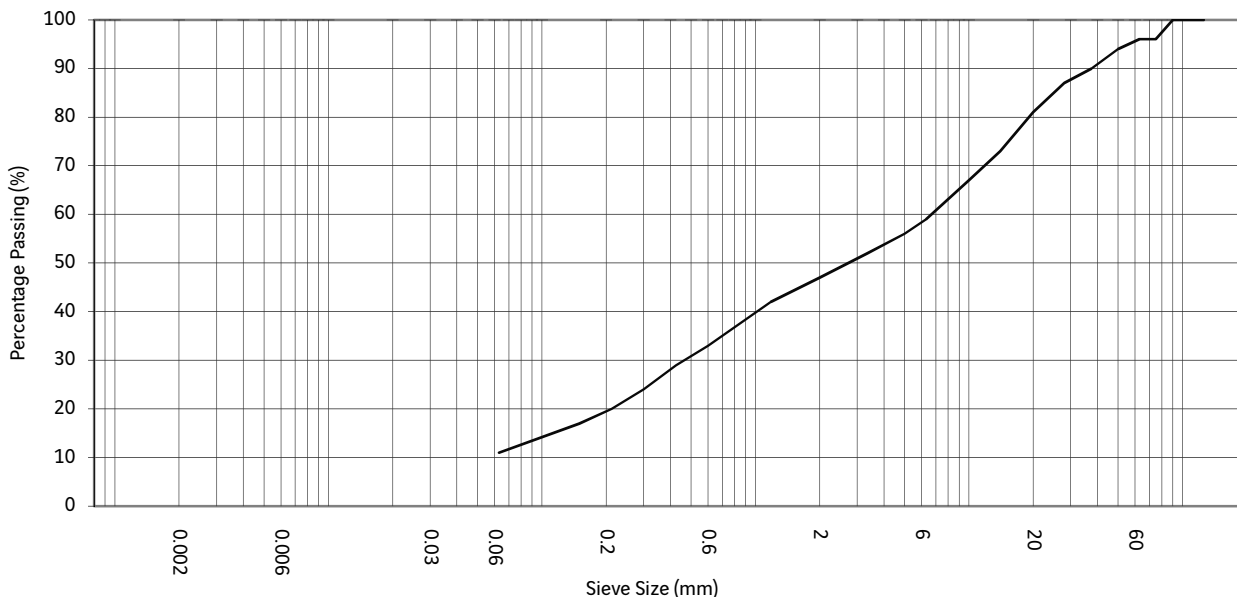
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	3	
Sand:	36	
Gravel:	56	
Cobbles:	6	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	63
		10.0	58
		6.3	51
125.0	100	5.0	49
90.0	100	3.35	45
75.0	96	2.00	39
63.0	96	1.18	30
50.0	89	0.600	18
37.5	78	0.425	14
28.0	72	0.300	10
20.0	68	0.212	8
		0.150	6
		0.063	3

Approved by:	Leeds Laboratory	Print date 28/11/2013	 SOIL ENGINEERING Part of the Bachy Soletanche Group
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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2	Hole ID TP14
		Sample Depth 0.50m
		Sample Number 002
		Sample type B
Description MADE GROUND : Brown gravelly sand with occasional cobbles, concrete and tar fragments.	Specimen Depth 0.50m	
	Specimen No. 1	



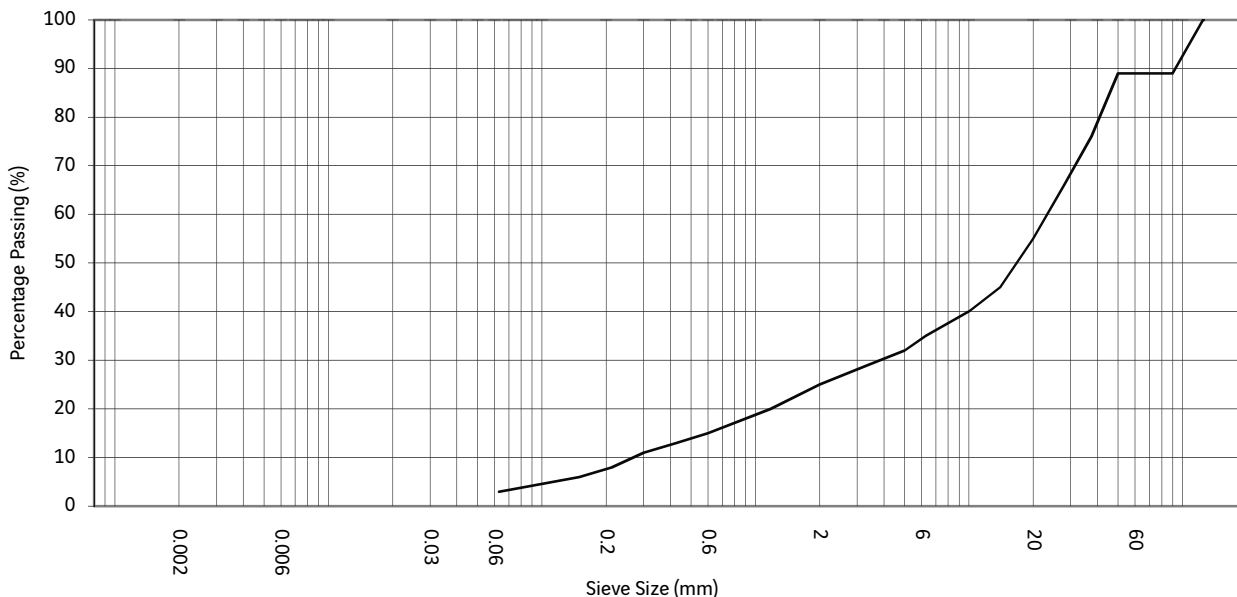
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks
Silt and clay:	11	
Sand:	37	
Gravel:	48	
Cobbles:	4	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	73
		10.0	67
		6.3	59
		5.0	56
125.0	100	3.35	52
90.0	100	2.00	47
75.0	96	1.18	42
63.0	96	0.600	33
50.0	94	0.425	29
37.5	90	0.300	24
28.0	87	0.212	20
20.0	81	0.150	17
		0.063	11

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Sushil Sharda		Print date 28/11/2013	
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	TP15	
Project No.	TA7148		Sample Depth	1.80m	
Engineer	Arch Henderson LLP		Sample Number	003	
Employer	Aberdeen Harbour Board		Sample type	B	
Description			Brown sandy fine to coarse subrounded GRAVEL with some cobbles	Specimen Depth	1.80m
				Specimen No.	1



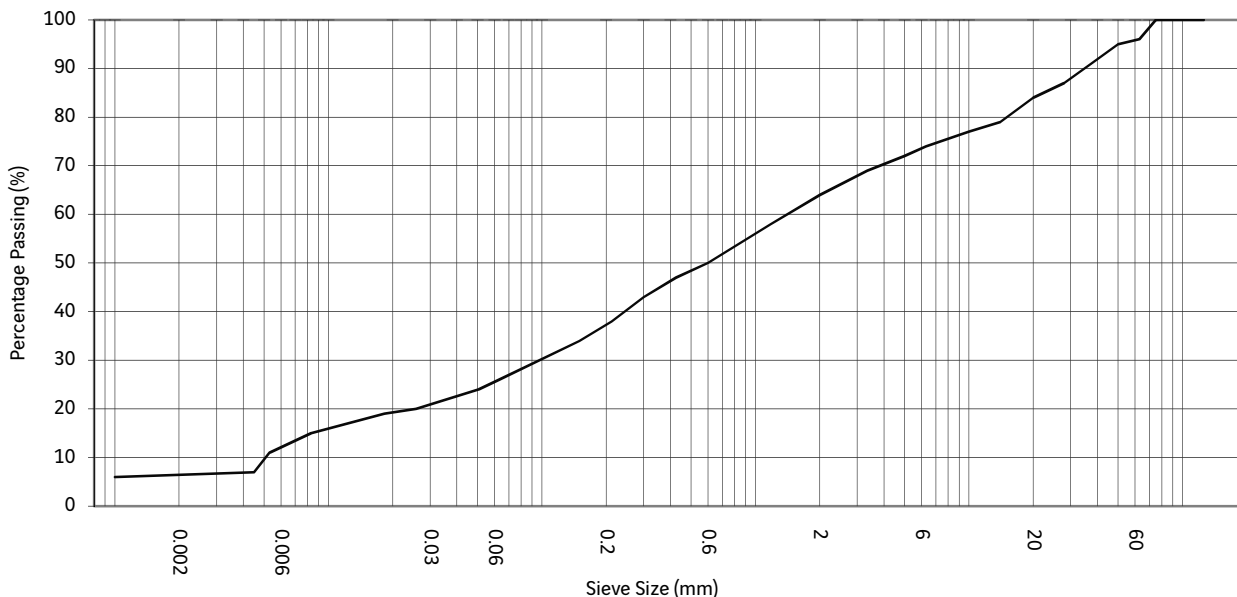
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	3	
Sand:	22	
Gravel:	64	
Cobbles:	11	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	45
		10.0	40
		6.3	35
		5.0	32
125.0	100	3.35	29
90.0	89	2.00	25
75.0	89	1.18	20
63.0	89	0.600	15
50.0	89	0.425	13
37.5	76	0.300	11
28.0	66	0.212	8
20.0	55	0.150	6
		0.063	3

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Project Name Bay of Nigg Harbour Development Ground Investigation Project No. TA7148 Engineer Arch Henderson LLP Employer Aberdeen Harbour Board	Particle Size Distribution BS 1377: Part 2: 1990: 9.2, 9.5	Hole ID TP16
		Sample Depth 0.00m
		Sample Number 001
		Sample type B
Description Brown gravelly sandy CLAY with occasional cobbles. Gravel is fine to coarse subangular	Specimen Depth 0.00m	
	Specimen No. 1	



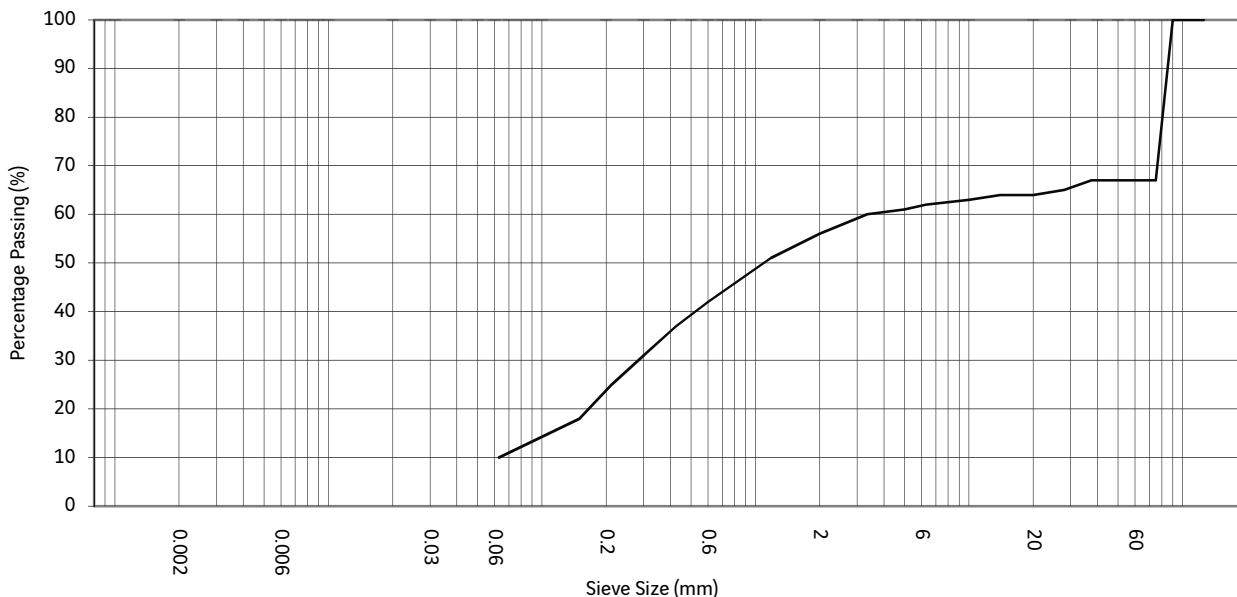
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE		%	General remarks
Clay:		6	
Silt:		19	
Sand:		39	
Gravel:		32	
Cobbles:		4	
		Particle density:	2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	79		
		10.0	77	0.0507	24
		6.3	74	0.0258	20
125.0	100	5.0	72	0.0183	19
90.0	100	3.35	69	0.0083	15
75.0	100	2.00	64	0.0053	11
63.0	96	1.18	58	0.0045	7
50.0	95	0.600	50	0.0010	6
37.5	91	0.425	47		
28.0	87	0.300	43		
20.0	84	0.212	38		
		0.150	34		
		0.063	26		

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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	TP17
Project No.	TA7148		Sample Depth	3.00m
Engineer	Arch Henderson LLP		Sample Number	006
Employer	Aberdeen Harbour Board		Sample type	B
Description		Brown slightly gravelly SAND with occasional cobbles.	Specimen Depth	3.00m
			Specimen No.	1



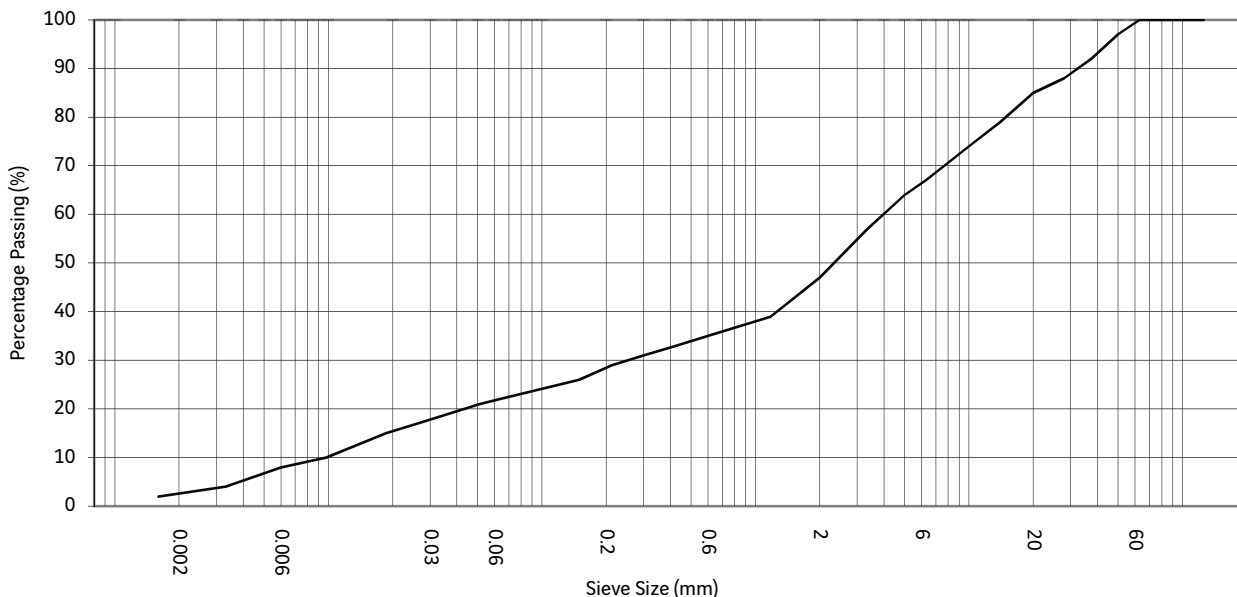
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Silt and clay:	10	
Sand:	46	
Gravel:	11	
Cobbles:	33	

WET SIEVE DATA			
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing
		14.0	64
		10.0	63
		6.3	62
125.0	100	5.0	61
90.0	100	3.35	60
75.0	67	2.00	56
63.0	67	1.18	51
50.0	67	0.600	42
37.5	67	0.425	37
28.0	65	0.300	31
20.0	64	0.212	25
		0.150	18
		0.063	10

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Sushil Sharda		
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Project Name	Bay of Nigg Harbour Development Ground Investigation	Particle Size Distribution	Hole ID	TP18	
Project No.	TA7148		Sample Depth	0.50m	
Engineer	Arch Henderson LLP		Sample Number	001	
Employer	Aberdeen Harbour Board		Sample type	B	
Description		Brownish grey slightly clayey sandy fine to coarse GRAVEL	Specimen Depth	0.50m	
				Specimen No.	1



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			

PARTICLE SIZE	%	General remarks Sample size was insufficient to be representative of particle size
Clay:	2	
Silt:	19	
Sand:	25	
Gravel:	52	
Cobbles:	1	
Particle density:		2.65Mg/m ³ Assumed

WET SIEVE DATA				SEDIMENTATION DATA	
Sieve size mm	Cumulative % passing	Sieve size mm	Cumulative % passing	Equivalent particle diameter mm	Cumulative % passing
		14.0	79		
		10.0	74	0.0513	21
		6.3	67	0.0261	17
125.0	100	5.0	64	0.0186	15
90.0	100	3.35	57	0.0098	10
75.0	100	2.00	47	0.0060	8
63.0	100	1.18	39	0.0033	4
50.0	97	0.600	35	0.0016	2
37.5	92	0.425	33		
28.0	88	0.300	31		
20.0	85	0.212	29		
		0.150	26		
		0.063	22		

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