Map Legend

- Site Location
- Rotary Borehole Location
- Window Sampler Boreholes

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Drawing Title	Exploratory Hole Location Plan
Project Title	Galway Inner Harbour, Galway
Drawn By: EOS	MW
Project No.: 220628	Drawing No.: 4-1
Scale: 1:1,800	Date: 2022-11-14

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5. GROUND AND GROUNDWATER CONDITIONS

5.1 Ground Conditions

The ground conditions encountered during the additional site investigation broadly corresponded to published geology and the findings of previous ground investigations conducted on the site and are presented in Table 5-1 below.

Table 5-1 Summary of Ground Conditions (MKO 2019 and 2022 Investigations)

Stratum	Depth to Top of Stratum (mbgl)	Typical Thickness (m)
Tarmac and concrete hard-standing	0.0	0.04 to 0.7
Topsoil [WS211 and WS212 only]	0.0	0.1
Grey, brown, black clayey sandy gravel, sandy gravelly clay, sandy clayey gravel, silty sandy gravelly clay, gravelly clayey sand, gravelly clay or gravel. Gravel is fine to coarse angular, subrounded to subangular with occasional cobbles and boulders of granite. Occasional fragments of plastic, metal, glass, red brick, clinker, slate, concrete, porcelain, tar and ash. Abundant shell fragments in WS-09 and WS-13 [MADE GROUND]	0.0 to 0.7	2.65 to 8.1
Grey, brown sandy gravelly clay, clayey gravelly sand or sandy clayey gravel. Grey, pink and green gravel cobbles and boulders. [POSSIBLE MADE GROUND]	0.8 to 1.0 1.3 to 6.6	0.6 to 1.4 1.8 to 5.4
Grey, brown, greenish, grey sandy gravelly silty CLAY, sandy organic CLAY, sandy gravelly silty CLAY or sandy gravelly CLAY with occasional subangular to subrounded cobbles of granite and occasional shell fragments. [WS-04, WS-21, BH07, BH08, BH10 and BH14] [POSSIBLE ESTUARINE SEDIMENTS]	1.0 to 5.4	1.2 to 3.1
Very strong massive pink and/or green, grey coarse grained porphyritic METAGABBRO [Unweathered to partially weathered]	6.7 to 9.45	1.55 to 4.4

Stratum	Depth to Top of Stratum (mbgl)	Typical Thickness (m)
[BH01, BH02, BH05, BH07, BH10, BH13] Very strong foliated dark greenish grey coarse grained phaneritic METAGABBRO [Unweathered] [BH04, BH08, BH09 and BH15] Very strong massive green coarse grained phaneritic METAGABBRO [Unweathered to partially weathered] [BH06] [METAGABBRO]		
Very strong foliated dark greenish grey coarse grained phaneritic GNEISS [Unweathered] [BH03, BH11, BH12 and BH14] [GNEISS]	7.1 to 9.1	3.2 to 4

A more detailed account of the ground conditions encountered during the 2022 MKO investigation is provided below, along with consideration of the results of in-situ testing.

5.2 Ground Model

5.2.1 Made Ground

Made Ground was encountered in all exploratory borehole locations below a layer of concrete or tarmac hardstanding, which was between 0.04m and 0.7m thick. A layer of topsoil was encountered in window sampler borehole WS211 and WS212 only. The Made Ground typically ranged in thickness between 2.65m to 8.1m. and was generally comprised of a clayey gravel, sandy gravelly clay, sandy clayey gravel, silty sandy gravelly clay, gravelly clayey sand, gravelly clay or gravel. The SPT-N values recorded in the granular Made Ground were between 4 and 42, which correspond to a material that is very loose to dense. The single SPT-N value recorded in the cohesive Made Ground in borehole BH07 was 2 which corresponds to a material that is very soft. The single SPT-N value recorded in the cohesive Made Ground in borehole BH08 was 25 which corresponds to a material that is very stiff.

Obstructions were encountered in window sampler boreholes WS201 (0.2 metres below ground level (mbgl)), WS202 (0.3mbgl), WS203 (0.7mbgl), WS204 (0.4mbgl), WS205 (0.5mbgl), WS206 (0.5mbgl), WS207 (0.6mbgl), WS208 (0.6mbgl), WS209 (0.6mbgl), WS210 (0.9mbgl), WS211 (0.7mbgl), WS212 (0.6mbgl), WS213 (0.5mbgl), WS214 (0.5mbgl) and WS215 (0.5mbgl) and therefore these boreholes were terminated at these depths due to the obstructions.

5.2.2 Possible Made Ground

Possible Made Ground was encountered in boreholes BH02, BH03, BH04, BH05, BH08, BH11 and BH12 and comprised of grey, pink, and green gravel, cobbles and boulders.

5.2.3 Possible Estuarine Sediments

Possible Estuarine Sediments (PED) were encountered in boreholes BH07, BH08, BH10 and BH14. The material was found to consist of a generally very soft to very stiff greyish brown slightly sandy gravelly clay, sandy organic clay or silty clay. The PED encountered in borehole BH14 was comprised of greenish, grey fine to coarse gravel. The estuarine sediments typically ranged in thickness between 1.2m to 3.1m and it was typically encountered at depths of 1.0m to 5.4m below ground level.

5.2.4 Metagabbro Suite

The metagabbro Suite was encountered beneath the Made Ground and PED in boreholes BH01, BH02, BH04 to BH10 inclusive, BH13 and BH15 at depths of between 6.7mbgl and 9.45mbgl and was proven to a depth of 12.3mbgl. The material was encountered as unweathered to partially weathered very strong massive pink and/or green, grey coarse grained porphyritic metagabbro, a very strong foliated dark greenish grey coarse grained phaneritic metagabbro or a very strong massive green coarse grained phaneritic metagabbro.

5.2.5 Orthogneiss Suite

The orthogneiss suite was encountered beneath the Made Ground and PED in boreholes BH03, BH11, BH12 and BH14 at depths of between 7.1mbgl and 9.1mbgl and was proven to a depth of 12.3mbgl. The material was encountered as unweathered very strong foliated dark greenish grey coarse grained phaneritic gneiss.

5.3 Ground Contamination

No visual or olfactory evidence of contamination was encountered during drilling. Hydrocarbon odours were observed in boreholes BH07 and BH13 during site monitoring. Organic odours were also observed in boreholes BH02 and BH10 during site monitoring.

5.3.1 Groundwater

Due to the nature of the rotary core drilling process groundwater strikes were not recorded in the boreholes during drilling. The groundwater levels in the monitoring standpipes were measured by GII during two monitoring visits. A summary of the groundwater levels is presented in Table 5-2.

Table 5-2 Summary of Groundwater Monitoring Results

Borehole No.	Response Zone	Depth to groundwater (mbgl)	
		11-12/10/22	10-11/11/22
BH01	Made Ground/Metagabbro	4.25	3.72
BH02	Made Ground/Metagabbro	3.92	4.19
BH03	Made Ground/Gneiss	4.49	4.13
BH04	Possible Made Ground/Metagabbro	4.46	3.99
BH05	Made Ground/Metagabbro	4.38	4.44

Borehole No.	Response Zone	Depth to groundwater (mbgl)	
		11-12/10/22	10-11/11/22
BH06	Made Ground/Metagabbro	3.93	4.39
BH07	Made Ground/PED/Metagabbro	3.76	3.64
BH08	Made Ground/PED/Metagabbro	2.9	3.99
BH09	Made Ground/Metagabbro	3.43	3.7
BH10	Made Ground/PED/Metagabbro	4.7	4.54
BH11	Made Ground/Gneiss	4.82	4.89
BH12	Made Ground/Gneiss	4.98	5.02
BH13	Made Ground/Metagabbro	4.09	4.15
BH14	Made Ground/Gneiss	3.92	4.05
BH15	Made Ground/Metagabbro	3.55	3.66

An analysis of the groundwater monitoring data indicates that groundwater in the response zone is likely to flow in a south easterly direction towards Galway Bay however given the sites proximity to Galway Bay, the groundwater is likely to be tidally influenced.

5.3.2 Ground gas

The atmospheric pressure and local pressure system recorded during the single ground gas monitoring visit on the $10^{th}/11^{th}$ November 2022 was 1004-1007 and falling.

The main findings of the monitoring are summarised in Table 5-3 below and further details are provided in Section 6.6:

Table 5-3 Summary of worst case ground gas monitoring records in all boreholes

Borehole	Response Zone	Flow (l/hr)	O_2 (min %)	CO_2 (max %)	CH_4 (max %)
WS-04	Made Ground/PED	0.2	20.7	0.2	<0.1
WS-09	Made Ground	0.1	21.2	0.2	<0.1
WS-10	Made Ground	-NR	-NR	-NR	-NR
WS-12	Made Ground	0.2	21.5	0.2	<0.1
WS-14	Made Ground	0.2	20.8	0.1	<0.1

Borehole	Response Zone	Flow (l/hr)	0_2 (min %)	CO_2 (max %)	CH_4 (max %)
WS-16	Made Ground	0.1	21.2	0.1	<0.1
WS-18	Made Ground	0.1	18.7	1.7	<0.1
WS-23	Made Ground	<0.1	21.6	0.1	<0.1

Notes
1 -NR = None recorded

6. CONTAMINATION ASSESSMENT

6.1 Introduction

This section evaluates risks to potential receptors at the site from identified chemical contamination. Potential receptors identified include future site occupants, construction workers, building & structures, vegetation & plants and controlled waters. MKO's approach and rationale to assessment criteria adoption for this site is presented in Appendix 4.

6.2 Risks to Human Health

MKO have screened the soil chemical results from the ground investigation against Generic Assessment Criteria (GAC) derived by LQM/CIEH (Suitable 4 Use Levels) for a number of end use scenarios including Residential (without Private Gardens) and Commercial land use scenario. It is noted that the Soil Guideline Value (SGV) for lead has been withdrawn and that the Category 4 Screening Level (C4SL) for lead will be used in its place.

For the purposes of this assessment the soil chemical results from both phases of the MKO investigation i.e. 2019 and 2022 have been screened against GACs. The results of the assessment are set out in Tables 4.2 to 4.5 of Appendix 4.

As part of the 2022 ground investigation, eleven Made Ground samples were tested by Element on behalf of MKO for a range of parameters including heavy metals, Total Petroleum Hydrocarbons, Benzene, toluene, ethylbenzene, xylenes and polycyclic aromatic hydrocarbons. An asbestos screen was also carried out on the eleven Made Ground samples.

6.2.1 Risks from Made Ground

6.2.1.1 Residential without Private Gardens Land Use Scenario

As can be observed from Table 4.2 of Appendix 4, elevated concentrations of lead and dibenzo(a,h)anthracene have been identified within the Made Ground across the site, which pose a risk to human health.

The concentrations of the remaining contaminants analysed are below the assessment criteria and therefore are not considered to present an unacceptable risk to human health based on a residential (without private gardens) land use scenario.

6.2.1.2 Commercial Land Use Scenario

As can be observed from Table 4.3 of Appendix 4, the measured concentrations for the determinants analysed in the Made Ground are below the assessment criteria and therefore are not considered to present an unacceptable risk to human health based on a Commercial land use scenario.

6.2.2 Risks from Natural Ground

6.2.2.1 Residential without Private Gardens Land Use Scenario

As can be observed from Table 4.4 of Appendix 4, the measured concentrations for the determinants analysed in the possible estuarine sediment samples are below the assessment criteria and therefore are

not considered to present an unacceptable risk to human health based on a residential (without private gardens) land use scenario.

6.2.2.2 Commercial Land Use Scenario

As can be observed from Table 4.5 of Appendix 4, the measured concentrations for the determinants analysed in the possible estuarine sediment samples are below the assessment criteria and therefore are not considered to present an unacceptable risk to human health based on a Commercial land use scenario.

6.3 Asbestos

There was no asbestos containing material identified in the eleven Made Ground samples tested as part of the 2022 ground investigation.

Asbestos containing material (amosite and chrysotile fibre bundles) were identified in the Made Ground samples from window sampler boreholes WS-10 between 1m and 2mbgl and WS-18 between 0m and 2mbgl during the previous phase of investigation. There was no asbestos identified in the other twenty two window sampler boreholes.

Therefore, asbestos is present in the soils at the site, which poses a potential risk to human health and is addressed in Section 7.2 below.

6.4 Risks to Plant Growth

The risks to plant growth (i.e. phytotoxicity) have also been assessed for specific contaminants where the limits for phytotoxic effect proposed by BS3882:2015[5] are significantly lower than the health GAC. The results of the assessment are presented in Table 6-1 below.

Table 6-1 Soil Risks to Vegetation and Plants

Determinant	Assessment Criteria	Measured Range (mg/kg)	Concentration > Assessment Criteria (Y/N)
Copper	135	<1 to 2,146	Y
Zinc	200	7 to 10,741	Y
Nickel	75	4.5 to 47.8	N

As can be observed in Table 6-1, the concentrations of copper and zinc in the Made Ground soil material are above those prescribed by BS3882:2015 and therefore pose a risk to vegetation and plant growth. The concentration of nickel are below the criteria and therefore do not pose a risk to vegetation and plant growth.

6.5 Risks to Controlled Waters

Chemical test results from groundwater samples collected during the monitoring visit are presented in Table 4.6 of Appendix 4. The results have been compared against Annual Average Environmental

[5] *BSI (2015). Specification for Topsoil BS3882:2015. BSI Standards Publication*

Quality Standards (AA-EQS)[6,7,8] and Groundwater Threshold Values (GTV)[9,10,11,12]. In the absence of specific AA-EQS and GTV values, EPA interim guideline values (IGV)[13] have been used. Table 4.6 summarises analysis from standpipes generally in the response zones of the Made Ground and bedrock.

As can be observed from Table 4.6 the contamination concentrations measured in groundwater are below the EQS with the exception of cadmium, lead, benzo(a)pyrene and fluoranthene in borehole BH13, lead in borehole BH15, total cyanide in borehole BH10 and benzo(b+k)fluoranthene in borehole BH7.

As can also be observed from Table 4.6, the concentrations of arsenic and lead in the groundwater sample from borehole BH15, lead in the groundwater sample from borehole BH13 and Total Petroleum Hydrocarbons in the groundwater sample from borehole BH7 are above the GTV threshold. The sulphate concentrations in all fifteen of the groundwater samples and the ammoniacal nitrogen as NH_3 in thirteen of the groundwater samples were also above the GTV threshold.

As can also be observed from Table 4.6, the concentrations of arsenic and lead in the groundwater sample from borehole BH15, lead in the groundwater sample from borehole BH13, total cyanide in the groundwater sample from borehole BH10 and Total Petroleum Hydrocarbons from the groundwater sample in borehole BH7 are above the IGV threshold. In addition, the sulphate concentrations in all fifteen groundwater samples and the boron concentration in twelve of the groundwater samples were also above the IGV value.

Whilst it is noted that there were recorded exceedances of the EQS and GTV for arsenic, cadmium, lead, PAHs, TPH and total cyanide in four of the fifteen boreholes, the site investigation data would indicate that contamination beneath the site occurs in a series of discrete hotspots which may be impacting directly upon perched groundwater found in the Made Ground and is not indicative of site-wide contamination within the Made Ground or Metagabbro bedrock. The lack of a confining impermeable clay layer in some sections of the site may indicate that hydraulic connectivity is occurring between the groundwater found in the Made Ground and the groundwater found in the Metagabbro Suite. This would therefore indicate that the main source of contamination found in the Metagabbro Suite is derived from the Made Ground. The elevated ammoniacal nitrogen, boron and sulphate concentrations are likely to be indicative of background concentrations found in the regional groundwater and not attributable to site concentrations

6.6 Ground Gas Assessment

A summary of the maximum recorded ground gas concentrations and flow rates are presented below in Table 6-3. Table 6-3 also presents the calculated gas screening value (GSV) and the associated Risk classification and Characteristic Situation[14] to CIRIA 665[15] based on the results of monitoring undertaken on the 19th September 2019, 4th October 2019 and the 10th/11th November 2022. The GSV for each borehole is based on the product of the greater of the methane (CH_4) or carbon dioxide (CO_2) concentration measured and the flow rate recorded in each borehole during the monitoring visits. The corresponding risk categories are outlined within Table 6-2 below.

[6] *European Communities Environmental Objectives (Surface Water) Regulations 2009. S.I. No. 272 of 2009*
[7] *European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2015. S.I. No. 386 of 2015*
[8] *European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019. S.I. No. 77 of 2019*
[9] *European Communities Environmental Objectives (Groundwater) Regulations 2010. S.I. No. 9 of 2010*
[10] *European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016. S.I. No. 366 of 2016*
[11] *European Communities Environmental Objectives (Groundwater) Regulations 2010. S.I. No. 9 of 2010*
[12] *European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016. S.I. No. 366 of 2016*
[13] *Environment Protection Agency (2003). Towards Setting Guideline Values for the Protection of Groundwater in Ireland. Interim Report*
[14] *Wilson et. al. (2006/2007). Characteristic situations, CIRIA 149*
[15] *Wilson et. al. (2007). Assessing risks posed by hazardous ground gases to building, CIRIA C665*

Table 6-2 Modified Wilson and Card Classification (CIRIA Report 659)

Characteristic Situation	Risk Classification	Gas Screening Value (l/hr)		Typical Source Generation
		Lower boundary	Upper Boundary	
1	Very low risk	0	<0.07	Natural soils with low organic content. "Typical" made-up ground.
2	Low risk	0.07	<0.7	Natural soil, high peat/organic content.
3	Moderate risk	0.7	<3.5	Old landfill, inert waste, flood mineworking.
4	Moderate to high risk	3.5	<15	Mineworking susceptible to flooding, completed landfill.
5	High risk	15	<70	Unflooded, inactive mineworking with shallow working near surface.
6	Very high risk	>70	N.A	Recent landfill site.

Table 6-3 Summary of worst case ground gas monitoring records in boreholes

Borehole	Response Zone	Flow (l/hr)	O_2 (min %)	CO_2 (max %)	CH_4 (max %)	CO_2 Gas screening value (GSV)	CH_4 Gas screening value (GSV)	Classification CIRIA
WS-04	Made Ground/PED	0.2	20.0	0.2	0.3	0.0004	0.0006	Characteristic Situation 1
WS-09	Made Ground	0.1	19.4	2.0	<0.1	0.002	0.0001	Characteristic Situation 1
WS-10	Made Ground	<0.1	20.1	0.1	<0.1	0.0001	0.0001	Characteristic Situation 1
WS-12	Made Ground	0.2	19.2	0.5	0.2	0.001	0.0004	Characteristic Situation 1
WS-14	Made Ground	0.2	20.3	0.1	0.2	0.0002	0.0004	Characteristic Situation 1
WS-16	Made Ground	0.1	20.1	0.1	0.3	0.0001	0.0003	Characteristic Situation 1
WS-18	Made Ground	0.1	18.3	2.0	0.1	0.002	0.0001	Characteristic Situation 1
WS-23	Made Ground	<0.1	20.5	0.1	<0.1	0.0001	0.0001	Characteristic Situation 1

CIRIA guidance (C665) recommends that site characterisation of ground gas risk is calculated from the maximum concentrations and flow rates across the site as a whole, taking into consideration the conceptual site model.

The maximum recorded gas concentrations (volume gas/volume air) across the site were recorded as 0.3 v/v% for methane and 2.0 v/v% for carbon dioxide. The maximum flow rate recorded in the monitoring wells was recorded as 0.2 litres/hour (l/hr). The GSV would therefore be 0.0006 l/h for methane and 0.004 l/h for carbon dioxide. Therefore, currently available monitoring data indicates that the site conforms to Characteristic Situation 1.

6.7 Waste Classification

The soil laboratory test results were assessed to evaluate whether the material should be classified as 'hazardous' or 'non-hazardous', in accordance with the Environmental Protection Agency guidance document; 'Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-hazardous (2015)', and in accordance with the guidance in UK Environmental Agency Technical Guidance WM3.

An assessment of the soil for waste classification purposes (see Table 6-4) indicates that of the eleven Made Ground samples tested by Element on behalf of MKO in 2022, one sample would be classified as hazardous and ten samples would be classified as not-hazardous (i.e. inert or non-hazardous) for waste recovery/disposal purposes.

Table 6-4 Summary of Waste Characterisation (MKO 2022)

Sample Location	Depth (mbgl)	Stratum	Characterisation[1]	Contaminants
WS203	0.00-0.70	Made Ground	Not-hazardous	N/A
WS206	0.00-0.50	Made Ground	Hazardous	TPH
WS207	0.00-0.60	Made Ground	Not-hazardous	N/A
WS208	0.00-0.90	Made Ground	Not-hazardous	N/A
WS209	0.00-0.60	Made Ground	Not-hazardous	N/A
WS210	0.00-0.90	Made Ground	Not-hazardous	N/A
WS211	0.00-0.70	Made Ground	Not-hazardous	N/A
WS-212	0.00-0.60	Made Ground	Not-hazardous	N/A
WS-213	0.00-0.50	Made Ground	Not-hazardous	N/A
WS-214	0.00-0.50	Made Ground	Not-hazardous	N/A
WS-215	0.00-0.50	Made Ground	Not-hazardous	N/A

Notes
1. Not hazardous i.e., inert or non-hazardous

7. REFINED RISK ASSESSMENT

7.1 Introduction

Further semi-quantitative risk assessment has been undertaken based on the findings of the 2019 and 2022 intrusive investigations and subsequent assessment to evaluate the potential pollutant linkages identified at the site in accordance with Contaminated Land Report (CLR) 11. An assessment of the risks based on the pollutant linkages identified at the site is outlined in Table 7-1 below. A graphical representation of the conceptual site model is included as Figure 7-1.

Table 7-1 Semi-quantitative risk assessment

Source/Medium	Receptor	Potential Exposure Route	Risk Rating
Organic/inorganic contaminants (including PAHs, hydrocarbons, metals, asbestos, etc.) within underlying soils/Made Ground	Future site occupants	Direct ingestion of soil & dust, inhalation of particulates & vapours, and dermal contact	Medium – where soil is exposed Negligible/Low – beneath buildings and hard standing
	Construction workers	Direct ingestion of soil & dust, inhalation of particulates	Low to medium - presence of asbestos and elevated concentrations of lead and PAH recorded within Made Ground.
	Vegetation & Plants	Root uptake	Medium (due to copper and zinc concentrations identified in the Made Ground).
	Building & Structures	Direct contact with water supply pipes and underground concrete structures	Low to medium – hydrocarbons present at potential depth of water pipe at two locations.
Explosive / asphyxiating gases from underlying soils/Made Ground, if present	Internal building spaces and current/ future occupiers	Migration of gases/vapour through the surface and via permeable soils	Low - based on the results of the gas monitoring visits.
Organic/inorganic contaminants within underlying soils/Made Ground	Local surface water bodies	Lateral migration of contaminants	Low to medium – due to concentrations of metals, total cyanide, TPH, PAH
	Groundwater	Lateral migration of contaminants	Low to medium – due to concentrations of metals, total cyanide, TPH, PAH

Source/Medium	Receptor	Potential Exposure Route	Risk Rating
		Vertical migration of contaminants	
Off-site sources	Ground and groundwater conditions beneath the study site	Lateral migration of contaminants. Vertical migration of contaminants.	Low to medium – due to concentrations of metals, total cyanide, TPH, PAH

7.2 Risks to Human Health

For a residential without private gardens end-use, the risk to future site users from contaminants in soil is considered to be low to medium due to the elevated concentrations of lead and PAHs encountered in the Made Ground at the site. It is considered that the potential risks to future users via dermal contact, inhalation and ingestion pathways can be mitigated through the provision of a suitable barrier layer comprising either buildings, hard cover or capping layers in communal landscaping areas which will prevent contact with underlying Made Ground.

Based on the gas monitoring conducted on site, a low risk to future users is associated with the concentrations of methane and carbon dioxide recorded.

The risk to construction workers from contaminants in the soil is considered to be low to medium. There is also considered to be a potential medium risk associated with the potential for asbestos containing material (ACM) to be present within the fabric of the existing buildings. Reference should be made to the asbestos register prior to construction. It is considered that the risk posed to construction workers can be minimised by the use of appropriate health, safety and welfare provisions. These include, but are not limited to good site hygiene and the use of appropriate personal protective equipment (PPE).

7.3 Risks to Vegetation and Plants

The risk to vegetation and plants is considered to be medium based on the concentrations of phytotoxic contaminants at the site. The risk to vegetation and plants can be mitigated by the use of capping layers in communal landscaping and importation of clean topsoil and growth medium.

7.4 Risks to Controlled Waters

A low to medium risk is considered for controlled waters as elevated concentrations of contaminants were encountered in isolated groundwater samples from the Made Ground and Metagabbro Suite taking into consideration the isolated nature of the recorded exceedances. As discussed in Section 6.5, there were recorded exceedances of the EQS and GTV in four of the fifteen boreholes which indicates that contamination beneath the site occurs in a series of discrete hotspots which may be impacting directly upon perched groundwater found in the Made Ground and is not indicative of site-wide contamination within the Made Ground or Metagabbro bedrock.

7.5 Risks to Buildings and Structures

The contaminants encountered beneath the site may pose a risk to underground services, particularly water supply pipes. This risk can be mitigated through the use of appropriate pipework material.

Sources:

S1. Made Ground (lead, PAH, and asbestos)
S2. Off-site sources

Receptors:

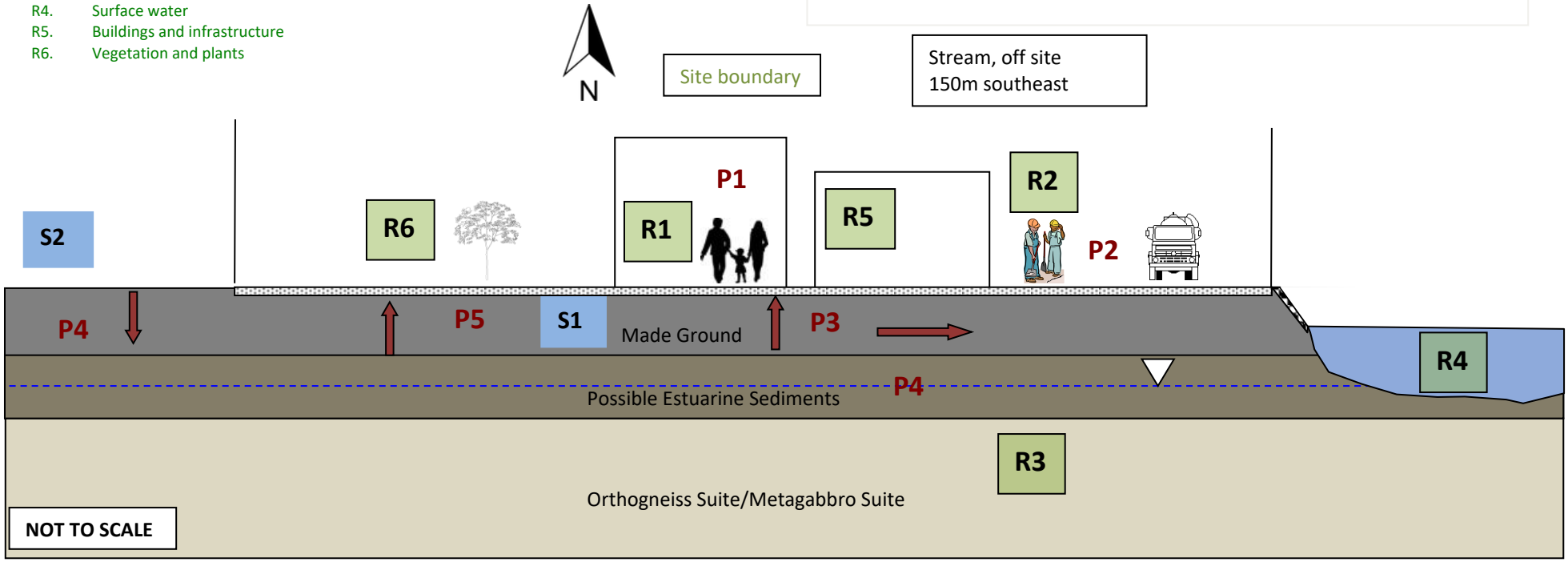
R1. Future occupants
R2. Construction workers
R3. Groundwater
R4. Surface water
R5. Buildings and infrastructure
R6. Vegetation and plants

Pathways:

P1. Ingestion & inhalation
P2. Direct dermal contact
P3. Direct contact with underground infrastructure/ pipework
P4. Migration of contaminants through permeable soils and groundwater
P5. Root uptake

Risk to receptors and mitigation measures:

- Future occupants (negligible/low to medium risk) – Barrier layers comprising buildings, hard cover or capping in landscaping areas will prevent contact with underlying Made Ground.
- Construction workers (Low to Medium risk) – Appropriate health and safety procedures during demolition and construction and appropriate PPE.
- Buildings and infrastructure (Low to Medium) – Appropriate material for service pipes.
- Groundwater/Surface Water (Low Medium risk) – Dewatering and disposal off-site..
- Vegetation and plants (Medium risk) – Capping layers in landscaping areas.



MKO	Project: **Galway Inner Harbour, Galway**	Project No: **220628**
	Title: **Conceptual Site Model**	**Figure 7-1**

8. GEOTECHNICAL RECOMMENDATIONS

8.1 General

The following sections will consider different options for the foundation solution for the proposed development based on the ground and groundwater conditions encountered.

8.2 Foundations

Based on the ground conditions encountered (i.e. thick variable Made Ground over generally very low strength Estuarine Sediments), piled foundations bearing into the Metagabbro or Orthogneiss Suites may be appropriate for development at the site. Depending on the final scheme, a driven pile solution or continuous flight auger (CFA) piling could be adopted. Point load testing undertaken on the Metagabbro and Orthogneiss cores indicate a rock strength range of very strong to extremely strong. The point load testing results can be found in Appendix 1.

8.3 Excavations

Based on the ground conditions encountered across the site, excavations required during the development should not pose difficulties for conventional excavators and earthmoving equipment.

Excavations within the Made Ground, or similar material, are likely to be unstable and dependant on the formation levels may extend below the level of the perched water in the shallow soils and will require dewatering/groundwater control during excavation. These excavations will require shoring during excavation and construction.

Excavations in excess of 1.2mbgl should be suitably shored or otherwise supported or battered and should be inspected regularly by a competent person. No operatives should enter un-shored or otherwise unprotected excavations.

Groundwater control is likely to be achieved within shallow excavations within the Made Ground by adopting a sump and pump system around the perimeter of the excavation.

8.4 Retaining structures and groundwater control

Should basements be proposed, the excavations required will necessitate the construction of temporary and permanent perimeter retaining structures. It is recommended that secant walls are adopted for large deep basement excavations that may extend below the perched and shallow groundwater levels. Secant walls will generally provide a barrier to groundwater flow into the excavation.

For shallower basement excavation of 2.5m or less, a contiguous piled wall may be appropriate but consideration should be given to the need to control water ingress from perched groundwater within the Made Ground.

Where extensive excavation is not required or perimeter walls will not be subjected to large vertical loads, interlocking sheet pile walls may provide an alternative solution.

Consideration should be given to the presence of ground obstructions, which will hinder the installation of the sheet piles. Sheet piles can also be adopted for temporary works. Additionally, potential obstruction in the near surface Made Ground will also impact piling progress for foundation and retaining walls.

The chosen basement excavation support system will depend on the size and depth of excavation required and a review of the ground and groundwater levels within and surrounding the finalised basement location. Any vertical loading and/or nearby surcharges should also be considered.

Results of chemical testing indicate that shallow groundwater has been impacted by contamination in isolated locations. During groundwater control, this water should be extracted, stored, transported or appropriately treated and disposed of at an appropriate offsite licensed facility.

8.5 Buried concrete

The design of the foundations, buildings and underground services should consider aggressive ground conditions at the site. The BRE Special Digest 1:2005 Concrete in Aggressive Ground considers that the concrete specification should cover for sulphate, sulphides and acids.

9. GEOENVIRONMENTAL RECOMMENDATIONS

9.1 Contamination and Remediation

Based on a Residential (without private gardens) end use scenario, elevated concentrations of lead, asbestos and PAHs were encountered in the Made Ground during the MKO ground investigations. It is considered that the risks presented to the health of future occupants by asbestos, lead and PAHs can be mitigated by the provision of barrier layers within the development where the soils are to remain. These barrier layers can be comprised of the future development footprint i.e. buildings, tarmac/concrete hardstanding or capping layers in communal landscaping areas (see section 9.1.1).

If soil is required to be excavated to facilitate construction of basements, foundations and buried services in areas of contamination, soil samples should be submitted for chemical analysis to confirm that residual sources of contamination do not remain on site. The soil should be excavated and removed from the site for treatment or disposal within a licensed waste facility. Additional validation samples should be taken to ensure that a 'clean edge' is reached in the area of excavation.

Should groundwater be encountered during earthworks or piling operations, dewatering measures may be necessary. Contaminated groundwater may need to be disposed off-site to a licensed waste disposal facility or it may be passed through a three stage interceptor and discharged to foul sewer under a discharge license from the local authority.

9.1.1 Capping Layers

Due to the presence of lead, PAHs and asbestos within Made Ground, proposed areas of communal soft landscaping that overly the existing soils should be provided with suitable topsoil and subsoil to form a capping layer to act as a barrier to the underlying contamination and also to act as a growth medium. The capping layer could comprise either 600mm of imported soil including minimum 150mm topsoil or 450mm imported soil including 150mm topsoil over a geotextile.

9.2 Gas protection measures

The result of the gas monitoring undertaken to date correlates to a Characteristic Situation 1, indicating that no gas protection measures are required for future developments at the site.

9.3 Underground services

In accordance with current UKWIR[16] guidance, the use of barrier pipes for water supply may be required in some areas of the site, to prevent possible permeation of contaminants into drinking water supplies.

9.4 Material Management and Waste Classification

It may be prudent to undertake further soil sampling at the site once the extent of the soil excavation is known and in advance of individual phases of development, in order to fully delineate the areas for waste management planning purposes and to reduce disposal costs.

[16] *UK Water Industry Research (2010) Guidance for the selection of water supply pipes to be used in brownfield sites*

9.4.1 Re-use, Recycling and Recovery

In order to minimise the volumes of soils for off-site disposal/recovery, it is prudent to consider material management options prior to waste disposal/recovery. The on-site re-use of uncontaminated excavated materials is excluded from the provisions of the Waste Management Acts when it meets the following criteria:

- The material must be uncontaminated.
- The material must not comprise of bricks rubble or other man-made substances or objects.
- It must have been excavated as part of the construction activities and be used on the site from which it was excavated for the purposes of construction.
- The holder of the material must be able to demonstrate that the material will definitely be used. Intention of use is not considered satisfactory.

9.4.2 Waste Recovery/Disposal

Where offsite recovery or disposal is required, the available laboratory results indicates that of the forty two Made Ground and four soil samples tested during both phases of investigations, eight samples would be classified as hazardous and thirty eight samples would be classified as not-hazardous (i.e. inert or non-hazardous) for waste recovery/disposal purposes.

Waste Acceptance Criteria (WAC) testing was also undertaken on all thirty five soil samples to determine the materials suitability for disposal to landfill. The results of the WAC testing and waste characterisation is presented in Table 9-1 and Figure 9-1.

Table 9-1 Summary of Waste Acceptance Criteria Testing

Sample Location	Depth (mbgl)	Stratum	Characterisation[1]	Landfill Type[2] based on WAC Results
WS-01	0.00-0.50	Made Ground	Not-hazardous	Inert
WS-02	0.00-0.50	Made Ground	Not-hazardous	Inert
WS-03	0.00-0.54	Made Ground	Not-hazardous	Inert
WS-04	0.00-1.00	Made Ground	Not-hazardous	Inert
WS-04	1.00-2.00	Possible Estuarine Sediments	Not-hazardous	Inert
WS-04	2.00-2.20	Possible Estuarine Sediments	Not-hazardous	Inert
WS-05	0.00-1.00	Made Ground	Not-hazardous	Inert
WS-05	1.00-1.70	Made Ground	Not-hazardous	Inert
WS-07	0.00-0.70	Made Ground	Not-hazardous	Non-hazardous
WS-09	0.00-1.00	Made Ground	Not-hazardous	Non-hazardous
WS-09	1.00-1.50	Made Ground	Not-hazardous	Inert

Sample Location	Depth (mbgl)	Stratum	Characterisation[1]	Landfill Type[2] based on WAC Results
WS-10	0.00-1.00	Made Ground	Hazardous	Hazardous
WS-10	1.00-2.00	Made Ground	Hazardous	Hazardous that accepts asbestos
WS-11	0.00-0.70	Made Ground	Hazardous	Hazardous
WS-12	0.00-1.00	Made Ground	Not-hazardous	Inert
WS-12	1.00-2.00	Made Ground	Not-hazardous	Inert
WS-13	0.00-1.00	Made Ground	Not-hazardous	Non-hazardous
WS-13	1.00-2.00	Made Ground	Not-hazardous	Inert
WS-14	0.00-1.00	Made Ground	Not-hazardous	Non-hazardous
WS-16	0.00-1.00	Made Ground	Hazardous	Hazardous
WS-17	0.00-1.00	Made Ground	Not-hazardous	Non-hazardous
WS-18	0.00-1.00	Made Ground	Hazardous	Hazardous that accepts asbestos
WS-18	1.00-2.00	Made Ground	Hazardous	Hazardous that accepts asbestos
WS-18	2.00-2.80	Made Ground	Hazardous	Hazardous
WS-19	0.00-1.00	Made Ground	Not-hazardous	Inert
WS-19	1.00-1.60	Made Ground	Not-hazardous	Inert
WS-20	0.00-1.00	Made Ground	Not-hazardous	Inert
WS-21	0.00-1.00	Made Ground	Not-hazardous	Inert
WS-21	1.00-2.00	Made Ground	Not-hazardous	Inert
WS-21	2.00-3.00	Possible Estuarine Sediments	Not-hazardous	Inert
WS-21	3.00-4.00	Possible Estuarine Sediments	Not-hazardous	Inert
WS-22	0.00-1.00	Made Ground	Not-hazardous	Inert
WS-23	0.00-1.00	Made Ground	Not-hazardous	Non-hazardous
WS-23	1.00-2.00	Made Ground	Not-hazardous	Inert

Sample Location	Depth (mbgl)	Stratum	Characterisation[1]	Landfill Type[2] based on WAC Results
WS-24	0.00-0.50	Made Ground	Not-hazardous	Non-hazardous
WS203	0.00-0.70	Made Ground	Not-hazardous	Non-hazardous
WS206	0.00-0.50	Made Ground	Hazardous	Hazardous
WS207	0.00-0.60	Made Ground	Not-hazardous	Inert
WS208	0.00-0.90	Made Ground	Not-hazardous	Inert
WS209	0.00-0.60	Made Ground	Not-hazardous	Inert
WS210	0.00-0.90	Made Ground	Not-hazardous	Non-hazardous
WS211	0.00-0.70	Made Ground	Not-hazardous	Inert
WS-212	0.00-0.60	Made Ground	Not-hazardous	Non-hazardous
WS-213	0.00-0.50	Made Ground	Not-hazardous	Inert
WS-214	0.00-0.50	Made Ground	Not-hazardous	Inert
WS-215	0.00-0.50	Made Ground	Not-hazardous	Non-hazardous

Notes
1. Not hazardous i.e., inert or non-hazardous
2. Non-hazardous i.e. waste which is not classified as hazardous waste.

Please note given the presence of foreign objects in the Made Ground, acceptance at an inert landfill would be subject to confirmation by the selected permitted facility.

It may also be possible to dispose of the non-hazardous material to a licensed soil waste recovery facility, where disposal does not incur landfill tax. This should be discussed with a suitable facility.

All material intended for off-site disposal should be transported and disposed in accordance with the Waste Management Act 1996 and Environmental Protection Agency Act, 1992.

9.4.3 Asbestos

Asbestos containing material (amosite and chrysotile fibre bundles) were identified in the Made Ground samples from window sampler boreholes WS-10 between 1m and 2mbgl and WS-18 between 0m and 2mbgl during the 2019 ground investigation. Given the scale of the site, this is a very localised area and is not considered a significant risk to the future development of the site. If this material is to remain on site, a barrier layer, as indicated above, would mitigate the potential risks presented. If excavated, the Made Ground in this area should be stockpiled separately for offsite disposal by an experienced contractor in accordance with standard methods for the handling of ACM..

Due to the potential for asbestos containing material within the buildings on-site it is recommended that, if not already available, an asbestos survey is completed prior to any future development at the site.

Map Legend

- Site Location
- Hazardous Waste Location
- Inert Waste Location
- Non-hazardous Location

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N

Drawing Title: Waste Classification

Project Title: Galway Inner Harbour, Galway

Drawn By	MW
EOS	MW
Project No.	Drawing No.
220628	9-1
Scale	Date
1:1,800	2022-11-14

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9.5 Health and Safety

All site works should be undertaken in accordance with the guidelines prepared by the Safety, Health and Welfare at Work (Construction) Regulations 2013. Works should also be carried out in accordance with the Construction and Environmental Management Plan. During the redevelopment, precautions should be taken to minimise exposure of workers and the general public to potentially harmful substances. Attention should also be paid to restricting possible off-site nuisance such as dust and odour emissions. Such precautions should include, but not be limited to:

1. *Personal hygiene, washing and changing procedures.*
2. *Adequate personal protective equipment, including, but not limited to, disposable overalls, gloves and particulate filter masks/vapour respirators, where required.*
3. *Measures to avoid surface water ponding and positive collection and disposal of onsite run-off.*
4. *Regular cleaning of site roads, access roads and the public highway including dust suppressions methods (e.g. water spraying), if necessary.*
5. *Waste haulage vehicles should be covered when leaving the site to minimise the release of airborne particulates.*

APPENDIX 1

FACTUAL GROUND INVESTIGATION REPORT

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Ground Investigations Ireland

Galway Harbour

MKO

Ground Investigation Report

October 2022

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DOCUMENT CONTROL SHEET

Project Title	Galway Harbour
Client	Galway Harbour Company
Engineer	MKO
Project No	12058-07-22
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
A	Final	B Sexton	J Cashen	B Sexton	Dublin	27 October 2022

Ground Investigations Ireland Ltd. present the results of the fieldworks and laboratory testing in accordance with the specification and related documents provided by or on behalf of the client The possibility of variation in the ground and/or groundwater conditions between or below exploratory locations or due to the investigation techniques employed must be taken into account when this report and the appendices inform designs or decisions where such variation may be considered relevant. Ground and/or groundwater conditions may vary due to seasonal, man-made or other activities not apparent during the fieldworks and no responsibility can be taken for such variation. The data presented and the recommendations included in this report and associated appendices are intended for the use of the client and the client's geotechnical representative only and any duty of care to others is excluded unless approved in writing.

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CONTENTS

APPENDICES

1.0 Preamble

On the instructions of MKO, a site investigation was carried out by Ground Investigations Ireland Ltd., between August and September 2022 at Galway Harbour.

2.0 Overview

2.1. Background

A site investigation was required to supply information for the Galway Harbour master planning process. At the time of the site investigation the site was limited to the western portion of the harbour as outlined in Figure 1.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 15 No. Window Sample Boreholes to recover soil samples
- Carry out 15 No. Rotary Core Boreholes to a maximum depth of 12.30m BGL
- Installation of 15 No. Groundwater monitoring wells
- Groundwater Sampling
- Geotechnical & Environmental Laboratory testing
- Factual Report

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.
The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

3.2. Window Sampling

The window sampling was carried out at the locations shown in Figure 2 in Appendix 1 using a Tecopsa SPT Tec 10 percussion drilling rig. The window sampling consists of a 1m long steel tube with a cutting

edge and an internal plastic liner which is mechanically driven into the ground utilising a 50kg weight falling a height of 500mm. Upon completion of the 1m sample, the tube is withdrawn and the plastic liner removed and sealed for logging and sub sampling by a Geotechnical Engineer/Engineering Geologist. The tube is replaced in the borehole and a subsequent 1m sample can be recovered. Occasionally outer casing or a reduced diameter tube is utilised to enable the window sample to progress in difficult drilling conditions. Geotechnical or environmental soil samples can be recovered from each of the liners following logging. The window sample records are provided in Appendix 2 of this Report.

3.3. Rotary Boreholes

The rotary coring was carried out by a track mounted Comacchio 305 rig at the locations shown in Figure 3 in Appendix 1. The rotary boreholes were completed from the ground surface.
The Comacchio 305 is equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage to the surface. The Comacchio 305 utilises a triple tube core barrel system operated using a wireline drilling process. The outer barrel is rotated by the drill rods and at its lower end, carries the coring bit. The inner barrel is mounted on a swivel so that it does not rotate during the process. The third barrel or liner is placed within the second one to retain the core intact and to preserve as much as possible the fabric of the drilling stratum. The core is cut by the coring bit and passes to the inner liner. The core is brought up to the surface within the inner barrel on a small diameter wire rope or line attached to the “overshoot” recovery tool which is then placed into a core box in order of recovery. A drilling fluid, typically air mist or water flush is passed from the surface through hollow drill rods to the drill bit and is used to cool the drill bit. Temporary casing is used in some situations to support unstable ground or to seal off fissures or voids.

It should be noted that the rotary coring can only achieve limited recovery in overburden, particularly granular or weakly cemented strata due to the flushing medium washing away the cohesive fraction during coring. The recovery achieved, where required, is noted on the borehole logs and core photographs are provided to allow assessment of the core recovered. The rotary borehole logs are provided in Appendix 3 of this Report.

3.4. Surveying

The exploratory hole locations have been recorded using a KQ GEO Technologies KQ-M8 System which records the coordinates and elevation of the locations to ITM as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.5. Groundwater Monitoring Installations

Groundwater Monitoring Installations were installed upon the completion of the boreholes to enable sampling and the determination of the equilibrium groundwater level. The typical groundwater monitoring installation consists of a 50mm uPVC/HDPE slotted pipe with a pea gravel response zone and bentonite seal installed to the Engineers specification. Where required the standpipe is sealed with a gas tap and

finished with a durable steel cover fixed in place with a concrete surround. The installation details are provided on the exploratory hole logs in the appendices of this Report.

3.6. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.
Environmental & Chemical testing as required by the specification, including the Rilta Suite testing was carried out by Element Materials Technology Laboratory in the United Kingdom (UK). The Rilta suite testing includes both Solid Waste and Leachate Waste Acceptance Criteria.
Groundwater samples collected from the on-site wells were analysed for a selection of parameters by Element Materials Technology Laboratory in the UK, also.
Rock strength testing including Point Load (Is_{50}) and Unconfined Compressive Strength (UCS) testing was carried out by CMTL Ireland Ltd. geotechnical testing laboratory in Portloaise, County Laois.
The results of the laboratory testing are included in Appendix 4 of this Report.

4.0 Ground Conditions

4.1. General

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

The sequence of strata encountered were relatively consistent across the site and generally comprised;

- Surfacing
- Made Ground
- Granular Deposits
- Cohesive Deposits
- Bedrock

SURFACING: Concrete or tarmacadam surfacing was encountered at the majority of the exploratory hole locations. Concrete was encountered to a maximum depth of 0.85m BGL. Tarmacadam was encountered to a maximum depth of 0.10m BGL. Where concrete or tarmacadam was absent crushed rock FILL was encountered to a maximum depth of 0.90m BGL.

MADE GROUND: Made Ground deposits were encountered beneath the Surfacing or Crushed Rock Fill and were present to a maximum depth of up to 9.10m BGL. These deposits were described generally as *gravels, cobbles and boulders with rare fragments of steel.*

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Made Ground in BH-07, BH-08 and BH-10 and were described as *greyish brown slightly sandy gravelly CLAY with some cobbles* in BH-07, as *dark brown sandy organic clay* in BH-08 and as *soft silty CLAY* in BH-10.

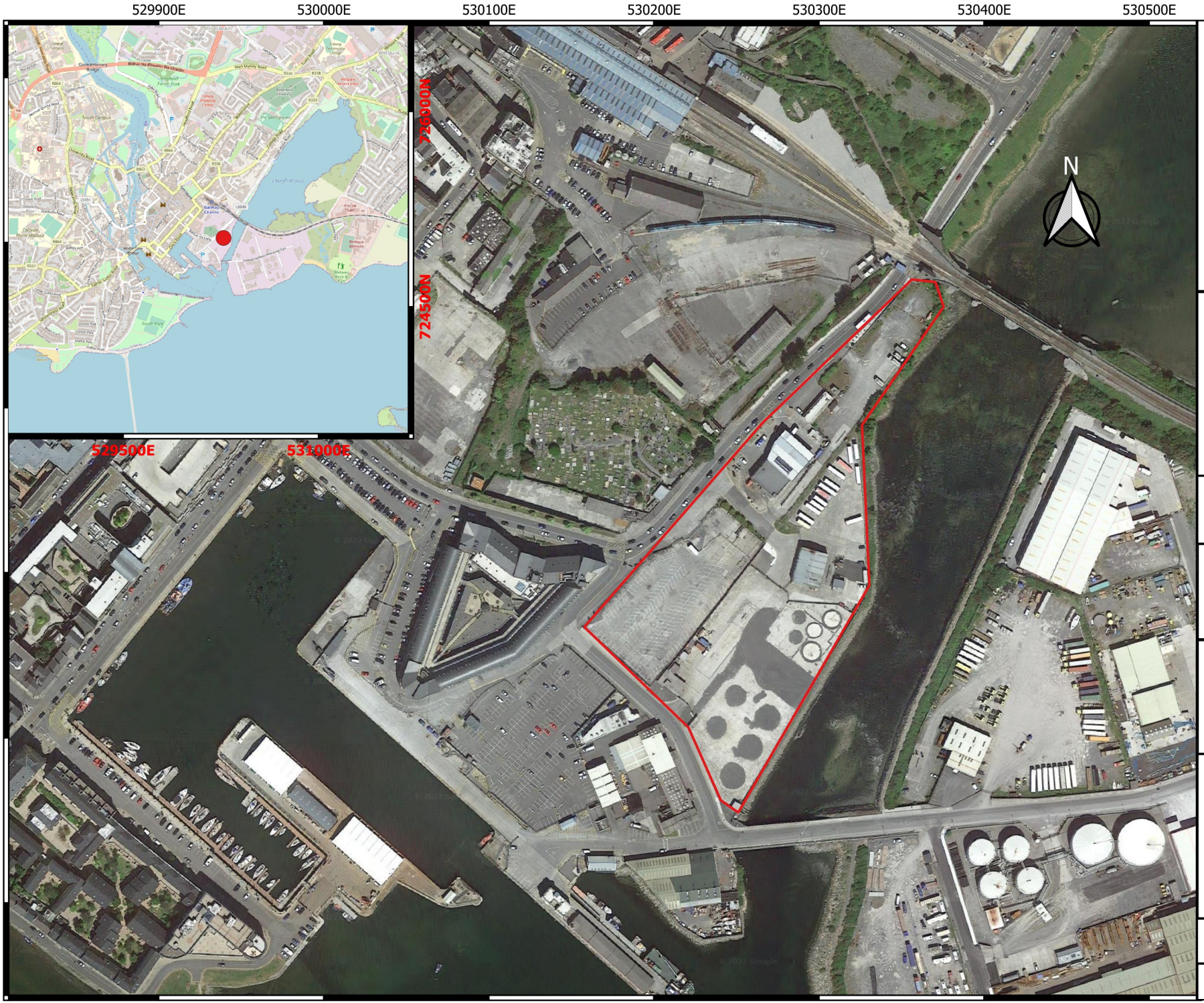
BEDROCK: The rotary core boreholes recovered three bedrock types across the site. The first rock type encountered was *very strong massive red/green fine to coarse grained porphyritic METAGABBRO.* The second type was a *very strong foliated dark greenish grey coarse grained phaneritic METAGABBRO.* The third type encountered was *very strong foliated dark greenish grey fine to coarse grained phaneritic GNEISS*. This is typical of the Grampian Metagabbro and Orthogneiss Suite, which is noted on the Geological Survey of Ireland's (GSI) geological mapping of the site. The degree of weathering ranges from unweathered to partially weathered.

The depth to bedrock varied from 6.70m BGL in BH-04 to 9.45m BGL in BH-02. The depth to bedrock encountered is presented in Figure 3. The total core recovery is good, typically 100% with some of the uppermost runs dropping to 90%. The SCR and RQD both are relatively poor in the upper weathered zone, often recovered as non-intact, however both indices show an increase with depth in each of the boreholes.

4.2. Groundwater

Due to the use of water flush during the coring process it was no possible to record accurate groundwater strikes. The exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction, and other factors. For this reason, standpipes were installed in all boreholes to allow the equilibrium groundwater level to be determined and to facilitate groundwater sampling. The groundwater monitoring is included in Appendix 5 of this Report.

APPENDIX 1 – Figures



Site Location

Indicative Site Boundary

Client:

MKO

Project Code:
12058-07-22

Project Title:
Galway Harbour

Drawing Title:
Figure 1 Site Location

GROUND INVESTIGATIONS IRELAND
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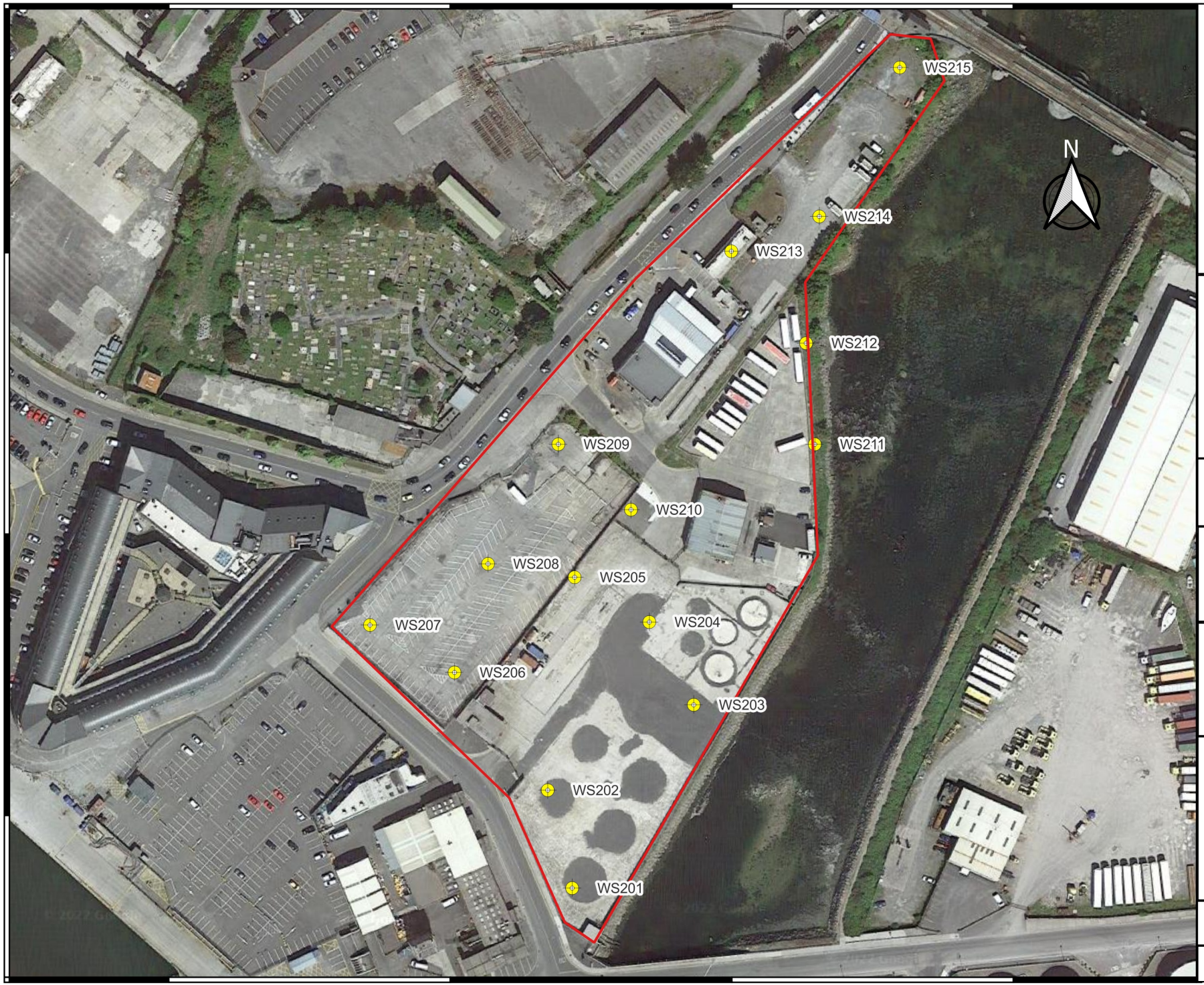
Newcastle, Co. Dublin
www.gii.ie 01-6015175/5176

0 25 50 75 100 125 m

Drawn By:	Date:
BS	27-10-2022



Indicative Site Boundary

Window Sample

Client:

MKO

Project Code:

12058-07-22

Project Title:

Galway Harbour

Drawing Title:

Figure 2 Window Sample Locations

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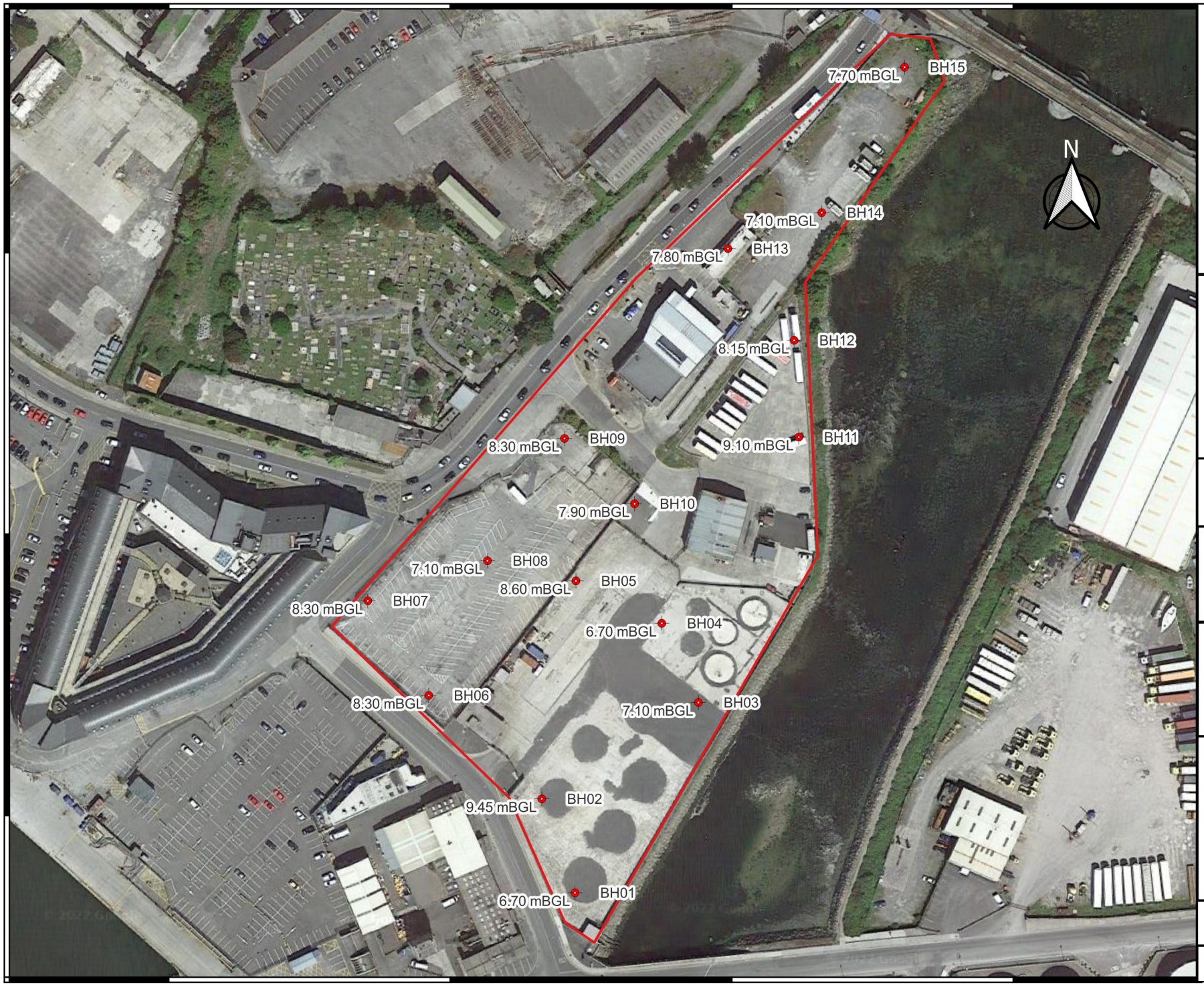
0 15 30 45 60 75 m

Drawn By:	Date:
BS	27-10-2022



Indicative Site Boundary

Borehole

Client:

MKO

Project Code:

12058-07-22

Project Title:

Galway Harbour

Drawing Title:

Figure 3 Borehole Locations & Depth to Rock

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0 15 30 45 60 75 m

Drawn By:	Date:
BS	27-10-2022

APPENDIX 2 – Window Sample Records

Ground Investigations Ireland Ltd
www.gii.ie

Site Galway Harbour Company				**Number** WS201
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.20m	**Ground Level (mOD)** 4.29	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530243.2 E 724874.1 N	**Dates** 29/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	FILL: Grey sandy coarse angular Gravel (Crushed Rock Fill)		
				4.09	0.20	Complete at 0.20m		

Remarks
0.00m-0.20m BGL: 0% Recovery
Refusal at 0.20m BGL

Scale (approx)	Logged By
1:25	AB

Figure No. 12058-07-22.WS201

Produced by the GEOtechnical DAtabase SYstem (GEODASY) © all rights reserved

Ground Investigations Ireland Ltd
www.gii.ie

Site Galway Harbour Company			**Number** WS202
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.30m	**Ground Level (mOD)** 4.29	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530234.6 E 724908.9 N	**Dates** 29/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	FILL: Grey sandy coarse angular Gravel (Crushed Rock Fill)		
				3.99	0.30	Complete at 0.30m		

Remarks
0.00m-0.30m BGL: 0% Recovery
Refusal at 0.30m BGL

Scale (approx)	Logged By
1:25	AB

Figure No. 12058-07-22.WS202

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Ground Investigations Ireland Ltd
www.gii.ie

Site Galway Harbour Company			**Number** WS203
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.70m	**Ground Level (mOD)** 4.74	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530286.4 E 724939.3 N	**Dates** 29/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.70	ES				(0.70)	FILL: Grey sandy coarse angular Gravel (Crushed Rock Fill) with occasional fragments of concrete		
				4.04	0.70	Complete at 0.70m		

Remarks
0.00m-0.70m BGL: 60% Recovery
Refusal at 0.70m BGL

Scale (approx)	Logged By
1:25	AB

Figure No. 12058-07-22.WS203

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Ground Investigations Ireland Ltd
www.gii.ie

Site Galway Harbour Company			**Number** WS204
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.40m	**Ground Level (mOD)** 4.79	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530270.6 E 724968.7 N	**Dates** 29/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	FILL: Grey sandy coarse angular Gravel (Crushed Rock Fill))		
				4.39	0.40	Complete at 0.40m		

Remarks
0.00m-0.40m BGL: 0% Recovery
Refusal at 0.40m BGL

Scale (approx)	Logged By
1:25	AB

Figure No.
12058-07-22.WS204

Produced by the GEOtechnical DAtabase SYstem (GEODASY) © all rights reserved

Ground Investigations Ireland Ltd
www.gii.ie

Site Galway Harbour Company			**Number** WS205
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.50m	**Ground Level (mOD)** 5.28	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530244.1 E 724984.6 N	**Dates** 29/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	FILL: Grey sandy coarse angular Gravel (Crushed Rock Fill)		
				4.78	0.50	Complete at 0.50m		

Remarks
0.00m-0.50m BGL: 0% Recovery
Refusal at 0.50m BGL

Scale (approx)	Logged By
1:25	AB

Figure No.
12058-07-22.WS203

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Site Galway Harbour Company			**Number** WS206
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.50m	**Ground Level (mOD)** 5.09	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530201.4 E 724950.8 N	**Dates** 29/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	ES				(0.50)	FILL: Black clayey sandy coarse angular Gravel (Crushed Rock Fill) with fragments of metal, concrete and tar		
				4.59	0.50	Complete at 0.50m		

Remarks
0.00m-0.50m BGL: 90% Recovery
Refusal at 0.50m BGL

Scale (approx)	Logged By
1:25	AB

Figure No.
12058-07-22.WS206

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Site Galway Harbour Company			**Number** WS207
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.60m	**Ground Level (mOD)** 4.86	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530171.4 E 724967.6 N	**Dates** 29/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.60	ES				(0.60)	FILL: Black clayey sandy coarse angular Gravel (Crushed Rock Fill) with fragments of metal, concrete and tar		
				4.26	0.60	Complete at 0.60m		

Remarks
0.00m-0.60m BGL: 70% Recovery
Refusal at 0.60m BGL

Scale (approx)	Logged By
1:25	AB

Figure No. 12058-07-22.WS207

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Site Galway Harbour Company			**Number** WS208
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.60m	**Ground Level (mOD)** 4.99	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530213.3 E 724989.4 N	**Dates** 29/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.60	ES				(0.60)	FILL: Black clayey sandy coarse angular Gravel (Crushed Rock Fill) with fragments of metal, concrete and tar		
				4.39	0.60	Complete at 0.60m		

Remarks
0.00m-0.60m BGL: 65% Recovery
Refusal at 0.60m BGL

Scale (approx)	Logged By
1:25	AB

Figure No.
12058-07-22.WS208

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Site Galway Harbour Company			**Number** WS209
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.60m	**Ground Level (mOD)** 5.34	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530238.3 E 725031.9 N	**Dates** 30/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.60	ES				(0.60)	FILL: Black/grey clayey sandy coarse angular Gravel (Crushed Rock Fill)		
				4.74	0.60	Complete at 0.60m		

Remarks
0.00m-0.60m BGL: 70% Recovery
Refusal at 0.60m BGL

Scale (approx)	Logged By
1:25	AB

Figure No.
12058-07-22.WS209

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Site Galway Harbour Company			**Number** WS210
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.90m	**Ground Level (mOD)** 5.18	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530264.1 E 725008.6 N	**Dates** 29/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.90	ES			5.13	0.05	TARMACADAM		
					(0.85)	FILL: Black clayey sandy coarse angular Gravel (Crushed Rock Fill) with fragments of metal, concrete and tar		
				4.28	0.90	Complete at 0.90m		

Remarks
0.00m-0.90m BGL: 60% Recovery
Refusal at 0.90m BGL

Scale (approx)	Logged By
1:25	AB

Figure No.
12058-07-22.WS210

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Site Galway Harbour Company			**Number** WS211
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.70m	**Ground Level (mOD)** 5.39	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530329.4 E 725031.9 N	**Dates** 29/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.70	ES			5.29	(0.10) 0.10	TOPSOIL		
						FILL: Black clayey sandy coarse angular Gravel (Crushed Rock Fill) with fragments of metal, concrete and tar		
					(0.60)			
				4.69	0.70	Complete at 0.70m		

Remarks
0.00m-0.70m BGL: 60% Recovery
Refusal at 0.70m BGL

Scale (approx)	Logged By
1:25	AB

Figure No. 12058-07-22.WS211

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Site Galway Harbour Company			**Number** WS212
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.60m	**Ground Level (mOD)** 5.70	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530326.3 E 725067.8 N	**Dates** 29/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.60	ES			5.60	(0.10) 0.10	TOPSOIL		
					(0.50)	FILL: Black clayey sandy coarse angular Gravel (Crushed Rock Fill) with fragments of metal, concrete and tar		
				5.10	0.60	Complete at 0.60m		

Remarks
0.00m-0.60m BGL: 90% Recovery
Refusal at 0.60m BGL

Scale (approx)	Logged By
1:25	AB

Figure No.
12058-07-22.WS212

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Site Galway Harbour Company			**Number** WS213
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.50m	**Ground Level (mOD)** 5.62	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530299.8 E 725100.4 N	**Dates** 30/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	ES				(0.50)	FILL: Grey clayey sandy coarse angular Gravel (Crushed Rock Fill)		
				5.12	0.50	Complete at 0.50m		

Remarks
0.00m-0.50m BGL: 90% Recovery
Refusal at 0.50m BGL

Scale (approx)	Logged By
1:25	AB

Figure No. 12058-07-22.WS213

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Site Galway Harbour Company			**Number** WS214
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.50m	**Ground Level (mOD)** 5.35	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530331 E 725112.8 N	**Dates** 30/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	ES				(0.50)	FILL: Grey clayey sandy coarse angular Gravel (Crushed Rock Fill)		
				4.85	0.50	Complete at 0.50m		

Remarks
0.00m-0.50m BGL: 100% Recovery
Refusal at 0.50m BGL

Scale (approx)	Logged By
1:25	AB

Figure No. 12058-07-22.WS214

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Site Galway Harbour Company			**Number** WS215
Machine : Tecop 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 68mm to 0.50m	**Ground Level (mOD)** 4.92	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530359.6 E 725165.8 N	**Dates** 29/09/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	ES				(0.50)	FILL: Black clayey sandy coarse angular Gravel (Crushed Rock Fill) with fragments of metal, concrete and tar		
				4.42	0.50	Complete at 0.50m		

Remarks
0.00m-0.50m BGL: 95% Recovery
Refusal at 0.50m BGL

Scale (approx)	Logged By
1:25	AB

Figure No. 12058-07-22.WS215

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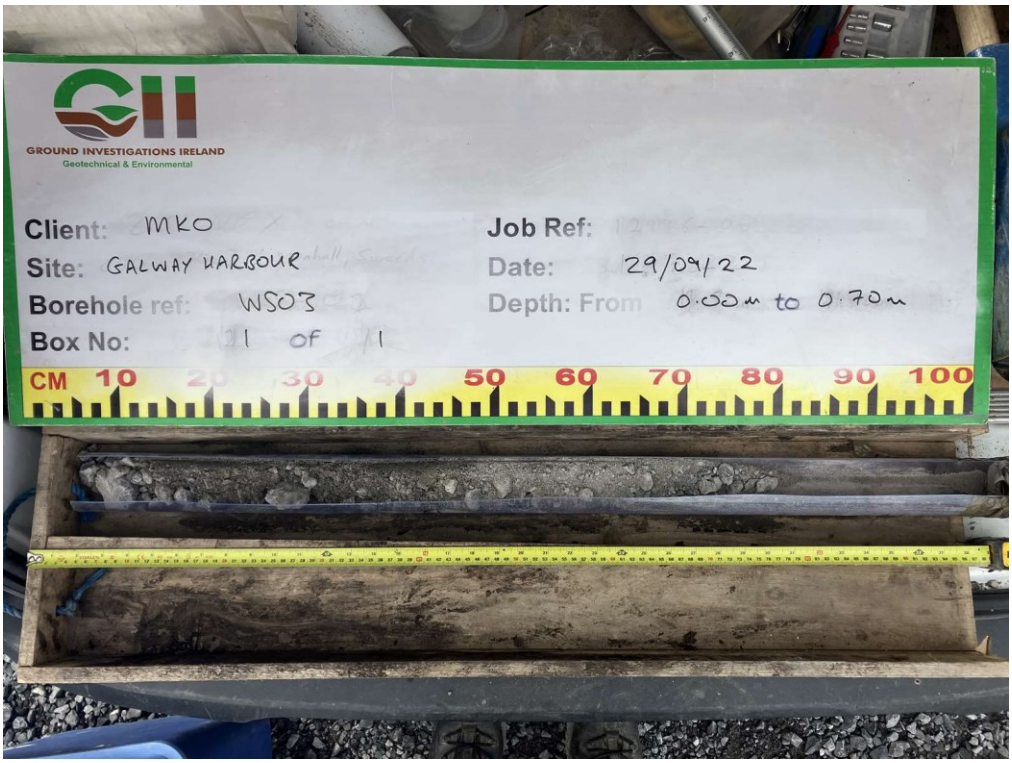
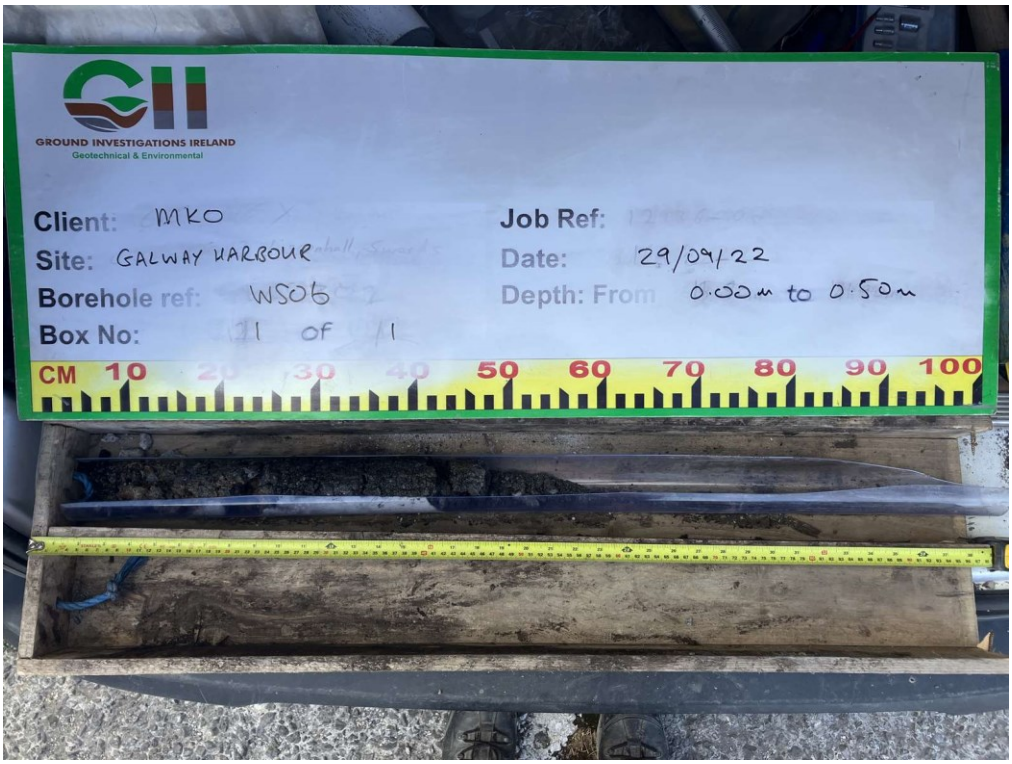
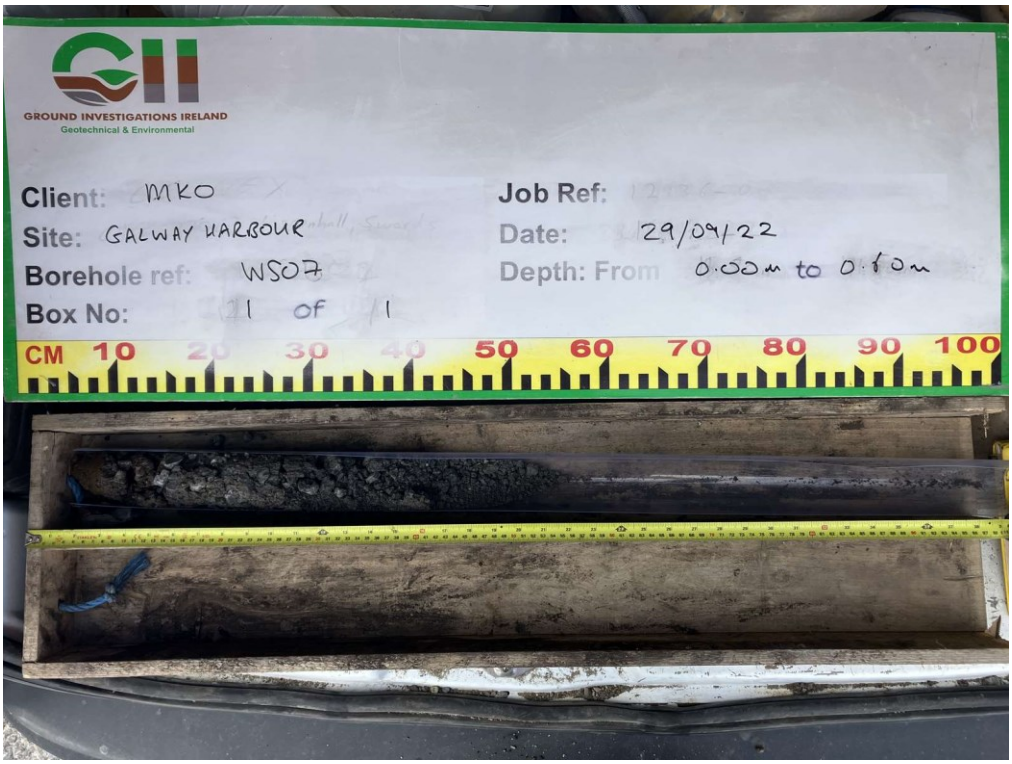
Galway Harbour Company
Window Sample Photographs
WS203



WS206


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: MKO
Job Ref:
Site: GALWAY HARBOUR
Date: 29/09/22
Borehole ref: WS06
Depth: From 0.00m to 0.50m
Box No: 1 of 1
CM 10 20 30 40 50 60 70 80 90 100

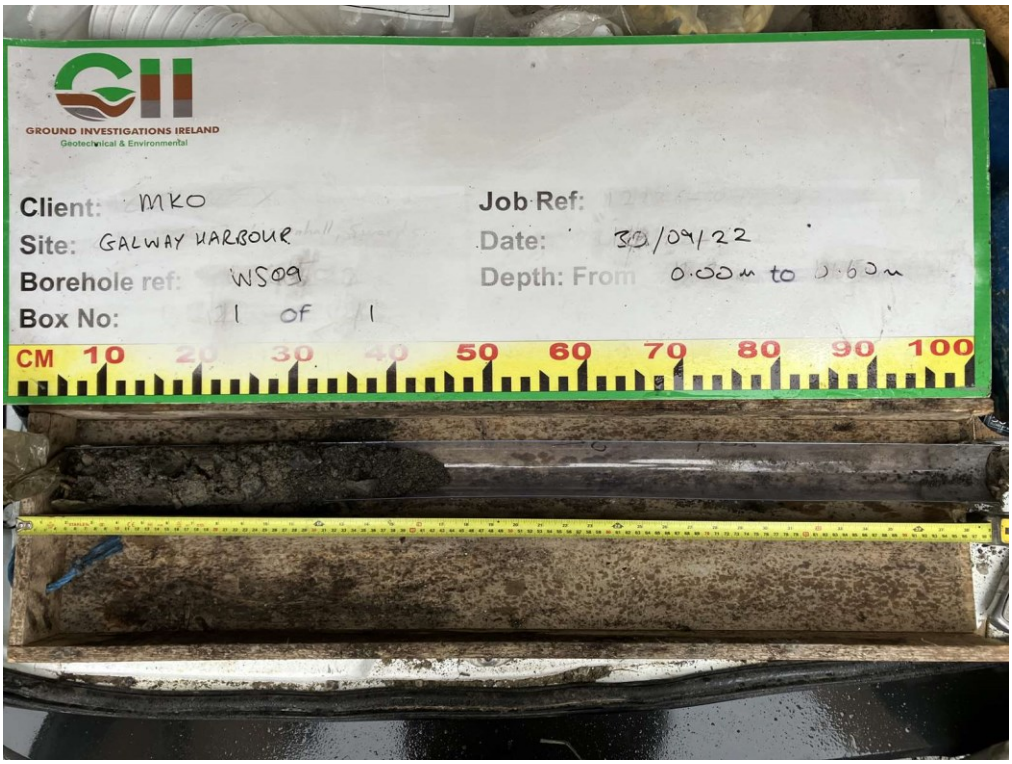
WS207


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: MKO
Job Ref:
Site: GALWAY HARBOUR
Date: 29/09/22
Borehole ref: WS07
Depth: From 0.00m to 0.10m
Box No: 1 of 1
CM 10 20 30 40 50 60 70 80 90 100

WS208


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: MKO
Job Ref:
Site: GALWAY HARBOUR
Date: 29/09/22
Borehole ref: WS08
Depth: From 0.00m to 0.10m
Box No: 1 of 1
CM 10 20 30 40 50 60 70 80 90 100

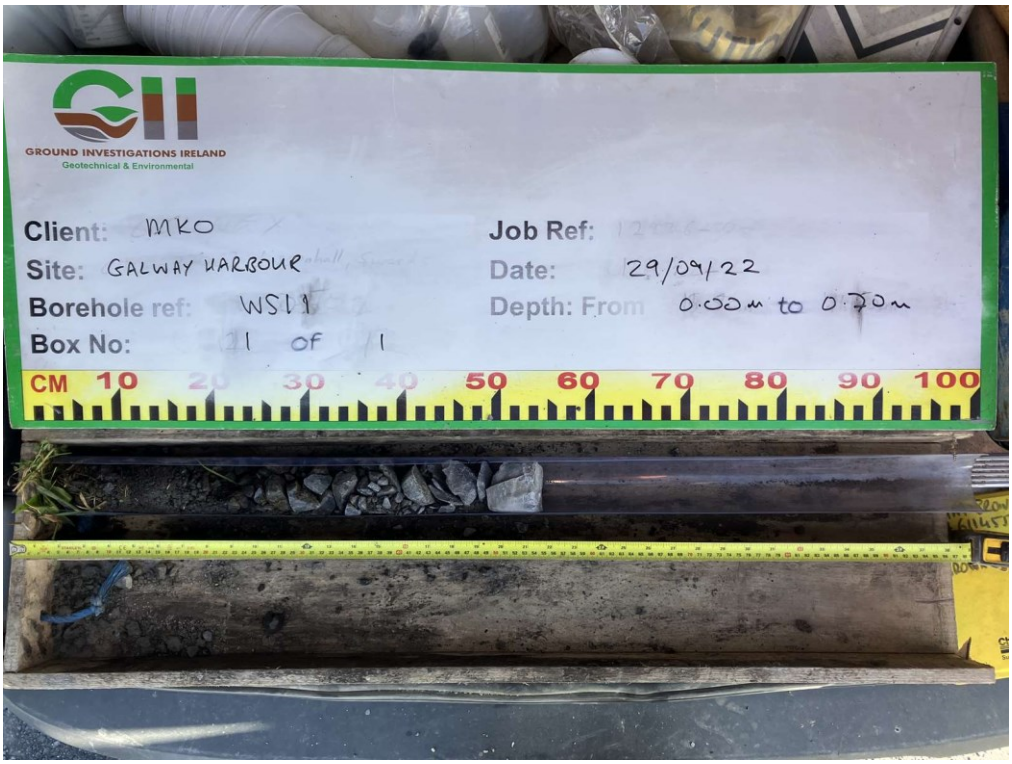
WS209


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: MKO
Job Ref:
Site: GALWAY HARBOUR
Date: 30/09/22
Borehole ref: WS09
Depth: From 0.00m to 0.60m
Box No: 1 of 1
CM 10 20 30 40 50 60 70 80 90 100

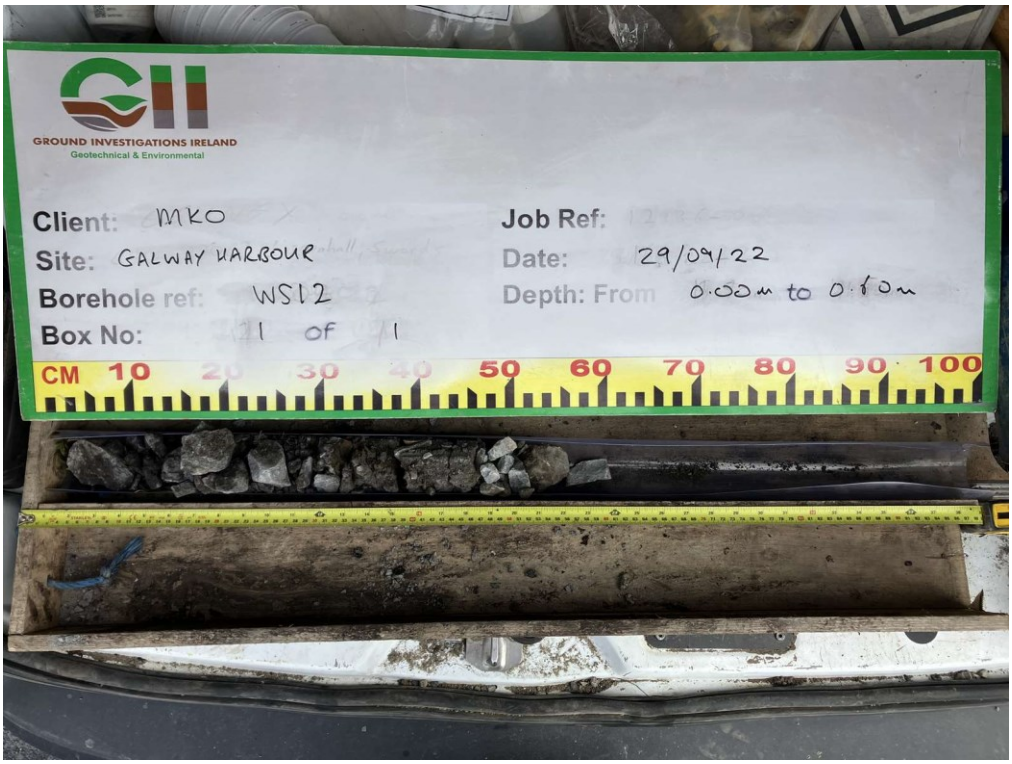
WS210


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: MKO
Job Ref:
Site: GALWAY HARBOUR
Date: 29/09/22
Borehole ref: WS10
Depth: From 0.00m to 0.90m
Box No: 1 of 1
CM 10 20 30 40 50 60 70 80 90 100

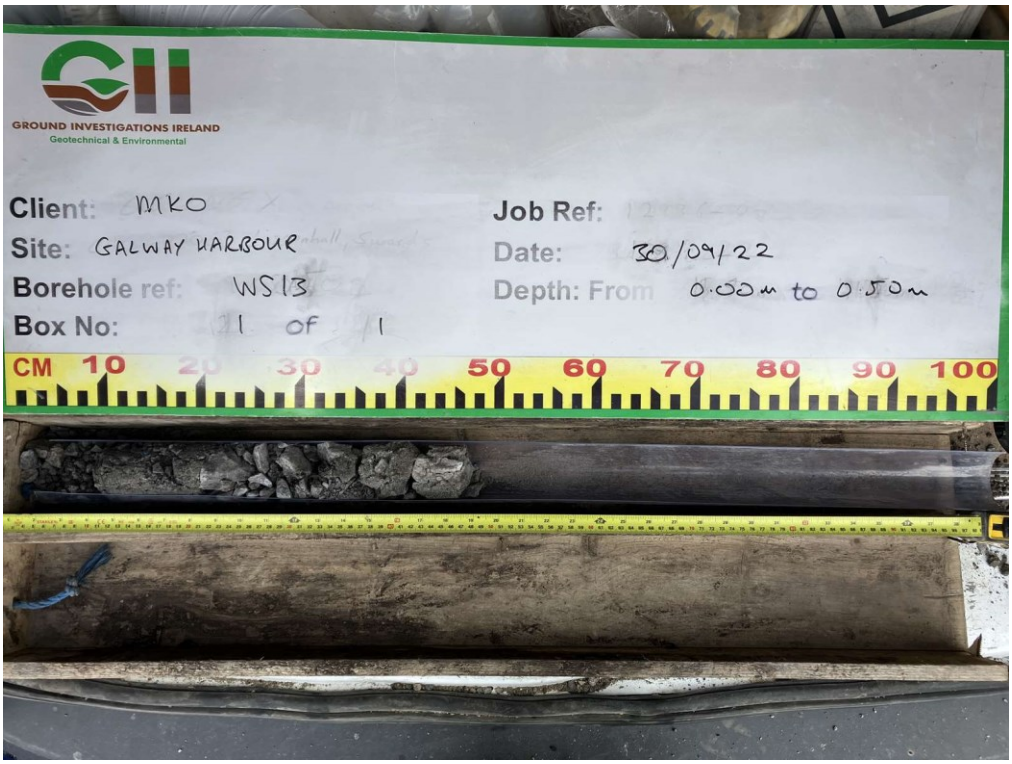
WS211


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: MKO
Job Ref:
Site: GALWAY HARBOUR
Date: 29/09/22
Borehole ref: WS11
Depth: From 0.00m to 0.70m
Box No: 1 of 1
CM 10 20 30 40 50 60 70 80 90 100

WS212


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: MKO
Job Ref:
Site: GALWAY HARBOUR
Date: 29/09/22
Borehole ref: WS12
Depth: From 0.00m to 0.10m
Box No: 1 of 1
CM 10 20 30 40 50 60 70 80 90 100

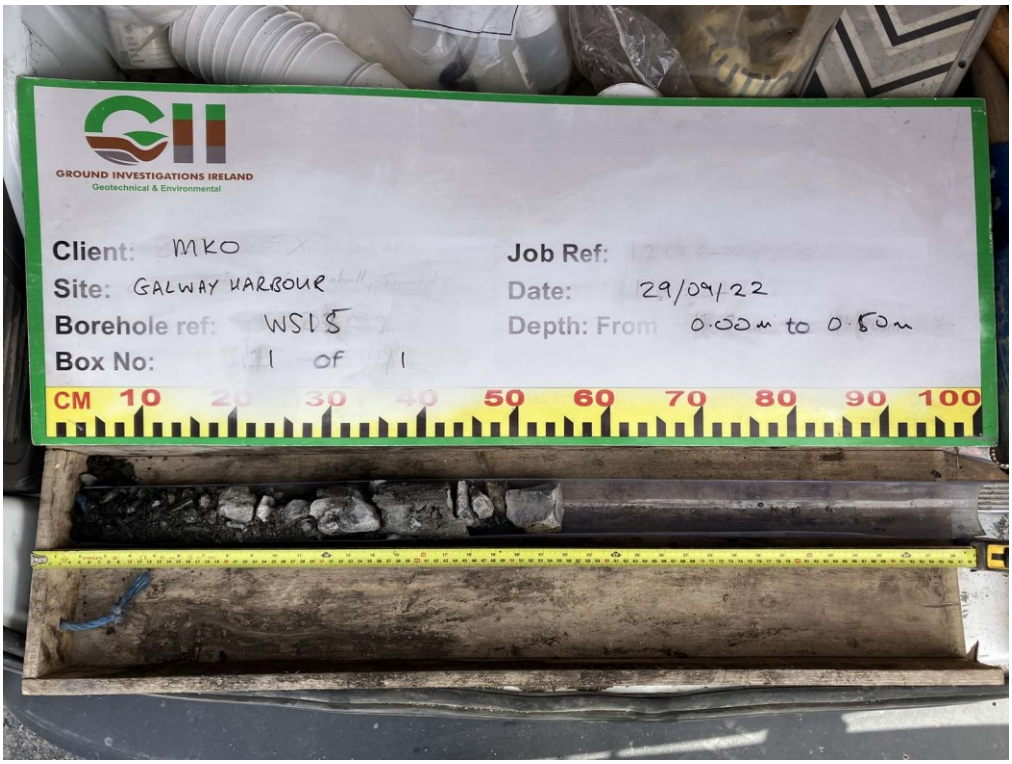
WS213


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: MKO
Job Ref:
Site: GALWAY HARBOUR
Date: 30/09/22
Borehole ref: WS13
Depth: From 0.00m to 0.50m
Box No: 1 of 1
CM 10 20 30 40 50 60 70 80 90 100

WS214


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: MKO
Job Ref:
Site: GALWAY HARBOUR
Date: 30/09/22
Borehole ref: WS14
Depth: From 0.00m to 0.50m
Box No: 1 of 1
CM 10 20 30 40 50 60 70 80 90 100

WS215


GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Client: MKO
Job Ref:
Site: GALWAY HARBOUR
Date: 29/09/22
Borehole ref: WS15
Depth: From 0.00m to 0.50m
Box No: 1 OF 1
CM 10 20 30 40 50 60 70 80 90 100

APPENDIX 3 –Rotary Borehole Records

www.gii.ie

Ground Investigations Ireland Ltd
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Site Galway Harbour Company			**Borehole Number** BH01
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.10m **Location** (dGPS) 530244.3 E 724872.4 N	**Ground Level (mOD)** 4.32 **Dates** 29/08/2022	**Client** Galway Harbour **Engineer** MKO Consultants	**Job Number** 12058-07-22 **Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(0.70)	CONCRETE			
	100					3.62	0.70	Recovery consists of MADE GROUND: Grey Cobbles and Boulders with some gravel. Driller notes boulders and fill			
1.20	65										
2.20	53										
3.60	65						(6.00)				
5.30	37	31	31								
6.70						-2.38	6.70	Very strong massive pink coarse grained porphyritic METAGABBRO. Unweathered 6.70m to 9.10m BGL: Two fracture sets. F1: 20 to 40 degrees medium to widely spaced planar to undulating rough. F2: 50 to 70 degrees medium to widely spaced planar to undulating rough.			
7.00 7.00-7.08	100	92	70	3	PL		(2.40)				
8.30	100	97	76								
9.10 9.15-9.35					UC	-4.78	9.10	Very strong massive green coarse grained porphyritic METAGABBRO. Unweathered 9.10m to 11.10m BGL: Two fracture sets. F1: 20 to 40 degrees medium to widely spaced planar to undulating rough. F2: 50 to 70 degrees medium to widely spaced planar to			
9.90											

Remarks
Borehole complete at 11.10m BGL
50mm slotted standpipe with a pea gravel surround installed from 11.00m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH01

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Site Galway Harbour Company				**Borehole Number** BH01
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.10m	**Ground Level (mOD)** 4.32	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530244.3 E 724872.4 N	**Dates** 29/08/2022	**Engineer** MKO Consultants	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	100	100	85	3			(2.00)	undulating rough			
10.90-11.00					PL						
11.10						-6.78	11.10	Complete at 11.10m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH01

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Site Galway Harbour Company			**Borehole Number** BH02
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.00m	**Ground Level (mOD)** 4.27	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530232.4 E 724905.8 N	**Dates** 30/08/2022	**Engineer** MKO Consultants	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						4.07	(0.20) 0.20	CONCRETE			
	33							MADE GROUND: Grey Cobbles and Boulders with some gravel			
0.90							(1.90)				
	83										
2.10						2.17	2.10	Recovery consists of MADE GROUND: Grey Cobbles and Boulders with much gravel. Driller notes boulders and fill			
	52										
3.40											
	50						(4.50)				
5.00											
	54										
6.20											
	81					-2.33	6.60	Recovery consists of MADE GROUND: Grey, pink and green Cobbles and Boulders with much gravel. Driller notes boulders			
7.10											
	66						(2.85)				
8.30											
	72	47	38								
9.45						-5.18	9.45	Very strong massive pink and green coarse grained porphyritic METAGABBRO. Unweathered			
9.45-9.55					PL						
9.90											

Remarks
Borehole complete at 11.00m BGL
50mm slotted standpipe with a pea gravel surround installed from 11.00m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH02

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Site Galway Harbour Company			**Borehole Number** BH02
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.00m	**Ground Level (mOD)** 4.27	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530232.4 E 724905.8 N	**Dates** 30/08/2022	**Engineer** MKO Consultants	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.10-10.26 10.50-10.58	100	100	100	3	UC PL		(1.55)	9.45m to 11.00m BGL: One fracture set. F1: 30 to 50 degrees medium to widely spaced planar to undulating rough			
11.00						-6.73	11.00	Complete at 11.00m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH02

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Site Galway Harbour Company				**Borehole Number** BH03
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.10m	**Ground Level (mOD)** 4.76	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530288.1 E 724940.1 N	**Dates** 30/08/2022	**Engineer** MKO Consultants	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						4.76					
	67					4.21	(0.55) 0.55	CONCRETE			
0.90	80						(2.45)	MADE GROUND: Grey Cobbles and Boulders with some gravel			
1.90	90										
3.00	62					1.76	3.00	Recovery consists of MADE GROUND: Grey Cobbles and Boulders with some gravel. Driller notes boulders			
4.30	50						(2.30)				
5.30	64					-0.54	5.30	Recovery consists of Possible MADE GROUND: Greenish grey Cobbles and Boulders with some gravel. Driller notes boulders			
7.10						-2.34	7.10				
7.70-7.80	91	94	80	5	PL		(4.00)	Very strong foliated dark greenish grey coarse grained phaneritic GNEISS. Unweathered 7.10m to 11.10m BGL: Two fracture sets. F1: 0 to 20 degrees close to medium spaced planar to undulating rough. F2: 30 to 50 degrees close to widely spaced planar to undulating rough			
9.15-9.30					UC						
9.30											

Remarks
Borehole complete at 11.10m BGL
50mm slotted standpipe with a pea gravel surround installed from 11.00m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH03

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Site Galway Harbour Company				**Borehole Number** BH03
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.10m	**Ground Level (mOD)** 4.76	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530288.1 E 724940.1 N	**Dates** 30/08/2022	**Engineer** MKO Consultants	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.55-11.65	100	100	65		PL						
11.10						-6.34	11.10	Complete at 11.10m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH03

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Site Galway Harbour Company				**Borehole Number** BH04
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 9.90m	**Ground Level (mOD)** 4.80	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530275.1 E 724968.2 N	**Dates** 31/08/2022	**Engineer** MKO Consultants	**Sheet** 1/1

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						4.80	(0.40)	CONCRETE			
	50					4.40	0.40	Recovery consists of MADE GROUND: Grey Cobbles with much gravel. Driller notes boulders			
1.30							(0.90)				
	38					3.50	1.30	Recovery consists of Possible MADE GROUND: Greenish grey Cobbles and Boulders with some gravel. Driller notes boulders			
3.10											
	24						(5.40)				
4.80											
	67										
5.70											
	35										
6.70						-1.90	6.70	Very strong foliated greenish grey coarse grained phaneritic METAGABBRO. Unweathered			
6.80-6.90					PL			6.70m to 9.90m BGL: Two fracture sets. F1: 0 to 15 degrees medium spaced planar to undulating rough. F2: 30 to 50 degrees close to medium spaced planar to undulating rough.			
	100	97	84								
8.30				4			(3.20)				
8.50-8.70					UC						
	100	100	80								
9.50-9.57					PL						
9.90						-5.10	9.90				

Remarks
Borehole complete at 9.90m BGL
50mm slotted standpipe with a pea gravel surround installed from 9.90m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH04

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Site Galway Harbour Company				**Borehole Number** BH05
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.80m	**Ground Level (mOD)** 5.24	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530244.6 E 724983.3 N	**Dates** 29/08/2022	**Engineer** MKO Consultants	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	42						(0.60)	Recovery consists of MADE GROUND: Grey subangular fine to coarse Gravel. Driller notes Fill			
0.60						4.64	0.60				
							(0.25)	CONCRETE			
	44					4.39	0.85	Recovery consists of MADE GROUND: Grey Cobbles with much gravel. Driller notes boulders and clay			
2.30											
	35						(3.75)				
4.60						0.64	4.60				
	100							Recovery consists of Possible MADE GROUND: Green and grey Cobbles and Boulders with some Gravel. Driller notes boulders and clay			
5.30											
	95										
6.20							(4.00)				
	52										
7.30											
8.60						-3.36	8.60				
8.60-8.70	88	88	70	2	PL			Very strong massive pink and greenish grey coarse grained porphyritic to phaneritic METAGABBRO. Unweathered 8.60m to 11.80m BGL: One fracture set. F1: 20 to 30 degrees widely spaced planar smooth			

Remarks
Borehole complete at 11.80m BGL
50mm slotted standpipe with a pea gravel surround installed from 11.80m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH05

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Site Galway Harbour Company			**Borehole Number** BH05
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.80m	**Ground Level (mOD)** 5.24	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530244.6 E 724983.3 N	**Dates** 29/08/2022	**Engineer** MKO Consultants	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.20 10.20-10.40	100	100	100	0	UC		(3.20)				
11.40-11.50					PL						
11.80						-6.56	11.80	Complete at 11.80m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH05

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Site Galway Harbour Company				**Borehole Number** BH06
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 12.30m	**Ground Level (mOD)** 5.13	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530192.3 E 724942.6 N	**Dates** 01/09/2022	**Engineer** MKO Consultants	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						4.93	(0.20) 0.20	CONCRETE			
	28							Recovery consists of MADE GROUND: Grey and green Cobbles and Boulders with some gravels			
1.00	20										
2.30	55										
3.30	60										
4.30 4.40-4.85	31				3,3/2,1,1,0 SPT(C) N=4		(8.10)				
6.10 6.10-6.18	17				25/ SPT(C) 25*/75						
8.30	36	22	16			-3.17	8.30	Very strong massive green coarse grained phaneritic METAGABBRO. Unweathered to partially weathered with occasional clay infilling 8.30m to 12.30m BGL: Two fracture sets. F1: 0 to 20 degrees close to widely spaced planar to undualting rough. F2: 50 to 70 degrees medium to widely spaced planar to undulating rough.			
9.40 9.60-9.70 9.70	100	100	33		PL						

Remarks
Borehole complete at 12.30m BGL
50mm slotted standpipe with a pea gravel surround installed from 12.30m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH06

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Site Galway Harbour Company			**Borehole Number** BH06
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 12.30m	**Ground Level (mOD)** 5.13	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530192.3 E 724942.6 N	**Dates** 01/09/2022	**Engineer** MKO Consultants	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.00-10.18	100	100	72		UC		(4.00)				
10.60	100	100	60								
11.60	100	100	67								
12.10-12.18					PL						
12.30						-7.17	12.30	Complete at 12.30m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH06

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Site Galway Harbour Company			**Borehole Number** BH07
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.30m	**Ground Level (mOD)** 4.88	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530170.6 E 724976.2 N	**Dates** 05/09/2022	**Engineer** MKO Consultants	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						4.68	(0.20) 0.20	CONCRETE			
	20							Recovery consists of MADE GROUND: Grey and pink Cobbles and Boulders with some gravel. Driller notes fill onto clay			
2.00	33						(5.10)				
3.50 3.50-3.95	38				7,7/9,7,10,12 SPT(C) N=38						
5.30 5.30-5.38	75				25/ SPT(C) 25*/75	-0.42	5.30 (1.60)	Very stiff greyish brown slightly sandy gravelly CLAY with some cobbles. Gravel is subangular to subrounded fine to coarse			
6.90	30					-2.02	6.90	Recovery consists of greyish brown slightly sandy gravelly CLAY with some cobbles. Driller notes boulder Clay (Very stiff)			
7.50	44						(1.40)				
8.30 8.65-8.75	100	94	72	5	PL	-3.42	8.30	Very stong massive pink coarse grained porphyritic METAGABBRO. Unweathered to partially weathered 8.30m to 11.30m. Two fracture sets. F1: 0 to 20 degrees medium to widely spaced planar to undulating, rough. F2: 50 to 70 degrees medium to widely spaced planar to undulating, rough			
9.20-9.40					UC						
9.90 10.05							(3.00)				

Remarks
Borehole complete at 11.30m BGL
50mm slotted standpipe with a pea gravel surround installed from 11.30m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH07

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Site Galway Harbour Company			**Borehole Number** BH07
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.30m	**Ground Level (mOD)** 4.88	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530170.6 E 724976.2 N	**Dates** 05/09/2022	**Engineer** MKO Consultants	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	100	100	90	3							
11.20-11.30 11.30					PL	-6.42	11.30	Complete at 11.30m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH07

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Site Galway Harbour Company				**Borehole Number** BH08
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 10.30m	**Ground Level (mOD)** 5.07	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530213.2 E 724990.4 N	**Dates** 01/09/2022	**Engineer** MKO Consultants	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						4.82	(0.25) 0.25	CONCRETE			
	94						(0.65)	MADE GROUND: Dark grey aungular to subrounded fine to coarse Gravel			
0.90						4.17	0.90				
	64						(2.00)	Recovery consists of MADE GROUND: Grey and greenish grey Cobbles and Boulders with rare fragment of steel. Driller notes boulders and a steel bar			
2.30	42										
2.90						2.17	2.90				
	10						(1.10)	Recovery consists of Possible MADE GROUND: Greenish grey subangular coarse Gravel. Driller notes sediment washed away			
4.00 4.00-4.45	8				1,0/0,0,0,0 SPT(C) N=0	1.07	4.00 (1.30)	No recovery. Driller notes sediment washed away			
5.30 5.30-5.75	22				1,1/0,2,0,0 SPT(C) N=2	-0.23	5.30 (1.80)	Recovery consists of Dark brown sandy organic Clay onto grey Gravel. Driller notes Seafloor (Very soft)			
7.10 7.10-7.25	100	55	15	NI	25/50 SPT(C) 25*/75 50/75	-2.03	7.10	Very strong foliated greenish grey coarse grained phaneritic METAGABBRO. Unweathered 7.10m to 8.30m BGL: Mostly non-intact 8.30m to 10.30m BGL: Two fracture sets. F1: 0 to 20 degrees close to medium spaced planar to undulating rough. F2: 50 to 70 degrees close to medium spaced planar to undulating rough			
8.10 8.30 8.30-8.40					PL						
8.70-8.81	100	91	75	4	UC		(3.20)				
9.70 9.90-10.00					PL						

Remarks
Borehole complete at 10.30m BGL
50mm slotted standpipe with a pea gravel surround installed from 10.30m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH08

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Site Galway Harbour Company				**Borehole Number** BH08
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 10.30m	**Ground Level (mOD)** 5.07	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530213.2 E 724990.4 N	**Dates** 01/09/2022	**Engineer** MKO Consultants	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	100	67	67								
10.30						-5.23	10.30	Complete at 10.30m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH08

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Site Galway Harbour Company			**Borehole Number** BH09
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.10m	**Ground Level (mOD)** 5.28	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530240.5 E 725033.9 N	**Dates** 05/09/2022	**Engineer** MKO Consultants	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(0.45)	CONCRETE			
	42					4.83	0.45	Recovery consists of MADE GROUND: Brownish grey slightly sandy slightly clayey angular to subrounded fine to coarse Gravel. Driller notes fill			
1.30							(0.85)				
	30					3.98	1.30	Recovery consists of MADE GROUND: Greenish grey and dark grey Cobbles and Boulders with some gravel. Driller notes boulders			
2.80 2.80-3.25					5,7/1,1,0,1 SPT(C) N=3						
	46										
4.30 4.30-4.75					1,1/0,1,1,0 SPT(C) N=2						
	28						(6.90)				
5.30											
	38										
7.00											
	35										
8.00											
8.20 8.20-8.30					PL	-2.92	8.20	Very strong foliated dark greenish grey coarse grained phaneritic METAGABBRO. Unweathered			
	100	100	83					8.20m to 11.10m BGL: Two fracture sets. F1: 0 to 10 degree medium spaced planar to undulating rough. F2: 30 to 50 degrees closely to medium spaced planar to undulating rough			
9.50 9.50-9.70				5	UC		(2.90)				

Remarks
Borehole complete at 11.10m BGL
50mm slotted standpipe with a pea gravel surround installed from 11.10m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH09

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Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.10m **Location** (dGPS) 530240.5 E 725033.9 N	**Ground Level (mOD)** 5.28 **Dates** 05/09/2022	**Site** Galway Harbour Company **Client** Galway Harbour **Engineer** MKO Consultants	**Borehole Number** **BH09** **Job Number** 12058-07-22 **Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.80-10.90	100	100	68		PL						
11.10						-5.82	11.10	Complete at 11.10m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No.
12058-07-22.BH09

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Site Galway Harbour Company			**Borehole Number** BH10
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.10m	**Ground Level (mOD)** 5.22	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530265.4 E 725010.7 N	**Dates** 06/09/2022	**Engineer** MKO Consultants	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						5.12	0.10	TARMACADAM			
	44						(0.70)	Recovery consists of MADE GROUND: Dark grey subangular to subrounded fine to coarse Gravel. Driller notes fill			
0.80						4.42	0.80				
	60							Recovery consists of MADE GROUND: Greenish grey Cobbles with much gravel. Driller notes boulders and cobbles			
1.60											
	20										
2.50							(3.30)				
	24										
4.10						1.12	4.10	MADE GROUND: Greenish grey Cobbles and Boulders with little gravel			
	80						(1.30)				
5.30						-0.18	5.40	Recovery consists of grey subangular to subrounded coarse Gravel. Driller notes cavity and soft silty CLAY			
	26	13	13				(2.50)				
7.90						-2.68	7.90	Very strong massive pink coarse grained porphyritic METAGABBRO. Unweathered			
8.30 8.30-8.40	100	100	100		PL			7.90m to 11.10m BGL: Two fracture sets. F1: 10 to 20 degrees closely wo wideley spaced planar to undulating rough. F2: 50 to 70 degrees medium to widely spaced planar to undulating rough to smooth			
9.50 9.60-9.85				3	UC		(3.20)				

Remarks
Borehole complete at 11.10m BGL
50mm slotted standpipe with a pea gravel surround installed from 11.10m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH10

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Site Galway Harbour Company				**Borehole Number** BH10
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.10m	**Ground Level (mOD)** 5.22	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530265.4 E 725010.7 N	**Dates** 06/09/2022	**Engineer** MKO Consultants	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.70-10.80	100	100	100		PL						
11.10						-5.88	11.10	Complete at 11.10m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH10

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Site Galway Harbour Company			**Borehole Number** BH11
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 12.30m	**Ground Level (mOD)** 5.53	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530323.8 E 725034.4 N	**Dates** 06/09/2022	**Engineer** MKO Consultants	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						5.38	(0.15) 0.15	CONCRETE			
	61						(0.65)	Recovery consists of MADE GROUND: Grey angular to subrounded fine to coarse Gravel with occasional cobbles. Driller notes fill			
0.90						4.73	0.80				
	19							Recovery consists of MADE GROUND: Greenish grey Cobbles and Boulders with some gravel. Driller notes fill and boulders			
2.20							(3.00)				
	33										
3.80						1.73	3.80				
	70							Possible MADE GROUND: Greenish grey Cobbles and Boulders with little gravel			
5.30							(3.20)				
	88										
7.00						-1.47	7.00				
	25							Recovery consists of Possible MADE GROUND: Greenish grey Cobbles and Boulders with some gravels . Driller notes boulders			
8.00							(2.10)				
	42										
8.90											
9.10	100	78	61	3		-3.57	9.10	Very strong foliated dark greenish grey coarse grained phaneritic GNEISS. Unweathered			
9.60-9.70					PL			9.10m to 12.30m BGL: Three fracture sets. F1: 0 to 20 degrees medium to widely spaced planar to undulating rough to smooth. F2: 50 to 70 degrees medium to widely spaced			
9.80											

Remarks
Borehole complete at 12.30m BGL
50mm slotted standpipe with a pea gravel surround installed from 12.30m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH11

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Site Galway Harbour Company			**Borehole Number** BH11
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 12.30m	**Ground Level (mOD)** 5.53	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530323.8 E 725034.4 N	**Dates** 06/09/2022	**Engineer** MKO Consultants	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.70-10.95	100	100	80	5	UC		(3.20)	planar to undulating rough to smooth. F3: 80 to 90 degrees widely spaced planar to undulating rough to smooth			
11.30	100	100	55		PL						
12.05-12.15											
12.30						-6.77	12.30	Complete at 12.30m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH11

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Site Galway Harbour Company			**Borehole Number** BH12
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.30m	**Ground Level (mOD)** 5.67	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530322.1 E 725068.8 N	**Dates** 07/09/2022	**Engineer** MKO Consultants	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						5.47	(0.20) 0.20	CONCRETE			
	30						(1.30)	Recovery consists of MADE GROUND: Grey subangular to subrounded fine to coarse Gravel. Driller notes fill and boulders			
1.50						4.17	1.50				
	10						(3.80)	Recovery consists of MADE GROUND: Pink, grey and greenish grey subangular to subrounded coarse Gravel with occasional cobbles. Driller notes fill			
4.40 4.40-4.85	19				1,0/1,0,0,1 SPT(C) N=2						
5.30	85					0.37	5.30	Possible MADE GROUND: Grey and dark greenish grey BOULDERS with some cobbles with little gravel. Driller notes boulders			
							(1.00)				
6.30 6.30-6.75	22				3,3/4,1,3,5 SPT(C) N=13	-0.63	6.30	Recovery consists of MADE GROUND: Pink, grey and greenish grey Cobbles and Boulders with much gravel. Driller notes fill			
							(1.85)				
7.90 7.90-8.20					13,15/25,25 SPT(C) 50/150	-2.48	8.15	Very strong foliated dark greenish grey coarse grained phaneritic GNEISS. Unweathered			
8.30 8.30-8.42	94	66	66		PL			8.30m to 11.30m BGL: Two fracture sets. F1: 20 to 40 degrees medium spaced to widely spaced. F2: 50 to 70 degrees medium to widely spaced planar to undulating rough			
9.10	100	100	85	3			(3.15)				

Remarks
Borehole complete at 11.30m BGL
50mm slotted standpipe with a pea gravel surround installed from 11.30m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH12

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Site Galway Harbour Company			**Borehole Number** BH12
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.30m	**Ground Level (mOD)** 5.67	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530322.1 E 725068.8 N	**Dates** 07/09/2022	**Engineer** MKO Consultants	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.00-10.15					UC						
10.10	100	100	88								
10.95-11.05					PL						
11.30						-5.63	11.30	Complete at 11.30m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH12

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Site Galway Harbour Company				**Borehole Number** BH13
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.00m	**Ground Level (mOD)** 5.61	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530298.6 E 725101.4 N	**Dates** 07/09/2022	**Engineer** MKO Consultants	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	42					5.51	0.10	CONCRETE Recovery consists of MADE GROUND: Dark grey subangular to subrounded fine to coarse Gravel with many cobbles. Driller notes fill and boulders			
1.40	31										
2.30	27						(7.70)				
4.10	13										
5.30 5.30-5.75	8				1,0/0,1,0,1 SPT(C) N=2						
6.50 6.50-6.80	32	8	0		11,13/25,25 SPT(C) 50/150						
7.80						-2.19	7.80	Very strong massive pink coarse grained porphyritic METAGABBRO. Unweathered 7.80m to 11.00m BGL: Two fracture spaces. F1: 0 to 20 degrees close to medium spaced planar to undulating rough to smooth. F2: 70 to 80 degrees medium to widely spaced planar to undulating rough to smooth			
7.90	100	92	61								
9.40-9.48				7	PL		(3.20)				
9.50											

Remarks
Borehole complete at 11.00m BGL
50mm slotted standpipe with a pea gravel surround installed from 11.00m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH13

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Site Galway Harbour Company				**Borehole Number** BH13
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.00m	**Ground Level (mOD)** 5.61	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530298.6 E 725101.4 N	**Dates** 07/09/2022	**Engineer** MKO Consultants	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.30-10.40	100	100	35		PL						
10.80-10.95					UC						
11.00						-5.39	11.00	Complete at 11.00m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH13

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Site Galway Harbour Company			**Borehole Number** BH14
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 10.50m **Location** (dGPS) 530331.9 E 725114.1 N	**Ground Level (mOD)** 5.36 **Dates** 08/09/2022	**Client** Galway Harbour **Engineer** MKO Consultants	**Job Number** 12058-07-22 **Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						5.26	0.10	TARMACADAM			
	55						(0.80)	Recovery consists of MADE GROUND: Dark grey angular to subrounded fine to coarse Gravel with fragments of tarmac. Driller notes fill			
0.90						4.46	0.90				
	46							Recovery consists of MADE GROUND: Greenish grey subangular to subrounded fine to coarse Gravel with many cobbles. Driller notes fill and cobbles			
2.30							(3.70)				
	18										
4.10											
	83	54	54			0.76	4.60	Greenish grey BOULDER of gneiss			
							(0.70)				
5.30					1,0/0,0,0,0	0.06	5.30				
5.40-5.85					SPT(C) N=0			Recovery consists of greenish grey angular to subrounded fine to coarse GRAVEL. Driller notes cavity (loose)			
	46	37	31				(1.80)				
7.10					4,5/20,30	-1.74	7.10				
7.10-7.40					SPT(C) 50/150			Very strong foliated dark greenish grey coarse grained phaneritic GNEISS. Unweathered to partially weathered			
7.90-8.00					PL			7.10m to 10.50m BGL: One fracture set. F1: 50 to 70 degrees closely to widely spaced planar to undulating rough			
8.20				5							
	100	100	80				(3.40)				
9.30-9.50					UC						
9.60											
9.80											

Remarks
Borehole complete at 10.50m BGL
50mm slotted standpipe with a pea gravel surround installed from 10.50m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH14

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Site Galway Harbour Company				**Borehole Number** BH14
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 10.50m	**Ground Level (mOD)** 5.36	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location (dGPS) 530331.9 E 725114.1 N	**Dates** 08/09/2022	**Engineer** MKO Consultants	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
9.97-10.04	100	100	0	15	PL						
10.50						-5.14	10.50	Complete at 10.50m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH14

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Site Galway Harbour Company				**Borehole Number** BH15
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.00m	**Ground Level (mOD)** 4.95	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530361.3 E 725165.9 N	**Dates** 08/09/2022	**Engineer** MKO Consultants	**Sheet** 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	23							Recovery consists of MADE GROUND: Dark grey, light brown and greenish grey Cobbles and Boulders with some gravels. Driller notes fill and boulders			
1.20	68										
2.30	8										
3.30 3.30-3.75	23				1,0/0,1,0,0 SPT(C) N=1		(7.70)				
5.30 5.30-5.75	11				6,6/9,9,11,13 SPT(C) N=42						
7.70	100	100	50	11		-2.75	7.70	Very strong foliated dark greenish grey coarse grained phaneritic METAGABBRO with green and white mineral veins. Unweathered 7.70m to 11.00m BGL: Two fracture sets. F2: 0 to 20 degrees close to medium spaced undulating rough. F1: 35 to 55 degrees close to medium spaced undulating to planar rough.			
8.30 8.30-8.36 8.50	100	100	80		PL						
9.60-9.85				4	UC		(3.30)				
9.90											

Remarks
Borehole complete at 11.00m BGL
50mm slotted standpipe with a pea gravel surround installed from 11.00m to 3.00m BGL. 50mm plain standpipe with a bentonite seal installed from 3.00m BGL to GL, with a flush cover

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH15

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Site Galway Harbour Company			**Borehole Number** BH15
Machine : Comacchio 305 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 11.00m	**Ground Level (mOD)** 4.95	**Client** Galway Harbour	**Job Number** 12058-07-22
	Location 530361.3 E 725165.9 N	**Dates** 08/09/2022	**Engineer** MKO Consultants	**Sheet** 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.85-10.95	100	100	86		PL	-6.05	11.00				
11.00								Complete at 11.00m			

Remarks

Scale (approx)	Logged By
1:50	FOD

Figure No. 12058-07-22.BH15

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