Map Legend

Site Location

Subsoil Lithology

- Airfield/Airport
- Alluvium
- Bedrock outcrop or subcrop
- Blanket Peat
- Cut over raised peat
- Esturine silts and clays
- Fen Peat
- Kartsified bedrock outcrop or subcrop
- Lacustrine sediments
- Marine beach sands
- Pier
- Till derived from granites
- Till derived from limestones
- Urban
- Water

GALWAY
Gaillimh

Galway Bay
Cuan na Gaillimhe

River Corrib

Salthill
Bóthar na Trá

Lough Atalia

Oileán na Feamainne
Illaunafamona

Rabbit Island
Oileán Rois Bhig

Hare Isd
Oileán Rois Mhóir

Inis Caorach

Cora na Feamainne
Seaweed Pt.

Middens

Pier

Lifeboat Station

Star-shaped Fort

Holy Well

Loch an tSáile

Rinmore Pt

Saunder's Rock

Black Rock

Cooneen

Birdoo Beg

Birdoo More

Seamount

An Roisín
Rusheen Pt.

Blake's Hill

Ballybrit Race Course

Merlin Park

Roscam Round Tower

Standing Stone

Quay

MAP TITLE: **Subsoil Map**		MAP NO.: **Figure 4.1**	SCALE: **1:25,000**
PROJECT TITLE: **Phase 1 - Galway Inner Harbour, Galway**			DATE: **03-10-2019**
DRAWING BY: **Eoin O'Sullivan**	CHECKED BY: **Michael Watson**		ISSUE NO.: **190532-2019.10.03-D1**

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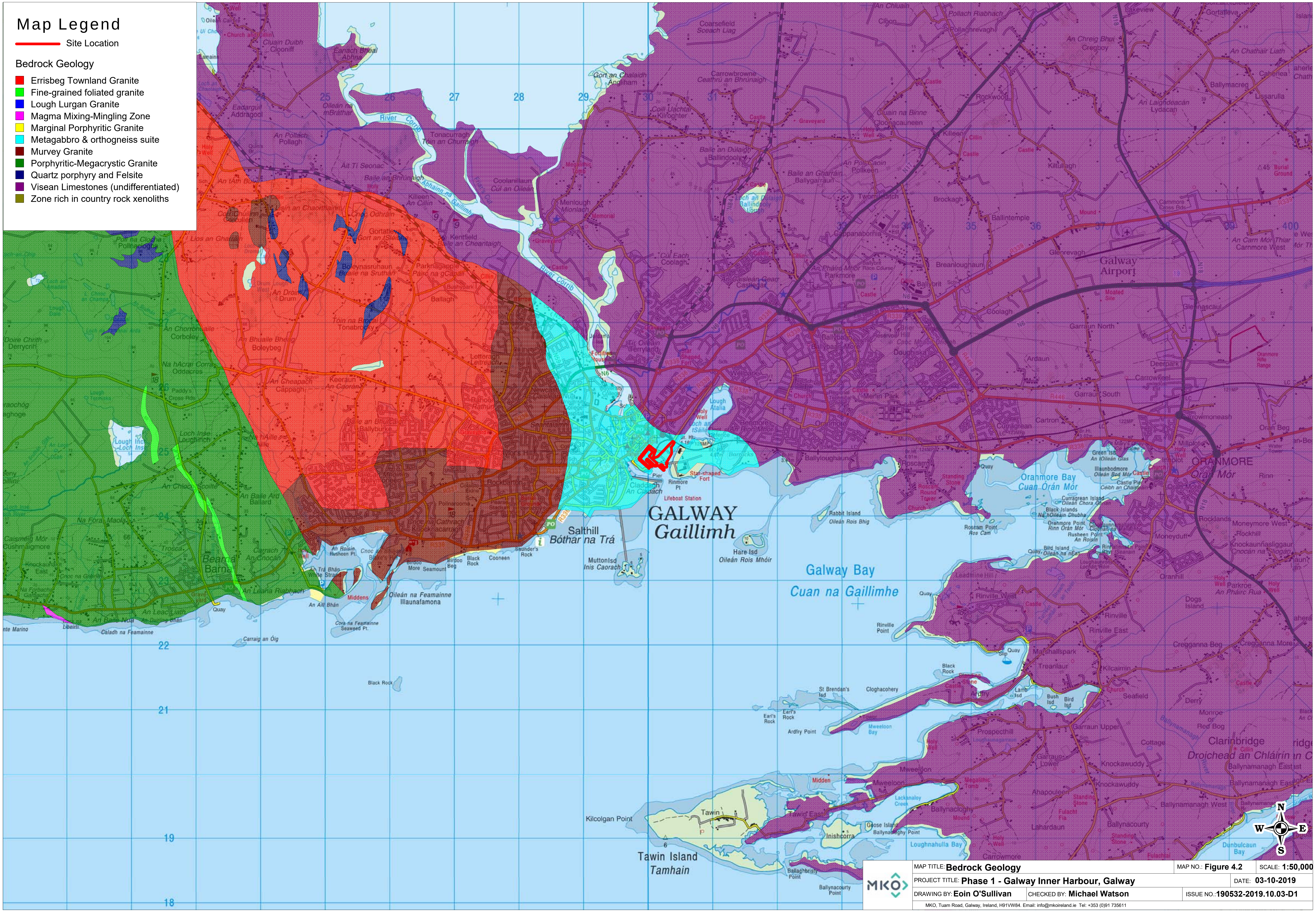
Map Legend
Site Location
Bedrock Geology
Errisbeg Townland Granite
Fine-grained foliated granite
Lough Lurgan Granite
Magma Mixing-Mingling Zone
Marginal Porphyritic Granite
Metagabbro & orthogneiss suite
Murvey Granite
Porphyritic-Megacrystic Granite
Quartz porphyry and Felsite
Visean Limestones (undifferentiated)
Zone rich in country rock xenoliths
GALWAY
Gaillimh
Galway Bay
Cuan na Gaillimhe
Salthill
Bóthar na Trá
Galway Airport
ORANMORE
Oranmore Bay
Tawin Island
Tamhain
MAP TITLE: Bedrock Geology
MAP NO.: Figure 4.2
SCALE: 1:50,000
PROJECT TITLE: Phase 1 - Galway Inner Harbour, Galway
DATE: 03-10-2019
DRAWING BY: Eoin O'Sullivan
CHECKED BY: Michael Watson
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Map Legend

Site Location

Groundwater Vulnerability Classes

- Extreme
- HIgh
- Low
- Moderate
- Water
- X

GALWAY
Gaillimh

Galway Bay
Cuan na Gaillimhe

MAP TITLE: **Groundwater Vulnerability Map**		MAP NO.: **Figure 4.3**	SCALE: **1:25,000**
PROJECT TITLE: **Phase 1 - Galway Inner Harbour, Galway**			DATE: **04-10-2019**
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4.4 Hydrology

The nearest surface water bodies to the site are the Corrib Estuary which is adjacent to the site and the River Corrib which is located approximately 230 metres to the west of the site. The Corrib Estuary is classed as a transitional waterbody by the EPA.

A review of the EPA Water Framework Directive monitoring database indicates that the Corrib Estuary is classed as been unpolluted and not at risk. The EPA has classed the River Corrib, as having a 'Good' status and not at risk.

The local hydrology is presented on Figure 4-4.

4.5 Designated Sites and Habitats

In the Republic of Ireland, designated sites include National Heritage Areas (NHAs), Proposed National Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

The site is adjacent to the Galway Bay Complex SAC, Inner Galway Bay SPA and Galway Bay Complex pNHA. The designated sites are presented on Figure 4-5.

4.6 Environmental Regulation

The EPA Map portal was reviewed to provide information on the environmental regulation setting of the surrounding area. There are no Industrial Emissions Licensed facilities, Integrated Pollution Control Sites or Waste facilities within 1.5 kilometres of the site.

4.7 Human Receptors

The nearest residential receptors are located at the northern, eastern and south western boundaries of the site.

Map Legend

- Site Location
- River
- Stream
- Lake

GALWAY
Gaillimh

Galway Bay
Cuan na Gaillimhe

Oranmore Bay
Cuan Órán Mór

MAP TITLE: **Local Hydrology**		MAP NO.: **Figure 4.4**	SCALE: **1:35,000**
PROJECT TITLE: **Phase 1 - Galway Inner Harbour, Galway**			DATE: **04-10-2019**
DRAWING BY: **Eoin O'Sullivan**	CHECKED BY: **Michael Watson**		ISSUE NO.:**190532-2019.10.04-D1**

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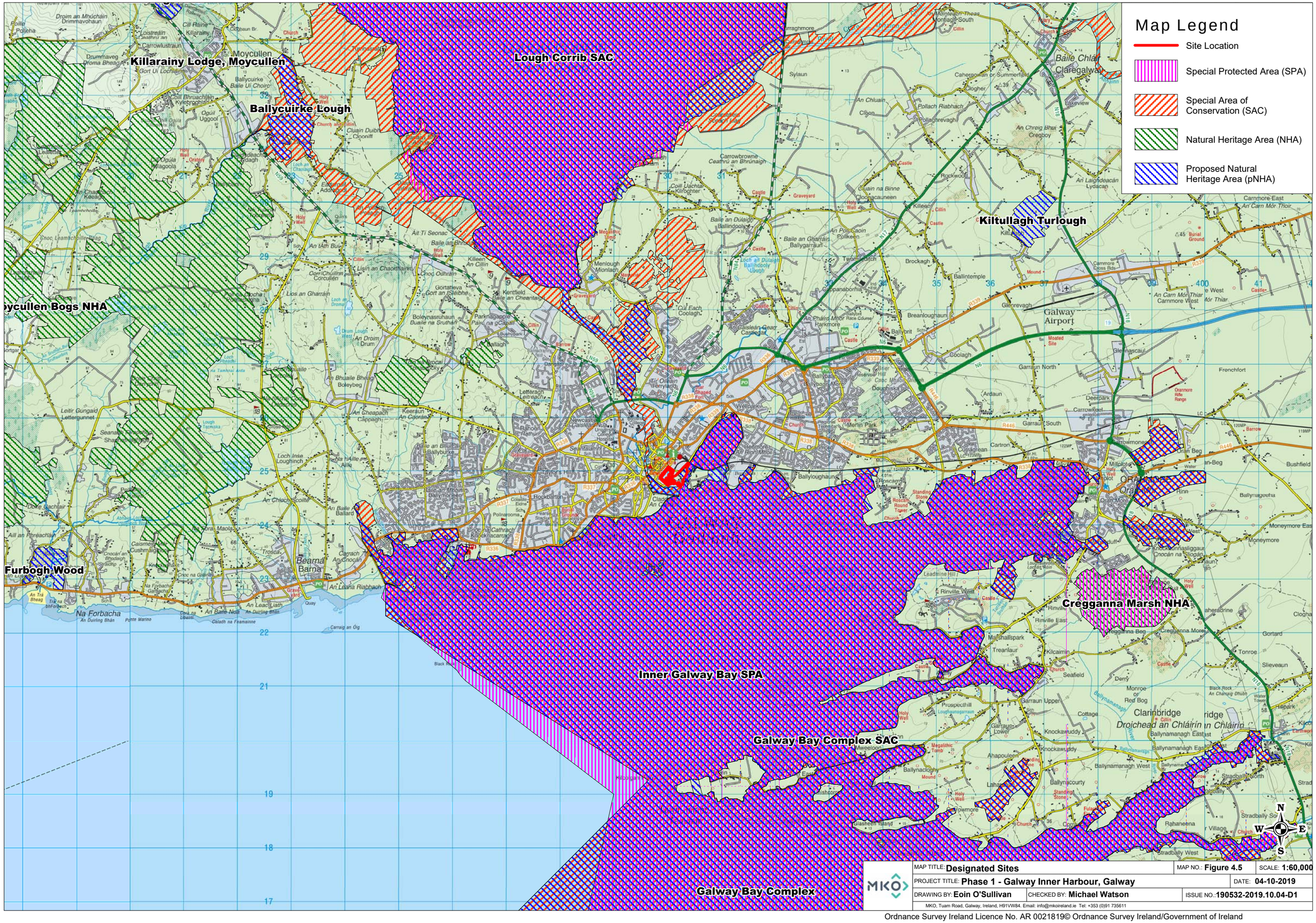

MAP TITLE: **Designated Sites**		MAP NO.: **Figure 4.5**	SCALE: **1:60,000**
PROJECT TITLE: **Phase 1 - Galway Inner Harbour, Galway**			DATE: **04-10-2019**
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5. PREVIOUS REPORTS

A Quantitative Risk Assessment (QRA) has been produced by RSK[1] Group Plc that relates to a section of the proposed site. Pertinent information relating to the site has been summarised below, however the full report should be referenced to for further detail.

It is understood that the QRA was based on information included in an Environmental Site Assessment (ESA) also produced by RSK in 2009. MKO was not in receipt of the ESA for the purposes of this assessment. It is understood that a ground investigation had been previously undertaken in the former tank area of the site.

- The soil and groundwater results obtained from the RSK investigation were compared to human health screening values for a continued oil use that were derived in-house by RSK.
- Human Health Generic Quantitative Risk Assessment (GQRA)
  - Soil – *No concentrations of MTBE (methyl tert-butyl ether), BTEX (benzene, toluene, ethylbenzene and xylenes) range compounds or aliphatic or aromatic hydrocarbon fractions exceed the generic soil screening values for human health.*
  - The report indicated that the potential risk to off-site workers from the soils is considered acceptable. The report also indicated that given the presence of less volatile Total Petroleum Hydrocarbons fractions the linkage to the nearest off-site residential receptors is considered to be incomplete.
  - Groundwater – *No concentrations of MTBE, BTEX range compounds or aliphatic or aromatic hydrocarbon fractions exceed the generic groundwater screening values for human health nor the laboratory detection limit. Therefore a linkage to onsite workers, offsite workers and any offsite residents is considered incomplete.*
- Water Environment GQRA
  - Risks to the water environment were quantified by comparing the groundwater samples to Interim Guideline Values.
  - *Groundwater analytical results from all monitoring positions onsite were below the laboratory method detection limit (LMDL), and therefore at levels below the Interim Guideline Values. Thus a linkage to the water environment is considered incomplete.*
- Risks to Utilities
  - The GAC for permeation of plastic pipes were exceeded in five of the soil samples tested from the top 1 metre of soil.
  - The report concluded that a potential risks exists to the water supply and further investigation is required to determine the level of risk.
- Summary of Pollutant Linkages
  - *A potentially complete pollutant linkage has been identified at the site with respect to the permeation of plastic services by hydrocarbons sorbed to shallow soil and also to construction workers associated with direct contact with hydrocarbon impacted soil.*

[1] *RSK Group Plc (July 2009). Site Quantitative Risk Assessment. Texoil Galway Truck Park, Galway, County Galway, Ireland. Report 23132-2(01)*

6. PRELIMINARY RISK ASSESSMENT

6.1 Introduction

Historical contamination of land may present harm to human health and the environment. Currently there is no specific legislation addressing contaminated land in Ireland. Contaminated land issues are dealt with either through the planning process by the imposition of conditions in planning permission or by clean-up orders under the water or waste legislation. The most typical mechanism for the clean-up of land is an application for a clean-up order under Sections 57/58 of the Waste Management Act 1996, as amended. This can be directed to the "holder" of the waste, which can be the current landowner or any persons (such as a previous owner) who released or permitted the release of contaminants on the land. Where contaminated land is creating a risk to the groundwater or surface water, the water pollution legislation can also be used.

This preliminary risk assessment has generally been undertaken in accordance with the Environmental Protection Agency's Code of Practice: Environmental Risk Assessment for Unregulated Waste Disposal Sites and the UK Environment Agency's document Model Procedures for the Management of Land Contamination: Contaminated Land Report No.113 (CLR 11).

The rudimentary principle behind the risk-based approach is the source-pathway-receptor concept which requires the three elements to be present in the consideration of risk. The presence of a risk is therefore not considered when one or more of these elements are absent.

6.2 Preliminary conceptual site model

A preliminary conceptual site model has been compiled for the site based on the desk study information to identify the potential sources of contamination and the associated potential pollutant linkages.

6.2.1 Potential sources

Potential contamination sources can include current and historical activities both on site and on neighbouring land. The following potential sources have been identified at the site:

On-site Sources – It is anticipated that minimal amounts of contamination would be associated with the current site activities however there is the potential for localised spillages/leakages from the petrol station and vehicles using and parking at the site.

Historical records show that the site was used for oil, coal, waste metal and iron ore storage. The following contaminants could be associated with the site activities:

- Metals - (Metal fines and cinders possibly containing arsenic, cadmium, chromium, copper, lead, nickel and zinc).
- Organic Chemicals - (Hydrocarbons from storage, use and spillages of lubricating oils, greases, paraffin based solvents and polycyclic aromatic hydrocarbons (PAH), solvents).
- Other Contaminants - (Asbestos fibres, ash and fill).

Made Ground/Fill Material – Given the developed nature of the site and the history of site reclamation, it is possible that Made Ground may be present within the site, which represents a source of potential ground contamination. The make-up of these fill materials is unknown, however, it is likely that the fill would be composed of heterogeneous material, which is generally comprised of locally excavated soils and construction rubble.

Ground gas – if any encountered Made Ground/superficial deposits have an appreciable organic content there may be a potential to generate ground gases.

Asbestos – may be present in the buildings and structures on site, and also within underlying Made Ground, due to the age of the site.

Off-site sources – potential historical off site sources include the gas works to the northwest of the site, the railway works to the north of the site, the graveyard to the northwest and the foundry located to the west of the site.

6.2.2 Potential receptors and associated pathways

Future site occupants – primarily at risk from direct contact, inhalation or ingestion where soil is exposed and from soil gas/vapour accumulation within buildings, arising from organic estuarine silts and clays and possibly contaminated Made Ground/Fill material, if present.

Construction Workers – primarily at risk from direct contact, inhalation or ingestion of contaminants.

Buildings & structures – buried concrete and services, such as plastic water supply pipes, can be at risk from chemically aggressive ground and hydrocarbon contamination if present. Ground gases and vapours may also accumulate in buildings and structures presenting an explosive or asphyxiation risk.

Vegetation & plants – primarily at risk from uptake phytotoxic contaminants such as copper and zinc.

Controlled waters – groundwater and surface water bodies could be at risk from the infiltration and migration of possible contaminants.

6.3 Preliminary qualitative risk assessment

A qualitative risk assessment has been undertaken based on the findings of the Conceptual Site Model and the potential pollutant linkages that may exist at the site in accordance with the UK Environment Agency's Contaminated Land Report (CLR) 11 . The risks identified are in accordance with the UK Department for Environment, Food and Rural Affairs (DEFRA) Contaminated Land Report (CLR) 6 , site prioritisation and categorisation rating system, which is summarised in Table 6-1 below.

Table 6-1 Risk Rating Terminology

Risk Rating	Description
High Risk	• Contaminants very likely to represent an unacceptable risk to identified targets • Site probably not suitable for proposed use. • Enforcement action possible. • Urgent action required.
Medium Risk	• Contaminants likely to represent an unacceptable risk to identified targets. • Site probably not suitable for proposed use. • Action required in the medium term.
Low Risk	• Contaminants may be present but unlikely to create unacceptable risk to identified targets. • Site probably suitable for proposed use. • Action unlikely to be needed whilst site remains in current use.

Risk Rating	Description
Negligible Risk	• If contamination sources are present, they are considered to be minor in nature and extent. • Site suitable for proposed use. • No further action required.

Based on the above terminology, an assessment of the risks posed by the potential pollutant linkages at the site is outlined in Table 6-2 below.

Table 6-2 Qualitative Risk Assessment

Source/Medium	Receptor	Potential Exposure Route	Risk Rating
Organic/inorganic contaminants (including PAHs, hydrocarbons, metals, asbestos, etc.) within underlying soils/Made Ground, if present	Current/future site occupants	Direct ingestion of soil & dust, inhalation of particulates & vapours, and dermal contact	Low to medium
	Construction workers	Direct ingestion of soil & dust, inhalation of particulates	Low to medium
	Vegetation & Plants	Root uptake	Low to medium
	Building & Structures	Direct contact with water supply pipes and underground concrete structures	Low to medium
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 to medium
Organic/inorganic contaminants within underlying soils/Made Ground	Local surface water bodies	Lateral migration of contaminants	Medium
	Groundwater	Lateral migration of contaminants Vertical migration of contaminants	Medium
Off-site sources	Ground and groundwater conditions beneath the study site	Lateral migration of contaminants. Vertical migration of contaminants.	Low to medium

6.3.1 Summary

Based on the findings of the desk study, the anticipated ground conditions and past land uses identified in and around the site, a generally low to medium risk is considered for the identified receptors. This is due to the potential for hydrocarbon and heavy metal contamination associated with the previous uses of the site and the potential for contaminated Made Ground from previous phases of redevelopment and past activities at the site. Asbestos may also be contained within the current site structures and underlying Made Ground.

7. CURRENT GROUND INVESTIGATION

7.1 Fieldwork

The ground investigation was undertaken from the 28th August to the 3rd September 2019 and comprised the excavation of twenty four window sampler boreholes (WS-01 to WS-24) to a maximum depth of 4.0mbgl. Gas and groundwater monitoring standpipes were installed in WS-04, WS-09, WS-10, WS-12, WS-14, WS-16, WS-18 and WS-23. The borehole locations were discussed in advance with the client and agreed with the tenants.

In order to obtain samples for laboratory chemical testing and to characterise the near surface ground conditions across the site, the exploratory hole arisings were logged and representatively sampled by a suitably qualified engineer from Ground Investigations Ireland Ltd (GII).

The investigation was undertaken generally in accordance with the requirements set out within BS 5930:2015[2] and BS 10175:2011+A2:2017[3]. A site layout and exploratory hole location plan is presented as Figure 7-1, and a record of the borehole logs outlining the material encountered, samples and field testing undertaken for each exploratory hole is presented in Appendix 3.

7.2 Monitoring

Monitoring has been undertaken on three occasions on the 3rd September, 19th September and 4th October 2019 to record groundwater levels from the standpipes. Ground gas concentrations were also obtained during the monitoring rounds on the 19th September and 4th October 2019. There was no groundwater encountered in boreholes WS-04, WS-09, WS-10, WS-12, WS-14, WS-16, WS-18 and WS-23 during the monitoring round on the 19th September and therefore no groundwater samples were retrieved for laboratory analysis. Groundwater samples were retrieved from two boreholes that were previously installed at the site by RSK during the visit on the 19th September 2019. Where encountered, the water was tested during sampling for in-situ parameters including pH, temperature and electrical conductivity.

The monitoring records are included in Appendix 4.

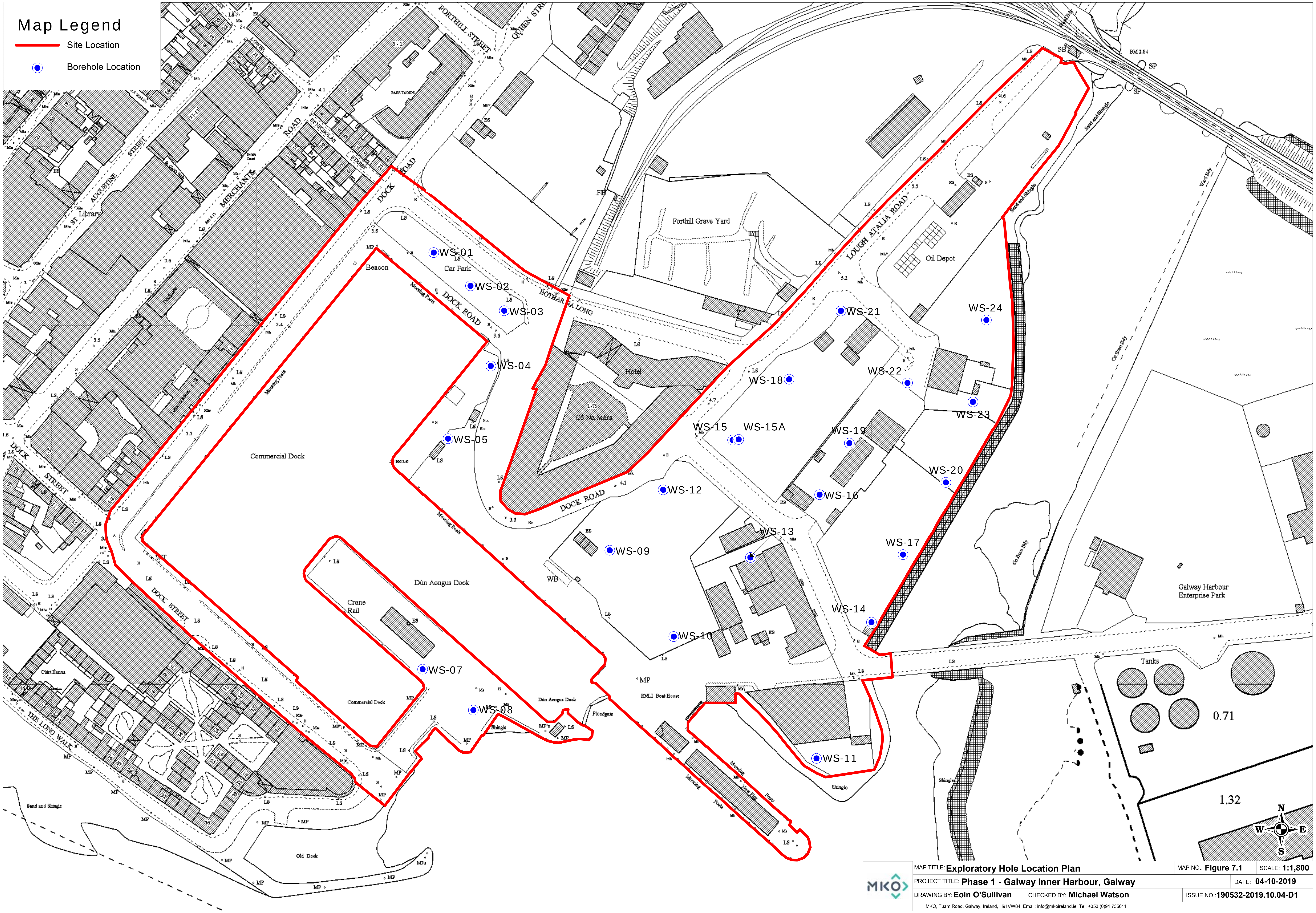
7.3 Laboratory testing

Representative soil samples were sent to Element Materials Technology (a UKAS and MCERTS accredited laboratory) for chemical testing. The analysis included the following determinants:

- Heavy metals including; antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium and zinc;
- Benzene, toluene, ethylbenzene, xylenes (BTEX) compounds;
- Total Petroleum Hydrocarbons (TPHCWG) and Polycyclic aromatic hydrocarbons (PAHs);
- Polychlorinated biphenyl (PCBs);
- Total monohydric phenols;
- Total Organic Carbon;
- Natural Moisture Content; and
- pH determination.

[2] *BSI (2015). Code of Practice for Ground Investigations BS 5930:2015. BSI Standards Publication*
[3] *BSI (2017). Investigation of Potentially Contaminated Sites – Code of Practice BS10175:2011+A2:2017. BSI Standards Publication*

Groundwater samples were analysed for a similar suite of contaminants, which included hardness ($CaCO_3$) within the results. Samples of Made Ground that were scheduled for laboratory analysis were screened for asbestos. Laboratory testing results are presented in Appendix 5.


Map Legend
Site Location
Borehole Location
WS-01
WS-02
WS-03
WS-04
WS-05
WS-07
WS-08
WS-09
WS-10
WS-11
WS-12
WS-13
WS-14
WS-15
WS-15A
WS-16
WS-17
WS-18
WS-19
WS-20
WS-21
WS-22
WS-23
WS-24
Car Park
Beacon
Dock Road
Commercial Dock
Dún Aengus Dock
Crane Rail
Hotel
Cé Na Mara
Forthill Grave Yard
Oil Depot
Lough Atalia Road
Bothar Na Long
Dock Street
Merchants Road
St Augustine Street
Library
The Long Walk
Forthill Street
Queen Street
RNLI Boat House
Floodgate
New Pier
Old Dock
Tanks
Galway Harbour Enterprise Park
Sand and Shingle
Shingle
0.71
1.32
N
W
E
S
MAP TITLE: Exploratory Hole Location Plan
MAP NO.: Figure 7.1
SCALE: 1:1,800
PROJECT TITLE: Phase 1 - Galway Inner Harbour, Galway
DATE: 04-10-2019
DRAWING BY: Eoin O'Sullivan
CHECKED BY: Michael Watson
ISSUE NO.: 190532-2019.10.04-D1
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8. GROUND CONDITIONS

The ground conditions encountered during the MKO ground investigation are summarised in Table 8-1, below.

Table 8-1 Summary of Ground Conditions

Stratum	Depth to Top of Stratum (mbgl)	Typical Thickness (m)
Tarmac and concrete hard-standing	0.0	0.04 to 0.5
Grey brown clayey gravel, sandy gravelly clay, sandy clayey gravel, silty sandy gravelly clay, gravelly clayey sand, gravelly clay or gravel. Gravel is fine to coarse subrounded to subangular with occasional cobbles of granite. Occasional fragments of plastic, glass, red brick, clinker, slate, concrete, porcelain, and ash. Abundant shell fragments in WS-09 and WS-13 [MADE GROUND]	0.04 to 0.5	0.2 to 2.6
Grey brown sandy gravelly clay, clayey gravelly sand or sandy clayey gravel. [POSSIBLE MADE GROUND]	0.8 to 1.0	0.6 to 1.4
Grey brown sandy gravelly silty CLAY, sandy gravelly silty CLAY or sandy gravelly CLAY with occasional subangular to subrounded cobbles of granite and occasional shell fragments. [WS-04 and WS-21 only] [POSSIBLE ESTUARINE SEDIMENTS]	1.0 to 2.0	1.2 to 2.0

8.1.1 Made Ground

Tarmac or reinforced concrete hardstanding was encountered in all exploratory hole locations and varied in thickness between 0.04m and 0.5 metres, over Made Ground in all exploratory hole locations during the ground investigation. The Made Ground typically ranged in thickness between 0.2 metres and 2.6 metres. The Made Ground generally comprised of a clayey gravel, sandy gravelly clay, sandy clayey gravel, silty sandy gravelly clay, gravelly clayey sand, gravelly clay or gravel.

Obstructions were encountered in window sampler boreholes WS-01 (0.5 metres below ground level (mbgl)), WS-02 (0.5mbgl), WS-03 (0.54mbgl), WS-07 (0.7mbgl), WS-08 (0.5mbgl), WS-11 (0.7mbgl), WS-15 (0.5mbgl), WS-15A (0.4mbgl) and WS-24 (0.5mbgl) and therefore these boreholes were terminated at these depths due to the obstructions.

8.1.2 Possible Estuarine Sediments

Possible Estuarine Sediments (PED) were encountered in WS-04 and WS-21 only. The material was found to consist of a generally soft to firm sandy gravelly silty clay. The estuarine sediments typically ranged in thickness between 1.2m to 2.0m and it was typically encountered at depths of 1.0m to 2.0m below ground level.

8.1.3 Groundwater

There were no groundwater encountered in the boreholes during drilling. The groundwater levels in the monitoring standpipes were measured by GII during three monitoring visits. A summary of the groundwater levels is presented in Table 8-2.

Table 8-2 Summary of Groundwater Monitoring Results

Borehole No.	Response Zone	Depth to groundwater (mbgl)		
		03/09/19	19/09/19	04/10/19
WS-04	Made Ground/PED	1.80	Dry	2.00
WS-09	Made Ground	Dry	Dry	Dry
WS-10	Made Ground	Dry	Dry	Dry
WS-12	Made Ground	Dry	Dry	Dry
WS-14	Made Ground	Dry	Dry	Dry
WS-16	Made Ground	Dry	Dry	Dry
WS-18	Made Ground	2.60	2.63	2.62
WS-23	Made Ground	Dry	Dry	Dry
WS-28 (RSK)	Not known	Not recorded	4.58	4.37
WS-29 (RSK)	Not known	Not recorded	4.43	3.61

The groundwater flow direction in the Made Ground was not conclusively determined based on site data. There is insufficient data available to conclude whether groundwater exists as a separate waterbody within the Made Ground and whether there is connectivity in the groundwater between the Made Ground and other strata.

8.1.4 Ground gas

The atmospheric pressures and local pressure system during the two rounds of ground gas monitoring visits are presented in Table 8-3.

Table 8-3 Summary of Ground Gas Monitoring Pressures

Visits	Atmospheric pressure (mb)	Local pressure system
19/09/2019	1030-1032	Falling
04/10/2019	1002-1006	Rising

The main findings of the monitoring are summarised below and further details are provided in Section 9.5:

Table 8-4 Summary of worst case ground gas monitoring records in all boreholes

Borehole	Response Zone	Flow (l/hr)	0_2 (min %)	CO_2 (max %)	CH_4 (max %)
WS-04	Made Ground/PED	<0.1	20.0	0.2	0.3
WS-09	Made Ground	<0.1	19.4	2.0	<0.1
WS-10	Made Ground	<0.1	20.1	0.1	<0.1
WS-12	Made Ground	<0.1	19.2	0.5	0.2
WS-14	Made Ground	<0.1	20.3	0.1	0.2
WS-16	Made Ground	<0.1	20.1	0.1	0.3
WS-18	Made Ground	<0.1	18.3	2.0	0.1
WS-23	Made Ground	<0.1	20.5	0.1	<0.1

8.1.5 Ground Contamination

No visual or olfactory evidence of contamination was encountered during drilling or site monitoring.

9. SOIL CONTAMINATION ASSESSMENT

9.1 Risks to Human Health

The results of the assessment undertaken on samples of the Made Ground and Possible Estuarine Sediments are set out in Tables 6.2 to 6.5 of Appendix 6. 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.

Where the dataset is of appropriate size, assessment against the applicable GAC or is carried out at the 95th percentile of the sample mean (designated US95), which is considered to represent a reasonable worst-case scenario. An assessment of the normality of the data has been undertaken. Where datasets are normally distributed the one sample t-test has been applied to calculate the US95. In the case of nonparametric datasets, the Chebychev Theorem has been applied. The Grubbs Test has also been used to identify potential outliers within datasets.

Thirty one Made Ground samples and four soil 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 thirty five soil samples.

9.1.1 Risks from Made Ground

9.1.1.1 Residential without Private Gardens Land Use Scenario

As can be observed from Table 6.2 of Appendix 6, elevated concentrations of lead, benzo(a)pyrene, benzo(b)fluoranthene 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.

9.1.1.2 Commercial Land Use Scenario

As can be observed from Table 6.3 of Appendix 6, 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.

9.1.2 Risks from Natural Ground

9.1.2.1 Residential without Private Gardens Land Use Scenario

As can be observed from Table 6.4 of Appendix 6, 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.

9.1.2.2 Commercial Land Use Scenario

As can be observed from Table 6.5 of Appendix 6, 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.

9.2 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. There was no asbestos identified in the other window sampler boreholes.

9.3 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[4] are significantly lower than the health GAC. The results of the assessment are presented in Table 9-1 below.

Table 9-1 Soil Risks to Vegetation and Plants

Determinant	Assessment Criteria	Measured Range (mg/kg)	Concentration > Assessment Criteria (Y/N)
Copper	135	<1.0 to 2,146	Y
Zinc	200	13.0 to 10,741.00	Y
Nickel	75	5.6 to 47.80	N

As can be observed in Table 9-1, 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.

9.4 Risks to Controlled Waters

Chemical test results from the groundwater samples collected from the two RSK boreholes are presented in Table 6.6 of Appendix 6. The results have been compared against Annual Average Environmental Quality Standards (AA-EQS)[5,6,7] and Groundwater Threshold Values (GTV)[8,9,10,11]. In the absence of specific AA-EQS and GTV values, EPA interim guideline values (IGV)[12] have been

[4] *BSI (2015). Specification for Topsoil BS3882:2015. BSI Standards Publication*
[5] *European Communities Environmental Objectives (Surface Water) Regulations 2009. S.I. No. 272 of 2009*
[6] *European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2015. S.I. No. 386 of 2015*
[7] *European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019. S.I. No. 77 of 2019*
[8] *European Communities Environmental Objectives (Groundwater) Regulations 2010. S.I. No. 9 of 2010*
[9] *European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016. S.I. No. 366 of 2016*
[10] *European Communities Environmental Objectives (Groundwater) Regulations 2010. S.I. No. 9 of 2010*
[11] *European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016. S.I. No. 366 of 2016*
[12] *Environment Protection Agency (2003). Towards Setting Guideline Values for the Protection of Groundwater in Ireland. Interim Report*

used. The RSK borehole logs were not available for the purposes of this assessment and therefore the response zone is unknown. Therefore, this screening exercise is for information purposes only.

As can be observed from Table 6.6 the contamination concentrations measured in groundwater found in the RSK Boreholes are below the EQS with the exception of total cyanide, benzo(b+k)fluoranthene and fluoranthene.

As can also be observed from Table 6.6, the concentrations of arsenic in one of the samples and sulphate in two samples are above the GTV threshold. The total cyanide and sulphate concentrations was also above the IGV value.

Whilst it is noted that the limits of detection for cadmium, mercury, phenol, polycyclic aromatic hydrocarbons, Total Petroleum Hydrocarbons and benzene exceed the EQS, GTV and IGV in some instances, the chemical test results of the soil samples have not identified significant elevated concentrations of these contaminants and therefore it is not considered that these contaminants are present at concentrations of concern in the groundwater.

9.5 Ground Gas Assessment

A summary of the maximum recorded ground gas concentrations and flow rates are presented below in Table 9-3. Table 9-3 also presents the calculated gas screening value (GSV) and the associated Risk classification and Characteristic Situation[13] to CIRIA 665[14] based on the results of monitoring undertaken. 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 9-2 below.

Table 9-2 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.

[13] *Wilson et. al. (2006/2007). Characteristic situations, CIRIA 149*
[14] *Wilson et. al. (2007). Assessing risks posed by hazardous ground gases to building, CIRIA C665*

Table 9-3 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	<0.1	20.0	0.2	0.3	0.0002	0.0003	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	<0.1	19.2	0.5	0.2	0.0005	0.0002	Characteristic Situation 1
WS-14	Made Ground	<0.1	20.3	0.1	0.2	0.0001	0.0002	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 <0.1 litres/hour (l/hr). The GSV would therefore be 0.0003 l/h for methane and 0.002 l/h for carbon dioxide. Therefore, currently available monitoring data indicates that the site conforms to Characteristic Situation 1.

9.6 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 9-5) indicates that of the thirty one Made Ground and four soil samples tested by Element on behalf of MKO, seven samples would be classified as hazardous and twenty eight samples would be classified as not-hazardous (i.e. inert or non-hazardous) for waste recovery/disposal purposes.

As indicated in Section 9.2 asbestos containing material were identified in the Made Ground samples from window sampler boreholes WS-10 between 1m and 2mbgl and WS-18 between 0m and 2mbgl.

Asbestos quantification was subsequently carried on the samples from WS-10 between 1m and 2mbgl and WS-18 between 0m and 2mbgl. The results from the asbestos quantification are presented in Table 9-4 below.

Table 9-4 Asbestos Quantification Results

Location	Asbestos Identification Name	Asbestos Quantification (%)
WS10 1.0-2.0mbgl	Chrysotile fibre bundles	< 0.1%
WS18 0.0-1.0mbgl	Chrysotile fibre bundles	< 0.1%
WS18 1.0-2.0mbgl	Chrysotile, amosite fibre bundles, bitumen products	< 0.1%

The result from the quantification testing indicates that the areas of Made Ground where asbestos was identified in window sampler boreholes WS-10 between 1m and 2mbgl and WS-18 between 0m and 2mbgl were below the hazardous threshold of >0.1% asbestos by weight.

Table 9-5 Summary of Waste Characterisation

Sample Location	Depth (mbgl)	Stratum	Characterisation[1]	Contaminants
WS-01	0.00-0.50	Made Ground	Not-hazardous	N/A
WS-02	0.00-0.50	Made Ground	Not-hazardous	N/A
WS-03	0.00-0.54	Made Ground	Not-hazardous	N/A
WS-04	0.00-1.00	Made Ground	Not-hazardous	N/A
WS-04	1.00-2.00	Possible Estuarine Sediments	Not-hazardous	N/A
WS-04	2.00-2.20	Possible Estuarine Sediments	Not-hazardous	N/A
WS-05	0.00-1.00	Made Ground	Not-hazardous	N/A
WS-05	1.00-1.70	Made Ground	Not-hazardous	N/A
WS-07	0.00-0.70	Made Ground	Not-hazardous	N/A
WS-09	0.00-1.00	Made Ground	Not-hazardous	N/A
WS-09	1.00-1.50	Made Ground	Not-hazardous	N/A
WS-10	0.00-1.00	Made Ground	Hazardous	Metals
WS-10	1.00-2.00	Made Ground	Hazardous	Metals, <0.1% Asbestos
WS-11	0.00-0.70	Made Ground	Hazardous	Metals
WS-12	0.00-1.00	Made Ground	Not-hazardous	N/A

Sample Location	Depth (mbgl)	Stratum	Characterisation[1]	Contaminants
WS-12	1.00-2.00	Made Ground	Not-hazardous	N/A
WS-13	0.00-1.00	Made Ground	Not-hazardous	N/A
WS-13	1.00-2.00	Made Ground	Not-hazardous	N/A
WS-14	0.00-1.00	Made Ground	Not-hazardous	N/A
WS-16	0.00-1.00	Made Ground	Hazardous	Metals
WS-17	0.00-1.00	Made Ground	Not-hazardous	N/A
WS-18	0.00-1.00	Made Ground	Hazardous	Metals, <0.1% Asbestos
WS-18	1.00-2.00	Made Ground	Hazardous	Metals, TPH, PAH, <0.1% Asbestos
WS-18	2.00-2.80	Made Ground	Hazardous	Metals, TPH, PAH
WS-19	0.00-1.00	Made Ground	Not-hazardous	N/A
WS-19	1.00-1.60	Made Ground	Not-hazardous	N/A
WS-20	0.00-1.00	Made Ground	Not-hazardous	N/A
WS-21	0.00-1.00	Made Ground	Not-hazardous	N/A
WS-21	1.00-2.00	Made Ground	Not-hazardous	N/A
WS-21	2.00-3.00	Possible Estuarine Sediments	Not-hazardous	N/A
WS-21	3.00-4.00	Possible Estuarine Sediments	Not-hazardous	N/A
WS-22	0.00-1.00	Made Ground	Not-hazardous	N/A
WS-23	0.00-1.00	Made Ground	Not-hazardous	N/A
WS-23	1.00-2.00	Made Ground	Not-hazardous	N/A
WS-24	0.00-0.50	Made Ground	Not-hazardous	N/A

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

10. REFINED RISK ASSESSMENT

10.1 Introduction

Further semi-quantitative risk assessment has been undertaken based on the findings of the intrusive investigation 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 10-1 below. A graphical representation of the conceptual site model is included as Figure 10-1.

Table 10-1 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 – Ground investigation inconclusive. Further investigation to address data gaps.
	Groundwater	Lateral migration of contaminants	Low to Medium – Ground investigation inconclusive.

Source/Medium	Receptor	Potential Exposure Route	Risk Rating
		Vertical migration of contaminants	Further investigation to address data gaps.
Off-site sources	Ground and groundwater conditions beneath the study site	Lateral migration of contaminants. Vertical migration of contaminants.	Low to Medium – Ground investigation inconclusive. Further investigation to address data gaps.

10.2 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).

10.3 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.

10.4 Risks to Controlled Waters

There was insufficient groundwater encountered in the MKO boreholes to obtain samples for laboratory analysis. Two groundwater samples were obtained from the RSK boreholes and tested which showed some exceedances above the EQS and GTV threshold values. However, the RSK borehole logs were not available for this assessment and therefore the response zone in the borehole is unknown. Given the uncertainty regarding these results, it is recommended that further investigation and groundwater monitoring be undertaken at the site.

10.5 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:

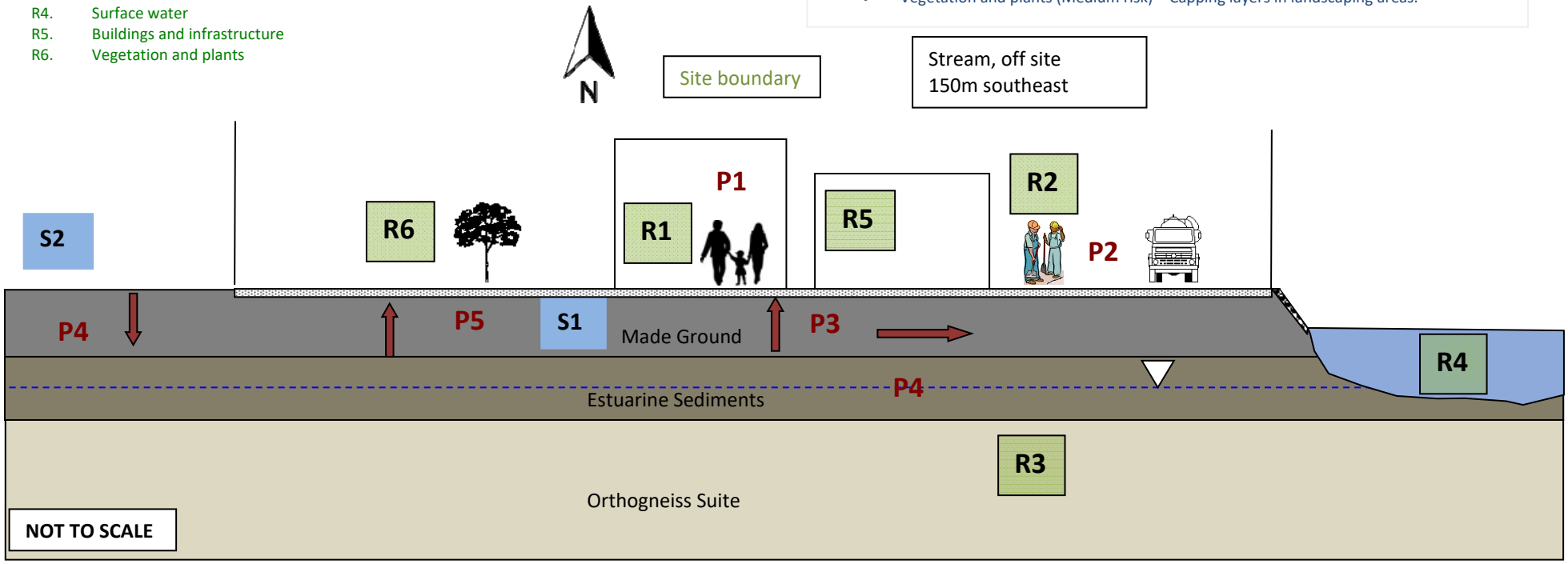
R1. Future occupants
R2. Construction workers
R3. Groundwater
R4. Surface water
R5. Buildings and infrastructure
R6. Vegetation and plants

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) – Further investigation to address data gaps.
- Vegetation and plants (Medium risk) – Capping layers in landscaping areas.



MKO	Project **Phase 1 – Galway Inner Harbour, Galway**	Project No **190532**
	Title **Conceptual Site Model**	**Figure 10.1**

11. FURTHER INVESTIGATION

11.1 Introduction

A preliminary ground investigation was undertaken at the Galway Inner Harbour site by GII on behalf of MKO in August 2019. At the time of the investigation the area to the north of the site (Texaco petrol station and swathe of land) was inaccessible and therefore this section of the site has not been investigated.

In addition, a number of the window sampler boreholes refused at shallow depths within the Made Ground and therefore it will be necessary to undertake further investigation by means of rotary or cable percussive drilling to understand the ground conditions at depth. It will also be necessary to install groundwater monitoring wells in order to characterise and assess the groundwater at depth.

Therefore, the objective of further investigation is to obtain information on the previously inaccessible areas of site, confirm the geotechnical and geo-environmental ground/groundwater conditions at depth and investigate potential anomalies from the preliminary investigation.

11.2 Proposed Further Investigation

The investigative works below are proposed to quantify the environmental and ground conditions and to confirm the preliminary ground investigation and conceptual model.

- 7 No. rotary core drilling to 20-30mbgl to provide geotechnical and geo-environmental data throughout the soil and rock horizon with in-situ testing, sampling and installation of four monitoring wells.
- Geotechnical and chemical laboratory analysis of representative soil/groundwater samples.
- Two groundwater sampling visits with gas monitoring, to be followed with two additional gas monitoring visits including recording of groundwater levels.

12. PRELIMINARY GEOENVIRONMENTAL RECOMMENDATIONS

12.1 Contamination and Remediation

Based on a Residential (without private gardens) end use scenario, elevated concentrations of lead and PAHs were encountered in the Made Ground during the ground investigation. The statistical analysis suggests that this is indicative of possible site-wide lead and PAHs contamination within the Made Ground, and may present a potential risk to human health where soil is exposed. It is considered that the risks presented to the health of future occupants by 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 12.1.1).

12.1.1 Capping Layers

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.

12.2 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.

12.3 Underground services

In accordance with current UKWIR[15] 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.

12.4 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.

12.4.1 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.

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

- 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.

12.4.2 Waste Recovery/Disposal

Where offsite recovery or disposal is required, the available laboratory results indicates that of the thirty one Made Ground and four soil samples tested, seven samples would be classified as hazardous and twenty 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 12-1 and Figure 12-1.

Table 12-1 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
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

Sample Location	Depth (mbgl)	Stratum	Characterisation[1]	Landfill Type[2] based on WAC Results
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
WS-24	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.

Map Legend

▬ Site Location
● Borehole Location
🟥 Hazardous Waste Location
🟧 Non-hazardous Waste Location
🟩 Inert Waste Location

MAP TITLE: **Waste Classification of Soil Arisings**
MAP NO.: **Figure 12.1**
SCALE: **1:1,800**
PROJECT TITLE: **Phase 1 - Galway Inner Harbour, Galway**
DATE: **04-10-2019**
DRAWING BY: **Eoin O'Sullivan**
CHECKED BY: **Michael Watson**
ISSUE NO.: **190532-2019.10.04-D1**

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12.4.3 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. 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.

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.

12.5 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

PHOTOGRAPH RECORDS

Plate 1 – View of transit shed to the rear of the Galway Harbour Office in Area 1

Plate 2 – View of former ice tower building in Area 1

Plate 3 – View of Lasta Mara Steel Fabrication and hardstanding in Area 1

Plate 4 – View of Dun Aengus Dock and scrap metal storage area in Area 2

Plate 5 – View of Contract Car Park in Area 2 (looking west)

Plate 6 – View of Contract Car Park in Area 2 (looking northwest)

Plate 7 – View of fuel storage tanks and bridge access to Galway Harbour Enterprise Park

Plate 8 – View of eastern boundary of site and railway bridge looking north

Plate 9 – View of hardstanding and site office containers in former coal yard site

Plate 10 – View of hardstanding in former coal yard site looking southwest

Plate 11 – View of hardstanding in former oil depot site looking southeast

Plate 12 – View of former oil depot site and Area 4 to the rear looking north

APPENDIX 2

HISTORICAL MAPS

Drawing Legend

Site Boundary

N

DRAWING TITLE:

Historical Map 1830 -1930

PROJECT TITLE:

GHC Framework – Environmental Phase 1

DRAWING BY:	CHECKED BY:
Joseph O Brien	Eoin O'Sullivan
PROJECT No.: 190532	DRAWING No.: 190532 - 01
SCALE: 1:2,500 @ A3	DATE: 08.10.2019
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Drawing Legend

Site Boundary

N

DRAWING TITLE:

Historical Map 1888 - 1913

PROJECT TITLE:

GHC Framework – Environmental Phase 1

DRAWING BY:	CHECKED BY:
Joseph O Brien	Eoin O'Sullivan
PROJECT No.: 190532	DRAWING No.: 190532 - 02
SCALE: 1:2,500 @ A3	DATE: 08.10.2019

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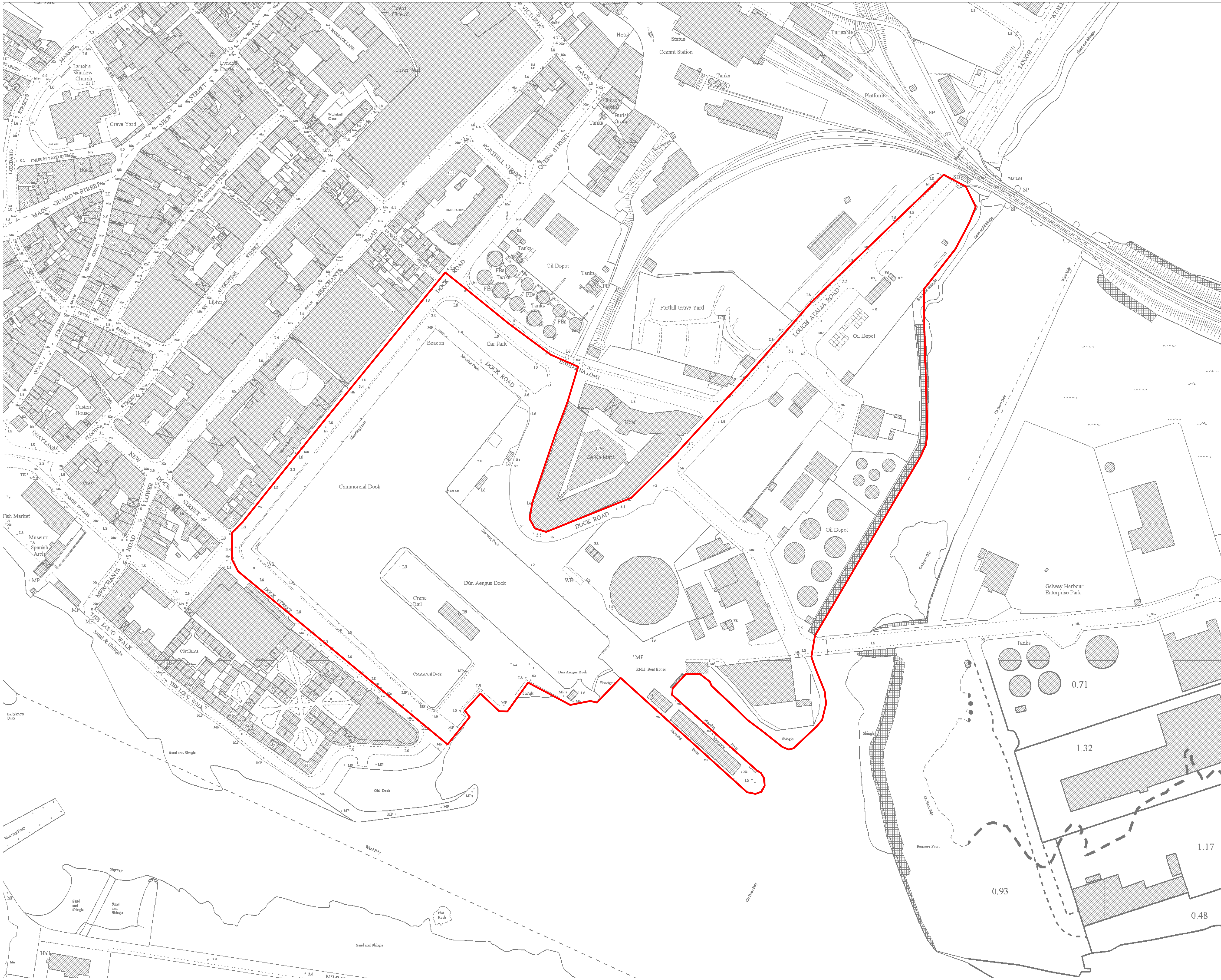

Drawing Legend

Site Boundary

Ordnance Survey Ireland Licence No. AR0021819© Ordnance Survey Ireland/Government of Ireland

DRAWING TITLE:

Historical Map circa 2005

PROJECT TITLE:

GHC Framework – Environmental Phase 1

DRAWING BY: Joseph O Brien	CHECKED BY: Eoin O'Sullivan
PROJECT No.: 190532	DRAWING No.: 190532 - 03
SCALE: 1:2,500 @ A3	DATE: 08.10.2019
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Drawing Legend

Site Boundary

N

DRAWING TITLE:

Aerial Map

PROJECT TITLE:

GHC Framework – Environmental Phase 1

DRAWING BY: Joseph O Brien	CHECKED BY: Eoin O'Sullivan
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APPENDIX 3

EXPLORATORY HOLE LOGS

Ground Investigations Ireland Ltd
www.gii.ie

Site Galway Port			**Number** WS-01
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530007.3 E 725070.8 N	**Dates** 02/09/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	EN				0.06	TARMACADAM		
					(0.44)	MADE GROUND: Grey sandy slightly clayey fine to coarse subangular GRAVEL with occasional subangular to subangular cobbles.		
					0.50	Complete at 0.50m		

Remarks
Refusal at 0.50m due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-01

Ground Investigations Ireland Ltd
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Site Galway Port			**Number** WS-02
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530027.8 E 725052.3 N	**Dates** 02/09/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	EN				(0.09) 0.09 (0.41) 0.50	TARMACADAM MADE GROUND: Grey sandy slightly clayey fine to coarse subangular GRAVEL with occasional subangular to subrounded cobbles. Complete at 0.50m		

Remarks
Refusal at 0.50m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-02

Ground Investigations Ireland Ltd

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Site Galway Port			**Number** WS-03
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530046.6 E 725038.4 N	**Dates** 02/09/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.54	EN				(0.08) 0.08	TARMACADAM		
					(0.46)	MADE GROUND: Grey sandy slightly clayey fine to coarse subangular GRAVEL with occasional subangular to subrounded cobbles.		
					0.54	Complete at 0.54m		

Remarks
Refusal at 0.54m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-03

Ground Investigations Ireland Ltd
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Site Galway Port			**Number** WS-04
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530039.1 E 725007.6 N	**Dates** 02/09/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00	EN				0.05	TARMACADAM			
					(0.35)	MADE GROUND: Light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles.			
					0.40	MADE GROUND: Grey sandy clayey fine to coarse subangular GRAVEL with occasional subangular to subrounded cobbles			
					(0.60)				
1.00-2.00	EN				1.00	Firm grey slightly sandy slightly gravelly silty CLAY with occasional subangular to subrounded cobbles and occasional shell fragments. Fine to coarse sand and fine to coarse subangular gravel. Some orange mottling.			
					(1.00)				
2.00-2.20	EN				2.00	Firm grey slightly sandy slightly gravelly silty CLAY with occasional subangular to subrounded cobbles of granite.			
					(0.20)				
					2.20	Complete at 2.20m			

Remarks
Refusal at 2.20m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-04

Ground Investigations Ireland Ltd
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Site Galway Port			**Number** WS-05
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530015.3 E 724967.1 N	**Dates** 02/09/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				(0.08) 0.08	TARMACADAM		
					(0.32)	MADE GROUND: Grey sandy slightly clayey fine to coarse subangular GRAVEL with occasional subangular cobbles.		
					0.40			
					(0.40)	MADE GROUND: Dark brown sandy clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles.		
					0.80			
1.00-1.70	EN				(0.90)	Firm grey slightly sandy slightly gravelly silty CLAY with occasional subangular to subrounded cobbles of granite. (Possible MADE GROUND)		
					1.70	Complete at 1.70m		

Remarks
Refusal at 1.70m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-05

Ground Investigations Ireland Ltd
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Site	Number
Galway Port	WS-07

Machine / Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine : Tech 10 Probing Rig Method : Drive-in Windowless Sampler			MKO Planning and Environmental Consultants	8979-08-19
	Location 530001.1 E 724838.6 N	**Dates** 30/08/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.70	EN				(0.29) 0.29 (0.41) 0.70	CONCRETE with rebar. MADE GROUND: Brownish grey sandy clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles. Complete at 0.70m		

Remarks
Refusal at 0.70m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No.
8979-08-19.WS-07

Ground Investigations Ireland Ltd
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Site Galway Port			**Number** WS-08
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530029.4 E 724815.8 N	**Dates** 30/08/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.28)	CONCRETE with rebar.		
					0.28			
					(0.22)	MADE GROUND: Grey slightly sandy slightly clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles.		
					0.50	Complete at 0.50m		

Remarks
No environmental sampling possible.
Refusal at 0.50m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-08

Ground Investigations Ireland Ltd
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Site	Number
Galway Port	WS-09

Machine : Tech 10 Probing Rig Method : Drive-in Windowless Sampler	Dimensions	Ground Level (mOD)	Client	Job Number
			MKO Planning and Environmental Consultants	8979-08-19
	Location 530105.4 E 724904.9 N	**Dates** 03/09/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00	EN				0.05 (0.25) 0.30	TARMACADAM MADE GROUND: Grey sandy slightly clayey fine to coarse angular to subangular GRAVEL with occasional subangular to subrounded cobbles of granite and occasional fragments of plastic and glass. Sand is fine to coarse and gravel is subangular to subrounded.			
					(0.50) 0.80	MADE GROUND: Brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. Abundant shell fragments with occasional fragments of red brick.			
1.00-2.00	EN				(0.40) 1.20	MADE GROUND: slightly silty slightly sandy sightly gravelly CLAY with abundant shell fragments.			
					(0.30) 1.50	MADE GROUND: Dark brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles and some orange mottling.			
						Complete at 1.50m			

Remarks
Refusal at 1.50m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No.
8979-08-19.WS-09

Ground Investigations Ireland Ltd
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Site	Number
Galway Port	WS-10

Machine / Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine : Tech 10 Probing Rig Method : Drive-in Windowless Sampler			MKO Planning and Environmental Consultants	8979-08-19
	Location 530141.1 E 724856.8 N	**Dates** 29/08/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00	EN				0.05	TARMACADAM			
						MADE GROUND: Greyish brown sandy clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles.			
					(0.95)				
1.00-2.00	EN				1.00	MADE GROUND: Dark brownish grey sandy clayey fine to coarse subangular GRAVEL with occasional subangular to subrounded cobbles.			
					(1.20)				
					2.20	Complete at 2.20m			

Remarks
Refusal at 2.20m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No.
8979-08-19.WS-10

Ground Investigations Ireland Ltd
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Site	Number
Galway Port	WS-11

Machine / Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine : Tech 10 Probing Rig Method : Drive-in Windowless Sampler			MKO Planning and Environmental Consultants	8979-08-19
	Location 530220.7 E 724788.9 N	**Dates** 03/09/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.70	EN				(0.20) 0.20 (0.50) 0.70	CONCRETE with rebar. MADE GROUND: Brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles of granite and occasional fragments of plastic and glass. Sand is fine to coarse and gravel is subangular to subrounded. Complete at 0.70m		

Remarks
Refusal at 0.70m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No.
8979-08-19.WS-11

Ground Investigations Ireland Ltd
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Site Galway Port			**Number** WS-12
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530135.2 E 724938.6 N	**Dates** 29/08/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00	EN				0.04	TARMACADAM			
					(0.36)	MADE GROUND: Grey slightly sandy clayey fine to coarse angular to subangular GRAVEL.			
					0.40				
					(0.27)	MADE GROUND: Light brown sandy slightly gravelly clayey SAND with occasional fragments of red brick clinker and concrete.			
					0.67				
					(0.33)	MADE GROUND: Grey slightly sandy slightly gravelly CLAY with occasional fragments of red brick and clinker.			
1.00-2.00	EN				1.00				
					(0.40)	Brown slightly clayey slightly gravelly fine to coarse SAND with occasional shell fragments. (Possible MADE GROUND)			
					1.40				
					(0.15)	Brown slightly clayey slightly gravelly fine to coarse SAND with occasional shell fragments. (Possible MADE GROUND)			
					1.55				
					(0.20)	Firm light brownish grey sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles. (Possible MADE GROUND)			
					1.75				
					(0.25)	No recovery			
					2.00	Complete at 2.20m			

Remarks
Refusal at 2.20m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-12

Ground Investigations Ireland Ltd
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Site Galway Port			**Number** WS-13
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530183.8 E 724900.9 N	**Dates** 03/09/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				0.05	TARMACADAM		
					(0.75)	MADE GROUND: Dark brown to grey sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles and occasional fragments of red brick glass and clinker. Fine to coarse sand and fine to coarse subangular to subrounded gravel.		
					0.80			
					(0.20)	MADE GROUND: Grey slightly silty slightly sandy slightly gravelly CLAY with occasional cobbles of granite. Abundant shell fragments and occasional fragments of red brick.		
1.00-2.00	EN				1.00			
					(0.40)	MADE GROUND: Brownish grey sandy gravelly CLAY with occasional subangular to subrounded cobbles of granite and occasional fragments of red brick and clinker.		
					1.40	No recovery		
					(0.80)			
					2.20	Complete at 2.20m		

Remarks
Refusal at 2.20m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-13

Ground Investigations Ireland Ltd
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Site Galway Port			**Number** WS-14
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530251.3 E 724864.8 N	**Dates** 28/08/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00	EN				(0.10) 0.10	CONCRETE			
					(0.25) 0.35	MADE GROUND: Dark grey medium to coarse subangular to subrounded GRAVEL with occasional subangular cobbles.			
					(0.65) 1.00	MADE GROUND: Dark brown sandy clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles.			
					(0.35) 1.35	MADE GROUND: Grey medium to coarse subangular GRAVEL with occasional subangular cobbles.			
					(0.65) 2.00	No recovery			
					(0.30) 2.30	MADE GROUND: Grey fine to coarse sightly sandy slightly clayey GRAVEL with occasional subangular to subrounded cobbles.			
						Complete at 2.30m			

Remarks
Refusal at 2.30m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-14

Ground Investigations Ireland Ltd
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Site Galway Port			**Number** WS-15
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530173.9 E 724966.3 N	**Dates** 28/08/2019-29/08/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	CONCRETE with rebar.		
					(0.40)	MADE GROUND: Brownish grey slightly clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles.		
					0.50	Complete at 0.50m		

Remarks
Refusal at 0.50m depth due to obstruction.
No environmental sampling posible.
WS-15 moved 3.00m from initial planned location to WS-15A.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-15

Ground Investigations Ireland Ltd
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Site	Number
Galway Port	WS-15A

Machine / Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine : Tech 10 Probing Rig Method : Drive-in Windowless Sampler			MKO Planning and Environmental Consultants	8979-08-19
	Location 530177.3 E 724966.7 N	**Dates** 28/08/2019-29/08/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.16)	CONCRETE with rebar.		
					0.16			
					(0.24)	MADE GROUND: Brownish grey slightly clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles.		
					0.40			
						Complete at 0.40m		

Remarks
Refusal at 0.40m depth due to obstruction.
No environmental sampling possible.

Scale (approx)	Logged By
1:25	PM

Figure No.
8979-08-19.WS-15A

Ground Investigations Ireland Ltd
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Site Galway Port			**Number** WS-16
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530222.4 E 724935.9 N	**Dates** 03/09/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00	EN				(0.21) 0.21	CONCRETE			
					(0.19) 0.40	MADE GROUND: Brownish grey sandy slightly clayey fine to coarse subangular GRAVEL with occasional subangular to subrounded cobbles.			
					(0.18) 0.58	MADE GROUND: Brown sandy gravelly CLAY with occasional subangular to subrounded cobbles of granite.			
					(0.42) 1.00	No recovery			
					(0.40) 1.40	MADE GROUND: Grey sandy slightly clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles.			
					(0.60) 2.00	No recovery			
					(0.20) 2.20	Brownish grey sandy slightly clayey fine to coarse subangular to subrounded GRAVEL. (Possible MADE GROUND)			
						Complete at 2.20m			

Remarks
Refusal at 2.20m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-16

Ground Investigations Ireland Ltd
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Site Galway Port			**Number** WS-17
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530268.9 E 724902.5 N	**Dates** 28/08/2019-29/08/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				(0.53)	CONCRETE		
					0.53	MADE GROUND: Brownish grey slightly clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles.		
					(1.04)			
					1.57	No recovery		
					(0.43)			
					2.00	MADE GROUND: Brownish grey slightly clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles.		
					(0.53)			
					2.53	Complete at 2.53m		

Remarks
Refusal at 2.53m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-17

Ground Investigations Ireland Ltd
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Site Galway Port			**Number** WS-18
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530205.4 E 725000.2 N	**Dates** 28/08/2019-29/08/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00	EN				(0.19) 0.19	CONCRETE with rebar.			
					(0.81)	MADE GROUND: Brownish grey slightly sandy clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles of granite and occasional fragments of red brick.			
1.00-2.00	EN				1.00 (1.00)	MADE GROUND: Dark brown sandy clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles and occasional fragments of glass red brick roof slate and concrete.			
2.00-2.80	EN				2.00 (0.80)	MADE GROUND: Dark brown sandy gravelly CLAY with occasional subangular to subrounded cobbles. Occasional fragments of red brick ceramics concrete and ash.			
					2.80	Complete at 2.80m			

Remarks
Refusal at 2.80m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-18

Ground Investigations Ireland Ltd
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Site Galway Port			**Number** WS-19
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530239 E 724964.6 N	**Dates** 03/09/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				(0.49)	CONCRETE		
					0.49	Brownish grey sandy gravelly CLAY with occasional subangular to subrounded cobbles. (Possible MADE GROUND)		
					(0.41)			
					0.90	No recovery		
					(0.10)			
1.00-1.60	EN				1.00	Brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles of granite. (Possible MADE GROUND)		
					(0.60)			
					1.60	Complete at 1.60m		

Remarks
Refusal at 1.60m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-19

Ground Investigations Ireland Ltd
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Site	Number
Galway Port	WS-20

Machine / Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine : Tech 10 Probing Rig Method : Drive-in Windowless Sampler			MKO Planning and Environmental Consultants	8979-08-19
	Location 530292.8 E 724942.7 N	**Dates** 29/08/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				(0.30) 0.30	CONCRETE		
					(0.70) 1.00	MADE GROUND: Dark grey sandy clayey fine to coarse subangular GRAVEL with occasional subangular to subrounded cobbles and rare fragments of metal.		
					(0.58) 1.58	MADE GROUND: Dark grey sandy clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles		
					(0.42) 2.00	No recovery		
					(0.50) 2.50	MADE GROUND: Dark grey slightly clayey fine to coarse subangular GRAVEL with occasional subangular cobbles.		
						Complete at 2.50m		

Remarks
Refusal at 2.50m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No.
8979-08-19.WS-20

Ground Investigations Ireland Ltd
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Site Galway Port			**Number** WS-21
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530234.3 E 725038.3 N	**Dates** 29/08/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				(0.25) 0.25	CONCRETE		
					(0.75)	MADE GROUND: Brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles of granite.		
1.00-2.00	EN				1.00			
					(0.75)	MADE GROUND:Brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles of granite and occasional fragments of clinker porcelain and shells.		
					1.75			
					(0.25)	No recovery		
2.00-3.00	EN				2.00			
					(0.66)	Firm light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles of granite and occasional shell fragments.		
					2.66			
					(0.34)	No recovery		
3.00-4.00	EN				3.00			
					(0.80)	Firm to soft light brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles of granite.		
					3.80			
					(0.20)	No recovery		
					4.00	Complete at 4.00m		

Remarks
Refusal at 4.00m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-21

Ground Investigations Ireland Ltd
www.gii.ie

Site Galway Port			**Number** WS-22
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530271.4 E 724998.2 N	**Dates** 29/08/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-1.00	EN				(0.25) 0.25	CONCRETE with rebar.		
					0.30	MADE GROUND: Brownish grey slightly sandy clayey GRAVEL with occasional subangular to subrounded cobbles.		
					(1.10)	MADE GROUND: Brownish grey slightly sandy clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles of granite.		
					1.40	Complete at 1.40m		

Remarks
Refusal at 1.40m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-22

Ground Investigations Ireland Ltd
www.gii.ie

Site Galway Port			**Number** WS-23
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler	**Dimensions**	**Ground Level (mOD)**	**Client** MKO Planning and Environmental Consultants	**Job Number** 8979-08-19
	Location 530307.9 E 724987.6 N	**Dates** 29/08/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-1.00	EN				(0.23) 0.23	CONCRETE with rebar.			
					(0.67) 0.90	MADE GROUND: Grey sandy slightly clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles.			
1.00-2.00	EN				(0.10) 1.00	MADE GROUND: Brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles.			
					(0.53) 1.53	Firm brown slightly sandy slightly gravelly CLAY with occasional subangular to subrounded cobbles of granite. (Possible MADE GROUND)			
					(0.47) 2.00	No recovery			
					(0.40) 2.40	Grey slightly sandy slightly clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular to subrounded cobbles of granite. (Possible MADE GROUND)			
						Complete at 2.40m			

Remarks
Refusal at 2.40m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No. 8979-08-19.WS-23

Ground Investigations Ireland Ltd

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Site	Number
Galway Port	**WS-24**

Machine / Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine : Tech 10 Probing Rig **Method :** Drive-in Windowless Sampler			MKO Planning and Environmental Consultants	8979-08-19
	Location 530315.4 E 725033.2 N	**Dates** 02/09/2019	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	EN				(0.17) 0.17	CONCRETE with rebar.		
					(0.33)	MADE GROUND: Brownish grey sandy slightly clayey fine to coarse subangular to subrounded GRAVEL with occasional subangular cobbles.		
					0.50	Complete at 0.50m		

Remarks
Refusal at 0.50m depth due to obstruction.

Scale (approx)	Logged By
1:25	PM

Figure No.
8979-08-19.WS-24

APPENDIX 4

MONITORING RECORDS

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	19/09/2019
Client	MKO	Well I.D.	WS-04
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24 hours	Dry
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.03
Stick Up (mm)	Flush	Water Level (mBTOC)	Dry
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Additional Comment
WS-04	Gas well	0.3%	0.2%	1ppm	2ppm	20%	1032mb	

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	19/09/2019
Client	MKO	Well I.D.	WS-09
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24 hours	Dry
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	1.65
Stick Up (mm)	Flush	Water Level (mBTOC)	Dry
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Additional Comment
WS-09	Gas well	0%	2%	3ppm	4ppm	19.4%	1030mb	

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	19/09/2019
Client	MKO	Well I.D.	WS-10
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24 hours	Dry
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.18
Stick Up (mm)	Flush	Water Level (mBTOC)	Dry
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Additional Comment
WS-10	Gas well	0.0%	0.1%	2ppm	4ppm	20.1%	1030mb	

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	19/09/2019
Client	MKO	Well I.D.	WS-12
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24 hours	Dry
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.10
Stick Up (mm)	Flush	Water Level (mBTOC)	Dry
Cover Condition	Good	Odour	none
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Additional Comment
WS-12	Gas well	0.2%	0.4%	2ppm	4ppm	19.2%	1030mb	

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	19/09/2019
Client	MKO	Well I.D.	WS-14
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24 hours	Dry
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.30
Stick Up (mm)	Flush	Water Level (mBTOC)	Dry
Cover Condition	Good	Odour	none
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Additional Comment
WS-14	Gas well	0.2%	0.1%	1ppm	3ppm	20.3%	1032mb	

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	19/09/2019
Client	MKO	Well I.D.	WS-16
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24 hours	Dry
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.12
Stick Up (mm)	Flush	Water Level (mBTOC)	Dry
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Additional Comment
WS-16	Gas well	0.3%	0.1%	1ppm	3ppm	20.1%	1032mb	

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	19/09/2019
Client	MKO	Well I.D.	WS-18
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24 hours	Dry
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.72
Stick Up (mm)	Flush	Water Level (mBTOC)	2.63
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Additional Comment
WS-18	Gas well	0.1%	1.4%	1ppm	3ppm	18.9%	1032mb	

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	19/09/2019
Client	MKO	Well I.D.	WS-23
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24 hours	Dry
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.42
Stick Up (mm)	Flush	Water Level (mBTOC)	Dry
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Additional Comment
WS-23	Gas well	0.0%	0.1%	1ppm	3ppm	20.5%	1031mb	

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	04/10/2019
Client	MKO	Well I.D.	WS-04
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24 hours	Wet
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.03
Stick Up (mm)	Flush	Water Level (mBTOC)	2.00
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Internal Flow Rate
WS-04	Gas well	0%	0.2%	0ppm	0ppm	20.2%	1006mb	-0.1 l/h

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	04/10/2019
Client	MKO	Well I.D.	WS-09
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24 hours	Wet
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	1.65
Stick Up (mm)	Flush	Water Level (mBTOC)	Dry
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Internal Flow Rate
WS-09	Gas well	0%	0%	1ppm	0ppm	21%	1006mb	-0.1 l/h

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	04/10/2019
Client	MKO	Well I.D.	WS-10
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24 hours	Wet
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.15
Stick Up (mm)	Flush	Water Level (mBTOC)	Dry
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Internal Flow Rate
WS-10	Gas well	0%	0%	1ppm	0ppm	21%	1006mb	-0.0 l/h

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	04/10/2019
Client	MKO	Well I.D.	WS-12
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24 hours	Wet
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.10
Stick Up (mm)	Flush	Water Level (mBTOC)	Dry
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Internal Flow Rate
WS-12	Gas well	0%	0.5%	0ppm	0ppm	20.1%	1006mb	-0.1 l/h

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	04/10/2019
Client	MKO	Well I.D.	WS-14
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24 hours	Wet
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.23
Stick Up (mm)	Flush	Water Level (mBTOC)	Dry
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Internal Flow Rate
WS-14	Gas well	0%	0.1%	1ppm	0ppm	20.7%	1004mb	-0.0 l/h

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	04/10/2019
Client	MKO	Well I.D.	WS-16
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24 hours	Wet
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.06
Stick Up (mm)	Flush	Water Level (mBTOC)	Dry
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Internal Flow Rate
WS-16	Gas well	0%	0.1%	0ppm	0ppm	20.2%	1002mb	-0.0 l/h

Additional Comments/Observations:

[pj

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	04/10/2019
Client	MKO	Well I.D.	WS-18
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24 hours	Wet
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.70
Stick Up (mm)	Flush	Water Level (mBTOC)	2.62
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Internal Flow Rate
WS-18	Gas well	0%	2%	0ppm	0ppm	18.3%	1003mb	-0.1 l/h

Additional Comments/Observations:

Ground Investigations Ireland
Gas Monitoring Field Sheet

(V1 August 2018)

Project Information			
Project Number	8979-08-19	Sample Date	04/10/2019
Client	MKO	Well I.D.	WS-23
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24 hours	Wet
Well Data			
Casing Diameter (mm)	100mm	Standpipe Type uPVC etc.	PVC
Standpipe Diameter (mm)	50mm	Total Well Depth (m)	2.40
Stick Up (mm)	Flush	Water Level (mBTOC)	Dry
Cover Condition	Good	Odour	None
Gas Meter Model	Geotech GA 5000	Gas Valve/Cap Condition	In good repair

Gas Data

Sample I.D.	Location Type	CH4	CO2	CO	H2S	O2	Barometric Pressure	Internal Flow Rate
WS-23	Gas well	0%	0.1%	0ppm	0ppm	20.8%	1004mb	-0.0 l/h

Additional Comments/Observations:

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GROUNDWATER MONITORING

GALWAY PORT

BOREHOLE	DATE	TIME	GROUNDWATER (mBGL)	Comments
WS-04	03/09/2019	16.34	1.80	
WS-09	03/09/2019	15.45	DRY	
WS-10	03/09/2019	17.15	DRY	
WS-12	03/09/2019	16.40	DRY	
WS-14	03/09/2019	18.15	DRY	
WS-16	03/09/2019	16.25	DRY	
WS-18	03/09/2019	17.31	2.60	
WS-23	03/09/2019	16.55	DRY	

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	19-09-2019
Client	MKO	Well I.D.	WS-04
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24hrs	Dry
Well Data			
Casing Diameter (mm)	100mm	Total Well Depth (m)	2.04
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	Dry
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA
Purge Data			
Time Purging Start	13.25	**Sampling Method/Equipment (Tick)**	
Timer Purging End	13.27	Submersible Pump	
Purge Volume (litres)	0	Bailer	√
Colour	NA	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
2 minutes	Dry	NA	NA	NA	NA	NA	NA

Additional Comments/Observations:
No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	19-09-2019
Client	MKO	Well I.D.	WS-09
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24hrs	Dry

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	1.65
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	Dry
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	16.12	**Sampling Method/Equipment (Tick)**	
Timer Purging End	16.14	Submersible Pump	
Purge Volume (litres)	0	Bailer	√
Colour	NA	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
2 minutes	Dry	NA	NA	NA	NA	NA	NA

Additional Comments/Observations:

No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	19-09-2019
Client	MKO	Well I.D.	WS-10
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24hrs	Dry

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	2.18
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	Dry
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	16.25	**Sampling Method/Equipment (Tick)**	
Timer Purging End	16.27	Submersible Pump	
Purge Volume (litres)	0	Bailer	√
Colour	NA	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	**Litres Purged**	**Ph**	**EC (mS)**	**Temp**	**ORP**	**DO (mg/l)**	**Odour**
2 minutes	Dry	NA	NA	NA	NA	NA	NA

Additional Comments/Observations:
No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	19-09-2019
Client	MKO	Well I.D.	WS-12
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24hrs	Dry

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	2.10
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	Dry
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	15.58	**Sampling Method/Equipment (Tick)**	
Timer Purging End	16.00	Submersible Pump	
Purge Volume (litres)	0	Bailer	√
Colour	NA	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	**Litres Purged**	**Ph**	**EC (mS)**	**Temp**	**ORP**	**DO (mg/l)**	**Odour**
2 minutes	Dry	NA	NA	NA	NA	NA	NA

Additional Comments/Observations:
No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	19-09-2019
Client	MKO	Well I.D.	WS-14
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24hrs	Dry

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	2.30
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	Dry
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	13.18	**Sampling Method/Equipment (Tick)**	
Timer Purging End	13.20	Submersible Pump	
Purge Volume (litres)	0	Bailer	√
Colour	NA	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
2 minutes	Dry	NA	NA	NA	NA	NA	NA

Additional Comments/Observations:

No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	19-09-2019
Client	MKO	Well I.D.	WS-16
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24hrs	Dry

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	2.12
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	Dry
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	13.08	**Sampling Method/Equipment (Tick)**	
Timer Purging End	13.10	Submersible Pump	
Purge Volume (litres)	0	Bailer	√
Colour	NA	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
2 minutes	Dry	NA	NA	NA	NA	NA	NA

Additional Comments/Observations:

No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	19-09-2019
Client	MKO	Well I.D.	WS-18
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24hrs	Dry

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	2.72
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	2.63
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	13.44	**Sampling Method/Equipment (Tick)**	
Timer Purging End	13.46	Submersible Pump	
Purge Volume (litres)	To Dry	Bailer	√
Colour	Dark Brown	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
2 minutes	To Dry	7.32	13.32	18.6	NA	NA	None

Additional Comments/Observations:
No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	19-09-2019
Client	MKO	Well I.D.	WS-23
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24hrs	Dry

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	2.42
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	Dry
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	14.28	**Sampling Method/Equipment (Tick)**	
Timer Purging End	14.30	Submersible Pump	
Purge Volume (litres)	Dry	Bailer	√
Colour	NA	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	**Litres Purged**	**Ph**	**EC (mS)**	**Temp**	**ORP**	**DO (mg/l)**	**Odour**
2 minutes	Dry	NA	NA	NA	NA	NA	NA

Additional Comments/Observations:
No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	19-09-2019
Client	MKO	Well I.D.	WS-28
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24hrs	Dry

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	6.85
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	4.58
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	14.20	**Sampling Method/Equipment (Tick)**	
Timer Purging End	14.34	Submersible Pump	
Purge Volume (litres)	21 Litres	Bailer	√
Colour	Light Brown	Tube with foot valve	
Recovery	Good	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
14 minutes	21	7.61	11.45	19.1	NA	NA	None

Additional Comments/Observations:

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	19-09-2019
Client	MKO	Well I.D.	WS-29
Site Name	Galway Port	Weather	Dry
Sampler I.D.	PM	Weather Previous 24hrs	Dry

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	5.14
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	4.43
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	15.23	**Sampling Method/Equipment (Tick)**	
Timer Purging End	15.42	Submersible Pump	
Purge Volume (litres)	14 Litres	Bailer	√
Colour	Black	Tube with foot valve	
Recovery	Good	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
19 minutes	14	8.21	15.65	17.4	NA	NA	Organic

Additional Comments/Observations:

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	04-10-2019
Client	MKO	Well I.D.	WS-04
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24hrs	Wet

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	2.03
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	2.00
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	14.21	**Sampling Method/Equipment (Tick)**	
Timer Purging End	14.22	Submersible Pump	
Purge Volume (litres)	To Dry	Bailer	√
Colour	Light Brown	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
1 minute	Dry	NA	NA	NA	NA	NA	None

Additional Comments/Observations:

No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	04-10-2019
Client	MKO	Well I.D.	WS-09
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24hrs	Wet

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	1.65
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	Dry
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	NA	**Sampling Method/Equipment (Tick)**	
Timer Purging End	NA	Submersible Pump	
Purge Volume (litres)	NA	Bailer	√
Colour	NA	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
NA	Dry	NA	NA	NA	NA	NA	NA

Additional Comments/Observations:
No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	04-10-2019
Client	MKO	Well I.D.	WS-10
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24hrs	Wet

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	2.15
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	Dry
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	NA	**Sampling Method/Equipment (Tick)**	
Timer Purging End	NA	Submersible Pump	
Purge Volume (litres)	0	Bailer	√
Colour	NA	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
NA	Dry	NA	NA	NA	NA	NA	NA

Additional Comments/Observations:

No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	04-10-2019
Client	MKO	Well I.D.	WS-12
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24hrs	Wet

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	2.10
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	Dry
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	NA	**Sampling Method/Equipment (Tick)**	
Timer Purging End	NA	Submersible Pump	
Purge Volume (litres)	NA	Bailer	√
Colour	NA	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
NA	Dry	NA	NA	NA	NA	NA	NA

Additional Comments/Observations:
No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	04-10-2019
Client	MKO	Well I.D.	WS-14
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24hrs	Wet

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	2.23
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	Dry
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	NA	**Sampling Method/Equipment (Tick)**	
Timer Purging End	NA	Submersible Pump	
Purge Volume (litres)	NA	Bailer	√
Colour	NA	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
NA	Dry	NA	NA	NA	NA	NA	NA

Additional Comments/Observations:
No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	04-10-2019
Client	MKO	Well I.D.	WS-16
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24hrs	Wet

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	2.06
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	Dry
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	NA	**Sampling Method/Equipment (Tick)**	
Timer Purging End	NA	Submersible Pump	
Purge Volume (litres)	NA	Bailer	√
Colour	NA	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
NA	Dry	NA	NA	NA	NA	NA	NA

Additional Comments/Observations:
No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	04-10-2019
Client	MKO	Well I.D.	WS-18
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24hrs	Wet

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	2.70
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	2.62
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	11.57	**Sampling Method/Equipment (Tick)**	
Timer Purging End	12.00	Submersible Pump	
Purge Volume (litres)	1 litre to Dry	Bailer	√
Colour	Black	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
3 minutes	To Dry	7.25	12.32	13.6	NA	NA	None

Additional Comments/Observations:

No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	04-10-2019
Client	MKO	Well I.D.	WS-23
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24hrs	Wet
Well Data			
Casing Diameter (mm)	100mm	Total Well Depth (m)	2.40
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	Dry
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA
Purge Data			
Time Purging Start	NA	**Sampling Method/Equipment (Tick)**	
Timer Purging End	NA	Submersible Pump	
Purge Volume (litres)	Dry	Bailer	√
Colour	NA	Tube with foot valve	
Recovery	Poor	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
NA	Dry	NA	NA	NA	NA	NA	NA

Additional Comments/Observations:
No groundwater sample obtained due to dry well

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	04-10-2019
Client	MKO	Well I.D.	WS-28
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24hrs	Wet

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	6.81
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	4.37
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	13.06	**Sampling Method/Equipment (Tick)**	
Timer Purging End	13.30	Submersible Pump	
Purge Volume (litres)	26 Litres	Bailer	√
Colour	Clear to light brown	Tube with foot valve	
Recovery	Good	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
24 minutes	26	7.46	11.25	15.1	NA	NA	None

Additional Comments/Observations:

Ground Investigations Ireland
Groundwater Monitoring Field Sheet

(V1 August 2018)

Project Number	8979-08-19	Sample Date	04-10-2019
Client	MKO	Well I.D.	WS-29
Site Name	Galway Port	Weather	Wet
Sampler I.D.	PM	Weather Previous 24hrs	Wet

Well Data

Casing Diameter (mm)	100mm	Total Well Depth (m)	5.11
Standpipe Diam. (mm)	50mm	Water Level (mBTOC)	3.61
Stick Up (mm)	Flush	VOC Screen in casing (y/n)	N
Standpipe Type pvc, HDPE etc.	PVC	VOC Data (ppm)	NA

Purge Data

Time Purging Start	12.05	**Sampling Method/Equipment (Tick)**	
Timer Purging End	12.27	Submersible Pump	
Purge Volume (litres)	21 Litres	Bailer	√
Colour	Clear to black	Tube with foot valve	
Recovery	Good	Low Flow Pumping	

Time	Litres Purged	Ph	EC (mS)	Temp	ORP	DO (mg/l)	Odour
19 minutes	21	8.11	15.25	14.4	NA	NA	Organic

Additional Comments/Observations:

APPENDIX 5

LABORATORY RESULTS

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

P: +44 (0) 1244 833780
F: +44 (0) 1244 833781
W: www.element.com

Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland

Attention :	Barry Sexton
Date :	20th September, 2019
Your reference :	8979-08-19
Our reference :	Test Report 19/14295 Batch 1
Location :	Galway Docklands/Port
Date samples received :	5th September, 2019
Status :	Final report
Issue :	1

Thirty five samples were received for analysis on 5th September, 2019 of which thirty five were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Phil Sommerton BSc
Senior Project Manager

Client Name: Ground Investigations Ireland
Reference: 8979-08-19
Location: Galway Docklands/Port
Contact: Barry Sexton
EMT Job No: 19/14295

Report : Solid

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

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	LOD/LOR	Units	Method No.
Sample ID	WS-01	WS-02	WS-03	WS-04	WS-04	WS-04	WS-05	WS-05	WS-07	WS-09			
Depth	0.00-0.50	0.00-0.50	0.00-0.54	0.00-1.00	1.00-2.00	2.00-2.20	0.00-1.00	1.00-1.70	0.00-0.70	0.00-1.00			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	30/08/2019	30/08/2019			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019			
Antimony	1	<1	<1	<1	<1	<1	<1	<1	<1	2	<1	mg/kg	TM30/PM15
Arsenic #	3.5	3.4	3.8	2.1	2.0	2.1	2.6	3.0	2.8	16.5	<0.5	mg/kg	TM30/PM15
Barium #	187	433	324	28	21	22	36	35	28	444	<1	mg/kg	TM30/PM15
Cadmium #	0.8	0.4	0.5	0.6	0.3	0.3	0.4	0.5	0.4	0.9	<0.1	mg/kg	TM30/PM15
Chromium #	22.3	31.7	32.3	38.4	60.4	60.2	82.7	35.5	25.8	57.8	<0.5	mg/kg	TM30/PM15
Copper #	21	14	15	11	11	9	25	13	12	88	<1	mg/kg	TM30/PM15
Lead #	47	38	31	33	9	9	53	16	35	300	<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	mg/kg	TM30/PM15
Molybdenum #	1.6	2.6	2.2	2.1	3.2	3.5	4.5	1.7	2.2	3.8	<0.1	mg/kg	TM30/PM15
Nickel #	7.9	10.8	10.6	8.4	9.2	6.9	10.9	11.0	8.1	17.1	<0.7	mg/kg	TM30/PM15
Selenium #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	TM30/PM15
Zinc #	123	41	55	37	24	39	62	28	48	352	<5	mg/kg	TM30/PM15
Antimony	-	-	-	-	-	-	-	-	-	-	<1	mg/kg	TM30/PM62
Arsenic	-	-	-	-	-	-	-	-	-	-	<0.5	mg/kg	TM30/PM62
Barium	-	-	-	-	-	-	-	-	-	-	<1	mg/kg	TM30/PM62
Cadmium	-	-	-	-	-	-	-	-	-	-	<0.1	mg/kg	TM30/PM62
Chromium	-	-	-	-	-	-	-	-	-	-	<0.5	mg/kg	TM30/PM62
Copper	-	-	-	-	-	-	-	-	-	-	<1	mg/kg	TM30/PM62
Lead	-	-	-	-	-	-	-	-	-	-	<5	mg/kg	TM30/PM62
Mercury	-	-	-	-	-	-	-	-	-	-	<0.1	mg/kg	TM30/PM62
Molybdenum	-	-	-	-	-	-	-	-	-	-	<0.1	mg/kg	TM30/PM62
Nickel	-	-	-	-	-	-	-	-	-	-	<0.7	mg/kg	TM30/PM62
Selenium	-	-	-	-	-	-	-	-	-	-	<1	mg/kg	TM30/PM62
Zinc	-	-	-	-	-	-	-	-	-	-	<5	mg/kg	TM30/PM62

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 8979-08-19
Location: Galway Docklands/Port
Contact: Barry Sexton
EMT Job No: 19/14295

Report : Solid

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

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	LOD/LOR	Units	Method No.
Sample ID	WS-01	WS-02	WS-03	WS-04	WS-04	WS-04	WS-05	WS-05	WS-07	WS-09			
Depth	0.00-0.50	0.00-0.50	0.00-0.54	0.00-1.00	1.00-2.00	2.00-2.20	0.00-1.00	1.00-1.70	0.00-0.70	0.00-1.00			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	30/08/2019	30/08/2019			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019			
PAH MS													
Naphthalene #	0.04	<0.04	<0.04	0.08	<0.04	<0.04	<0.04	<0.04	<0.04	0.46	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.91	<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.12	<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.31	<0.04	mg/kg	TM4/PM8
Phenanthrene #	0.07	<0.03	0.05	0.15	<0.03	<0.03	0.07	<0.03	0.04	3.59	<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	1.58	<0.04	mg/kg	TM4/PM8
Fluoranthene #	0.11	0.04	0.09	0.27	<0.03	<0.03	0.13	<0.03	0.06	10.51	<0.03	mg/kg	TM4/PM8
Pyrene #	0.11	0.03	0.09	0.26	<0.03	<0.03	0.11	<0.03	0.05	9.12	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.09	<0.06	0.10	0.19	<0.06	<0.06	0.12	<0.06	<0.06	6.66	<0.06	mg/kg	TM4/PM8
Chrysene #	0.06	<0.02	0.06	0.19	<0.02	<0.02	0.11	<0.02	<0.02	5.98	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	0.11	<0.07	0.17	0.36	<0.07	<0.07	0.18	<0.07	<0.07	11.76	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	0.05	<0.04	0.09	0.17	<0.04	<0.04	0.09	<0.04	<0.04	6.32	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	<0.04	<0.04	0.05	0.11	<0.04	<0.04	0.05	<0.04	<0.04	3.97	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.86	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	0.07	0.13	<0.04	<0.04	0.06	<0.04	<0.04	3.93	<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.87	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	0.27	<0.22	0.47	1.04	<0.22	<0.22	0.51	<0.22	<0.22	36.49	<0.22	mg/kg	TM4/PM8
PAH 17 Total	0.64	<0.64	0.77	1.94	<0.64	<0.64	0.92	<0.64	<0.64	66.95	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.08	<0.05	0.12	0.26	<0.05	<0.05	0.13	<0.05	<0.05	8.47	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.03	<0.02	0.05	0.10	<0.02	<0.02	0.05	<0.02	<0.02	3.29	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	4	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	102	98	94	100	85	88	96	72	96	94	<0	%	TM4/PM8
Mineral Oil (C10-C40)	150	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	mg/kg	TM5/PM8/PM16
TPH CWG													
Aliphatics													
>C5-C6 #	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 #	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	85	<7	<7	<7	<7	<7	11	<7	12	<7	<7	mg/kg	TM5/PM8/PM16
>C35-C40	65	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	150	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>C25-C35	86	<10	<10	<10	<10	<10	11	<10	12	<10	<10	mg/kg	TM5/PM8/PM16

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 8979-08-19
Location: Galway Docklands/Port
Contact: Barry Sexton
EMT Job No: 19/14295

Report : Solid

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

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	LOD/LOR	Units	Method No.
Sample ID	WS-01	WS-02	WS-03	WS-04	WS-04	WS-04	WS-05	WS-05	WS-07	WS-09			
Depth	0.00-0.50	0.00-0.50	0.00-0.54	0.00-1.00	1.00-2.00	2.00-2.20	0.00-1.00	1.00-1.70	0.00-0.70	0.00-1.00			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	30/08/2019	30/08/2019			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019			
TPH CWG													
Aromatics													
>C5-EC7 #	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 #	<4	<4	<4	<4	<4	<4	<4	<4	<4	6	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 #	<7	<7	<7	<7	<7	<7	<7	<7	<7	66	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 #	332	<7	<7	<7	<7	<7	<7	<7	<7	334	<7	mg/kg	TM5/PM8/PM16
>EC35-EC40	237	<7	<7	<7	<7	<7	<7	<7	<7	48	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	569	<26	<26	<26	<26	<26	<26	<26	<26	454	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40)	719	<52	<52	<52	<52	<52	<52	<52	<52	454	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 #	<0.1 SV	<0.1 SV	<0.1 SV	<0.1	<0.1	<0.1	<0.1 SV	<0.1	<0.1	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC25	26	<10	<10	<10	<10	<10	<10	<10	<10	160	<10	mg/kg	TM5/PM8/PM16
>EC25-EC35	312	<10	<10	<10	<10	<10	<10	<10	<10	239	<10	mg/kg	TM5/PM8/PM16
MTBE #	<5 SV	<5 SV	<5 SV	<5	<5	<5	<5 SV	<5	<5	<5	<5	ug/kg	TM31/PM12
Benzene #	<5 SV	<5 SV	<5 SV	<5	<5	<5	<5 SV	<5	<5	<5	<5	ug/kg	TM31/PM12
Toluene #	<5 SV	<5 SV	<5 SV	<5	<5	<5	<5 SV	<5	<5	<5	<5	ug/kg	TM31/PM12
Ethylbenzene #	<5 SV	<5 SV	<5 SV	<5	<5	<5	<5 SV	<5	<5	<5	<5	ug/kg	TM31/PM12
m/p-Xylene #	<5 SV	<5 SV	<5 SV	<5	<5	<5	<5 SV	<5	<5	<5	<5	ug/kg	TM31/PM12
o-Xylene #	<5 SV	<5 SV	<5 SV	<5	<5	<5	<5 SV	<5	<5	<5	<5	ug/kg	TM31/PM12
PCB 28 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
Total 7 PCBs #	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	ug/kg	TM17/PM8
Natural Moisture Content	6.6	6.9	6.3	9.3	12.2	8.6	6.3	13.8	4.7	17.7	<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	6.2	6.4	6.0	8.5	10.8	7.9	5.9	12.1	4.5	15.0	<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Chromium III	22.3	31.7	32.3	38.4	60.4	60.2	82.7	35.5	25.8	57.8	<0.5	mg/kg	NONE/NONE
Chromium III	-	-	-	-	-	-	-	-	-	-	<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.43	0.17	0.52	0.37	0.08	0.14	0.47	0.11	0.32	7.10	<0.02	%	TM21/PM24
pH #	9.13	8.51	8.97	9.01	9.05	9.16	9.06	9.14	8.69	8.66	<0.01	pH units	TM73/PM11
Mass of raw test portion	0.0963	0.0948	0.0877	0.0973	0.105	0.0996	0.1071	0.1019	0.0942	0.1078		kg	NONE/PM17

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 8979-08-19
Location: Galway Docklands/Port
Contact: Barry Sexton
EMT Job No: 19/14295

Report : Solid

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

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30			
Sample ID	WS-01	WS-02	WS-03	WS-04	WS-04	WS-04	WS-05	WS-05	WS-07	WS-09			
Depth	0.00-0.50	0.00-0.50	0.00-0.54	0.00-1.00	1.00-2.00	2.00-2.20	0.00-1.00	1.00-1.70	0.00-0.70	0.00-1.00	Please see attached notes for all abbreviations and acronyms		
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	02/09/2019	30/08/2019	30/08/2019			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019	05/09/2019			
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		kg	NONE/PM17