Appendix 7 – Land Soils Water

Appendix 7.1 Preliminary Risk Assessment

Appendix 7.2 Generic Quantitative Risk Assessment

PRAGMA PLANNING

PROPOSED DEVELOPMENT LANDS LOCATED BETWEEN BOWTOWN ROAD AND MOVILLA ROAD, NEWTOWNARDS, CO DOWN

P347 SOILS, WATERS AND CONTAMINATED LAND ASSESSMENT

13 SEPTEMBER 2018

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O'Sullivan Macfarlane
Environmental Consulting

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1 INTRODUCTION

1.1 Report Brief

O`Sullivan Macfarlane Environmental Consulting (OSM) were instructed in August 2018 by Pragma Planning to undertake a Soils, Waters and Contaminated Land Assessment for an area of development land located between the Movilla Road and the Bowtown Road, Newtownards, Co Down.

The assessment lands comprise a portion of land located to the north of the Bowtown Road and to the south of the Movilla Road, Newtownards, Co Down. The current land use is primarily agricultural land, with a number of associated residential dwellings and commercial farms. The area of land has been zoned for residential housing and public open space in the Ards and Down Area Plan (ADAP).

The site is proposed to be redeveloped as residential housing, community facility and public open space, with associated access roads, pedestrian and cycle pathways

A Concept Development Plan is presented as Appendix A. Currently, there is no Planning Reference number for the site.

1.2 Assessment Methodology

The first step in assessing the site was to undertake a Phase 1 Preliminary Risk Assessment (PRA).

The objective of the PRA is to determine the previous uses of the land under consideration or land nearby or adjacent to it, review the environmental setting in which the site and adjacent lands are located, identify potential sources of contamination, receptors and pathways using available datasets and local knowledge. This information is used to develop a conceptual model of risk for the site. If any significant pollutant linkages are determined to be present in the site conceptual model, recommendation will be made for a Phase 2 Generic Quantitative Risk Assessment (GQRA).

The Model Procedures for the Management of Land Contamination (CLR11) has been developed to provide the technical framework for applying a risk management process when dealing with land affected by contamination. The process involves identifying, making decisions on, and taking appropriate action to deal with, land contamination in a way that is consistent with government policies and legislation within the UK. CLR11 indicates that the assessment of land for contamination should always start with a Phase 1 Preliminary Risk Assessment (PRA), with the following objectives;

- Define the objectives of the assessments;
- Collect basic information about the site;
- Decide if further assessment of the site is required.

If the Phase 1 PRA identifies unacceptable human health and / or environmental risk, then the site should be further investigated and assessed. These further assessments are summarised below;

- A Quantitative Risk Assessment - collect more site information, by way of a site investigation, for comparison with general standards, also known as generic assessment criteria (GAC), to decide if the level of risk needs a more detailed assessment or a plan for dealing with the contamination. If required, site specific clean-up targets will be developed if remedial works are required;

- If the PRA and quantitative risk assessment identifies unacceptable risk, then a Remediation Strategy must be developed for the site. The Remediation Strategy will demonstrate how the site will be safely developed in respect to the sites end use and detail the remedial measures to be incorporated;
- Validation Report – Following the implementation of the remedial measures, as outlined in the Remediation Strategy, a Validation Report is completed to validate / verify that the remedial measures have been correctly installed.

This report presents the Phase 1 PRA for the development site.

2 PRELIMINARY RISK ASSESSMENT

2.1 Scope of Works

The following scope of works was undertaken as part of this assessment;

- Review of site development proposals / planning application (if any);
- Site walkover / inspection by an Environmental Engineer / Scientist;
- Detailed review of site history using historical ordnance survey mapping;
- Search of regulatory databases to include NIEA groundwater abstraction database, Drinking Water Inspectorate (DWI) and NIEA contaminated land register;
- Review of service provider records (gas and electric);
- Detailed review of site environmental setting including solid and superficial geology, hydrogeology, hydrology and groundwater vulnerability;
- Development of an outline Conceptual Site Model (CSM);
- Presentation of a Phase 1 PRA report including recommendations for further works (if required).

2.2 Site Description

The assessment site is located on lands located to the north of Bowtown Road (with Bowtown Road forming the southern boundary of the site) and to the south of Movilla Road (with Movilla Road forming the northern boundary of the site), Newtownards, Co Down.

The grid reference for the site is J 51325 73984 (centre of the site). The site has a total area of c.41.05ha. A Site Location Map is presented as Figure 1, with a Site Boundary Map presented as Figure 2.

Figure 1: Site Location Map, Bowtown Road, Newtownards

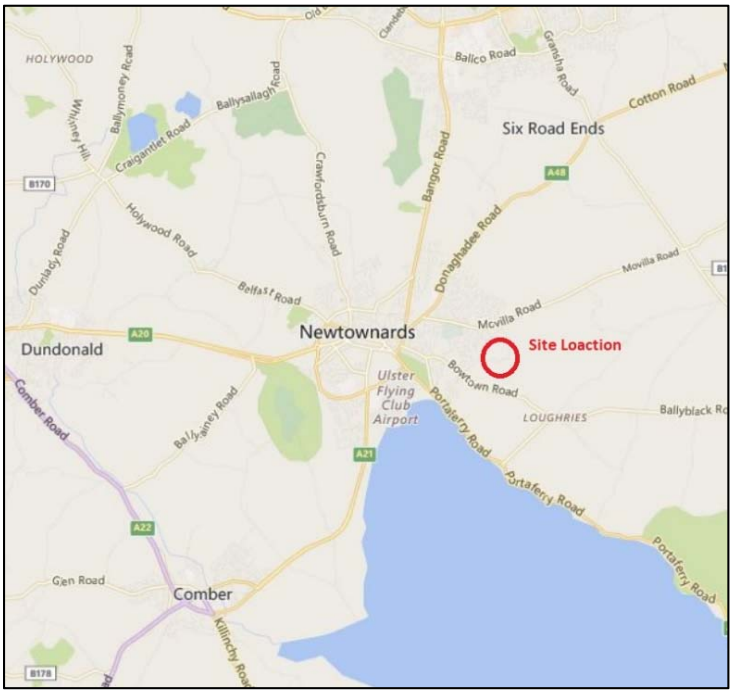


Figure 2: Site Plan, Bowtown Road, Newtownards

The lands within the assessment area are primarily agricultural lands, located on the periphery of the urban sprawl of Newtownards town, with residential developments located immediately adjacent to the north-western boundary of the site. A summary of the land-use immediately adjacent to the site is presented in Table 1;

Table 1: Summary of adjacent land-use, Bowtown Road, Newtownards

Orientation from Site	Land-Use
North	Movilla Road, residential housing and agricultural lands.
South	Bowtown Road and agricultural lands.
East	Agricultural Lands.
West	Residential housing.

2.3 Site Walkover

A site detailed walkover was undertaken at the site on Friday 31st August 2018 by an Environmental Engineer from OSM. A detailed photographic log obtained during the site walkover is presented as Appendix B, and the findings of the site walkover are summarised in Table 2;

Table 2: Site Walkover Information, Bowtown Road, Newtownards

Area Inspected	Description
Site access / boundary	Access was gained onto the site the Bowtown Road, Movilla Road and Ballyreagh Road.
Current site use	The current land use is primary agricultural land, with a number of associated residential dwellings and commercial farms.
Ground cover	The site is primarily grassed agricultural lands, with minor inclusions of hardstanding surrounding the residential land, farm buildings and internal access roads.
Neighbouring land-use	See Table 1
Topography of land	The slopes in a general southerly direction, from ~49mOD at the Movilla Road in the north of the site, to ~33mOD at the Bowtown Road in the south of the site.
Fuel / Oil tanks	A number of unbunded above-ground storage tanks (AST`s) were observed, at most of the dwellings and farm buildings within the site boundary. The AST`s observed ranged from small scale residential sized tanks, to larger commercial sized tanks for refuelling agricultural plant.
Asbestos	Asbestos was only observed in one location, relating to an asbestos roof in a disused agricultural barn. The roof appeared to be in good condition, intact, and there was no obvious asbestos on the ground surrounding the building.
Any other obvious contamination	None
Surface waters	See Section 2.7.6
Site drainage	No obvious significant surface drainage network present.

2.4 Site History

An assessment of the site history was undertaken by reviewing the available historical Ordnance Survey (OS) maps for the site, provided by the Ordnance Survey of Northern Ireland (OSNI).

The OSNI have published a series of historical OS maps for Northern Ireland spanning 1830`s – 1980`s (Historic six-inch series / 1:10,000 Metric Scale Irish Grid 1960`s). A summary of the available OS maps is presented in Table 3 and the historical maps are presented as Appendix C.

Table 3: Review of Historical OS Maps, Bowtown Road, Newtownards

Map Publication	Summary of Site Setting
1830`s OS Map	In this OS map the site is occupied by agricultural lands and a small number of associated residential / farm dwellings. The lands adjacent to the site are also occupied by agricultural lands. The Movilla Road is present along the northern boundary of the site. A small "Slate Quarry" is present to the north of the site. No significant land use observed.
1850`s OS Map	The land use in the 1850`s OS is similar to the previous OS map, with the site occupied by agricultural lands and a small number of associated residential / farm dwellings. The lands adjacent to the site are also occupied by agricultural lands. The Movilla Road is present along the northern boundary of the site and the Bowtown Road to the south. The slate quarry, previously to the north of the site, is no longer indicated. No significant land use observed.
1900`s OS Map	The land use in the 1900`s OS is similar to the previous OS map, with the site occupied by agricultural lands and a small number of associated residential / farm dwellings. The lands adjacent to the site are also occupied by agricultural lands. The Movilla Road is present along the northern boundary of the site and the Bowtown Road to the south. No significant land use observed.
1920-1939 OS Map	The land use in the 1920`s OS is similar to the previous OS map, with the site occupied by agricultural lands and a small number of associated residential / farm dwellings. The lands adjacent to the site are also occupied by agricultural lands. The Movilla Road is present along the northern boundary of the site and the Bowtown Road to the south. No significant land use observed.
1955- 1975 OS Map	The land use in the 1950`s OS is similar to the previous OS map, with the site occupied by agricultural lands and a small number of associated residential / farm dwellings. The lands adjacent to the site are also occupied by agricultural lands. The Movilla Road is present along the northern boundary of the site and the Bowtown Road to the south. No significant land use observed.

The historical maps have indicated that the development site and adjacent lands have been historically used for agricultural purposes, with the site area primarily occupied by agricultural grassland and a small number of associated residential and farm buildings.

The available OS maps have indicated no obvious on-site land uses of concern. With regards to off-site land uses, a slate quarry indicated close to the north of the site, and this is considered to be the only significant land-uses indicated in the OS maps.

2.5 Regulatory Consultations

Regulator information was obtained from to the following regulatory searches;

- NIEA groundwater Abstraction Database;
- NIEA Waste and Contaminated Land Database (WCLD);
- Drinking Water Inspectorate (DWI).

The regulator responses are presented as Appendix D and now discussed.

The DWI indicated that there were no known private groundwater abstractions or dairy farms extracting groundwater within a 1km radius of the site.

The NIEA abstraction database indicated that there are no abstraction licences held within a 1km radius of the site. The closest known groundwater abstraction is located at a distance of ~2.44km to the east (Daisy Hill Leisure Centre Reference No. AIL/2016/0008).

A review of the NIEA Waste and Contaminated Land Database was undertaken, and the results within a 500m radius of the site are presented below in Figure 3;

Figure 3: NIEA Waste and Contaminated Land Database, Bowtown Road, Newtownards

Table 4: NIEA Waste and Contaminated Land Database, Bowtown Road, Newtownards

Number	ID	Grid Reference	Distance from site	Land use history
1	20203	J 51520 74700	~175m to the North	Slate quarry
2	20205	J 51804 74850	~300m to the north-east	Disused quarry
3	22425	J 52156 74923	~300m to the north-east	Waste recycling

2.6 Service Providers

Service mark-ups were requested from the following service providers;

- Phoenix Natural Gas;
- Northern Ireland Electricity (NIE).

The service provider responses are presented as Appendix E, with detailed maps.

The response received from NIE indicates that there are a number of overhead and underground powerlines present within the boundary of the site, with the approximate locations presented in Appendix E.

The Phoenix Natural Gas indicated that there were no gas services within the site boundary, however services to the residential developments to the north of the site were present.

2.7 Environmental Setting

2.7.1 Sources of Information

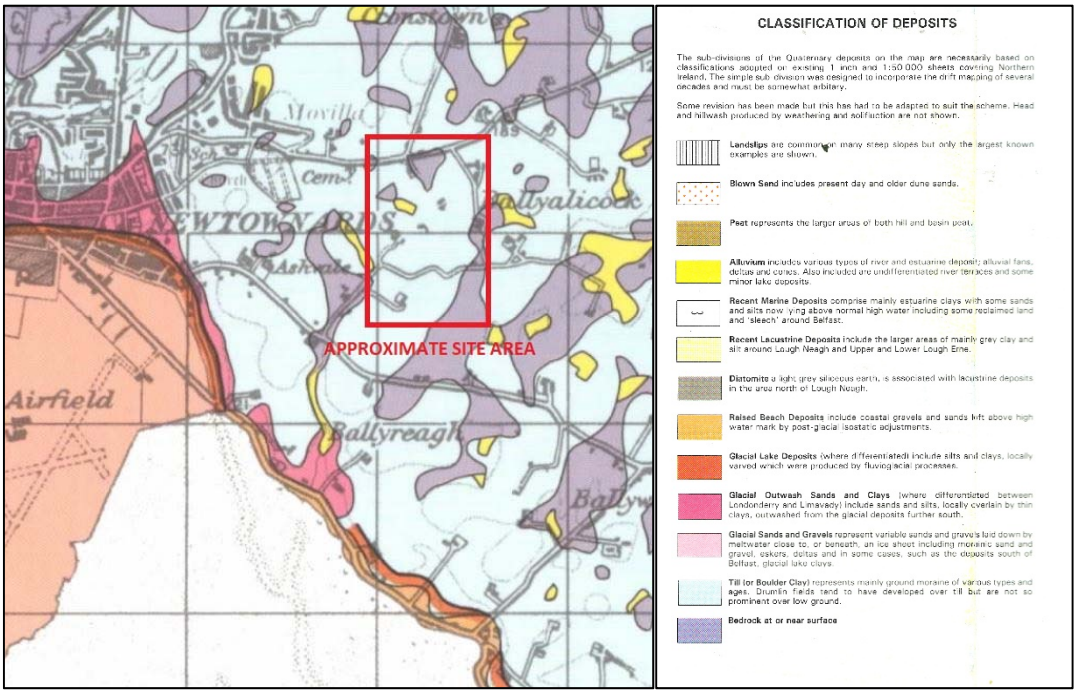
Information on the environmental setting of the site was obtained from the following sources

- GSNI Regional Solid Geology Maps of Northern Ireland (1:250,000 scale);
- GSNI GeoIndex (online tool);
- Flood Maps NI;
- GSNI Newtownards Sheet 37 and Part of Sheet 38 (1:50,000 Drift Edition).

2.7.2 Superficial Geology

An extract from the published drift geology map (Newtownards Sheet 37) is presented as Figure 4 below;

Figure 4: Drift Geology Map, Bowtown Road, Newtownards



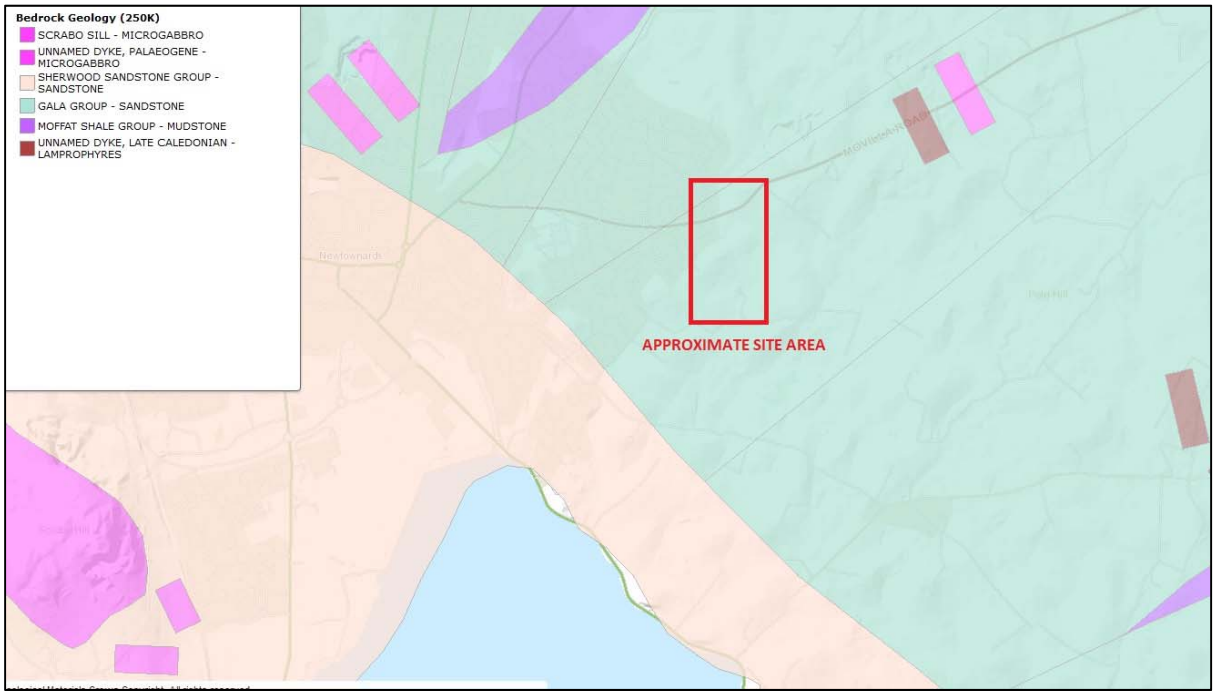
The published drift geology map (Figure 4) has indicated that the site is predominantly underlain by boulder clay. There are a small number of areas where alluvium is mapped, which is likely to be relatively thin and likely underlain by boulder clay.

A number of areas within the site are also mapped as bedrock, at, or near the surface. The presence of mapped bedrock at or near the surface within the boundary of the site, would indicate that the boulder clay also mapped within the boundary of the site, is likely to be relatively thin.

2.7.3 Solid Geology

An extract from the published regional solid geology map (Regional Solid Geology Maps of Northern Ireland 1:250,000 scale) is presented as Figure 5;

Figure 5: Drift Geology Map, Bowtown Road, Newtownards



The published solid geology map (Figure 5) has indicated that the is underlain by the Gala Group Sandstones. Sherwood Sandstone is mapped further to the south, but not within, or close to, the development site.

2.7.4 Hydrogeology

The underlying boulder clay, or small pockets of alluvium, are not considered to represent a potential superficial aquifer, particularly given the likely thin layer of the deposits within the site boundary. Small volumes of shallow groundwater may be encountered within thicker and more permeable lenses within the drift deposits, but volumes would be very modest and would not represent a significant superficial aquifer at this location.

The site is located on the Gala Group bedrock. The Northern Ireland GSNI/NIEA aquifer classification reports this bedrock type as an aquifer with low productivity potential where groundwater moves by fracture flow Bl(f). Where the upper bedrock is more weathered and fractured, enhanced flow can occur. Groundwater flow would be local, discharging to local watercourses, with little potential for wider regional flow. Whilst groundwater can be abstracted from the bedrock, supply volumes are generally very modest.

2.7.5 Groundwater Vulnerability

The site is in an area mapped under the Northern Ireland regional groundwater vulnerability screening layer as Class 4 (high risk) on a scale from 1 to 5 where 1 is lowest vulnerability and 5 is highest vulnerability.

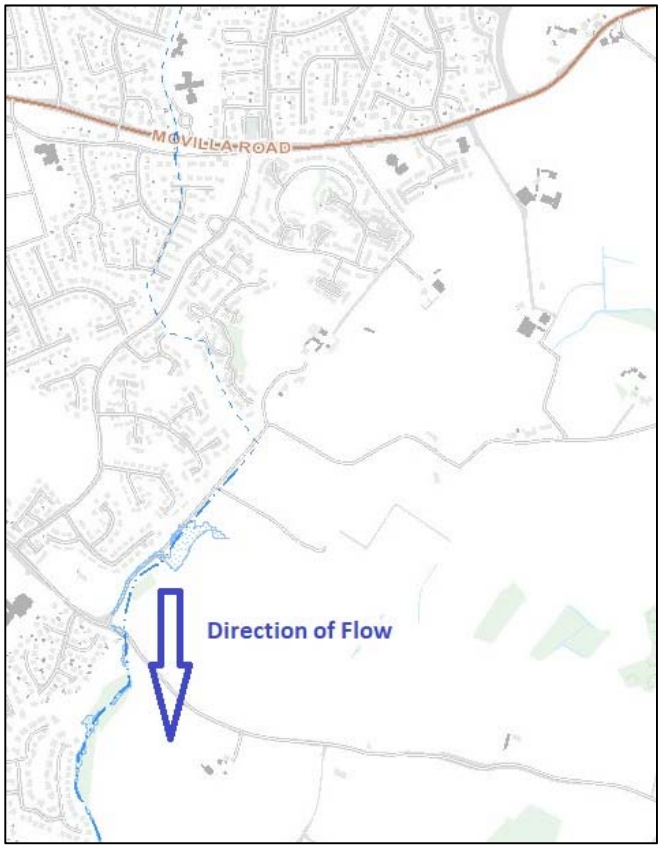
The high vulnerability rating relates to likely presence of a thin layer of drift deposits and / or the bedrock at or near the surface at the site, therefore offering little or no protection to the bedrock aquifer.

2.7.6 Hydrology

The closest surface water feature to the site relates to a small and un-named watercourse present in the southern boundary of the site.

The watercourse enters the site from the adjacent residential housing area to the west of the site (culverted), and it flows in a southerly direction along the Ballyreagh Road, crossing the Bowtown Road, and eventually discharging into Strangford Lough ~600m to the south of the site. The location of the watercourse is presented in Figure 6 below;

Figure 6: Flood Maps NI, Bowtown Road, Newtownards



The site is considered to be hydraulically linked to Strangford Lough, via the identified watercourse in the south of the site. Strangford Lough is designated, as both a Special Area of Conservation (SAC) and a Marine Conservation Zone (MCZ).

3 OUTLINE CONCEPTUAL MODEL

3.1 Introduction to Conceptual Site Model

In the context of the assessment of land contamination, there are three essential elements to any environmental and / or human health risk that must be considered to develop a Conceptual Site Model (CSM). These elements are now summarised;

- **A source** – a substance that is in, on or under the land and has the potential to cause harm and/or pollution of controlled waters;
- **A pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant/substance;
- **A receptor** – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body.

Each of these elements can exist independently at a site, but they create a risk only where viable links are present, so that a contaminant affects a receptor through a pathway. This linked combination of contaminant – pathway – receptor is described as a **pollutant linkage**. An outline CSM for the assessment site is presented in the following sections.

3.2 Source

The PRA has indicated that the site has historically, and currently, been occupied by agricultural grassland and a small number of associated residential dwellings and farm buildings. The only obvious sources of contamination associated with the historical and current land use within the site boundary relates to a number of AST`s, used for residential heating oil and the refuelling of farm machinery. The tanks ranged in size from small residential tanks to larger commercial sized tanks and all observed tanks were unbunded. These tanks have the potential to have caused land contamination. It is anticipated that these tanks will be removed as part of the site development works.

The contaminants of concern associated with the AST`s, in relation to soil and / or groundwater, are now summarised.

- Hydrocarbons (aliphatics and aromatics), including BTEX compounds and MTBE;
- Polycyclic Aromatic Hydrocarbons (PAH`s);
- Heavy metals;
- Volatile Organic Compounds (VOC`s);
- MTBE and BTEX compounds.

Volatile vapour could also be present, associated with any potentially impacted / contaminated shallow groundwater (if any present).

It was noted during the site walkover that one farm shed / building was constructed with asbestos roofing. The roof appeared intact and to be in good conditions and there were no obvious fragments / asbestos on the surface surrounding the building. It is recommended that the asbestos is properly removed by a specialist contactor prior to demolition. It is also recommended that an asbestos survey of the site is carried out prior to demolition works and any additional identified asbestos removed. Following the completion of the asbestos survey, and the removal of any identified

asbestos by a specialist contractor, the risks posed by asbestos will be low. Therefore any risk associated with asbestos have not been considered any further.

In terms of off-site sources of contamination information, the historical maps indicated that the adjacent lands were also historically primary agricultural grassland, and most recently residential and agricultural. A small number of nearby sites were indicated in the historical maps and the NIEA WCLD, however given the distances involved to the closest known site (former slate mine at a distance of 175m) it is considered that there are no significant off-site sources.

In summary, the only significant sources of contamination associated with the site relate to the identified AST`s. As previously mentioned, this is subject to the suitable surveying of the site for asbestos and the removal of this material by a specialist contractor.

3.3 Pathways

The site developed plan includes residential properties, with gardens. Human health pathways are considered to potentially be present in the gardens and soft landscaped areas of the site relating to direct dermal contact, ingestion and inhalation of dust / fibres.

Inhalation of vapours from potentially contaminated shallow groundwater are considered to be a potential human health pathway.

A potential human health pathway which should be considered is human consumption of contaminated groundwater. The setting of the site is such that the shallow groundwater within the upper superficial deposits in this locality is not considered to be a groundwater resource and as such would not be utilised for drinking purposes. Additionally, the bedrock aquifer is not considered to be a significant aquifer with the search of the NIEA database and the DWI response not indicating any groundwater abstractions within a 1km radius of the site. Thus, the pathway of human consumption of contaminated groundwater is not considered to be significant, at this locality.

The potential environmental pathways relate to infiltration into contaminated soils and subsequent leaching of pollutants into the shallow groundwater, (if any present). Shallow groundwater can then move laterally towards surface waters or downward into the underlying bedrock aquifer. Additionally, shallow groundwater can move laterally from off-site sources towards the site.

3.4 Receptors

The human health receptors, associated with the identified human health pathways, are the future site users.

In terms of environmental receptors, the shallow groundwater, if present, is not a recognised groundwater resource. At this location, the risks associated with the shallow groundwater are considered to be low. The bedrock is mapped as being Gala Group and given its low productivity it is not considered to be a significant receptor.

With regards to surface water receptors, associated with lateral migration of contamination in the shallow groundwater, the closest known AST to the watercourse was located at a distance of ~460m, as presented in Figure 7 below;

Figure 7: Distance from AST to Watercourse, Bowtown Road, Newtownards

Given that the watercourse is located in an area of the site which is agricultural grassland and given the distance involved the identified source (closest AST) the potential risks to the identified watercourse would be considered to be very low.

3.5 Summary of CSM

The outline CSM has identified the following significant pollutant linkage associated with the site:

- **Human Health:** Direct dermal contact, ingestion and inhalation of contaminated soils by future site users;
- **Human Health (future site users)**: Volatile vapour, associated with potentially contaminated shallow groundwater, and ingress site buildings and subsequent inhalation.

A summary of identified significant pollutant pathways is presented in Table 5:

Table 5: Outline CSM and Risk Rating, Bowtown Road, Newtownards

Source	Pathway	Receptor	Contaminants of Concern	Risk Rating
AST`s within the site boundary	Direct dermal contact with contaminated soils	Future site users	Hydrocarbons BTEX compounds PAH`s MTBE VOC`s Heavy metals	**MEDIUM**
Contaminated shallow groundwater because of AST`s	Ingress and accumulation of volatile vapour into site buildings and subsequent inhalation	Future site users	Volatile vapour	**MEDIUM**

4 SUMMARY AND CONCLUSION

The outline CSM developed in the Phase 1 PRA has identified a total of 2 No. potential human health pollutant linkages associated with the presence of a potentially contaminating on-site source (AST`s). The CSM has concluded that the associated level of risk is considered to be a maximum of **MEDIUM**.

Given the presence of the identified pollutant linkages, it is recommended that these are further investigated and quantified by way of an intrusive site investigation and subsequent Phase 2 Generic Quantitative Risk Assessment (GQRA). A site wide intrusive assessment is not required for the site, the intrusive works should be targeted to the areas within the site in which the AST`s are located.

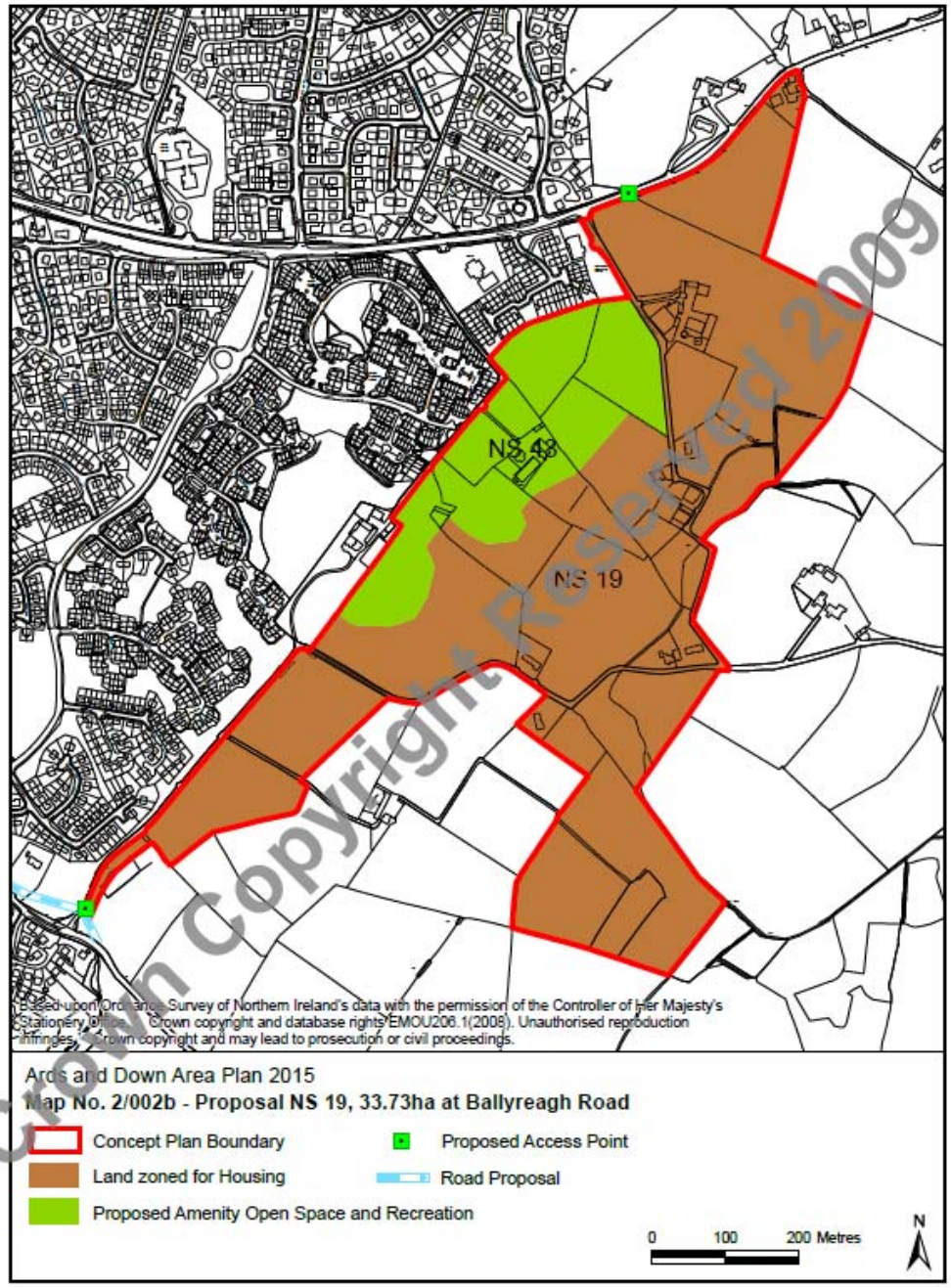
The Phase 2 GQRA, and intrusive site investigation, should consist of the following works as a minimum;

- Supervised drilling of investigation boreholes targeted at areas of the site in which the AST`s are located;
- Installation of boreholes for groundwater monitoring;
- Logging of ground conditions;
- Sampling and analysis of groundwater and soil samples (UKAS accredited laboratory);
- Analytical suite in line with the identified compounds in Section 3.2;
- Groundwater level monitoring, survey of boreholes to Ordnance Datum (mOD);
- Ground gas monitoring and ground gas risk assessment;
- Phase 2 GQRA report;
- Recommendations for further assessments, if required.

In addition to the further assessment detailed above, it is recommended that an asbestos survey of the site (in particular the farm buildings) should be carried out. Any identified asbestos should be removed from site by a specialist contractor prior to the start of site works.

Appendix A

Site Development Plan



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Appendix B

Photographic of Site Walkover

Plate 1: View of the site from Movilla Road (northern boundary) looking soith-east.

Plate 2: View of the site from Movilla Road, looking east.

Plate 3: Movilla Road on northern site boundary, looking north-east.

Plate 4: Residential property (with domestic oil tank), located at north-eastern corner of the site.

Plate 5: Movilla Road on northern site boundary, looking north-west.

Plate 6: Ballyreagh Road looking south.

Plate 7: Vacant farmhouse located on Ballyreagh Road.

Plate 8: Material present across the farm yard area.

Plate 9: Derelict barn.

Plate 10: Derelict barns.

Plate 11: Disused oil drum.

Plate 12: Storage barn and above ground storage tank.

Plate 13: Former red diesel tank within barn.

Plate 14: Former oil barrel present within farm yard.

Plate 15: Farm entrance from Ballyreagh Road, looking south-west.

Plate 16: Large slurry tanks.

Plate 17: Farmyard, looking north.

Plate 18: Farm house looking west.

Plate 19: View of agricultural lands, looking east.

Plate 20: View of agricultural lands, looking north-east.

Plate 21: Residential property located on Ballyreagh Road.

Plate 22: Ballyreagh Road, looking south.

Plate 23: Derelict farm located on Ballyreagh Road.

Plate 24: Derelict farm.

Plate 25: Derelict property located adjacent to the derelict farm.

Plate 26: Derelict barn and fly tipped material.

Plate 27: Agricultural lands, looking north-west.

Plate 28: Fly tipped material.

Plate 29: Area of former above ground storage tanks.

Plate 30: Agricultural lands, looking west.

Plate 31: Agricultural lands looking south.

Plate 32: Derelict, old stone barn.

Plate 33: Disused barn with an asbestos roof.

Plate 34: Agricultural lands, looking south.

e 35: Residential properties located on the Ballyreagh R

Plate 36: Agricultural lands looking west.

Plate 37: Residential properties on Ballyreagh Road, looking north.

Plate 38: Residential properties on Ballyreagh Road, looking north.

Plate 39: Residential properties on Ballyreagh Road, looking north.

Plate 40: Residential properties on Ballyreagh Road, looking north.

Plate 41: Agricultural lands, looking west.

Plate 42: Residential property on Ballyreagh Road.

Plate 43: Property located off Movilla Road, in the western region of the site.

Plate 44: Agricultural lands, looking west.

Plate 45: Agricultural lands, looking south-east.

Plate 46: Vacant glass houses.

Plate 47: Former diesel tank used for agricultural machinery.

Plate 48: Area of former above ground storage tank.

Plate 49: Old, stone cottage, located in western region of the site.

Plate 50: Yard area of former vegetable wholesale business.

Plate 51: Residential bungalow located in western region of the site.

Plate 52: Agricultural lands, looking south-west.

Plate 53: Domestic oil tank associated with residential bungalow.

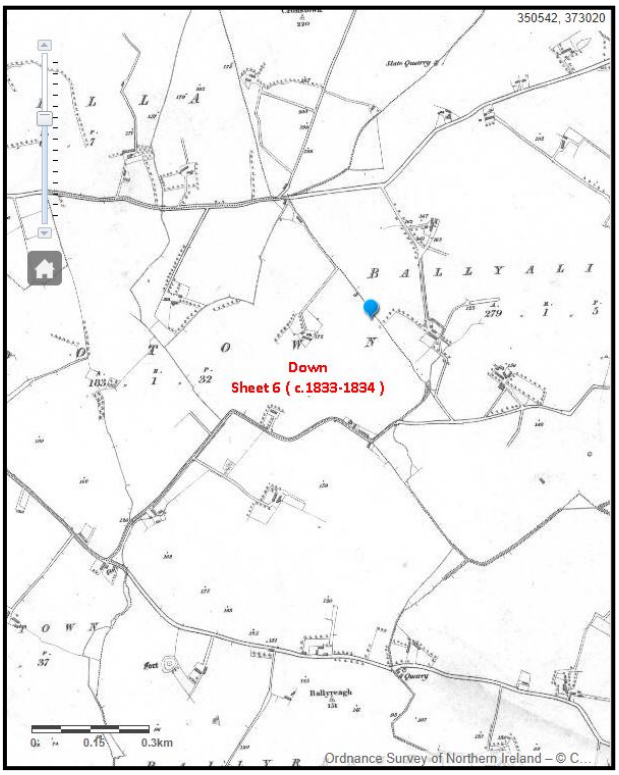
Appendix C

Historical Maps

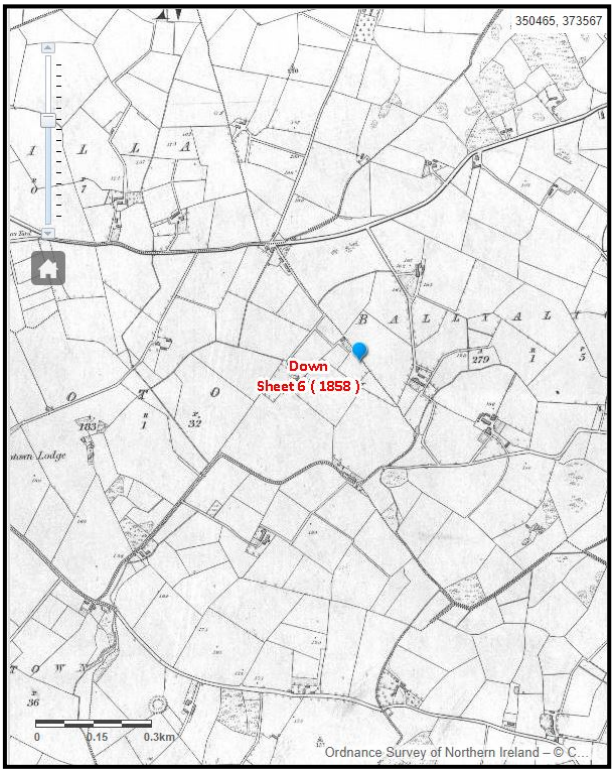
O'Sullivan Macfarlane
Environmental Consulting

HISTORICAL MAPS, BOWTOWN ROAD, NEWTOWNARDS

Slide 1: 1833 - 1834 OS Map



Slide 2: 1858 OS Map



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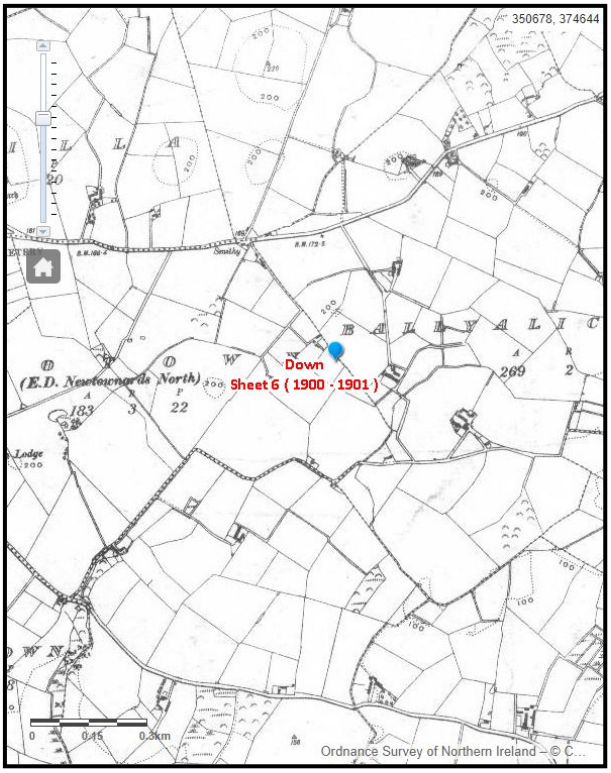
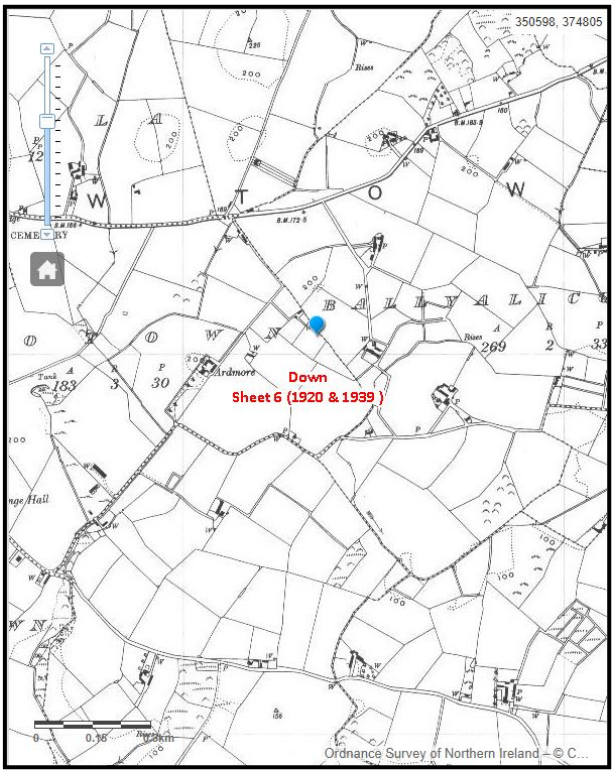
Environmental Consulting

Slide 3: 1900 - 1901 OS Map

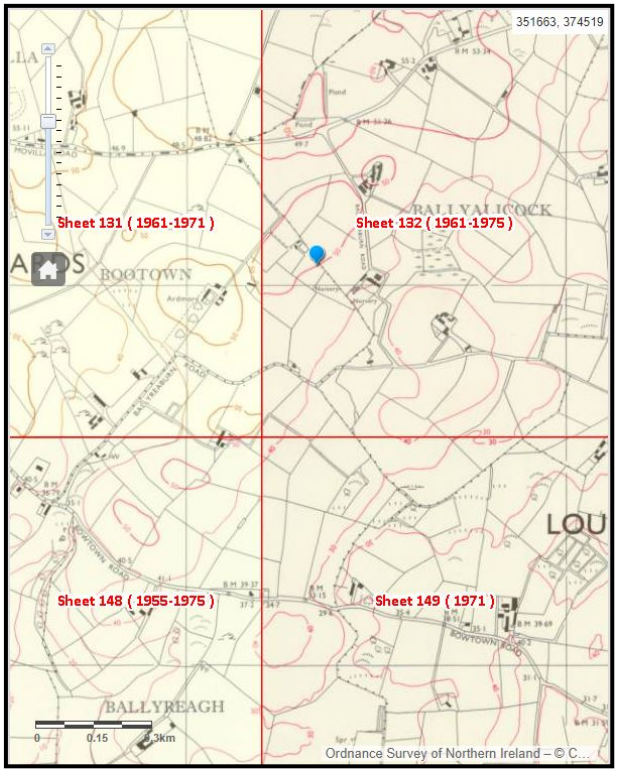


Slide 4: 1920 and 1939 OS Map



O'Sullivan Macfarlane
Environmental Consulting

Slide 5: 1960s OS Map



Appendix D

Regulator Responses

From: PWS
To: Katherine
Cc: PWS; DWI
Subject: NIEA - DWI - PWS 1200 - Site between Bowtown and Movilla Roads, Newtownards
Date: 21 August 2018 09:05:38
Attachments: image002.png

REF: PWS 1200

Katherine,

Site between Bowtown and Movilla Roads, Newtownards

The Drinking Water Inspectorate only holds information on private water supplies registered with the Inspectorate under The Private Water Supplies Regulations (Northern Ireland) 2017 and has provided this below.

There are no private drinking water supplies registered with the Inspectorate within 1km of the outlined site.

Please note the information provided in this e-mail is accurate in accordance with our latest records only.

Primary production sites, such as dairy farms, are not required to be registered with the Drinking Water Inspectorate. If you require information on these, you should contact the Quality Assurance Branch of the Department of Agriculture, Environment and Rural Affairs at Dundonald House, Upper Newtownards Road, Belfast. Tel. (028) 90 525001.

It is important that you note that the Drinking Water Inspectorate does not hold information on private water supplies which supply single dwellings. Details on these may be obtained from the Environmental Health Department of Ards and North Down Borough Council Tel: 0300 013 3333 or email: enquiries@ardsandnorthdown.gov.uk.

You may also wish to contact Northern Ireland Water for information on any Northern Ireland Water sites in the area - Tel. 03457 440088 or Email: waterline@cs.niwater.com.

NIEA Water Management Unit can be contacted regarding other information that you may require: waterinfo@daera-ni.gov.uk.

You should also undertake your own scoping exercise of premises in the vicinity of the development as there may be private water supplies for which records are not held by the above agencies. This should include a survey of the surrounding properties to determine if they have a private water supply. This scoping exercise should include a desk study of relevant OS maps or other relevant information. If it has been assessed, in undertaking this assessment, that private drinking water supplies could be impacted upon by the development then the applicant should propose appropriate steps to mitigate against either a deterioration of drinking water quality or sufficiency of supply. This should include appropriate monitoring and sampling of the supply, if deemed appropriate. Details of any assessment of private water supplies should be made available to the DWI.

The Inspectorate is not in a position to comment on what other information may be relevant to a hydrology assessment.

Kind regards,
Elaine.

Private Water Supplies Team
Drinking Water Inspectorate Northern Ireland
TEL: 028 905 69282

Drinking Water Inspectorate | Northern Ireland Environment Agency
Klondyke Building, Gasworks Business Park, Cromac Avenue, Belfast BT7 2JA

DAERA's Privacy Notice may be accessed at: https://www.daera-ni.gov.uk/daera-privacy-statement

---

From: Katherine [mailto:k.livingston@osmni.co.uk]
Sent: 20 August 2018 16:17
To: PWS <privatewatersupplies@daera-ni.gov.uk>; DWI <dwi@daera-ni.gov.uk>; DAERA NIEA Water Info <WaterInfo@daera-ni.gov.uk>
Subject: Abstraction search, Bowtown Road

Hello

Would it be possible to obtain a search of the DWI private groundwater abstraction licence database within a 1km radius of a site located between Bowtown Road and Movilla Road, Newtownards.

Grid reference: 351343, 374048

I have also attached a site location map for the site.

Many thanks and kind regards,

Katherine

Katherine Livingston BSc MSc
Environmental Consultant

O'Sullivan Macfarlane
Environmental Consulting

O'Sullivan Macfarlane Environmental Consulting
Unit 70, Mallusk Enterprise Park, Newtownabbey, Co. Antrim BT36 4GN
Tel: +44 (0)28 9083 0216 | Mobile: 07793121475

website | email | map | LinkedIn

Confidentiality Note: This email may contain confidential and / or private information.
If you received this email in error please delete and notify the sender.

From:	DAERA NIEA Water Info
To:	k.livingston@osmni.co.uk
Subject:	WQU497 - WMU Response - Bowtown & Movilla Rds Newtownards
Date:	23 August 2018 09:16:59
Attachments:	image002.png

Dear Katherine

A search of the Groundwater Monitoring Database has found that there are no groundwater monitoring points within the requested 1km search area.

If you require any further water related environmental information about this or any other site please e-mail details of your information request to WaterInfo@daera-ni.gov.uk

Many thanks,

Data Analysis and Management Team
Water Management Unit

NIEA Northern Ireland Environment Agency
www.daera-ni.gov.uk

Department of Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

A living, working, active landscape valued by everyone.

Appendix E

Service Providers Maps

Our Ref: 1808/41926 Your Ref: none

Ms. Katherine Livingston
O'Sullivan Macfarlane Consulting
k.livingston@osmni.co.uk

21st August 2018 Website: http://www.nienetworks.co.uk/

Dear Ms. Livingston

Re: Bowtown Road, Newtownards BT23 8SH

We refer to your request for a marked up cable drawing showing NIE Networks equipment. We enclose for your attention but ask you to note that **all cable positions are approximate only** as indicated clearly on the drawing. Therefore, the onus is on you and your subcontractor to locate and avoid all underground and overhead electrical equipment owned by NIE Networks and to prevent any damage whatsoever to **any** electrical equipment.

Please note specifically that smaller service cables may not show on the marked up drawing and therefore all reasonable steps should be taken by you to locate any cable whether, underground or overhead.

As you know, work in the vicinity of any electrical equipment involves a high risk of danger or injury and therefore all care must be taken.

Any damage must be reported immediately as no matter how minor the damage may appear, live electricity cables are extremely dangerous and can kill.

All site safety **MUST** be maintained in accordance with Health and Safety legislation and we refer you to the following guidance notes, for information, but these do not form an exhaustive list:

1. HSE guidance notes GS6 (avoidance of danger from overhead electric lines) and
2. HSE booklet HS (G) 47 avoiding danger from underground services

These guidance notes are available from the Health & Safety Executive for N.I. (HSENI).

NIE Networks also have a website section on 'Contractor Safety' to which we refer you.

If any damage whatsover occurs to NIE Networks equipment all work in the vicinity **must stop immediately** and the damage **must be reported at once** to NIE Networks on the following number: **03457 643 643**

As you will appreciate, fault location and repairs are less expensive to carry out should a matter be reported immediately at the time of damage. We would ask you to note that even what may appear insignificant damage can involve a cable faulting at some time later and the location and repair costs in such an instance are considerably higher. NIE Networks will pursue the responsible party for all costs incurred by it in the locating and repairing of any of its electrical equipment and this letter will be used in

support of that claim.

You should ensure that the attached mark up and a copy of this letter are given to any contractor or subcontractor who may have personnel or machines working on this site and we have enclosed two copies for your convenience. Also note, that NIE Networks original drawings must be used at all times and this present drawing is only valid for 3 months from the date of this letter.

Please note that you will be working in close proximity to 33kV equipment. Therefore, a copy of your proposed works has been passed to our Network Manager, Mr. Cyril Carr who should be contacted before you commence any works whatsoever on 028 91801108.

Yours sincerely

NIE Networks

Network Performance and Safety

Map No : 14804ne

Based upon the ordnance Survey map with the permission of the director and the chief executive, Crown copyright. É	Title:	Map Centre : 351024,373531	Project No:	Scale : 1:2500
			Drawing No:	Date : 21/08/2018 07:13:00

400 kV
275 kV
110 kV
33 kV
11 kV
6.6 kV
MV
Service

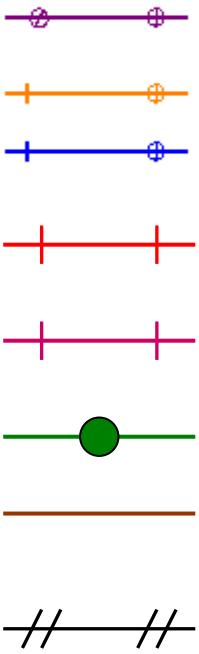
CAUTION! CABLE POSITIONS ARE APPROXIMATE ONLY.

Please note that smaller service cables may not be shown. Always remember that it is the responsibility of the excavator to locate and avoid damage to N.I.E. equipment. Failure to do so may result in those responsible being held liable.

Northern Ireland Electricity

1

GNIS SYMBOLOGY



275 KV Overhead

110 KV Overhead

33 KV Overhead

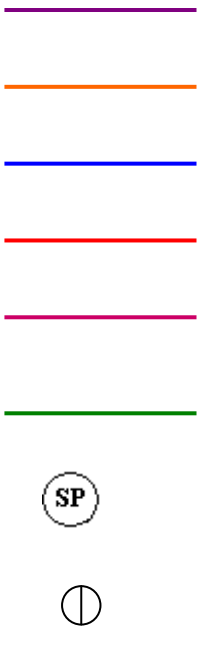
11 KV Overhead

6.6 KV Overhead

MV Overhead

Services

De-energised or Decommissioned (Voltage as per colour code below)



275 KV Cable

110 KV cable

33 KV Cable

11 KV Cable

6.6 KV cable

MV Cable

Steel Pole

Tower

HV Pole

Pole Mounted Sub

Ground Mounted Sub

Stay. Can be 2 Stay (2S) or 3 Stay (3S)

3 Pole. Can be 4 Pole (4P)

H Pole

Jockey Pole

V Stay

Switching Site

Leader Line

Flying Stay

MV Pole

MV Stay

MV 2 Stay

MV Strut

Mini Pillar

UDB

SP — Steel Pole

JP — Jockey Pole

GW — Guard Wire

FS — Flying Stay

OR — Outrigger Stay

Northern Ireland Electricity Networks

April 2018

Safety priorities

Advice to contractors on avoiding danger from underground electricity cables

From time to time your development and maintenance work can come close to or cross, NIE Networks infrastructure. It is essential you assess and control the risks associated with this work.

Damage to underground cables during excavation works will result in severe burn injuries or fatalities as well as disrupting essential electricity supplies. It is your responsibility to take all steps to ensure your activities are planned and completed safely.

Please ensure that you read and understand the content of the NIE Networks Access Statement

Prior to excavation

Nearly every road, footpath and public area will contain one or more electricity cable. In order to minimise injury risk when excavating near electricity cables, you must consider the following:

- Ensure the most up to date cable drawings are with you on site and that you fully understand them before you start the excavation. Note: some electricity cables may not be shown on our drawings such as older electricity cables or those that don't belong to us.
- Have a Cable Avoidance Tool (CAT) on site and ensure the operator is competent to use it. Survey the site before starting the excavation.
- Mark out the location of electricity cables in accordance with the CAT survey.
- Look around you and assess if there is anything adjacent to your work area that would contain an electricity cable - street lighting columns, phone boxes, bus shelters, traffic light control pillars. Some of these contain electricity cables that are not our equipment.

During excavation

Continue to use the Cable Avoidance Tool (CAT) during the entire excavation - **YOU MAY BE ONLY MILLIMETRES AWAY FROM A LIVE CABLE!**

- Electricity cables can be identified by marker tape, concrete or plastic tiles, bricks or timber. However, these may have moved and are no longer under their protective covers. Sometimes the marker tape or tiles may be missing altogether, never assume that protective covers will be in place.
- Do not use a mechanical excavator within 0.5m of electricity cables and keep everyone clear of the bucket while it is digging.
- Use spades and shovels with non-metallic handles in preference to other tools and do not throw or spike them into the ground.
- Use only picks with short chisel ended tines with non-metallic handles, to break up surface materials and when the ground is very hard.

If electricity cables are suspected of being embedded in the concrete that you need to excavate, do not start work until:

1. The electricity cables have been de-energised or proven to be dead; Or
2. NIE Networks has established an alternative safe system of work.

- Never assume that electricity cables follow a straight line or that they run at the same depth.
- Never disturb electricity cables and joints or their protective covers.
- Always ensure that all exposed electricity cables are adequately supported and never use them as a convenient step or hand-hold.

If you suspect that an electricity cable has been damaged, however slightly:

- Keep people at a safe distance and secure the site;
- Telephone NIE Networks IMMEDIATELY on: 03457 643 643;
- Remain onsite until NIE Networks arrive.

When calling, you will need to describe the incident and its exact location, giving the name, address and telephone number of your company. No charge will be made for electricity cable damage site visits where repairs are not required.

Detail of the basic safety precautions recommended on this sheet are in the HSE booklet HS(G)47 – Avoiding Danger from Underground Services.

More information: nienetworks.co.uk/safety

Northern Ireland Electricity Limited

Advice to Contractors on Avoiding Danger from Buried Electricity Cable

Many accidents occur when underground cables are damaged during excavation.
Damage to live electricity cables can cause an explosion which can result in serious injury or even death.

Nearly every footpath has one or more electricity cables beneath it. So that you avoid injury when excavating near our cables, you **must** pay special attention to the following points:

- Have cable drawings with you on site and check them before you start the excavation. **Remember:** some cables may not belong to Northern Ireland Electricity and, therefore, will not be shown on our drawings.

- Have a cable locator tool on site and use it to help you survey the site before you start the excavation. If you don't know how to use the cable locator, ask your supervisor to help you.

- Mark out the location of electricity cables in accordance with the cable locator signals.

Remember that:

1. the cable locator, in the 'power' mode, will not always detect the presence of cables – especially if they are not carrying any current at the time.
2. when the cable locator is used along with the signal generator, or in the 'radio' mode, it is more likely that cables that are not carrying current can be detected.

- Look around you to see if there is anything nearby that would have an electricity service, such as lamp columns, phone boxes, bus shelters, traffic light control pillar and so on. These would have small service cables which are easily damaged.

- Continue to use the cable locator during the entire excavation process-
  YOU MAY BE ONLY INCHES AWAY FROM A LIVE CABLE!

- Cables are usually protected by marking tape, tiles, bricks or timber. But they may have moved and are no longer under their protective covers. Sometimes the marking tape or tiles may be missing altogether.

- **Do not** use a mechanical excavator within 0.5m of electricity cables and keep everyone clear of the bucket while it is digging.

- Use spades and shovels in preference to other tools and **do not** throw or spike them into the ground.

- Use only picks with short chisel ended tines, to break up surface materials and when the ground is very hard.

- If cables are suspected of being embedded in the concrete that you need to excavate, **do not** start work until:

  1. the cables have been made dead;
     or
  2. a Northern Ireland Electricity supervisor has established an alternative safe system of work.

- **Never** assume that service cables follow a straight line or that they run at the same depth.

- **Never** disturb electricity cables and joints or their protective covers.

- **Always** ensure that all exposed cables are adequately supported and **never** use them as a convenient step or hand-hold.

Reporting Damaged Cables

If you suspect that a cable has been damaged, however slightly:

- mark the location

- keep people at a safe distance; and

- telephone Northern Ireland Electricity **IMMEDIATELY**, using the following number:

08457 643643

When calling, you will need to describe the incident and its exact location, giving the name, address and telephone number of your company. No charge will be made for cable damage site visits where cable repairs are not required.

The basic safety precautions recommended on this sheet are explained in detail in the HSE booklet HS(G)47 – Avoiding Danger from Underground Services, a copy of which may be obtained from your supervisor or The Stationary Office.

Northern Ireland Electricity Networks

NIE Networks

ACCESS STATEMENT

1. INTRODUCTION

Northern Ireland Electricity Networks (NIE Networks) owns the electricity transmission and distribution network and operates the electricity distribution network which transports electricity to over 860,000 customers. Our infrastructure supplies power to homes and businesses across Northern Ireland and our network consists of approximately 49,000km of overhead lines, 14,000km of underground cables and other connected equipment that can be situated both above and below ground.

From time to time the development and maintenance work of others can come close to, and often cross, this infrastructure. It is therefore important that we ensure the safety of those carrying out these works and facilitate an efficient system to give advice on working in proximity and quotations for moving our equipment if required.

This access statement contains the practical information necessary for developers and utilities whose work requires them to cross or work near NIE Networks' assets. Having consideration of your proposed work, remember there are privately owned electrical networks throughout Northern Ireland that we cannot provide you with details of or advice about. It is your responsibility to take all steps to ensure your activities are planned and completed safely.

Northern Ireland Electricity Networks Depot Areas

2. WHO TO CONTACT

Who you should contact will depend on the nature of your request. For example, are you planning to carry out excavation works and need information on where our cables are located or are you potentially going to be working near to overhead lines? In all cases, you should call our Customer Helpline on 03457 643 643.

2.1 Underground cables

Before you start digging, you should apply for network maps of the area that you are about to start working in. Always refer to Health and Safety Executive guidance HS(G) 47. You can find out more information here.

www.nienetworks.co.uk/Safety-Environment/Contractors/escavation-digging

www.hse.gov.uk/pubns/books/hsg47.htm

2.2 Overhead lines

If you plan to work close by to any of our overhead lines, you should contact us well before work takes place as we may need to arrange a temporary disconnection for the duration of the work. Always refer to Health and Safety Executive guidance GS 6 and Working in Proximity to Low Voltage Overhead Power Lines.

www.nienetworks.co.uk/Safety-Environment/Contractors/Tipper-mobile-plant

www.hseni.gov.uk/sites/hseni.gov.uk/files/publications/%5Bcurrent-domain%3Amachine-name%5D/Working-in-proximity-to-low-voltage-overhead-power-lines_0.pdf

www.hse.gov.uk/pubns/gs6.pdf

2.3 Other equipment

If you plan to work near any of our other plant or equipment, you should apply for network maps of the area that you are about to start working in.

3. ARRANGEMENTS FOR ACCESSING INFORMATION

To understand whether work you propose to carry out will go near to or cross our assets, maps detailing the location of our underground cables and overhead lines please request a network map by email, markups@nienetworks.co.uk or by post:

Northern Ireland Electricity Networks

Distribution Service Centre

Request for Markup

Carn Industrial Estate

Craigavon

BT63 5QJ

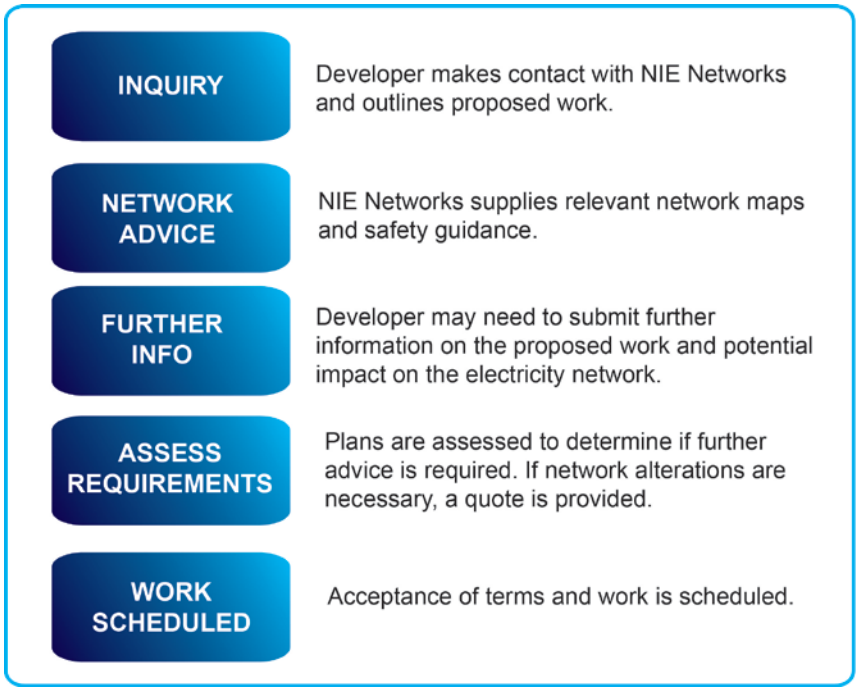
Further information is available on our website

www.nienetworks.co.uk/Safety-Environment/Network-maps

Please note that NIE Networks does not provide depths to underground cables on our mark up drawings so if a survey or any enabling works are required to establish such depths then this will need to be carried out at the customer's expense.

If you require information in accordance with a Street Works Licence Application please send this request for information included with a copy of the SWL2 form to markups@nienetworks.co.uk.

4. PROCESS



Further details on NIE Networks' timescales and process for alterations and new connections can be found on the Connections section of our website.

www.nienetworks.co.uk/Connections/Guide-price-timescales

NIE Networks current Statement of Charges can be accessed on our website from the link below.

www.nienetworks.co.uk/Statement-of-Charges

5. KEEPING INFRASTRUCTURE PROVIDERS INFORMED

We will keep you informed during the design and construction process by the single point of contact that has been assigned to your job, and where practicable, advised of changes to agreed timescales if they arise. NIE Networks gives a minimum notice period for changing our plans before work commences. Once work has started on site, we will not change our programme unless requested to do so by the customer.

6. DISPUTE RESOLUTION

NIE Networks follow the National Joint Utilities Group (NJUG) guidelines on Co-ordination, Co-operation & Communication, which is a document detailing cross-industry agreed best practice on working with other utilities. This should minimise the number of disputes. These guidelines can be accessed from the link below.

njug.org.uk/wp-content/uploads/2016/09/Volume-6-NJUG-Co-ordination-Co-operation-and-Communication-Issue-1.pdf

For further information on making a complaint to NIE Networks please refer to the link below.

www.nienetworks.co.uk/documents/Customer-leaflets/NIE_-making-a-complaint-update

PRAGMA PLANNING

MIXED USE DEVELOPMENT, LANDS AT BOWTOWN ROAD, BALLYREAGH ROAD AND MOVILLA ROAD, NEWTOWNARDS. PLANNING REFERENCE:LA06/2019/1046/F

P683 PHASE 2 GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA) AND REMEDIATION STRATEGY

20 AUGUST 2020

Report No. P683
www.osmni.co.uk

O'Sullivan Macfarlane
Environmental Consulting

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Report Prepared By:	Frank Macfarlane BSc MSc MIEnvSc	20/08/2020
Position	Environmental Consultant	
Report Reviewed By:	Peter McConvey BSc MSc	20/08/2020
Position	Senior Hydrogeologist	

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Figure 1 **Site Location Map**
Figure 2 **Site Boundary Plan**
Figure 3 **Location of AST`s / former AST`s**

APPENDICES

Appendix A **Site Development Plan**
Appendix B **Photographic Log of AST`s**
Appendix C **Borehole Logs**
Appendix D **Laboratory Certificates**
Appendix E **Screened Results**

1 INTRODUCTION

O`Sullivan Macfarlane Environmental Consulting (OSM) were instructed in June 2020 by Pragma Planning to undertake a Phase 2 Generic Quantitative Risk Assessment (GQRA) for a proposed mixed use development site located on lands on Ballyreagh Road, to the north of Bowtown Road, south of the Movilla Road and Movilla Mews and east of Burnreagh Drive, Greenlea Crescent, Fairfield Way, Fairfield Place, Ballyreagh Way, Abbot Close and Abbot Court, in eastern Newtownards

The development area ("the site") is currently occupied by mainly agricultural lands with a small number of residential housing. A planning application has been submitted for the development lands proposing the following;

- *Site for residential development (of a maximum of 675 dwellings) to include a mix of detached, semi-detached, terrace and apartment dwelling types. The replacement of Ballyreagh Road with the Bowtown Road to Movilla Road distributor road and associated roundabout junctions on Bowtown Road and Movilla Road. A mixed use centre to include ground retail and retail services in Class A and health, childcare and related community uses in Class D with apartments above and active elderly apartment in Class C1 (maximum 3 storey) open space including park, play area, MUGA and greenway pedestrian and cycle route pedestrian and vehicular access, landscaping incorporating hard and soft works drainage and any other necessary works.*

The planning reference for the site is LA06/2019/1046/F. A development plan is presented as Appendix A.

A Soils, Waters and Contaminated Land chapter of an Environmental Statement (ES) was previously completed by OSM for the application. The ES chapter contained a Phase 1 Preliminary Risk Assessment (PRA) titled as follows;

- *OSM September 2018. P347 Pragma Planning, Proposed Residential Development, Lands at Bowtown Road and Movilla Road, Newtownards. Planning Reference LA06/2018/1137/PAD and in the ES LA06/2019/1046/F. Phase 1 Preliminary Risk Assessment.*

This assessment concluded that a number of localised potential sources of contamination were present within the site boundary, relating to the presence of a number of commercial and residential sized above ground fuel storage tanks (AST`s). As such, a number of potential human health pollutant linkages were identified in the outline Conceptual Site Model (CSM). The Phase 1 PRA concluded that the potential pollutant linkages identified should be further investigated by way of a Phase 2 Generic Quantitative Risk Assessment (Phase 2 GQRA), which is now presented in this report.

The GQRA incorporates a targeted intrusive site investigation including the sampling of soil, and groundwater (where encountered). The results of which are compared against generic assessment criteria. The site-specific data is used to update the conceptual site model for the site, determining the significance of the previously identified source-pathway-receptor pollutant linkages.

If unacceptable linkages are identified (in terms of the environment or human health) then further assessment (Detailed Quantitative Risk Assessment / DQRA) and / or remedial works may be deemed necessary (Remediation Strategy).

2 SUMMARY OF PRELIMINARY RISK ASSESSMENT

2.1 General

The Phase 1 Preliminary Risk Assessment (PRA), previously completed for the site, included a desk top review of the environmental setting of the site as well as the historical uses of the site and surrounding lands. Additionally, searches of the NIEA Waste and Contaminated Land Database were undertaken as well as correspondence with the local council and regulatory bodies to identify any significant sources or receptors within the site and surrounding area.

The following section presents a summary of the outline Conceptual Site Model (CSM) developed in the PRA and includes updating, where relevant.

2.2 Source

The PRA indicated that the site has historically, and currently, been occupied by agricultural grassland and a small number of associated residential dwellings and farm buildings. The only obvious sources of contamination associated with the historical and current land use within the site boundary relates to a number of AST`s, used for residential heating oil and the refuelling of farm machinery. The tanks ranged in size from small residential tanks to larger commercial sized tanks and all observed tanks were unbunded. These tanks have the potential to have caused land contamination. It is anticipated that these tanks will be removed as part of the site development works, as they progress in a phased approach.

The contaminants of concern associated with the AST`s, in relation to soil and / or groundwater, are now summarised.

- Hydrocarbons (aliphatics and aromatics), including BTEX compounds and MTBE;
- Polycyclic Aromatic Hydrocarbons (PAH`s);
- Heavy metals (associated with petrol, if present);
- Volatile Organic Compounds (VOC`s);
- MTBE and BTEX compounds.

Volatile vapour could also be present, associated with any potentially impacted / contaminated shallow groundwater (if any present).

In terms of off-site sources of contamination information, the historical maps indicated that the adjacent lands were also historically primary agricultural grassland, and most recently residential and agricultural. A small number of nearby sites were indicated in the historical maps and the NIEA WCLD, however given the distances involved to the closest known site (former slate mine at a distance of 175m) it is considered that there are no significant off-site sources.

In summary, the only significant sources of contamination associated with the site relate to the identified AST`s.

It is noted that no significant source of ground gas was observed at the site, with most of the site natural agricultural land and no obvious natural superficial deposits that would be considered as potential significant source of ground gas.

2.3 Pathways

The site development plan includes residential properties, with gardens. Human health pathways are considered to potentially be present in the gardens and soft landscaped areas of the site relating to direct dermal contact, ingestion and inhalation of dust.

Inhalation of vapours from potentially contaminated shallow groundwater are considered to be a potential human health pathway.

A potential human health pathway which should be considered is human consumption of contaminated groundwater. The setting of the site is such that the shallow groundwater within the upper superficial deposits in this locality is not considered to be a groundwater resource and as such would not be utilised for drinking purposes. Additionally, the bedrock aquifer is not considered to be a significant aquifer with the search of the NIEA database and the DWI response not indicating any groundwater abstractions within a 1km radius of the site. Thus, the pathway of human consumption of contaminated groundwater is not considered to be significant, at this locality.

The potential environmental pathways relate to infiltration into contaminated soils and subsequent leaching of pollutants into the shallow groundwater, (if any present). Shallow groundwater can then move laterally towards surface waters or downward into the underlying bedrock aquifer. Additionally, shallow groundwater can move laterally from off-site sources towards the site.

2.4 Receptors

With human health receptors, associated with the identified human health pathways, are the future site users.

In terms of environmental receptors, the shallow groundwater, if present, is not a recognised groundwater resource. At this location, the risks associated with the shallow groundwater are considered to be low. The bedrock is mapped as being Gala Group and given its low productivity it is not considered to be a significant receptor.

With regards to surface water receptors, associated with lateral migration of contamination in the shallow groundwater, the closest known AST to the watercourse was located at a distance of ~460m. Given that the watercourse is located in an area of the site which is agricultural grassland and given the distance involved the identified source (closest AST) the potential risks to the identified watercourse would be considered to be very low.

2.5 Summary of CSM

The outline CSM has identified the following significant pollutant linkage associated with the site:

- **Human Health**: Direct dermal contact, ingestion and inhalation of contaminated soils by future site users;
- **Human Health**: Volatile vapour, associated with potentially contaminated shallow groundwater, and ingress site buildings and subsequent inhalation.

The outline CSM developed in the Phase 1 PRA has identified a total of 2 No. potential human health pollutant linkages associated with the presence of a potentially contaminating on-site source (AST`s). The CSM has concluded that the associated level of risk is considered to be a maximum of **MEDIUM**.

Given the presence of the identified pollutant linkages, it is recommended that these are further investigated and quantified by way of an intrusive site investigation and subsequent Phase 2 Generic Quantitative Risk Assessment (GQRA).

The PRA concluded that a site wide intrusive assessment is not required for the site, the intrusive works should be targeted to the areas within the site in which the AST`s are located.

It is noted that the CSM did not indicate any potential significant source of ground gas to be present at the site and therefore it is considered that a ground gas risk assessment is not required.

3 GENERIC QUANTITATIVE RISK ASSESSMENT

3.1 Introduction

Following the conclusion of the Phase 1 PRA and in line with its recommendations, OSM undertook an intrusive site investigation and subsequent Phase 2 Generic Quantitative Risk Assessment (GQRA) at the site, in February- June 2020.

The purpose of a GQRA is to refine the conceptual model developed from the previously completed Preliminary Risk Assessment (PRA) and establish whether there are potentially unacceptable human health / environmental risks associated with the pollutant linkages determined in the PRA.

3.2 Scope of Works

The following scope of works was undertaken as part of the GQRA assessment;

- Development of intrusive investigation and sampling strategy including design of monitoring installations;
- Supervised intrusive investigation (boreholes and trial pits);
- Logging of geological ground conditions;
- Sampling and laboratory analysis of soil and groundwater samples;
- Ground gas monitoring and ground gas risk assessment;
- Interpretation of analytical results and determination of relevant assessment criteria;
- Production of site Generic Quantitative Risk Assessment (GQRA);
- Recommendations for further works, if required.

3.3 Site Description

The assessment site is located on lands located to the north of Bowtown Road (with Bowtown Road forming the southern boundary of the site) and to the south of Movilla Road (with Movilla Road forming the northern boundary of the site), Newtownards, Co Down.

The grid reference for the site is J 51325 73984 (centre of the site). The site has a total area of c.41.05ha. A Site Location Map is presented as Figure 1, with a Site Boundary Map presented as Figure 2.

Figure 1: Site Location Map, Bowtown Road, Bowtown Road / Movilla Road, Newtownards

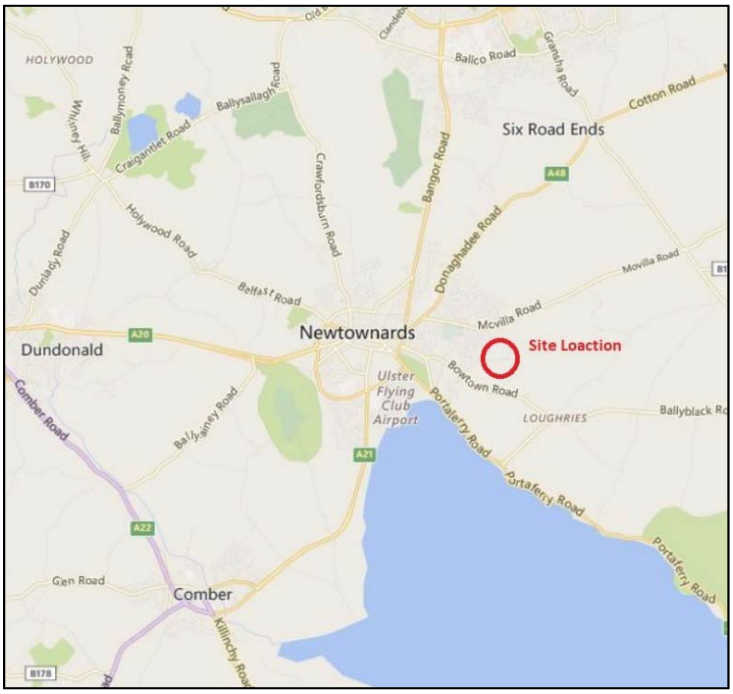
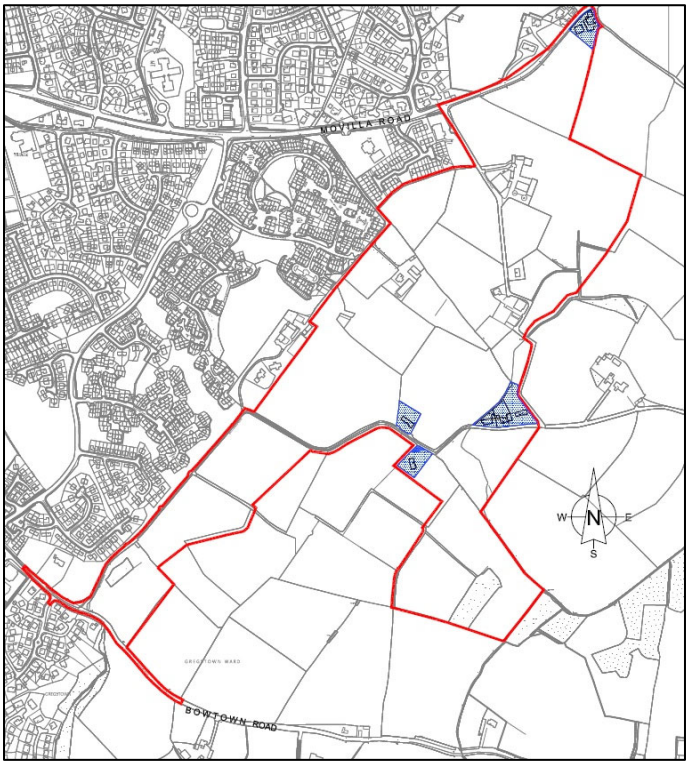


Figure 2: Site Plan, Bowtown Road, Bowtown Road / Movilla Road, Newtownards



3.4 Review of AST Locations

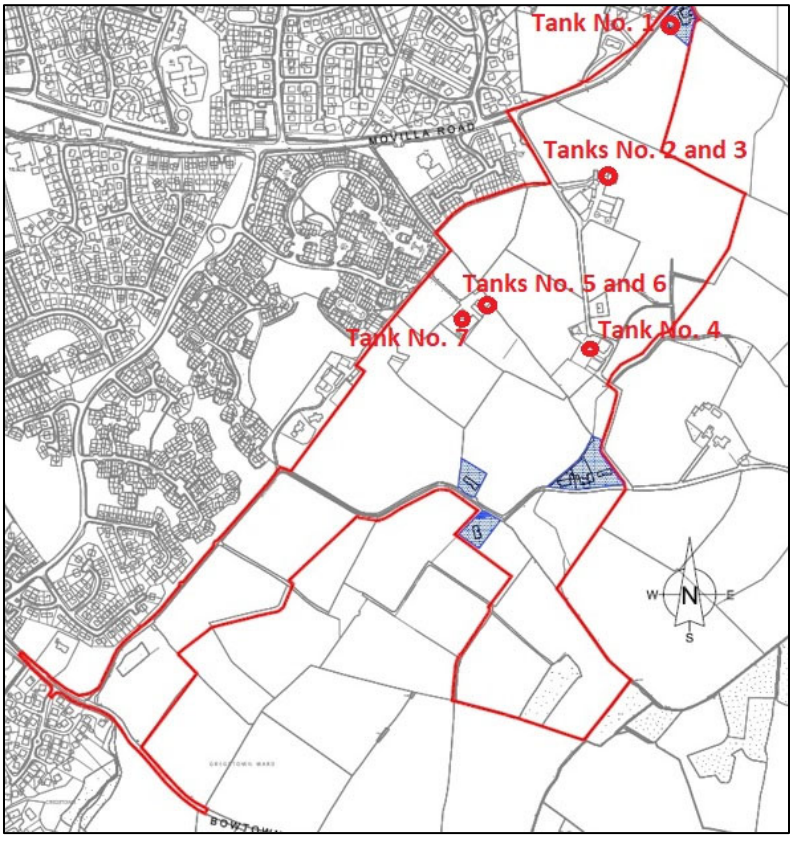
The PRA indicated the presence of a number of unbunded above-ground storage tanks (AST`s) in a number of the dwellings and farm buildings within the development boundary. The AST`s observed ranged from small scale residential sized tanks, to larger commercial sized tanks for refuelling agricultural plant.

A summary of the AST`s present within the site boundary is presented in Table 1 and Figure 3 below. The photographic log from the PRA, which shows the tanks, is also presented as Appendix B.

Table 1: Summary of AST`s, Bowtown Road / Movilla Road, Newtownards

Tank No.	Plate No of Attached Photographic Log	Tank Description	Is Tank Bunded	Fuel Type
1	Plate 4	Domestic Oil Tank	No	Heating oil
2	Plate 12	AST Agricultural	No	Red diesel
3	Plate 13	AST Agricultural	No	Red diesel
4	Plate 29	Former AST Agricultural / Now removed	No	Red diesel
5	Plate 47	AST Agricultural	No	Red diesel
6	Plate 48	Former AST Agricultural / Now removed	No	Red diesel
7	Plate 53	Domestic Oil Tank	No	Heating oil

Figure 3: Location of AST`s, Bowtown Road / Movilla Road, Newtownards



3.5 Intrusive Site Investigation

In line with the guidelines presented in BS10175 (Investigation of potentially contaminated sites / Code of practice) and based on the localised nature of the potential sources, it was considered that a total of 9 No. investigation points would be suitable for assessing the site. A minimum of 1 No. sample point per identified AST, located adjacent to and down-gradient.

The 9 No. investigation points consisted of 2 No. hand dug trial pits (TP1 and TP2) and 7 No. boreholes (BH1 – BH7) which were drilled using window sampling technique (Dando Terrier). A summary of the investigation point locations is now presented

- TP1 and TP2 – Adjacent to Tank No. 1. This area could not be reached with a drilling rig so 2 No. shallow trial pits were hand dug in the soils below the AST;
- BH1 – Adjacent to and down-gradient of Tank No. 2;
- BH2 - Adjacent to and down-gradient of Tank No. 3;
- BH3 and BH4 - Adjacent to and down-gradient of former Tank No. 4;
- BH5 and BH6 - Adjacent to and down-gradient of Tank No.`s 5 and 6;
- BH7 - Adjacent to and down-gradient of Tank No. 7.

The drilling and trial pitting works were supervised on a full-time basis by an Environmental Engineer from OSM, who advised on investigation / borehole locations, logged the ground conditions, and collected suitable soil samples for analysis.

For the purposes of groundwater measurement, 5 No. of the boreholes (BH1, BH2, BH5, BH6 and BH7) were completed with combined groundwater and ground gas monitoring installations. The installations consisted of slotted HDPE liner, plain HDPE, gravel pack, bentonite seal, lockable ground level cover and gas tap. BH3 and BH4 encountered bedrock at a very shallow depth, <1mbgl, with both boreholes obviously dry and were therefore not installed.

Details on the borehole installations and ground conditions encountered are provided in the borehole logs in Appendix C.

3.6 Collection and Analysis of Samples

Soil samples were collected from all investigation points by the OSM Engineer, with a shallow sample collected within the upper 0.5m and subsequent samples where relevant.

Groundwater samples were obtained by an OSM Engineer using a Waterra In-Situ PVC 1l bailer (one clean bailer per borehole). Groundwater level was recorded at each borehole prior to sampling. Each borehole was purged at least three times the volume of the saturated borehole volume, prior to the sample being retrieved. No groundwater was observed in the installed BH7 and no groundwater sample obtained.

A summary of the soil and groundwater samples obtained from the site, and analysed, is presented in Table 2.

Table 2: List of Samples Analysed, Bowtown Road / Movilla Road, Newtownards

Investigation Point	Depth of Sample (mbgl)	Soil	Groundwater
BH1	0.3	*	*
BH1	1.2	*	
BH2	0.3	*	*
BH2	1.2	*	
BH3	0.3	*	--
BH4	0.3	*	
BH5	0.3	*	*
BH5	1.2	*	
BH6	0.2	*	*
BH7	0.25	*	--
BH7	1.2	*	--
TP1	0.25	*	--
TP2	0.25	*	--
#TOTAL	**--**	**13**	**4**

All laboratory analysis was undertaken by a UKAS accredited laboratory. Given the nature of the potential contaminants (heating oil and red diesel) the following analytical suite was selected for all soil and groundwater samples;

- Hydrocarbons (aliphatics and aromatics), including BTEX compounds and MTBE;
- Polycyclic Aromatic Hydrocarbons (PAH`s);
- Volatile Organic Compounds (VOC`s);
- MTBE and BTEX compounds.

It is noted that the PRA also indicated heavy metals as a contaminant of concern, associated with petrol (potentially lead in older petrol). Given that no petrol tanks were present, heavy metals were not considered required in the analytical suite (the absence of petrol is confirmed later in the soil and groundwater data).

Results of the analysis are presented as laboratory certificates in Appendix D.

3.7 Ground Conditions / Geology

Details on the ground conditions encountered during the drilling of BH1 – BH7 and trial pits TP1-TP2 are provided in geological and engineering logs in Appendix C.

The ground conditions encountered are summarised in Table 3.

Table 3: Encountered Geology, Bowtown Road / Movilla Road, Newtownards

Stratum	Description	Depths Encountered (min-max)
SURFACE	Concrete and topsoil	0.0 -0.10mbgl
MADE-GROUND	MADE-GROUND containing gravel, reworked clay and brick in one borehole only (BH2)	0.0 – 0.6mbgl.
BOULDER CLAY	Medium to firm, brown orange BOULDER CLAY with gravel.	0.2 – 2.5mbgl
BEDROCK GREYWACKE	Firm weathered dark grey BEDROCK (GREYWACKE)	0.5 – 2.0mbgl

A relatively thin layer of made-ground was encountered in a number of the boreholes, reaching a maximum depth of 0.6mbgl. The made-ground consisted mainly of reworked natural material (boulder clay and gravel) with a small amount of brick also noted in BH2.

The made ground was underlain by boulder clay, which was encountered in all boreholes and trial pits confirmed to a maximum depth of 2.5mbgl (BH5). The boulder clay was described as medium to firm, brown orange clay with gravel.

Bedrock consisting of greywacke sandstone was encountered in a number of the boreholes and ranged in depth from 0.5m – 2.0m.

A visual and olfactory examination of the borehole arising indicated no obvious contamination in most of the sample points. However, a slight hydrocarbon odour was noted in the arising from BH4.

3.8 Groundwater

No obvious shallow groundwater seeps were noted during drilling and excavation of any of the 7 No. boreholes or 2 No trial pits.

A groundwater level monitoring round was completed on all 5 No. installed boreholes and measurable groundwater was encountered in BH1, BH2, BH5 and BH6. BH7 was found to be dry. The groundwater encountered is considered to represent shallow groundwater within more permeable gravel layers within the boulder clay. The recorded water levels are presented in Table 4 below;

Table 4: Groundwater Levels, Recorded on 10/07/2020, Bowtown Road / Movilla Road, Newtownards

Borehole ID	Date	Manual Dip (mbdat)
BH1	10/07/2020,	0.28
BH2	10/07/2020,	0.25
BH5	10/07/2020,	0.38
BH6	10/07/2020,	0.66

Given the shallow nature of the boreholes and the targeted spacing across a significant surface area of the site, it was considered that a shallow groundwater flow map would not be required for the dataset. It is note that all investigation point were located adjacent to and downgradient of the individual AST`s they were targeted to and are therefore considered suitable for assessing any groundwater impact associated with the AST`s.

3.9 Chemical Contamination Risk Assessment

3.9.1 Generic Assessment Criteria

The soil analytical results have been initially compared against published Soil Guidance Values (SGV`s) from the following sources:

- The LQM/CIEH S4UL`s for Human Health Risk Assessment;
- Atkins ATRISK Soil (Soil Screening Values – 2017 Edition);
- CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment (used for assessment of VOC`s).

The SGV`s assess the level of human health risk posed by the concentration of a compound with regards to direct human contact and inhalation of dust / fibres, over long-term exposure.

Soil Guidance Values (SGV`s) have been published for compounds within several end use land scenarios. The proposed development plan involves redevelopment of the site to include residential housing with gardens. With this proposed development, the soil data obtained from the site have been screened against the residential with plant uptake end-use SGV`s. The minimum available published SOM / SGV`s were selected for comparison (SOM of 1%).

Groundwater results have been compared against the following guidance values;

- UK Drinking Water Standards (DWS) – used to assess risk to human health via consumption of groundwater;
- UK Environmental Quality Standards (EQS) – used to assess environmental risk to surface waters;
- ATKINS Water Screening Values (WSV), residential end-use - The ATKINS Water Screening Values (WSV`s) have been developed for the assessment of chronic human health exposure from the inhalation of contaminants in shallow groundwater and / or perched groundwater.

3.9.2 Review of Soil Analysis

The soil analytical results have been presented as summary tables, including the SGV`s used for comparison and the sources of the SGV`s, and are presented as Appendix E (Table 1).

Assessment of the soil chemical data against the residential with plant uptake SGV`s indicated only one location in exceedance of the SGV`s which is now summarised;

- The sample obtained from BH4 0.3mbgl indicated a number of SGV exceedances for aliphatics and aromatics. The exceedances were all within the banding range C10-21 and would indicate kerosene / diesel type oils. It is also noted that the sample obtained from BH3 0.3m, which is

located in the vicinity of BH4 (both targeted at former tank No. 4) also indicated a number of positive detections for the same aliphatic and aromatic banding ranges, albeit below the relevant SGV`s.

The remaining soil samples indicated no significant impact and / or SGV exceedances.

The SGV exceedance is discussed further, later in the report.

3.9.3 Review of Groundwater Analysis

A total of 4 No. groundwater samples (BH1, BH2, BH5 and BH6) were obtained from the site on the 10/7/2020 by an environmental engineer from OSM. A previously mentioned, BH7 was found to be dry and therefore no sample could be obtained from this location.

The groundwater results have been presented in summary tables, along with the assessment criteria used to assess them. This is presented as Appendix E (Table 2).

A review of the results against the assessment criteria has indicated no exceedances, with no positive detections for any of the analysed compounds in any of the 4 No. groundwater samples.

A review of the shallow groundwater results against the Atkins residential WSV`s indicated no exceedances (and therefore no risks associated with volatile vapours).

4 REVISED CONCEPTUAL SITE MODEL

4.1 Summary of Results

The information obtained during the GQRA has enabled the outline CSM, developed in the PRA, to be revised and updated. A summary of the results is now presented.

With respect to soil samples, only one area of investigation was found to demonstrate any significant impact and related to BH3 and BH4 which were targeted at tank No. 4 (a former AST, now removed). In this area of the site the shallow soils obtained from BH4 0.3mbgl were found to exceed the SGV`s for a number of aliphatics and aromatics, in the banding range C10-21 (kerosene and / or diesel). These compounds were also positively detected in the shallow soils from BH3 0.3mbgl, albeit below the relevant SGV`s.

The soil and groundwater data obtained from the remaining locations indicated no obvious impact from the AST`s.

The hydrocarbons detected in BH3 and BH4 are now considered further in the revised CSM.

4.2 Sources

The source of the hydrocarbons in BH3 and BH4 is considered to relate to shallow soil contamination associated with the former AST in this area of the site.

4.3 Pathway

The human health pathways associated with the identified soil SGV exceedances relates to direct human contact, inhalation of dust, and plant uptake (ingestion of impacted vegetable). The

development plan includes residential housing with gardens and commercial development with peripheral soft landscaping, and direct contact with soils by end users will be possible in these areas of the site. A short-term pathway would also be present associated with direct contact / inhalation of dust by site workers during the construction phase.

Due to the shallow nature of the boreholes in BH3 and BH4 (maximum 0.7mbgl), with both boreholes encountering bedrock at 0.5-0.55mbgl, neither were installed for groundwater monitoring. No groundwater samples were therefore obtained from BH3 and BH4. Given the shallow nature of the drift deposits in this area of the site it considered unlikely that any significant shallow groundwater would be present, however it can not be totally ruled out that some may be present in the absence of groundwater level monitoring and sampling in this area. Therefore, a human health pathway associated with volatile vapour from hydrocarbon impacted shallow groundwater must be considered as a possibility.

A potential human health pathway which should be considered is human consumption of contaminated groundwater. The setting of the site is such that the shallow groundwater within the upper superficial deposits in this locality is not considered to be a groundwater resource and as such would not be utilised for drinking purposes. Additionally, the bedrock aquifer is not considered to be a significant aquifer with the search of the NIEA database and the DWI response not indicating any groundwater abstractions within a 1km radius of the site. Thus, the pathway of human consumption of contaminated groundwater is not considered to be significant, at this locality. Future development at the site will utilise mains water supply.

The potential environmental pathways relate to infiltration into contaminated soils and subsequent leaching of pollutants into the shallow groundwater, (if any present). Shallow groundwater can then move laterally towards surface waters or downward into the underlying bedrock aquifer. Additionally, shallow groundwater can move laterally from off-site sources towards the site.

4.4 Receptors

The receptors associated with the human health pathways identified (direct contact and volatile vapour) would be future users of the site residents.

In terms of environmental receptors, the shallow groundwater if present, is not a recognised groundwater resource. At this location, the risks associated with the shallow groundwater are considered to be low. The bedrock is mapped as being Gala Group and given its low productivity it is not considered to be a significant receptor in the absence of any nearby groundwater abstraction and the proposed development with a mains water supply.

With regards to surface water receptors, associated with lateral migration of contamination in the shallow groundwater, the closest known watercourse to Tank No. 4 was located at a distance of ~460m, and at this distance the risks would be considered to be low.

4.5 Summary of Revised CSM

The outline CSM has identified the following significant pollutant linkage associated with the tank in the area of BH3 and BH4 only (Tank No. 4 Figure 3):

- **Human Health:** Direct dermal contact, ingestion and inhalation of contaminated soils by future site users;
- **Human Health (future site users)**: Volatile vapour, associated with potentially contaminated shallow groundwater, and ingress site buildings and subsequent inhalation.

Given the presence of the identified human health pollutant linkages in the area of Tank No. 4, it is considered that suitable remedial measures should be undertaken to break the identified pollutant linkages. This is presented in the following sections.

5 REMEDIATION STRATEGY

5.1 Introduction

A total of 2 No. remedial measures were considered as being suitable to mitigate the above-mentioned pollutant linkages. These are:

- A clean cover system;
- Removal of the hotspot of contamination in the region around BH4 (dig and dump).

It is considered, given the nature of the contamination (hotspot) and the size of the site, that the most cost-effective option to remediate the site is the dig and dump strategy, removing the hotspot of contamination within the region of Tank No. 4. This will address the identified pollutant linkages whilst being environmentally sustainable in avoiding the need for wider site import and application of clean cover materials. Additionally, this remedial measure will remove any potential source of groundwater contamination.

5.2 Remedial Measures

The following remedial measures form part of a dig and dump strategy, which is considered to be required to sever the above-mentioned pollutant linkages at the site. The remedial strategy includes:

- Delineation of hotspot around BH3 and BH4;
- Waste soil classification testing (WM3 and WAC) of waste material to be removed offsite;
- Supervised excavation and removal of hot spot of contamination in the region around BH3 and BH4 (dig and dump);
- Validation and analysis of excavated area;
- Presentation of waste transfer information;
- Validation and analysis of imported material;
- Backfilling of excavated area.

All remedial works should be supervised by a suitably qualified Environmental Consultant, who will act as the client's representative throughout the works.

5.3 Timetable of Works

The proposed remedial works will be carried out upon approval by the local authority.

The proposed remedial works, now outlined in the following sections, are considered to take 3-4 weeks to complete, from the outset of delineation works until the presentation of a verification report.

5.4 Dig and Dump

The hydrocarbon exceedances identified in the sample obtained from BH4 at 0.3mbgl should be delineated and contaminated soils excavated and removed from the site (dig and dump). The impacted area is considered a hotspot and not a site wide issue and therefore removal of the hotspot has been considered as the most suitable remedial measure (no requirement for a site wide cover layer, given the hotspot nature of the exceedances).

5.5 Hotspot Delineation

It is recommended that the contaminated soils, in the vicinity of BH4, are excavated and removed from site at the outset of the site development works. The hotspot of contamination surrounding BH4 must first be delineated. Given the relatively thin nature of the made-ground and drift deposits around BH4 (~0.55m) it is considered that delineation can be achieved through visual and olfactory assessment of excavated soils by an experienced environmental engineer.

5.6 Waste Classification

During the delineation process, samples of the stockpiled excavated material will be analysed for waste characterisation and classification to confirm the correct waste stream (inert, non-hazardous, hazardous) and European Waste Code (EWC) for off-site disposal.

5.7 Excavation of Delineated Area

The delineation of the hotspot area will be undertaken as soils are excavated. Excavated soils will be stockpiled on-site on hard-standing or plastic sheeting prior to removal and disposal. Following waste classification, stockpiled excavated soils from the delineated hot spot area can be removed from site. The material will be suitably disposed of, at a waste disposal facility, and in line with the waste classification. A Waste Transfer Note will be obtained for the transfer of the waste material taken off-site.

The excavation works will be supervised by the contractor's environmental consultant, who will advise on the works and collect the required validation information (described in the following sections).

5.8 Validation of the Excavated Area

Once the hotspot has been excavated, a total of 4 No. soil samples will be obtained to validate the excavation. The samples will be obtained from the sides of the excavation. The base of the excavation will be on top of bedrock and therefore samples from the base of the excavation will not be required.

The samples will be analysed using a detailed speciated hydrocarbon suite (TPH-CWG). The results will be compared against the residential (with plant uptake) SGV's (1% SOM), as remedial targets, as summarised in Table 1 in Appendix E.

Shallow groundwater was not encountered in this area of the site during the GQRA and it is likely that there is no significant shallow groundwater is present in this area of the site given the shallow nature of the superficial deposits. Therefore, shallow groundwater analysis is will not be undertaken. In terms of assessing the bedrock aquifer, the proposed source removal of the contaminated soils will mitigate any risk to the bedrock aquifer. It is therefore not considered that monitoring of the bedrock aquifer would be required, subject to suitable soil validation of the dig out.

5.9 Validation and Analysis of Imported Material

Given the size of the overall development site, it is considered that the excavation can be backfilled with site-won soils / clays and therefore validation testing of the soils will not be required.

5.10 Validation Report

Following completion of the remediation works, a Verification Report should be submitted to the Local Planning Authority to confirm that the remedial works have been completed in line with the Remediation Strategy.

As previously mentioned, the remedial works will be supervised by the contractor's Environmental Consultant who will obtain the following information for incorporation into the Verification Report;

- Details on the delineation works;
- Determination of waste soil classification;
- Photographic record of excavation;
- Collection of validation samples from excavation and review of the results;
- Details on the waste transfer, including collection of waste transfer notes;
- Testing and review of data for any imported material;
- Production of a Verification Report.

The Verification Report will be completed in line with CLR11 and will present all the validation/verification information and demonstrate the effectiveness of the remedial works in managing all the risks and achieving the remedial objectives.

6 REMOVAL OF REMAINING AST`S

It is recommended that all remaining AST`s are decommissioned and removed from site at the outset of the development works and in line with the relevant Guidance for Pollution Prevention (GPP2 and PPG27).

At the outset of the decommissioning works a specialist contractor will be appointed to remove any residual hydrocarbon product from the tank and pipes (this is called 'bottoming') and remove any explosive vapours from the tank and pipes to make them safe prior to further decommissioning works (this is called "degassing).

Certificates on the completed bottoming and degassing of all AST`s will be obtained from the specialist contractor upon completion of these works and prior to the start of development works.

Soil validation samples will be obtained in the vicinity off and below the AST`s once removed. The samples will be analysed using a detailed hydrocarbon suite (TPH-CWG) and results compared against the residential end use SGV`s, as presented in Table 1 Appendix E of this report. If during these works detailed above, new contamination or risks are identified, all works onsite will cease immediately and the local authority will be informed. This new contamination, if encountered, will be fully assessed in line with CLR11.

The following validation information will be obtained from the contactor/s during decommissioning works:

- Degassing and bottoming certificates;
- Waste transfer notes will be provided by the contractor relating to the transfer of the waste tanks;
- All laboratory analysis and review of results;
- Photographic record of works.

The above validation information will be presented to the local authority in the form of a Validation Report upon completion of the site works.

7 UNEXPECTED CONTAMINATION

It is recommended that during the construction phase if any unexpected material is encountered which may pose a contamination risk (i.e. buried barrels, containers, strong fuel odours etc.) then site works should immediately cease in this area and soil samples should be taken to identical the material. This is outlined in Condition No 11 on planning permission LA11/2016/0175/O.

Appropriate remedial actions must be undertaken before work recommences if a risk is identified. Any further assessment and / or remedial measure would be subject to agreement with the local planning authority.

8 SUMMARY AND CONCLUSION

Assessment of the site in a previously completed Phase 1 PRA / Soils and Waters section of an ES indicated the presence of a number of in-situ and former AST locations within the boundary of the development site. A total of 7 No. tanks were identified and were all associated with either kerosene / heating oil or red diesel for agricultural machinery.

The soils, and where possible the groundwaters, immediately below all 7 No. tanks has been investigated and assessed as part of this assessment. Of the 7 No. tanks, only 1 No. tank area was found to demonstrate significant contamination. This related to a tank area, Indicated as Tank No. 4 in Figure 3. In this area of the site the shallow soil were observed to be impacted by kerosene and / or diesel. The remaining 6 No. tank areas indicated no obvious impact.

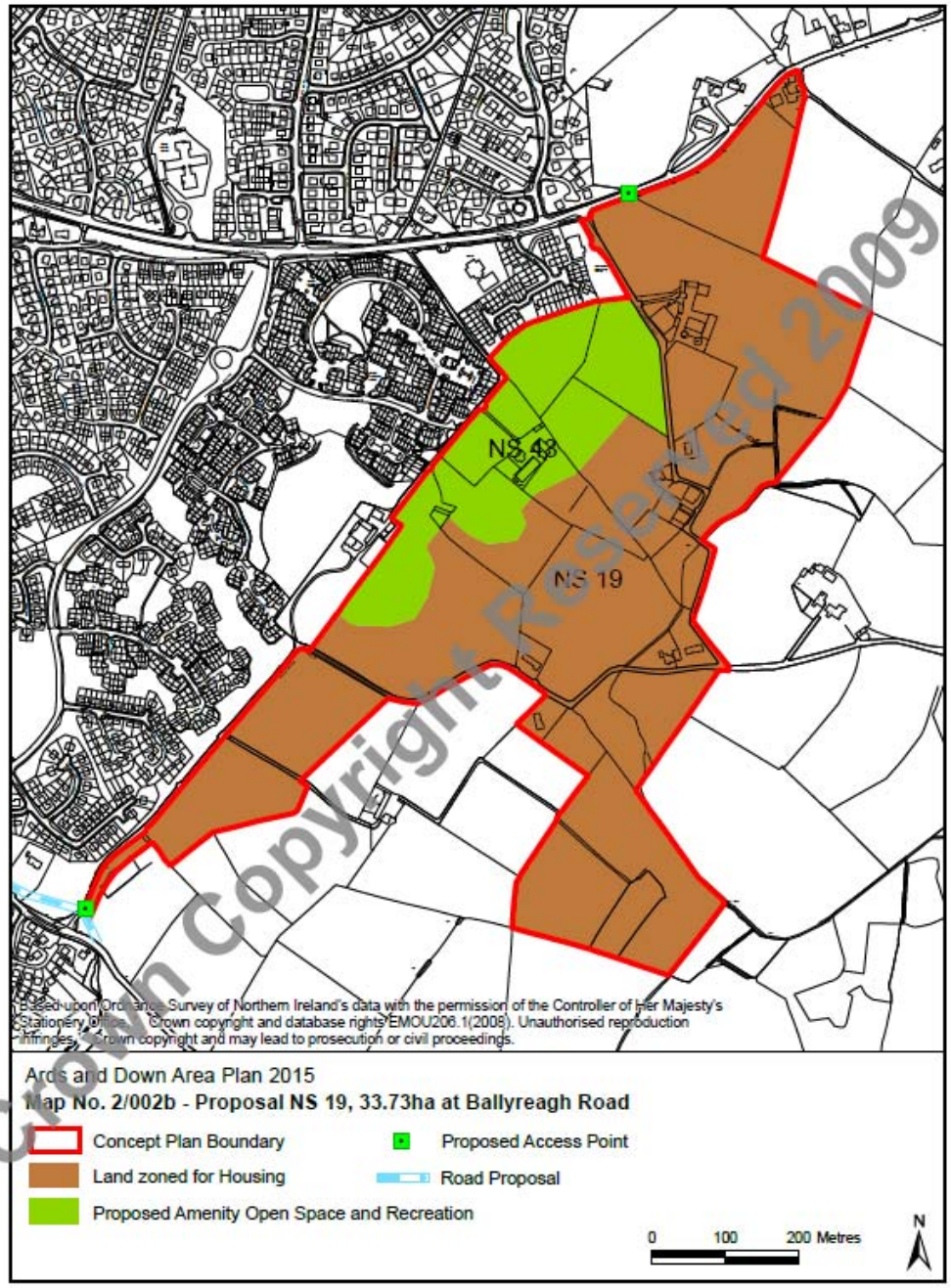
A remediation strategy has been presented in this report to address the risk associated with the contamination detected in the area of Tank No. 4. The remediation strategy proposes excavation and removal from site of all contaminated soils in the area of Tank No. 4.

It is recommended that any remaining tanks onsite are removed prior to the start of site works. A strategy for this has also been presented in this report.

If during site works, new contamination or risks are identified, all works onsite will cease immediately and the local authority will be informed. This new contamination, if encountered, will be fully assessed in line with CLR11.

Appendix A

Site Development Plan



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Appendix B

Photographic Log of AST`s

Plate 1: View of the site from Movilla Road (northern boundary) looking soith-east.

Plate 2: View of the site from Movilla Road, looking east.

Plate 3: Movilla Road on northern site boundary, looking north-east.

Plate 4: Residential property (with domestic oil tank), located at north-eastern corner of the site.

Plate 5: Movilla Road on northern site boundary, looking north-west.

Plate 6: Ballyreagh Road looking south.

Plate 7: Vacant farmhouse located on Ballyreagh Road.

Plate 8: Material present across the farm yard area.

Plate 9: Derelict barn.

Plate 10: Derelict barns.

Plate 11: Disused oil drum.

Plate 12: Storage barn and above ground storage tank.

Plate 13: Former red diesel tank within barn.

Plate 14: Former oil barrel present within farm yard.

Plate 15: Farm entrance from Ballyreagh Road, looking south-west.

Plate 16: Large slurry tanks.

Plate 17: Farmyard, looking north.

Plate 18: Farm house looking west.

Plate 19: View of agricultural lands, looking east.

Plate 20: View of agricultural lands, looking north-east.

Plate 21: Residential property located on Ballyreagh Road.

Plate 22: Ballyreagh Road, looking south.

Plate 23: Derelict farm located on Ballyreagh Road.

Plate 24: Derelict farm.

Plate 25: Derelict property located adjacent to the derelict farm.

Plate 26: Derelict barn and fly tipped material.

Plate 27: Agricultural lands, looking north-west.

Plate 28: Fly tipped material.

Plate 29: Area of former above ground storage tanks.

Plate 30: Agricultural lands, looking west.

Plate 31: Agricultural lands looking south.

Plate 32: Derelict, old stone barn.

Plate 33: Disused barn with an asbestos roof.

Plate 34: Agricultural lands, looking south.

e 35: Residential properties located on the Ballyreagh R

Plate 36: Agricultural lands looking west.

Plate 37: Residential properties on Ballyreagh Road, looking north.

Plate 38: Residential properties on Ballyreagh Road, looking north.

Plate 39: Residential properties on Ballyreagh Road, looking north.

Plate 40: Residential properties on Ballyreagh Road, looking north.

Plate 41: Agricultural lands, looking west.

Plate 42: Residential property on Ballyreagh Road.

Plate 43: Property located off Movilla Road, in the western region of the site.

Plate 44: Agricultural lands, looking west.

Plate 45: Agricultural lands, looking south-east.

Plate 46: Vacant glass houses.

Plate 47: Former diesel tank used for agricultural machinery.

Plate 48: Area of former above ground storage tank.

Plate 49: Old, stone cottage, located in western region of the site.

Plate 50: Yard area of former vegetable wholesale business.

Plate 51: Residential bungalow located in western region of the site.

Plate 52: Agricultural lands, looking south-west.

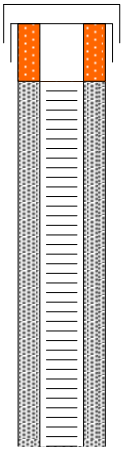
Plate 53: Domestic oil tank associated with residential bungalow.

Appendix C

Borehole Logs

SITE		BOREHOLE / TRIAL PIT REF	
BOWTOWN ROAD / MOVILLA ROAD NEWTOWNARDS		BH1	
CLIENT	LOGGED BY FM	E: TBC	N: TBC
PRAGMA PLANNING	DATE 17th June 20	DATUM LEVEL	

DESCRIPTION (Including comments)	DEPTH (m)	LEGEND	LEVEL (mOD)	SAMPLES Depth	SAMPLES Recepticles	WATER ENTRY	INSTALLATION
0.0 - 0.1m : CONCRETE 0.1 - 0.2m : GRAVEL	0			0	J P SV		
0.2 - 1.9m : Medium to firm, brown orange BOUDLER CLAY with gravel.	1			2	J P SV		
1.9 - 2.2m : Firm weathered dark grey BEDROCK (GREYWACKE)	2						
	3						
	4						
	5						
	6						
	7						



O'Sullivan Macfarlane
Environmental Consulting

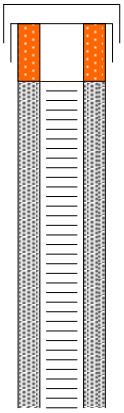
COMMENTS

SAMPLE KEY

S	SOIL
W	WATER
J	GLASS JAR
P	PLASTIC POT
SV	SOIL VIAL
G	1 LITRE GLASS BOTTLE
PL	1 LITRE PLASTIC BOTTLE
WV	WATER VIAL

SITE		BOREHOLE / TRIAL PIT REF	
BOWTOWN ROAD / MOVILLA ROAD NEWTOWNARDS		BH2	
CLIENT	LOGGED BY FM	E: TBC	N: TBC
PRAGMA PLANNING	DATE 17th June 20	DATUM LEVEL	

DESCRIPTION (Including comments)	DEPTH (m)	LEGEND	LEVEL (mOD)	SAMPLES Depth	SAMPLES Recepticles	WATER ENTRY	INSTALLATION
0.0 - 0.1m : CONCRETE	0						
0.1 - 0.5m : Gravel, reworked clay and a small volume of brick (MADE-GROUND)				– 0	J P SV		
0.5 - 1.6m : Medium to firm, brown orange BOUDLER CLAY with gravel.	1			– 2	J P SV		
1.9 - 2.0m : Firm weathered dark grey BEDROCK (GREYWACKE)	2		–				
	3						
	4						
	5						
	6						
	7						



O'Sullivan Macfarlane
Environmental Consulting

COMMENTS

SAMPLE KEY

S	SOIL
W	WATER
J	GLASS JAR
P	PLASTIC POT
SV	SOIL VIAL
G	1 LITRE GLASS BOTTLE
PL	1 LITRE PLASTIC BOTTLE
WV	WATER VIAL

SITE		BOREHOLE / TRIAL PIT REF	
BOWTOWN ROAD / MOVILLA ROAD NEWTOWNARDS		BH3	
CLIENT	LOGGED BY FM	E: TBC	N: TBC
PRAGMA PLANNING	DATE 17th June 20	DATUM LEVEL	

DESCRIPTION (Including comments)	DEPTH (m)	LEGEND	LEVEL (mOD)	SAMPLES Depth	SAMPLES Recepticles	WATER ENTRY	INSTALLATION
0.0 - 0.5m : Gravel and reworked clay (MADE-GROUND)	0			0	J P SV		
0.5 - 0.7m : Firm weathered dark grey BEDROCK (GREYWACKE)	1			2	J P SV		
	2						
	3						
	4						
	5						
	6						
	7						

O'Sullivan Macfarlane
Environmental Consulting

COMMENTS

SAMPLE KEY

S	SOIL
W	WATER
J	GLASS JAR
P	PLASTIC POT
SV	SOIL VIAL
G	1 LITRE GLASS BOTTLE
PL	1 LITRE PLASTIC BOTTLE
WV	WATER VIAL

SITE		BOREHOLE / TRIAL PIT REF	
BOWTOWN ROAD / MOVILLA ROAD NEWTOWNARDS		BH4	
CLIENT	LOGGED BY FM	E: TBC	N: TBC
PRAGMA PLANNING	DATE 17th June 20	DATUM LEVEL	

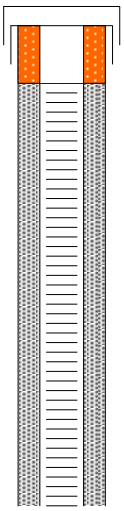
DESCRIPTION (Including comments)	DEPTH (m)	LEGEND	LEVEL (mOD)	SAMPLES Depth	SAMPLES Recepticles	WATER ENTRY	INSTALLATION
0.0 - 0.55m : Gravel and reworked clay (MADE-GROUND). Slight Hydrocarbon Odour noted in the soil arisings.	0						
0.55 - 0.7m : Firm weathered dark grey BEDROCK (GREYWACKE)	1						
	2						
	3						
	4						
	5						
	6						
	7						

O'Sullivan Macfarlane
Environmental Consulting

COMMENTS	SAMPLE KEY	
		S SOIL W WATER J GLASS JAR P PLASTIC POT SV SOIL VIAL G 1 LITRE GLASS BOTTLE PL 1 LITRE PLASTIC BOTTLE WV WATER VIAL

SITE		BOREHOLE / TRIAL PIT REF	
BOWTOWN ROAD / MOVILLA ROAD NEWTOWNARDS		BH5	
CLIENT	LOGGED BY FM	E: TBC	N: TBC
PRAGMA PLANNING	DATE 18th June 20	DATUM LEVEL	

DESCRIPTION (Including comments)	DEPTH (m)	LEGEND	LEVEL (mOD)	SAMPLES Depth	SAMPLES Recepticles	WATER ENTRY	INSTALLATION
0.0 - 0.6m : Gravel and reworked clay (MADE-GROUND)	0						
0.6 - 2.5m : Medium to firm, brown orange BOUDLER CLAY with gravel.	1						
	2						
	3						
	4						
	5						
	6						
	7						



O'Sullivan Macfarlane
Environmental Consulting

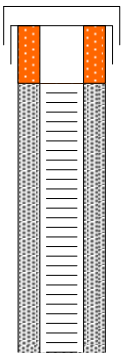
COMMENTS

SAMPLE KEY

S	SOIL
W	WATER
J	GLASS JAR
P	PLASTIC POT
SV	SOIL VIAL
G	1 LITRE GLASS BOTTLE
PL	1 LITRE PLASTIC BOTTLE
WV	WATER VIAL

SITE		BOREHOLE / TRIAL PIT REF
BOWTOWN ROAD / MOVILLA ROAD NEWTOWNARDS		BH6
CLIENT	LOGGED BY	E: N:
PRAGMA PLANNING	FM	
	DATE	DATUM LEVEL
	18th June 20	

DESCRIPTION (Including comments)	DEPTH (m)	LEGEND	LEVEL (mOD)	SAMPLES		WATER ENTRY	INSTALLATION
				Depth	Recepticles		
0.0 - 0.3m : Gravel and reworked clay (MADE-GROUND)	0						
0.3 - 1.7m : Medium to firm, brown orange BOUDLER CLAY with gravel. Obstructed on rock at 1.7mbgl, assumed to be bedrock.	1						
	2						
	3						
	4						
	5						
	6						
	7						



O'Sullivan Macfarlane
Environmental Consulting

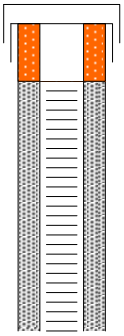
COMMENTS

SAMPLE KEY

S	SOIL
W	WATER
J	GLASS JAR
P	PLASTIC POT
SV	SOIL VIAL
G	1 LITRE GLASS BOTTLE
PL	1 LITRE PLASTIC BOTTLE
WV	WATER VIAL

SITE		BOREHOLE / TRIAL PIT REF	
BOWTOWN ROAD / MOVILLA ROAD NEWTOWNARDS		BH7	
CLIENT	LOGGED BY	E:	N:
PRAGMA PLANNING	FM		
	DATE	DATUM LEVEL	
	18th June 20		

DESCRIPTION (Including comments)	DEPTH (m)	LEGEND	LEVEL (mOD)	SAMPLES		WATER ENTRY	INSTALLATION
				Depth	Recepticles		
0.0 - 0.1m : CONCRETE 0.1 - 0.2m : GRAVEL 0.2 - 1.6m : Medium to firm, brown orange BOUDLER CLAY with gravel. Obstructed on rock at 1.7mbgl, assumed to be bedrock.	0 1 2 3 4 5 6 7		–				



O'Sullivan Macfarlane
Environmental Consulting

COMMENTS	SAMPLE KEY	
		S SOIL W WATER J GLASS JAR P PLASTIC POT SV SOIL VIAL G 1 LITRE GLASS BOTTLE PL 1 LITRE PLASTIC BOTTLE WV WATER VIAL

SITE		BOREHOLE / TRIAL PIT REF	
BOWTOWN ROAD / MOVILLA ROAD NEWTOWNARDS		TP1	
CLIENT	LOGGED BY FM	E:	N:
PRAGMA PLANNING	DATE 18th June 20	DATUM LEVEL	

DESCRIPTION (Including comments)	DEPTH (m)	LEGEND	LEVEL (mOD)	SAMPLES Depth	SAMPLES Recepticles	WATER ENTRY	INSTALLATION
0.0 - 0.1m : Gravel and reworked clay (MADE-GROUND)	0						
0.1 - 0.5m : Medium to firm, brown orange BOUDLER CLAY with gravel.			-				
	1						
	2						
	3						
	4						
	5						
	6						
	7						

O'Sullivan Macfarlane
Environmental Consulting

COMMENTS

SAMPLE KEY

S	SOIL
W	WATER
J	GLASS JAR
P	PLASTIC POT
SV	SOIL VIAL
G	1 LITRE GLASS BOTTLE
PL	1 LITRE PLASTIC BOTTLE
WV	WATER VIAL

SITE		BOREHOLE / TRIAL PIT REF	
CLIENT	LOGGED BY	E: N:	
	DATE	DATUM LEVEL	

DESCRIPTION (Including comments)	DEPTH (m)	LEGEND	LEVEL (mOD)	SAMPLES		WATER ENTRY	INSTALLATION
				Depth	Recepticles		
0.0 - 0.15m : Gravel and reworked clay (MADE-GROUND)	0						
0.15 - 0.5m : Medium to firm, brown orange BOUDLER CLAY with gravel.	1						
	2						
	3						
	4						
	5						
	6						
	7						

O'Sullivan Macfarlane
Environmental Consulting

COMMENTS	SAMPLE KEY	
		S SOIL
		W WATER
		J GLASS JAR
		P PLASTIC POT
		SV SOIL VIAL
		G 1 LITRE GLASS BOTTLE
		PL 1 LITRE PLASTIC BOTTLE
		WV WATER VIAL

Appendix D

Laboratory Certificates

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	20-15654-1
Initial Date of Issue:	25-Jun-2020
Client	O Sullivan Macfarlane
Client Address:	Unit 70, Mallusk Enterprise Park Newtonabbey Co Antrim BT36 4GN
Contact(s):	Frank Macfarlane Peter McCovney
Project	P683 Bowtown Road

Quotation No.:		**Date Received:**	22-Jun-2020
Order No.:		**Date Instructed:**	22-Jun-2020
No. of Samples:	13		
Turnaround (Wkdays):	5	**Results Due:**	26-Jun-2020
Date Approved:	25-Jun-2020		

Approved By:

Details: Glynn Harvey, Technical Manager

Chemtest
The right chemistry to deliver results

Results - Soil

Project: P683 Bowtown Road

Client: O Sullivan Macfarlane					Chemtest Job No.:	20-15654	20-15654	20-15654	20-15654	20-15654	20-15654	20-15654	20-15654
Quotation No.:					Chemtest Sample ID.:	1020233	1020234	1020235	1020236	1020237	1020238	1020239	1020240	1020241
					Sample Location:	BH1	BH1	BH2	BH2	BH3	BH4	TP1	TP1	BH5
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.3	1.2	0.3	1.2	0.3	0.3	0.25	0.25	0.3
					Date Sampled:	17-Jun-2020	17-Jun-2020	17-Jun-2020	17-Jun-2020	17-Jun-2020	17-Jun-2020	18-Jun-2020	18-Jun-2020	18-Jun-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
Moisture	N	2030	%	0.020		10	10	10	11	9.1	4.9	17	8.3	8.0
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	24	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	17	490	4.3	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	170	3700	43	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	340	7000	74	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	300	3500	44	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	19	9.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0		< 5.0	< 5.0	< 5.0	< 5.0	830	15000	170	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	2.8	200	5.8	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	37	1600	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	170	560	6.4	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0		< 5.0	< 5.0	< 5.0	< 5.0	210	2300	12	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0		< 10	< 10	< 10	< 10	1000	17000	190	< 10	< 10
Naphthalene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.80	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.11	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.3	< 0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.2	< 0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.51	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.48	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	4.4	< 2.0	< 2.0
Dichlorodifluoromethane	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Chemtest
The right chemistry to deliver results

Results - Soil

Project: P683 Bowtown Road

Client: O Sullivan Macfarlane		Chemtest Job No.:			20-15654	20-15654	20-15654	20-15654	20-15654	20-15654	20-15654	20-15654	20-15654
Quotation No.:		Chemtest Sample ID.:			1020233	1020234	1020235	1020236	1020237	1020238	1020239	1020240	1020241
		Sample Location:			BH1	BH1	BH2	BH2	BH3	BH4	TP1	TP1	BH5
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.3	1.2	0.3	1.2	0.3	0.3	0.25	0.25	0.3
		Date Sampled:			17-Jun-2020	17-Jun-2020	17-Jun-2020	17-Jun-2020	17-Jun-2020	17-Jun-2020	18-Jun-2020	18-Jun-2020	18-Jun-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Bromomethane	U	2760	µg/kg	20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Chloroethane	U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	U	2760	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene	U	2760	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Trichloromethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichloroethene	N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene	N	2760	µg/kg	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	2760	µg/kg	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
1,1,2-Trichloroethane	U	2760	µg/kg	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Tetrachloroethene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane	U	2760	µg/kg	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
1,2-Dibromoethane	U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	N	2760	µg/kg	50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
N-Propylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Chemtest
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Results - Soil

Project: P683 Bowtown Road

Client: O Sullivan Macfarlane		Chemtest Job No.:			20-15654	20-15654	20-15654	20-15654	20-15654	20-15654	20-15654	20-15654	20-15654
Quotation No.:		Chemtest Sample ID.:			1020233	1020234	1020235	1020236	1020237	1020238	1020239	1020240	1020241
		Sample Location:			BH1	BH1	BH2	BH2	BH3	BH4	TP1	TP1	BH5
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.3	1.2	0.3	1.2	0.3	0.3	0.25	0.25	0.3
		Date Sampled:			17-Jun-2020	17-Jun-2020	17-Jun-2020	17-Jun-2020	17-Jun-2020	17-Jun-2020	18-Jun-2020	18-Jun-2020	18-Jun-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Tert-Butylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane	U	2760	µg/kg	50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
1,2,4-Trichlorobenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

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Results - Soil

Project: P683 Bowtown Road

Client: O Sullivan Macfarlane		**Chemtest Job No.:**			20-15654	20-15654	20-15654	20-15654
Quotation No.:		**Chemtest Sample ID.:**			1020242	1020243	1020244	1020245
		Sample Location:			BH5	BH6	BH7	BH7
		Sample Type:			SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			1.2	0.2	0.25	1.2
		Date Sampled:			18-Jun-2020	18-Jun-2020	18-Jun-2020	18-Jun-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Moisture	N	2030	%	0.020	9.9	8.3	18	11
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	0.57	< 0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10	0.61	< 0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dichlorodifluoromethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0

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Results - Soil

Project: P683 Bowtown Road

Client: O Sullivan Macfarlane		**Chemtest Job No.:**			20-15654	20-15654	20-15654	20-15654
Quotation No.:		**Chemtest Sample ID.:**			1020242	1020243	1020244	1020245
		Sample Location:			BH5	BH6	BH7	BH7
		Sample Type:			SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			1.2	0.2	0.25	1.2
		Date Sampled:			18-Jun-2020	18-Jun-2020	18-Jun-2020	18-Jun-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Bromomethane	U	2760	µg/kg	20	< 20	< 20	< 20	< 20
Chloroethane	U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	U	2760	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene	U	2760	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Trichloromethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichloroethene	N	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene	N	2760	µg/kg	10	< 10	< 10	< 10	< 10
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	2760	µg/kg	10	< 10	< 10	< 10	< 10
1,1,2-Trichloroethane	U	2760	µg/kg	10	< 10	< 10	< 10	< 10
Tetrachloroethene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane	U	2760	µg/kg	10	< 10	< 10	< 10	< 10
1,2-Dibromoethane	U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	N	2760	µg/kg	50	< 50	< 50	< 50	< 50
N-Propylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0

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Results - Soil

Project: P683 Bowtown Road

Client: O Sullivan Macfarlane		**Chemtest Job No.:**			20-15654	20-15654	20-15654	20-15654
Quotation No.:		**Chemtest Sample ID.:**			1020242	1020243	1020244	1020245
		Sample Location:			BH5	BH6	BH7	BH7
		Sample Type:			SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			1.2	0.2	0.25	1.2
		Date Sampled:			18-Jun-2020	18-Jun-2020	18-Jun-2020	18-Jun-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Tert-Butylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane	U	2760	µg/kg	50	< 50	< 50	< 50	< 50
1,2,4-Trichlorobenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0

Test Methods

SOP	Title	Parameters included	Method summary
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	20-17852-1		
Initial Date of Issue:	17-Jul-2020		
Client	O Sullivan Macfarlane		
Client Address:	Unit 70, Mallusk Enterprise Park Newtonabbey Co Antrim BT36 4GN		
Contact(s):	Frank Macfarlane Peter McCovney		
Project	P683 Bowtown Road		
Quotation No.:	Q19-16518	**Date Received:**	13-Jul-2020
Order No.:	P683	**Date Instructed:**	13-Jul-2020
No. of Samples:	4		
Turnaround (Wkdays):	5	**Results Due:**	17-Jul-2020
Date Approved:	17-Jul-2020		

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Water

Project: P683 Bowtown Road

Client: O Sullivan Macfarlane		**Chemtest Job No.:**			20-17852	20-17852	20-17852	20-17852
Quotation No.: Q19-16518		**Chemtest Sample ID.:**			1030542	1030543	1030544	1030545
			Sample Location:		BH1	BH2	BH5	BH6
			Sample Type:		WATER	WATER	WATER	WATER
			Date Sampled:		10-Jul-2020	10-Jul-2020	10-Jul-2020	10-Jul-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Aliphatic TPH >C5-C6	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10	< 10	< 10
Naphthalene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	N	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	1700	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dichlorodifluoromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	U	1760	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0

Results - Water

Project: P683 Bowtown Road

Client: O Sullivan Macfarlane		**Chemtest Job No.:**			20-17852	20-17852	20-17852	20-17852
Quotation No.: Q19-16518		**Chemtest Sample ID.:**			1030542	1030543	1030544	1030545
			Sample Location:		BH1	BH2	BH5	BH6
			Sample Type:		WATER	WATER	WATER	WATER
			Date Sampled:		10-Jul-2020	10-Jul-2020	10-Jul-2020	10-Jul-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Trichlorofluoromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	U	1760	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Trichloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichloroethene	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	U	1760	µg/l	10	< 10	< 10	< 10	< 10
Bromodichloromethane	U	1760	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene	N	1760	µg/l	10	< 10	< 10	< 10	< 10
Toluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	1760	µg/l	10	< 10	< 10	< 10	< 10
1,1,2-Trichloroethane	U	1760	µg/l	10	< 10	< 10	< 10	< 10
Tetrachloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane	U	1760	µg/l	10	< 10	< 10	< 10	< 10
1,2-Dibromoethane	U	1760	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	N	1760	µg/l	50	< 50	< 50	< 50	< 50
N-Propylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Water

Project: P683 Bowtown Road

Client: O Sullivan Macfarlane		**Chemtest Job No.:**			20-17852	20-17852	20-17852	20-17852
Quotation No.: Q19-16518		**Chemtest Sample ID.:**			1030542	1030543	1030544	1030545
			Sample Location:		BH1	BH2	BH5	BH6
			Sample Type:		WATER	WATER	WATER	WATER
			Date Sampled:		10-Jul-2020	10-Jul-2020	10-Jul-2020	10-Jul-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
1,3-Dichlorobenzene	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane	U	1760	µg/l	50	< 50	< 50	< 50	< 50
1,2,4-Trichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0

Test Methods

SOP	Title	Parameters included	Method summary
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.

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customerservices@chemtest.com

Appendix E

Screened Results

Table 1: Summary of Soil Data and Assessment Criteria

Sample ID				BH1	BH1	BH2	BH2	BH3	BH4	TP1	TP1	BH5	BH5	BH6	BH7	BH7
Sample Depth (mbgl)				0.3	1.2	0.3	1.2	0.3	0.3	0.25	0.25	0.3	1.2	0.2	0.25	1.2
Sample Date		SGV	SOURCE	17-Jun-2020	17-Jun-2020	17-Jun-2020	17-Jun-2020	17-Jun-2020	17-Jun-2020	18-Jun-2020	18-Jun-2020	18-Jun-2020	18-Jun-2020	18-Jun-2020	18-Jun-2020	18-Jun-2020
Determinand	**Units**															
Hydrocarbons																
Aliphatic TPH >C5-C6	mg/kg	42	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	mg/kg	100	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	mg/kg	27	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	24	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	mg/kg	130	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	17	490	4.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	mg/kg	1100	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	170	3700	43	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C35	mg/kg	65000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	640	10500	118	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	mg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	19	9.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	mg/kg			< 5.0	< 5.0	< 5.0	< 5.0	830	15000	170	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	mg/kg	70	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	mg/kg	130	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	mg/kg	34	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	mg/kg	74	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	mg/kg	140	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	2.8	200	5.8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	mg/kg	260	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	37	1600	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	mg/kg	1100	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	170	560	6.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	mg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	mg/kg			< 5.0	< 5.0	< 5.0	< 5.0	210	2300	12	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	mg/kg			< 10	< 10	< 10	< 10	1000	17000	190	< 10	< 10	< 10	< 10	< 10	< 10
Methyl Tert-Butyl Ether	µg/kg	49000	CL:aire	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	µg/kg	87	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	130000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	47000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	µg/kg	115000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	µg/kg	60000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PAH`s																
Naphthalene	mg/kg	2.3	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	mg/kg	170	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	mg/kg	210	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	mg/kg	170	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	mg/kg	95	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.80	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	mg/kg	2400	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.11	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	mg/kg	280	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.3	< 0.10	< 0.10	< 0.10	0.57	< 0.10	< 0.10
Pyrene	mg/kg	620	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.2	< 0.10	< 0.10	< 0.10	0.61	< 0.10	< 0.10
Benzo[a]anthracene	mg/kg	7.2	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.51	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	mg/kg	15	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.48	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	mg/kg	2.6	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	mg/kg	77	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	mg/kg	2.2	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	mg/kg	27	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	mg/kg	0.24	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	mg/kg	320	S4UL	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	mg/kg			< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	4.4	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
VOC`s																
Dichlorodifluoromethane	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	µg/kg			< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Chloroethane	µg/kg	8300	CL:aire	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	mg/kg	230	CL:aire	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene	mg/kg	190	CL:aire	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	µg/kg	2400	CL:aire	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	µg/kg			< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Trichloromethane	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/kg	8800	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	µg/kg	7.1	S4UL	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichloroethene	µg/kg	16	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	µg/kg	24	CL:aire	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	µg/kg	580	CL:aire	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	µg/kg	16	CL:aire	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene	µg/kg			< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Trans-1,3-Dichloropropene	µg/kg			< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
1,1,2-Trichloroethane	µg/kg	600	CL:aire	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Tetrachloroethene	µg/kg	180	CL:aire	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	µg/kg			< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane	µg/kg			< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
1,2-Dibromoethane	µg/kg			< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene	µg/kg	460	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/kg	1200	S4UL	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Styrene	µg/kg	8100	CL:aire	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	µg/kg	11000	CL:aire	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	µg/kg	870	CL:aire	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	µg/kg			< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
N-Propylbenzene	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/kg	350	CL:aire	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/kg	400	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/kg	61000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene	µg/kg			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/kg	23000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane	µg/kg			< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
1,2,4-Trichlorobenzene	µg/kg	2600	CL:aire	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	µg/kg	290	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	µg/kg	1500	S4UL	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

O'Sullivan Macfarlane
Environmental Consulting

Table 2: Summary of Groundwater Results and Assessment Criteria

Sample ID						BH1	BH2	BH5	BH6
Sample Date		EQS	WHO	DWS	WSV - resi	10-Jul-2020	10-Jul-2020	10-Jul-2020	10-Jul-2020
Determinand	**Units**								
Hydrocarbons									
Aliphatic TPH >C5-C6	µg/l				1930	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	µg/l				1400	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	µg/l				29.6	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	µg/l				22.8	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	µg/l				5.47	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	µg/l					< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	µg/l					< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	µg/l					< 0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	µg/l					< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	µg/l				88.8	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	µg/l				96400	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	µg/l				98.5	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	µg/l				3870	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	µg/l				10500	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	µg/l					< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	µg/l					< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	µg/l					< 0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	µg/l					< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	µg/l			10		< 10	< 10	< 10	< 10
Methyl Tert-Butyl Ether	µg/l				352000	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	µg/l	30		1	88.8	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/l	50			96400	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l		300		13400	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	µg/l	30	500		8390	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	µg/l	30	500		5000	< 1.0	< 1.0	< 1.0	< 1.0
PAH`s									
Naphthalene	µg/l			0.1	952	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	µg/l			0.1		< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	µg/l			0.1	375000	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	µg/l			0.1		< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	µg/l			0.1		< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	µg/l			0.1		< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	µg/l			0.1		< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	µg/l			0.1		< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	µg/l			0.1	53.6	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	µg/l			0.1		< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	µg/l			0.1		< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	µg/l			0.1		< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	µg/l			0.1	63.8	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	µg/l			0.1		< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	µg/l			0.1	23.7	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	µg/l			0.1		< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	µg/l					< 2.0	< 2.0	< 2.0	< 2.0
VOC`s									
Dichlorodifluoromethane	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	µg/l				53.1	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	µg/l		5	0.5	2.48	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	µg/l					< 5.0	< 5.0	< 5.0	< 5.0
Chloroethane	µg/l				41500	< 2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	µg/l		30			< 1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	µg/l					< 5.0	< 5.0	< 5.0	< 5.0
Trichloromethane	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/l	100			13100	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	µg/l				22.9	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	µg/l	10	30		37.3	< 2.0	< 2.0	< 2.0	< 2.0
Trichloroethene	µg/l	10		10	222	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	µg/l				96.9	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	µg/l		20			< 10	< 10	< 10	< 10
Bromodichloromethane	µg/l				72.5	< 5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene	µg/l					< 10	< 10	< 10	< 10
Trans-1,3-Dichloropropene	µg/l					< 10	< 10	< 10	< 10
1,1,2-Trichloroethane	µg/l	400			2230	< 10	< 10	< 10	< 10
Tetrachloroethene	µg/l	10		10	1660	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	µg/l					< 2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane	µg/l					< 10	< 10	< 10	< 10
1,2-Dibromoethane	µg/l					< 5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/l					< 2.0	< 2.0	< 2.0	< 2.0
Styrene	µg/l				38600	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	µg/l				159000	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	µg/l				6890	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	µg/l				940	< 50	< 50	< 50	< 50
N-Propylbenzene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	µg/l				12300	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/l				110	< 1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane	µg/l					< 50	< 50	< 50	< 50
1,2,4-Trichlorobenzene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	µg/l					< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	µg/l					< 2.0	< 2.0	< 2.0	< 2.0

Appendix 8 – Population

Appendix 8.1 Population Projection

Table 1 - Population Projection

Year	Newtownards	0.56% growth rate	Annual total	Loughries Base population	0.56% growth rate	Annual total	Gregstown Base population	0.56% growth rate	Annual total	Cumulative (Base)	NS19	With NS19	NS20	with NS20	Allowance
2011	27846	155.94	28001.94	3556	19.91	3575.91	4444	24.89	4468.89	8044.80	0.00	8044.80	0.00	8044.80	
2012	28001.94	156.81	28158.75	3575.91	20.03	3595.94	4468.89	25.03	4493.91	8089.85	0.00	8089.85	0.00	8089.85	
2013	28158.75	157.69	28316.44	3595.94	20.14	3616.08	4493.91	25.17	4519.08	8135.15	0.00	8135.15	0.00	8135.15	
2014	28316.44	158.57	28475.01	3616.08	20.25	3636.33	4519.08	25.31	4544.38	8180.71	0.00	8180.71	0.00	8180.71	
2015	28475.01	159.46	28634.47	3636.33	20.36	3656.69	4544.38	25.45	4569.83	8226.52	0.00	8226.52	0.00	8226.52	
2016	28634.47	160.35	28794.82	3656.69	20.48	3677.17	4569.83	25.59	4595.42	8272.59	0.00	8272.59	75	8347.59	8327
2017	28794.82	161.25	28956.07	3677.17	20.59	3697.76	4595.42	25.73	4621.16	8318.92	0.00	8318.92	160	8478.92	8434
2018	28956.07	162.15	29118.23	3697.76	20.71	3718.47	4621.16	25.88	4647.04	8365.50	0.00	8365.50	268	8633.50	8558
2019	29118.23	163.06	29281.29	3718.47	20.82	3739.29	4647.04	26.02	4673.06	8412.35	0.00	8412.35	324	8736.35	8646
2020	29281.29	163.98	29445.26	3739.29	20.94	3760.23	4673.06	26.17	4699.23	8459.46	0.00	8459.46	409	8868.46	8754
2021	29445.26	164.89	29610.16	3760.23	21.06	3781.29	4699.23	26.32	4725.55	8506.83	0.00	8506.83	498	9004.83	8865
2022	29610.16	165.82	29775.98	3781.29	21.18	3802.46	4725.55	26.46	4752.01	8554.47	161.00	8715.47	688	9403.47	9211
2023	29775.98	166.75	29942.72	3802.46	21.29	3823.76	4752.01	26.61	4778.62	8602.38	322.00	8924.38	878	9802.38	9557
2024	29942.72	167.68	30110.40	3823.76	21.41	3845.17	4778.62	26.76	4805.38	8650.55	483.00	9133.55	1068	10201.55	9903
2025	30110.40	168.62	30279.02	3845.17	21.53	3866.70	4805.38	26.91	4832.29	8698.99	644.00	9342.99	1258	10600.99	10249
2026	30279.02	169.56	30448.58	3866.70	21.65	3888.36	4832.29	27.06	4859.35	8747.71	805.00	9552.71	1448	11000.71	10595
2027	30448.58	170.51	30619.09	3888.36	21.77	3910.13	4859.35	27.21	4886.56	8796.69	966.00	9762.69	1638	11400.69	10942
2028	30619.09	171.47	30790.56	3910.13	21.90	3932.03	4886.56	27.36	4913.93	8845.96	1127.00	9972.96	1878	11850.96	11325
2029	30790.56	172.43	30962.99	3932.03	22.02	3954.05	4913.93	27.52	4941.45	8895.49	1288.00	10183.49	2118	12301.49	11708
2030	30962.99	173.39	31136.38	3954.05	22.14	3976.19	4941.45	27.67	4969.12	8945.31	1449.00	10394.31	2358	12752.31	12092
2031	31136.38	174.36	31310.74	3976.19	22.27	3998.46	4969.12	27.83	4996.95	8995.40	1610.00	10605.40	2598	13203.40	12476
2032	31310.74	175.34	31486.08	3998.46	22.39	4020.85	4996.95	27.98	5024.93	9045.78	1627.00	10672.78	2795	13467.78	12685
2033	31486.08	176.32	31662.41	4020.85	22.52	4043.36	5024.93	28.14	5053.07	9096.43	1627.00	10723.43	2992	13715.43	12878
2034	31662.41	177.31	31839.71	4043.36	22.64	4066.01	5053.07	28.30	5081.37	9147.37	1627.00	10774.37	3189	13963.37	13070
2035	31839.71	178.30	32018.02	4066.01	22.77	4088.78	5081.37	28.46	5109.82	9198.60	1627.00	10825.60	3386	14211.60	13264
2036	32018.02	179.30	32197.32	4088.78	22.90	4111.67	5109.82	28.61	5138.44	9250.11	1627.00	10877.11	3583	14460.11	13457
2037	32197.32	180.30	32377.62	4111.67	23.03	4134.70	5138.44	28.78	5167.21	9301.91	1627.00	10928.91	3780	14708.91	13651

Age Group	N'Ards %	Development	Loughries 2030	Gregstown 2030	New Pop
0-15	20.2	329	817	1021	2166
16-29	16.9	275	683	854	1812
30-64	47.7	776	1929	2410	5115
65+	15.2	247	615	768	1630
		1627	4043.36	5053.07	10723

Appendix 9 – Air Quality

Appendix 9.1 Detailed Construction Dust Assessment

Appendix 9.2 Sensitive Receptor Locations

Appendix 9.3 Model Verification, Outputs and Calculations

Appendix 9.1

Detailed Construction Dust Assessment

Source - The IAQM dust guidance gives examples of the dust emission magnitudes for demolition, earthworks and construction activities and trackout. These example dust emission magnitudes are based on the site area, building volume, number of HDV movements generated by the activities and the materials used. These example magnitudes have been combined with details of the period of construction activities to provide the ranking for the source magnitude that is set out in Table A1.

Table A1 Risk Allocation – Source (Dust Emission Magnitude)

Features of the Source of Dust Emissions	Dust Emission Magnitude
Demolition - building over 50,000 m3, potentially dusty construction material (e.g. concrete), onsite crushing and screening, demolition activities > 20 m above ground level. **Earthworks** – total site area over 10,000 m2, potentially dusty soil type (e.g. clay), >10 heavy earth moving vehicles active at any one time, formation of bunds > 8 m in height, total material moved > 100,000 tonnes. **Construction** - total building volume over 100,000 m3, activities include piling, on-site concrete batching, sand blasting. Period of activities more than two years. **Trackout** – 50 HDV outwards movements in any one day, potentially dusty surface material (e.g. High clay content), unpaved road length > 100 m.	Large
Demolition - building between 20,000 to 50,000 m3, potentially dusty construction material and demolition activities 10 - 20 m above ground level. **Earthworks** – total site area between 2,500 to 10,000 m2, moderately dusty soil type (e.g. silt), 5 – 10 heavy earth moving vehicles active at any one time, formation of bunds 4 - 8 m in height, total material moved 20,000 to 100,000 tonnes. **Construction** - total building volume between 25,000 and 100,000 m3, use of construction materials with high potential for dust release (e.g.	Medium

Features of the Source of Dust Emissions	Dust Emission Magnitude
concrete), activities include piling, on-site concrete batching. Period of construction activities between one and two years. **Trackout** – 10 - 50 HDV outwards movements in any one day, moderately dusty surface material (e.g. High clay content), unpaved road length 50 – 100 m.	
Demolition - building less than 20,000 m3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities < 10 m above ground, demolition during winter months. **Earthworks** – total site area less than 2,500 m2. Soil type with large grain size (e.g. sand), < 5 heavy earth moving vehicles active at any one time, formation of bunds < 4 m in height, total material moved < 10,000 tonnes earthworks during winter months. **Construction** - total building volume below 25,000 m3, use of construction materials with low potential for dust release (e.g. metal cladding or timber). Period of construction activities less than one year. **Trackout** – < 10 HDV outwards movements in any one day, surface material with low potential for dust release, unpaved road length < 50 m.	Small

Pathway and Receptor - Sensitivity of the Area - Pathway means the route by which dust and particulate matter may be carried from the source to a receptor. The main factor affecting the pathway effectiveness is the distance from the receptor to the source. The orientation of the receptors to the source compared to the prevailing wind direction is a relevant risk factor for long-duration construction projects; however, short-term construction projects may be limited to a few months when the most frequent wind direction might be quite different, so adverse effects can potentially occur in any direction from the site. As set out in the IAQM dust guidance, a number of attempts have been made to categorise receptors into high, medium and low sensitivity categories; however there is no unified sensitivity classification scheme that covers the quite different potential effects on property, human health and ecological receptors.

Table A2 and Table A3 sets out the IAQM basis for categorising the sensitivity of people and property to dust and PM10 respectively. Table A4 sets out the basis for determining the sensitivity of ecological receptors to dust.

Table A2 Sensitivities of People and Property Receptors to Dust

Receptor	Sensitivity
Principles:- • Users can reasonably expect enjoyment of a high level of amenity; or, • the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land. Indicative Examples:- • Dwellings • Museums and other culturally important collections. • Medium and long-term car parks and car showrooms.	High
Principles:- • Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or, • the appearance, aesthetics or value of their property could be diminished by soiling; or, • the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Indicative Examples:- • Parks. • Places of work.	Medium
Principles:-	Low

Receptor	Sensitivity
• the enjoyment of amenity would not reasonably be expected; or, • there is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or, • there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Indicative Examples:- • Playing fields, farmland (unless commercially-sensitive horticultural). • Footpaths and roads. • Short-term car parks.	

Table A3 Sensitivities of People and Property Receptors to PM10

Receptor	Sensitivity
Principles:- • Locations where members of the public are exposed over a time period relevant to the air quality objective (in the case of the 24-hour objective for PM10, a relevant location would be one where individuals may be exposed for eight hours or more in a day). Indicative Examples:- • Residential properties. • Schools, hospitals and residential care homes.	High
Principles:- • Locations where the people exposed are workers and exposure is over a time period relevant to the air quality objective (in the case of the 24-hour objective for PM10, a relevant location would be one where individuals may be exposed for eight hours or more in a day). Indicative Examples:- • Office and shop workers (but generally excludes workers occupationally exposed to PM10 as protection is covered by Health and Safety at Work legislation).	Medium
Principles:- • Locations where human exposure is transient exposure. Indicative Examples:- • Public footpaths. • Playing fields, parks. • Shopping streets.	Low

Table A4 Sensitivities of Ecological Receptors to Dust

Receptor	Sensitivity
Principles:- • Locations with an international or national designation and the designated features may be affected by dust soiling; or, • locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List for Great Britain. Indicative Examples:- • Special Area of Conservation (SAC) designated for acid heathlands adjacent to the demolition of a large site containing concrete (alkali) buildings or for the presence of lichen.	High
Principles:- • Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or, • locations with a national designation where the features may be affected by dust deposition. Indicative Examples:- • Site of Special Scientific Interest (SSSI) with dust sensitive features	Medium
Principles:- • Locations with a local designation where the features may be affected by dust deposition. Indicative Examples:- • A Local Nature Reserve with dust sensitive features	Low

The IAQM methodology combines consideration of the pathway and receptor to derive the 'sensitivity of the area'. Table A5, Table A6 and Table A7 show how the sensitivity of the area has been derived for this assessment.

Table A5 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors [a]	Distance from the Source (m) [b]			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

The sensitivity of the area has been derived for demolition, construction, earthworks and trackout.

a The total number of receptors within the stated distance has been estimated. Only the highest level of area sensitivity from the table has been recorded.

b For trackout, the distances have been measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and trackout impacts have only been considered up to 50 m from the edge of the road.

Table A6 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration [a]	Number of Receptors [b, c]	Distance from the Source (m) [d]				
			<20	<50	<100	<200	<350
High	> 32 µg.m^{-3}	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28 - 32 µg.m^{-3}	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24 - 28 µg.m^{-3}	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low

		1-10	Medium	Low	Low	Low	Low
	< 24 µg.m^{-3}	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

The sensitivity of the area has been derived for demolition, construction, earthworks and trackout.

a This refers to the background concentration derived from the assessment of baseline conditions later in this report. The concentration categories listed in this column apply to England, Wales and Northern Ireland but not to Scotland.

b The total number of receptors within the stated distance has been estimated. Only the highest level of area sensitivity from the table has been recorded.

c For high sensitivity receptors with high occupancy (such as schools or hospitals), the approximate number of occupants has been used to derive an equivalent number of receptors.

d For trackout, the distances have been measured from the side of the roads used by construction traffic. Without site-specific mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and trackout impacts have only been considered up to 50 m from the edge of the road.

Table A7 Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m) [a]	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

The sensitivity of the area has been derived for demolition, construction, earthworks and trackout and for each designated site.

a Only the highest level of area sensitivity has been recorded.

The IAQM dust guidance lists the following additional factors that can potentially affect the sensitivity of the area and, where necessary, professional judgement has been used to adjust the sensitivity allocated to a particular area: any history of dust generating activities in the area; the likelihood of concurrent dust generating activity on nearby sites; any pre-existing screening between the source and the receptors; any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which the works will take place; any conclusions drawn from local topography; duration of the potential impact, as a receptor may become more sensitive over time; and any known specific receptor sensitivities which are considered go beyond the classifications given in the table above.

The matrices in Table A8, Table A9, Table A10 and Table A11 have been used to assign the risk for each activity to determine the level of mitigation that should be applied. For those cases where the risk category is 'negligible', no mitigation measures are required beyond those mandated by legislation.

Table A8 Risk of Dust Impacts – Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table A9 Risk of Dust Impacts – Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table A10 Risk of Dust Impacts – Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table A11 Risk of Dust Impacts – Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Appendix 9.2

Model Inputs

This appendix presents the inputs for the assessment of the effects on air quality due to the proposed redevelopment. The effects of 'Local' and 'Regional' air quality have been undertaken in accordance with the methodology for a 'Simple' assessment, as stated within the Design Manual for Roads and Bridges (DMRB) Advice Note 207/07, published by the Highways Agency (HA) (Highways Agency, 2007).Model Inputs are listed below:

Table B1 Defra Background Pollution Concentrations (µg.m^{-3})

Background Pollution Concentration	Year	NOx	Nitrogen Dioxide (NO_2)	Particulate Matter (PM_{10})	Particulate Matter ($PM_{2.5}$)
Defra Background X350500; Y381500.	2017	7.05	5.48	9.9	5.86
	2019	6.55	5.11	9.71	5.7
	2031	4.89	3.85	9.18	5.25

These Defra background levels are provided to assist local authorities in support of Review and Assessment of local air quality. To assist local authorities undertaking their air quality Review and Assessments, 2017-based background maps for years 2017 to 2030 for NOx, NO_2, PM_{10} and $PM_{2.5}$ are available. The information used in this assessment represent pollution concentrations at a location closest to the proposed redevelopment. The coordinates for the location are X351500; Y373500 located to the south of the proposed development site.

Table B2 Sensitive Receptors

Ref	**Distance from Link Road A**	**Distance from Link Road B**
Receptor A	2m	2m
Receptor B	8m	8m
Receptor C	2m	2m
Receptor D	8m	8m

Note: Each receptor was modelled at a worst case distance of 2m from link centre (centre of road). The lowest value accepted by the DMRB Screening Spreadsheet is 2m.

Table B3 Road Speeds

Ref	Speed (kmph)
Movilla Road	40
Bowtown Road	40
Site Road	25

Modelled speeds:

- There is a well-known correspondence between rates of emission and the average speed at which a vehicle is driven. It should normally be taken into account in an emission model.
- Variation of speed emission rates tend to increase under variable operating conditions, compared with those during steady state driving. The effect is implicitly considered in most speed related emission factors since the variability of speed during a trip is closely related to the average speed.
- Slow speed journeys in towns involve frequent speed changes in response to the traffic conditions, while higher speed trips are normally driven more smoothly. Nevertheless, for two trips at the same average speed, emissions can vary substantially depending on speed variability.
- If a project has features that suggest speeds may vary more than average a more complex treatment may be warranted, though the availability of input data may be a limiting factor.
- Slowed speeds have been used throughout this assessment in order to elevate emissions.

Table B4 Two Way Traffic Flows

24 hr AADT	100%	Cars	OGV
Base 2019			
Movilla Road	6030	5600	430
Bowtown Road	1919	1802	117
2031 Without			
Movilla Road	6452	5992	460

Bowtown Road	2053	1928	125
2031 With			
Movilla Road	9152	8503	649
Bowtown Road	4753	4439	314
Flows to Movilla Site	2700	2511	189
Flows to Bowtown Site	2700	2511	189

Appendix 9.3

Model Verification, Model Outputs and Calculations

Model Verification

Model verification involves the comparison of modelled data to monitored data in order to gain the best possible representation of current pollutant concentrations for the assessment years. The verification process is in general accordance with that contained in TG (16) guidance note and uses recent diffusion monitoring data to best represent this. The verification process consists of using the monitoring data and the published background air quality data in the UK National Air Quality Information Archive to calculate the road traffic contribution of nitrogen oxides (NOx) at the monitoring locations. Outputs from the DMRB Screening model are provided as predicted road traffic contribution NOx emissions. These are converted into predicted roadside contribution NO_2 exposure at the relevant receptor locations based on the updated approach to deriving NO_2 from NOx for road traffic sources. The calculation was derived using the NOx to NO_2 worksheet in the online LAQM tools website hosted by DEFRA.

Table C1 Model Calibration

ANDBC Diffusion Tube Number	**MONITORED 2017 (µg.m-3) closest urban locations**	**Unverified Modelled 2017 (µg.m-3)**	**Bias Factor need?**
1	12	Receptor A 9.35	No adjustment.
Within 25% of monitored diffusion tube recordings			

Comment: Potential differences between monitored and modelled data - Discrepancies can occur between measured concentrations and results from a dispersion model due to a number of different reasons that may include:

- traffic data uncertainties,
- including estimates of speeds, total flows and proportions of vehicle types; emission estimates for vehicles and other sources;
- estimates of background concentrations;
- meteorological data uncertainties;
- assumed NOx:NO2 conversion;
- overall model limitations; and
- the precision and accuracy of monitoring methods.

All air quality assessment tools, whether models or monitoring measurements, have a degree of uncertainty associated with the results. The choices that the practitioner makes in setting-up the model, choosing the input data, and selecting the baseline monitoring data will decide whether the final predicted impact should be considered a central estimate, or an estimate tending towards the upper bounds of the uncertainty range (i.e. tending towards worst-case).

The DMRB Screening model itself contributes some of this uncertainty, due to it being a simplified version of the real situation: it uses a sophisticated set of mathematical equations to approximate the complex physical and chemical atmospheric processes taking place as a pollutant is released and as it travels to a receptor. The predictive ability of even the best model is limited by how well the turbulent nature of the atmosphere can be represented.

Each of the data inputs for the model, set out in Appendix 9.2, will also have some uncertainty associated with them. Where it has been necessary to make assumptions, these have mainly been made towards the upper end of the range informed by an analysis of relevant, available data.

LAQM.TG(16) requires that local authorities verify the results of any detailed modelling undertaken for the purposes of fulfilling their R&A duties. Model verification refers to "checks that are carried out on model performance at a local level". Modelled concentrations are compared with the results of monitoring. Where there is a disparity between modelled and monitored concentrations, the first step is to review the appropriateness of the data inputs to determine whether the performance of the model can be improved. Once reasonable efforts have been made to reduce the uncertainties in the data inputs, an adjustment may be established and applied to reduce any remaining disparity between modelled and monitored concentrations. No adjustment factor is deemed necessary where the modelled concentrations are within 25% of the monitored concentrations.

Local Authorities generally implement a broad spread of monitoring, particularly in areas that are known to be sensitive to changes in air quality. Consequently, Local Authorities are usually able to verify the models they use for R&A purposes; however for individual developments, there is less likely to be a broad range of monitoring locations within the relevant study area.

Local Assessment - Raw Model Outputs

2016

Table C2 2017, 2019, 2025* DMRB Screening Output

Raw DMRB Screening Model Output - Roads Source Only			Pollutant concentrations at receptor						
			CO *	Benzene	1,3-butadiene	NO_x	NO_2 *	PM_{10}	
Receptor number	Name	Year	Annual mean mg/m^3	Annual mean mg/m^3	Annual mean ug/m^3	Annual mean ug/m^3	Annual mean ug/m^3	Annual mean ug/m^3	Days $>50mg/m^3$
1	Receptor 1	2017	0.04	0.05	0.04	7.05	2.79	0.72	0.00
2	Receptor 2	2017	0.04	0.04	0.04	6.69	2.67	0.68	0.00
3	Receptor 3	2017	0.01	0.01	0.01	2.24	1.06	0.23	0.00
4	Receptor 4	2017	0.01	0.01	0.01	2.13	1.02	0.22	0.00
5	Receptor 1	2019	0.04	0.04	0.04	6.71	2.68	0.69	0.00
6	Receptor 2	2019	0.04	0.04	0.04	6.38	2.57	0.66	0.00
7	Receptor 3	2019	0.01	0.01	0.01	2.14	1.02	0.22	0.00
8	Receptor 4	2019	0.01	0.01	0.01	2.03	0.98	0.21	0.00
9	Receptor 1 (WO)	2025	0.05	0.05	0.05	7.10	2.81	0.76	0.00
10	Receptor 2 (WO)	2025	0.05	0.05	0.05	6.74	2.69	0.72	0.00
11	Receptor 3 (WO)	2025	0.02	0.02	0.02	2.26	1.07	0.24	0.00
12	Receptor 4 (WO)	2025	0.01	0.01	0.01	2.15	1.02	0.23	0.00
13	Receptor 1 (W)	2025	0.07	0.07	0.07	10.50	3.87	1.12	0.00
14	Receptor 2 (W)	2025	0.07	0.07	0.07	9.97	3.71	1.06	0.00
15	Receptor 3 (W)	2025	0.04	0.04	0.04	5.66	2.33	0.60	0.00
16	Receptor 4 (W)	2025	0.04	0.04	0.04	5.37	2.23	0.57	0.00

*These are road source only predictions. The Defra background values are added to these predictions. *2025 is the highest year allowed for input inot the DMRB Screening Model.*

1. Regional Assessment - Raw Model Outputs

2017

Table C3 2017 Regional Assessment DMRB Screening Output

Summary			
Name	Bowtown		
Year	2017	**Number of links**	2
Pollutant		**Total emission**	**Units**
CO		5295	***kg/year***
THC		789	***kg/year***
NO_x		2803	***kg/year***
PM_{10}		78	***kg/year***
C		354	***tonnes/year***

2031 Without the Scheme in Place

Table C4 2031 Regional Assessment DMRB Screening Output (Without the Scheme in Place)

Summary			
Name	Bowtown		
Year	2025	**Number of links**	2
Pollutant		**Total emission**	**Units**
CO		5776	***kg/year***
THC		875	***kg/year***
NOx		3050	***kg/year***
PM10		87	***kg/year***
C		391	***tonnes/year***

2031 With the Scheme in Place

Table C5 2031 Regional Assessment DMRB Screening Output (With the Scheme in Place)

Summary			
Name	Bowtown		
Year	2025	**Number of links**	3
Pollutant		**Total emission**	**Units**
CO		9,397	***kg/year***
THC		1,424	***kg/year***
NOx		4,963	***kg/year***
PM10		142	***kg/year***
C		636	***tonnes/year***

The regional impacts are not significant in terms of overall regional impacts. **2025 is the highest year allowed for input inot the DMRB Screening Model.*

2. NOxNO2 Calculations

Base 2017 NOx – NO_2

Table C6 2017 & 2019 Calculation NOx – NO_2

Local Authority:	CALIBRATION			
Ards & North Down				All UK traffic
Receptor ID	Road increment NO_x	Backgroundug.m^{-3}		Total NO_2
	ug.m^{-3}	NO_x	NO_2	ug.m^{-3}
2017				
Receptor A	7.045133011	7.05	5.48	9.35
Receptor B	6.689520565	7.05	5.48	9.16
Receptor C	2.243226431	7.05	5.48	6.73
Receptor D	2.129996598	7.05	5.48	6.66
2019				
Receptor A	6.714510216	6.55	5.11	8.82
Receptor B	6.375586396	6.55	5.11	8.64
Receptor C	2.137953502	6.55	5.11	6.3
Receptor D	2.030037459	6.55	5.11	6.24

Nitrogen Dioxide: The nitrogen dioxide predictions indicate no breaches of the nitrogen dioxide annual mean objective at facades of representative receptors.

Without Proposed Development in Place 2031 NOx – NO_2

Table C7 2031 Without Calculation NOx – NO_2

Local Authority:	Without the scheme in place			2031
Ards & North Down				All UK traffic
Receptor ID	Road increment NO_x	Background ug.m^{-3}		Total NO_2
	ug.m^{-3}	NO_x	NO_2	ug.m^{-3}
Receptor A	7.100261631	4.89	3.85	7.68
Receptor B	6.741866495	4.89	3.85	7.49
Receptor C	2.260621416	4.89	3.85	5.08
Receptor D	2.146513548	4.89	3.85	5.02

Nitrogen Dioxide: The nitrogen dioxide predictions indicate no breaches of the nitrogen dioxide annual mean objective at facades of representative receptors.

With Proposed Development in Place 2031 NOx – NO_2

Table C8 2031 With Calculation NOx – NO_2

Local Authority:	**With the scheme in place**			**2031**
Ards & North Down				**All UK traffic**
Receptor ID	**Road increment NO_x**	**Background ug.m^{-3}**		**Total NO_2**
	ug.m^{-3}	**NO_x**	**NO_2**	**ug.m^{-3}**
Receptor A	10.49650038	4.89	3.85	9.48
Receptor B	9.966675581	4.89	3.85	9.21
Receptor C	5.656860164	4.89	3.85	6.92
Receptor D	5.371322634	4.89	3.85	6.77

Nitrogen Dioxide: The nitrogen dioxide predictions indicate no breaches of the nitrogen dioxide annual mean objective at facades of representative receptors.