Hampshire Water Transfer & Water Recycling Project

Preliminary Environmental Information Report -

Appendix 11.2 Geo-Environmental Interpretative Report

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WATER for LIFE

from Southern Water

Contents

1 Introduction

1.1 Preamble

As part of Southern Water's Water for Life Western Grid Project in Hampshire, SSP has been instructed by Southern Water Services (SWS) to prepare a Geo-Environmental Interpretative Report summarising the ground conditions within a parcel of land to the north of Harts Farm Way (the Site, also known as Land Parcel 72 [LP72]).

In 2021 SSP was appointed by SWS as part of their Water for Life Western Grid Project in Hampshire, to produce a Geo-environmental Desk Study for the Site to inform the 'reference design' of the proposed WRP.

This report presents a Geo-Environmental Interpretative Report comprising a desk study, Tier 1 (preliminary) qualitative contamination risk assessment and a Tier 2 (generic quantitative) risk assessment.

1.2 Context and Objective

This report has been prepared in a planning context (rather than a Part 2A statutory contaminated land context).

In preparing this report Stantec has considered the requirements of the National Planning Policy Framework (NPPF) (MHCLG, 2021) in respect of ground conditions and in particular paragraph 183 which states:

"*Planning policies and decisions should ensure that:*

a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and,

c) *adequate site investigation information, prepared by a competent person, is available to inform these assessments*".

The objective of this report is to identify the likely ground conditions using published and publicly available information (see below for sources of information accessed) and to assess whether there are contamination risks associated with the ground conditions that require management (remediation or mitigation).

1.3 Methodology

The following summarises the ground conditions assessment methodology adopted by SSP with a more detailed description in our guide entitled Stantec Guide: Methodology for Assessment of Land Contamination (England), a copy of which is presented in **Appendix A**.

1.3.1 Assessment of Ground Conditions – Contamination

As required by the NPPF this assessment has been carried out in accordance with "*established procedures*". Our methodology follows guidance on how to assess and manage the risks from land contamination given in "Land Contamination Risk Management" (LCRM) (EA, 2023).

The principal planning objective in respect of contamination is to ensure that any unacceptable risks to human health, buildings and other property and the natural and historical environment from the contaminated condition of the land are identified so that appropriate action can be considered and taken to address those risks.

LCRM presents a three-stage process to the management of contaminated land:

- Stage 1 = Risk assessment,
- Stage 2 = Options appraisal, and
- Stage 3 = Remediation.

The Stage 1 risk assessment is undertaken in a phased manner comprising three tiers, with the three tiers being:

- Tier 1 – "Preliminary Risk Assessment" – a qualitative assessment forming part of a Phase 1 report,
- Tier 2 – "Generic Risk Assessment" - a quantitative assessment using published criteria to screen site specific ground condition data forming part of a Phase 2 report and
- Tier 3 – "Detailed Risk Assessment" – a quantitative assessment involving the generation of site-specific assessment criteria (SSAC).

1.4 Report Format

This report begins with a summary of the Site's land-use history and environmental setting and presents a Tier 1 (Preliminary) risk assessment. It then progresses to an interpretative review of the ground conditions and geo-environmental conditions at the Site, as evidenced by an intrusive Ground Investigation (GI) undertaken by Delta-Simons in 2021[1] and presents a Tier 2 (Generic) risk assessment, followed by an outline remediation strategy.

1.5 Sources of Information

The following sources of information were used in the preparation of this report:

- A Geo-Environmental Desk Study for the Site and other land parcels in the site's immediate vicinity, prepared by SSP in November 2021 (SSP, 2021). This desk study was itself informed by a review of many of the historical reports listed below, as well as a Groundsure Geo and Enviro Insight Report (Groundsure Ltd., 2021) that includes historical Ordnance Survey (OS) maps and aerial photographs, information on waste and landfill sites, current and recent industrial activity, hydrogeology, hydrology,

[1] SWS has obtained reliance on this ground investigation in November 2022 via a Letter of Reliance from Delta Simons

environmental designations, habitats designations and information on ecologically sensitive sites and geology (basic).

- Geology maps and borehole records held by the British Geological Survey and accessed via their website (BGS, 2023) and Geological Survey of Great Britain (England and Wales) 1:63,360/1:50,000 geological map series.
- Imagery available on Google Earth ('street view' and aerial images).
- A "Phase 2 Geo-Environmental Investigation Report" prepared by White Young Green (WYG) for the Site in August 2017 (White Young Green, 2017). WYG's report includes the findings of a ground investigation undertaken at the Site in March 2017.
- A Factual Geo-Environmental Investigation Report prepared by DS for the Site in July 2021 (Delta Simons, 2021). Reliance on the digital ground investigation information supporting DS's assessment was purchased by SWS.
- An interpretative Geo-Environmental Assessment prepared by DS in January 2022 (Version 4) for the Site (Delta Simons, 2022).
- A "Remediation Options Appraisal and Verification Strategy" prepared by DS in January 2022 (Delta Simons, 2022b).
- Information and drawings provided by Havant Borough Council's Environmental Health department (a copy of which is provided in **Appendix B**).
- Information provided by the Environment Agency, a copy of which is provided in **Appendix C**.
- Historical aerial photographs of the Site available through Historic England's Aerial Photo Explorer (Historic England, 2023) and the University of Cambridge's Air Photos Archive (University of Cambridge, 2023).
- A "Report on Site Investigation for Proposed Urban Development – Phase One, Proposed Refuse Tip Storehouse Lake", prepared by Structural Soils Ltd. on behalf of Havant and Waterloo Urban District Council in August 1967 (Structural Soils Ltd., 1967).
- The factual report for a ground investigation undertaken at the Site by SOCOTEC during 2022 to inform the design of the tunnels and shafts leading to the Site from Budds Farm WWTW (SOCOTEC, 2023)

1.6 Limitations

This report has been prepared within an agreed timeframe and to an agreed budget that will necessarily apply some constraints on its content and usage. The remarks below are presented to assist the reader in understanding the context of this report and any general limitations or constraints. If there are any specific limitations and constraints, they are described in the report text.

The opinions and recommendations expressed in this report are based on statute, guidance, and best practice current at the time of its publication. Stantec UK Ltd (Stantec) does not accept any liability whatsoever for the consequences of any future legislative changes or the release of subsequent guidance documentation, etc. Such changes may render some of the opinions and advice in this report inappropriate or incorrect and the report should be returned to us and reassessed if required for re-use after one year from date of publication. Following delivery of the report, Stantec has no obligation to advise the Client or any other party of such changes or their repercussions.

Some of the conclusions in this report may be based on third party data. No guarantee can be given for the accuracy or completeness of any of the third-party data used.

Historical maps and aerial photographs provide a "snapshot" in time about conditions or activities at the site and cannot be relied upon as indicators of any events or activities that may have taken place at other times. It is possible for developments to have occurred between surveys that are not shown or for the map record to have been censored for military security.

The conclusions and recommendations made in this report and the opinions expressed are based on the information reviewed and/or the ground conditions encountered in exploratory holes and the results of any field or laboratory testing undertaken. There may be ground conditions at the site that have not been disclosed by the information reviewed or by the investigative work undertaken. Such undisclosed conditions cannot be considered in any analysis and reporting.

It should be noted that this report is a land condition assessment and does not purport to be an ecological, flood risk or archaeological survey and additional specific surveys may be required.
The identification of invasive and/or noxious plants such as Japanese Knotweed is outside the remit of our appointment.

This report has been written for the sole use of the Client stated at the front of the report in relation to a specific development or scheme. The conclusions and recommendations presented herein are only relevant to the scheme or the phase of project under consideration. This report shall not be relied upon or transferred to any other party without the expressed written authorisation of Stantec. Any such party relies upon the report at its own risk.

The interpretation carried out in this report is based on scientific and engineering appraisal carried out by suitably experienced and qualified technical consultants based on the scope of our engagement. We have not considered the perceptions of, for example, banks, insurers, other funders, lay people, etc., unless the report has been prepared specifically for that purpose. Advice from other specialists may be required such as the legal, planning and architecture professions, whether specifically recommended in our report or not.

Public or legal consultations or enquiries, or consultation with any Regulatory Bodies (such as the Environment Agency, Natural England or Local Authority) have taken place only as part of this work where specifically stated.

2 Site Location and Description

2.1 Site Location

The Site is located approximately 1.4 km south-west of the centre of Havant and approximately 300 m west of Budds Farm Wastewater Treatment Works (WTW) and may be located by NGR 470140E, 105670N, as shown on **Figure 1**, Site Location Plan.

2.2 Site Description

The Site occupies an area of approximately 7.9 ha and is accessed via a gated entrance off Harts Farm Way to the south.

A review of historical reports and information provided by both the Environment Agency and Havant Borough Council indicates that the Site comprises a former landfill (Harts Farm Way) that had been restored to grassland and is fringed with woodland. A hard-surfaced former access road/yard is present in the centre of the Site, connected to Harts Farm Way to the south by an access road.

A review of the topographic survey of the Site (Greenhatch Group, 2020) indicates that the eastern and western halves of the Site have very different topography:

- The western half of the Site is occupied by a plateau that is approximately level, with a slight fall from the north-western corner at approximately 10.5 m Above Ordnance Datum (AOD) to a low of approximately 9.0 m AOD on the southern boundary near the access road at the southern boundary. The plateau appears to be raised by between approximately 0.5 m and 3.0 m above the surrounding ground levels.
- The eastern half of the Site is occupied by a domed landform with a peak of approximately 15.2 m AOD. The land falls in all directions from the peak to approximately 10 m AOD on the northern boundary, 9.5 m AOD on the eastern boundary, 7.5 m AOD on the southern boundary and 8.5 m AOD at the eastern edge of the yard in the centre of the Site.

Beyond the Site, the land falls towards the east to the Hermitage Stream and the south towards Langstone Harbour (noting that the topography of the land immediately surrounding the Site is not natural and comprises reclaimed land).

Land use in the surrounding area is described as follows:

- North: The A27, beyond which (approximately 80 m north) is undeveloped agricultural land.
- East: The site's eastern boundary is formed by woodland, beyond which is a public footpath adjacent to the Hermitage Stream. Beyond the stream (approximately 60 m east of the Site) is an aggregates wharf, a business centre and depot, the Havant household waste recycling centre, and various commercial / light industrial units.
- South and West: Harts Farm Way, immediately beyond which are further restored landfill cells. Approximately 200 m to the south of the Site (beyond the other areas of landfill) is Langstone Harbour, an inlet of the English Channel.

3 Site History and Land Use Information

3.1 Land Use Information

This section presents a summary of current and historical land uses on and immediately adjacent to the site. Land use is used to inform the hazard identification element of the risk assessment.

3.2 Current Land Use

The Site is currently vacant and comprises open grassland (restored former landfill) with a hardstanding area in the centre of the Site, connected to Harts Farm Way by an access road.

The land to the east of the hardstanding area rises up into a domed landform, sloping down more steeply towards the northern Site boundary and more gently down towards the southern Site boundary. The landform is vegetated with grass and 'scrubland' plants. Woodland is present along the northern and eastern boundaries. At the eastern boundary, the land begins to fall to the east towards the adjacent Hermitage Stream.

The land to the west of the hardstanding area is grassed and approximately level, with a slight slope to the south. A low 'bund' is present around the edges of the flat, grassed area, beyond which the land is vegetated with trees and shrubs.

At the time of the reconnaissance survey (March 2022) it appeared that vegetation had recently been removed from around the hardstanding area in the centre of the Site, and from around the Site's north-eastern, eastern, and south-eastern boundaries.

An overhead power line crosses across the Site, parallel to the Site's southern boundary.

3.3 Historical Land Use

Pre-Landfilling – Pre 1900s to 1960s

The earliest map available within the Groundsure Report, dated 1866, indicates that the Site comprised undeveloped marshy ground crossed by the Hermitage Stream.

Historical aerial photography available through Historic England's archives (Historic England, 2023) dated 1946 and 1948[2] shows that the land within approximately 40m of the Site's northern boundary appears to be higher-lying and in use for agriculture. Historical mapping records that approximately the western-most 100 m of the site appears to be vegetated and crossed by streams and is labelled as "Broad Marsh". The remainder of the land within the Site appears to comprise marshland and the channel of the Hermitage Stream.

[2] https://historicengland.org.uk/images-books/archive/collections/aerial-photos/record/raf_106g_uk_1124_rvp4_6335, https://historicengland.org.uk/images-books/archive/collections/aerial-photos/record/raf_58_19_vp1_5010, https://historicengland.org.uk/images-books/archive/collections/aerial-photos/record/raf_3g_tud_uk_156_v_5043,

Landfill Construction and Waste Deposition – 1960s to 1980s

Planning application 14239/G proposed to develop the site through the construction of a "controlled refuse tip to level of surrounding area, with topsoil cover". The date of this application is unclear[3] but appears to have been approved in April 1962, subject to conditions.

Planning permission HWU.14239/3G, dated September 1968 granted permission for "*use of land at Storehouse Lake, Bedhampton, as a controlled tip, quay, slip-way and dinghy park and construction of a channel diversion and road*". A 'red-line' plan showing the extent of this permission is not provided, however it is likely to apply to the area recorded by the Environment Agency (EA) as an historical landfill. Drawing 639/59 (**Appendix B**) shows the location of a proposed bund wall, channel re-alignment works, proposed access road and indicates the areas where "level to be raised by controlled tipping" (appears to be the higher-lying land in the west of the site) and "area to be reclaimed by controlled tipping" (appears to be the lower lying coastal marshland).

Limited information relating to the landfill activities allowed by the planning permission is available within the Schedule of Conditions to the planning permission, as follows:

- *"Refuse shall be tipped in layers not exceeding 6 ft. in depth.*
- *"All refuse exposed to the air shall be covered each day with at least 9 ins. of earth or other suitable inert material capable of forming an effective seal.*
- *"Deposits mainly of animal or fish waste shall be covered forthwith with at least 2 ft. of earth or other suitable inert material capable of forming an effective seal".*
- *"No substance shall be deposited on the land other than the following: i) Soil, chalk, sand, gravel, hardcore and other earth spoil; ii) Trade refuse and domestic refuse.*
- *"No phenolic waste shall be deposited on the site without the prior consent of the Local Planning Authority".*

As described in Section 3.4 below, it appears that the bund was constructed with a sheet-piled wall on the seaward (southern / eastern) edge.

The EA has stated (**Appendix C**) that "*the site is also recorded as being a dilute and disperse facility, so any engineering is likely to be minimal*".

Historical aerial photographs available through Cambridge University's Air Photos Archive[4] (unknown date) show construction and filling of the landfill to have progressed. Pertinent details shown on these photos include:

- Harts Farm Way has been constructed on an embankment along the Site's southern boundary and a further haul/access road is present on an embankment approximately 60 m west of the edge of the

[3] The quality of the scanned document provided by Havant Borough Council is very poor and it is not possible to read all the information.
[4] These cannot be reproduced within this report however the relevant photos are available at the links below.
https://www.cambridgeairphotos.com/data/thumbnails/640/bmv90.jpg,
https://www.cambridgeairphotos.com/data/thumbnails/640/bmv91.jpg,
https://www.cambridgeairphotos.com/data/thumbnails/640/bmv92.jpg

new channel (extending northwards from what is now a small layby on Harts Farm Way near the south-eastern corner of the Site).

- The land in the western half of the Site appears to be reworked and potentially partially infilled.
- The land in the eastern half of the Site between the haul road embankment to the east, the Harts Farm Way embankment to the south and the higher lying/reworked/filled land to the west appears to have been reworked/filled to a lesser extent. The former channel of the Hermitage Stream appears to have been partially infilled in the Site's north-eastern corner, and a possible culvert beneath Harts Farm Way is noted.
- To the south of Harts Farm Way and to the north of the bund, the former channel of the Hermitage Stream remains, and appears to contain water. A possible culvert/outfall in the bund wall at the southern end of the former channel is noted (see Section 3.4 below).

The EA has stated (**Appendix C**) that "*the site was infilled (or deposited as land raise) between around 1969 and 1987*" and "*the site is known to have taken household waste, as was as some commercial/industrial waste*". (Delta Simons, 2022) states that wastes included "*concrete waste, construction and demolition waste, household waste and incinerator residues*[5]". Further aerial photos[6] (date unknown) show the filling in the western half of the Site to have been completed and this area to be grassed/vegetated whilst filling activities in the eastern half of the Site appear to be ongoing. The land to the south of the Site appears to also have been infilled, with the former stream channel no longer visible.

On the basis of the ground investigations undertaken it appears that different types of waste have been deposited in different areas of the Site. Wastes of a more 'commercial' type appear to have been deposited in the west of the Site and wastes of a more 'domestic' type appear to have been deposited in the eastern half of the Site (more detailed descriptions provided in **Section 4** below). **Figure 2** shows the interpreted extent of these areas of waste deposition. For ease of reference these areas of waste deposition will henceforth be referred to as the western cell and the eastern cell, noting that these 'cells' are not lined and do not appear to have an engineered cap. It is unknown if there is any structure (e.g., a bund) separating the western cell from the eastern cell in the centre of the Site.

Post-Landfilling – 1990s to Present

Historical mapping dated 1987 and 1998 recorded the hard-surfaced area in the centre of the Site. The land in the west of the Site appears to be approximately level and is labelled as "Playing Field".

Planning permission 98/54097/2/HBC granted permission for "Land raising by one metre". Historical aerial imagery dated 1999 (available through Google Earth) appears to show these land-raising works being undertaken in the western half of the Site. These works were shown to be complete by the next photograph dated 2004.

[5] A Local Authority incinerator being present approximately 200m to the east, in the location of the present-day household waste recycling centre.
[6] https://www.cambridgeairphotos.com/data/thumbnails/640/rc8ge064.jpg, https://www.cambridgeairphotos.com/data/thumbnails/640/rc8ge065.jpg

In 2005 all vegetation was cleared from the western half of the Site. During 2007 alterations to the junction between Harts Farm Way and the A27 were carried out, and the south-western quadrant of the Site appears to have been used for stockpiling and as a construction compound.

By 2011 the Site appears to have been almost entirely restored to its existing condition, with the exception of a limited area immediately west of the access road in the centre of the parcel. Cabins and vehicles can be seen on this image and are assumed to be the works compound associated with the cover re-engineering works. By 2015 the restoration works are shown to be completed.

During 2022 trees and vegetation were cleared from around the hard-surfaced area in the centre of the Site, from an area to the north of the hard-surfaced area, and in the north-eastern corner of the Site. The Site is shown in its existing configuration.

3.4 Bund and Outfall Construction

(Structural Soils Ltd., 1967) (**Appendix B**) provided recommendations for the construction of the proposed bund wall. The report provides the following statements:

- *"The shingle underlying the silt, although permeable should create a satisfactory bearing strata for any bund wall, assuming that any overlying silt is firstly removed and that the bund wall is founded at a depth into the base shingle of between [0.9 m and 1.5 m].*
- *"It is considered important that the core to the bund wall should be formed of sufficiently impermeable material to restrict the flow of sea water through the bund wall. This material could either consist of chalk or clay, provided that this fill material is compacted to its maximum dry density.*
- *"The bund wall if founded on shingle will allow water to pass under it to the area inside the wall during high tides. By constructing the core to a depth of [0.9 m to 1.2 m] below the shingle and constructing the wall in totally impermeable material the water path will be as long as is economically possible, allowing the minimum of water to flow under the wall.*
- *"Under the co-efficient of permeability values obtained [it is anticipated that] up to [0.15 m] of water inside the bund wall, and as soon as the tide drops below the inside surface level, the direction of flow will be reversed. It is anticipated that nearly all of the water passing into the inside area will percolate out at low tide, but as the mean of tides is above [Ordnance Datum] the ponding inside of the bund may on some occasions be present for a number of consecutive tides.*
- *"It is strongly recommended that an outlet pipe with a tidal flap is constructed through the bund wall in the base of the existing Storehouse Lake Channel to facilitate the immediate draining of any water in the area after each high tide".*

Following the grant of planning permission in 1968 it appears that the proposed bund was constructed. A sheet pile wall appears to have been added to the bund design, below the seaward face. Details of the length of the sheet-piles are unclear and appear to vary along different points in the bund, with various lengths of between approximately 1.8 m to 6.0 m (Drawing 639/92, **Appendix B**). The bund is indicated to be constructed of "chalk fill" (drawing 639/87, **Appendix B**). Drawing 639/112 (**Appendix B**) showing the flow-nets associated with various bund and sheet piled wall configurations indicates that when using a 2.7 m long pile, flow beneath the wall is not prevented.

Drawing 639/108 (**Appendix B**) shows details of an outfall structure within the bund wall, showing a "*Twin 36" dia. outfall in cofferdam*" was proposed, controlled by a sluice. This is potentially the structure recommended in the Structural Soils, 1967 report.

A letter from the County Surveyor to the Southern Water Authority, dated 1979 (**Appendix B**) describes the "*discharge to Langstone Harbour from Broadmarsh Refuse Tip"*, stating that *"the County Council will be undertaking certain remedial works… to abate the discharge of leachate into Langstone harbour… and will* *involve the prevention of the major discharge of leachate through the main sluices by means of steel shuttering placed around the sluices and backfilling of the present anaerobic lagoon with earth spoils. Moreover, this work will be supplemented by completely covering the eastern portion of the site with earth spoils to minimise percolation of rainfall through the deposited wastes*". It is possible that the outfall structure that was sealed is the outfall / sluice in the bund at the mouth of the former Hermitage Stream channel that was recommended by Structural Soils, 1967 and potentially evident in the historical aerial photographs. DS undertook a visit to the bund in 2022 (Delta Simons, 2022) and found no evidence of a sluice/outfall at the location where it should be present.

3.4.1 Potential Groundwater Level Implications

Structural Soils' 1967 assessment of water flow into the landfill and the recommendations for an outlet to allow water to flow out of the landfill were based upon a bund toed into the gravel and did not include consideration of a sheet piled wall. The inclusion of the sheet piled wall is likely to have reduced water flow into the landfill (and leachate flow out of the landfill). However, as shown on the flow-nets on drawing 639/112 (**Appendix B**), elimination of flow beneath the sheet piled wall was not predicted to be prevented.

If the outlet structure described in the 1979 letter is indeed the outlet structure recommended by Structural Soils, and no other such outlets were constructed, following the sealing of the outlet there may be a resulting build-up of water within the landfills, with water 'pumped in' on each incoming tide faster than it is able to drain out until a pressure equilibrium is reached, i.e., the water level within the landfill may be kept artificially elevated, even at low tides.

3.5 Industrial Setting and Environmental Regulation

A Groundsure Enviro+Geo Insight report which provides information on the industrial setting of the Site was procured during the site selection process. The results of the database search, augmented with the findings of the historical mapping review, are summarised in Table 3.1 and discussed in the text that follows.

Table 3.1 Summary of Industrial Setting & Environmental Regulation

Data Type	Number on-site (1)	Number within 250 m of Site (1)
Waste Regulation		
Landfill Sites	0 (1)	0 (2)
Licensed Waste Management Facilities	0 (0)	2 (2)
Statutory Permits/Authorisations		
Pollution Prevention and Control(2)	0 (0)	0 (3)
Radioactive Substance Authorisations	0 (0)	0 (0)
Planning Hazardous Substances	0 (0)	0 (0)
COMAH(3) and NIHHS Sites(4)	0 (0)	0 (0)
Pollution Records and Contaminated Land		
Pollution Incidents (EA/NRW)	0	2
Regulated Discharge of List 1 and List 2 Dangerous Substances	0 (0)	0 (0)

Data Type	Number on-site (1)	Number within 250 m of Site (1)
Contaminated Land (5)	0	0
Potential Contaminative Uses		
Relevant Recent and Historical Industrial and Energy Land Uses	0 (0)	Multiple
Licensed Discharges to Controlled Waters	0 (0)	1 (3)
Fuel Stations and Historical Garages	0 (0)	0 (0)

Note: 1) Numbers in brackets denotes number of authorisations, licenses or permits that are lapsed, revoked, cancelled, superseded, defunct, surrendered, not applicable, inactive, withdrawn or not yet started.
2) Includes Integrated Pollution Controls, Integrated Pollution Prevention and Control, Local Authority Integrated Pollution Prevention and Control and Local Authority Pollution Prevention and Control permits.
3) COMAH denotes Control of Major Accident Hazards
4) NIHHS denotes Notification of Installations Handling Hazardous Substances
5) Sites determined as Contaminated Land under Part 2A of the Environmental Protection Act

Landfill Sites

As described above, the Site forms part of an historical landfill. This landfill also extends off-site to the south and west of the Site, within the confines of the bund wall constructed to retain the landfills in the 1960s. The landfill will be taken forwards in this assessment as a Potential Source of Contamination (PSC).

A further landfill (Land South of Budds Farm Sewage Works) is present approximately 250 m south-east (hydraulically downgradient) of the Site, separated from the Site by the Hermitage Stream and Langstone Harbour. This landfill (WRC ref: 1700/1304) is indicated to have received household waste. No information relating to operational dates or licences/permits and associated operators is provided within the EA's dataset. This landfill will not be taken forwards as a PSC on the basis of the significant distance from the Site and the presence of surface water bodies between the Site and the off-site landfill. It is considered highly unlikely that landfill gases from the off-site landfill would migrate downwards through the saturated strata beneath the stream and harbour, to emerge within the Site. It is anticipated that shallow groundwater within the superficial deposits would be in hydraulic connectivity with the adjacent surface water and therefore any leachate migrating within these deposits would be intercepted by the surface water before reaching the Site. Any contamination from the off-site landfill within the deeper chalk aquifer is unlikely to be migrating to the north-west as this would by hydraulically upgradient (noting tidal effects within the deeper aquifer are not anticipated).

Licenced Waste Management Facilities

Historically, a waste incinerator was present approximately 170 m east of the Site, in the land today occupied by a household waste recycling centre. The incinerator appears to have been constructed in the early 1980s and demolished by the late 1990s. During this time, it was operated under a waste management licence and subsequently an environmental permit (refs: EA/EPR/WP3792HZ/S002) which permitted the receipt of between 25,000 and 75,000 tonnes of household, commercial and industrial wastes.

Following the demolition of the incinerator, the land appears to have been redeveloped into the existing layout between 2011 and 2015 and used as a household waste recycling centre. The recycling centre was operated under a waste management licence and today is operated under an Environmental Permit (ref: WA/EPR/PP3198HX/S003).

A Waste Transfer Station is present on Harts Farm Way approximately 210 m east of the Site and appears to have been operational since the early 2000s, operating under waste management licences and subsequently an environmental permit (ref: EA/EPR/HB3505TQ/V002) which permits the transfer of 25,000 tonnes of wastes by UK Remediation Ltd.

A "*physical treatment facility*" appears to have been briefly operated between 2012 and 2018 on Harts Farm Way by Conroys Recycling Ltd, under environmental permit ref: EA/EPR/JB3936RC/S003 which permitted the treatment of up to 25,000 tonnes of waste.

On the basis that the nearest of these waste management sites is located approximately 170 m to the east and are all separated from the Site by the Hermitage Stream (i.e., contamination migrating within the superficial deposits would be intercepted before reaching the Site), these waste management sites will not be taken forwards for assessment as a PSC.

Pollution Prevention and Control

Three Integrated Pollution Controls are recorded within 250 m of the Site, all of which relate to the former incinerator to the east of the Site. The most recent IPC was revoked in 1997 prior to the demolition of the incinerator in the late 1990s. As discussed above, the incinerator will not be taken forwards for assessment as a PSC.

Pollution Incidents

There are no Category 1 or Category 2 pollution incidents recorded within 250 m of the Site. Two Category 4 pollution incidents are recorded within 250 m of the Site as follows:

- Approximately 170 m east within the former household waste recycling centre (now Highways England depot) in February 2002. Incident ref 57618 involving release of "*other general biodegradable material or waste*". EA classified as Category 4 (No Impact) in relation to impact to water and Category 3 (Minor) in relation to impact to land.
- Approximately 170 m east within the former household waste recycling centre (now Highways England depot) in October 2003. Incident ref 195271 involving release of "*commercial waste*". EA classified as Category 4 (No Impact) in relation to both land and water.

On the basis that both incidents occurred approximately 20 years ago and are only identified as impacting land (minor) these pollution incidents will not be taken forwards for assessment as a PSC.

Licenced Discharges to Controlled Waters

A single active discharge consent is present within 250 m of the Site under environmental permit ref: EPRGB3696VZ version 1, dated October 2017. This consent is located approximately 70m east of the Site and permits the release of final/treated effluent from the adjacent aggregates wharf to the Hermitage Stream. This consent appears to replace two earlier similar consents at the aggregates wharf, one for final/treated effluent and one for site drainage, both of which were revoked in 2017 and 2013, respectively.

Multiple historical discharges are present within 250 m of the Site, typically relating to discharge of final/treated sewage effluent, treated trade effluent or run-off to the Hermitage Stream.

Based on the nature and time since surrender/revocation of the historical discharges, it is considered unlikely that the historical discharges would represent an ongoing hazard to the Site and these are therefore not taken forwards for assessment as a PSC.

The nature of the active discharge consent and the fast-flowing watercourse are such that the consent is not anticipated to present a hazard to the Site, and it is therefore not taken forwards for assessment as a PSC. It is however recognised that there may be impacts to the off-site watercourse as a result of this off-site discharge.

Relevant Recent and Historical Industrial and Energy Land Uses

The following industrial/energy land uses have been identified within 250 m of the Site:

- Historical – Sewage works located approximately 50 m north of the Site. The works is first recorded on mapping dated 1930 and comprised two filter beds and a small series of tanks. By 1939 the works had been extended with two further filter beds and further tanks. By 1972 the works had been demolished.
- Historical – Incinerator located approximately 170 m east of the Site. The incinerator appears to have been constructed in the early 1980s and comprised a yard, incinerator building and a chimney. The incinerator appears to have been demolished by the late 1990s.
- Historical – Wider landfill site north of Harts Farm Way. The land to the south and west of the Site, to the south of the A27 is part of the wider landfill, part of which is within the Site.
- Current – Bedhampton Wharf. An aggregates processing wharf located approximately 70 m south-east of the Site that comprises minerals washing plant, storage bays and an electricity substation. Appears to have been constructed on reclaimed estuary land in the 1960s following the realignment of the Hermitage Stream
- Current – Basepoint Business Centre. A collection of small commercial businesses, including offices, catering suppliers, hot tub suppliers, farm machinery sales, electrical engineers etc. Constructed between 1999 and 2004 on previously greenfield land approximately 60 m east of the Site.
- Current – National Grid 132kV substation. First recorded on mapping dated 1968 approximately 220 m east of the Site.
- Current – Yard to the north of Basepoint Business Centre, approximately 40 m east of the Site. Yard appears to be used for storage of aggregates, plant and construction materials by a public works contractor. Constructed between 2016 and 2019 on previously greenfield land.
- Current – Household Waste Recycling Centre, approximately 170 m east of the Site. Following the demolition of the incinerator, the land appears to have been used as a household waste recycling centre, being subsequently redeveloped into the existing layout between 2011 and 2015.
- Current – Waste Transfer Station. Historical aerial imagery and permitting information suggest that a parcel of land approximately 210 m east of the Site, on the western edge of the electricity substation was parcelled off from the substation and extended to the west in 1999 / 2000 and was subsequently operated as a waste transfer station.
- Current – Gas Peaking Plant. A gas-fired peaking plant was constructed on the previously greenfield land approximately 140 m east of the Site, to the north of the household waste recycling centre in 2015 / 2016.

Of the potentially contaminative land uses identified above, only the land-uses located to the west of the Hermitage Stream (historical sewage works, wider Harts Farm Way landfill) have been taken forwards for assessment as potential PSCs on the basis that contamination migrating from these land uses would likely be intercepted by the Hermitage Stream prior to reaching the Site.

3.6 Permitting Context

The EA, Havant Borough Council and Hampshire County Council have been consulted to establish the context of the site in relation to any extant Waste Management Licences (WMLs) or Environmental Permits (EPs).

The EA has stated (**Appendix C**) that "*Given that it ceased active operation in 1987, I don't think it ever licenced/permitted by the Environment Agency, and was probably regulated by Hampshire County Council. As such I don't think we would have any waste licencing/permit files*".

The information provided by HBC does not indicate that a WML was issued, or if one was it does not appear to ever have been converted to an EP.

A further enquiry was made to Hampshire County Council (HCC) in relation to historical environmental management of the site. HCC's response (**Appendix C**) states that:

> "*The EA are correct to say that the site was never licensed or permitted by themselves and any activity from the mid-1970s would have been Licenced by the County Council (under the old Control of Pollution Act I think). However, that part of the County Council, the Waste Regulation Section, actually became the Environment Agency in 1996 (along with the old National Rivers Authority and HM Inspectorate of Pollution) and they took responsibility for the regulation and licencing/permitting of waste activities, and, consequently, took all the relevant files with them.*
>
> *From a Planning perspective this site has now been completed for such a long time that there are no outstanding planning requirements. In terms of Licences, as the EA commented there was no modern Permit for the site so no modern conditions or surrender requirements, so again I do not think there will be any outstanding matters*".

On this basis, it is considered that there is not an extant EP for the Site.

4 Environmental Setting

The following section considers the site setting and context, in terms of local and regional geology, hydrogeology, hydrology and site sensitivity.

4.1 Geological Setting

3.4.1 Published Geology

The British Geological Survey (BGS) geological map of the area (BGS Sheet 316 – Fareham, Solid and Drift, 1998) and the online Geology of Britain Viewer (BGS, 2023) have been reviewed. Additionally, the Groundsure Report contains geological mapping reproduced from the British Geological Survey (BGS) mapping.

A summary of the geological maps is discussed below.

Artificial Ground

BGS mapping indicates that Made Ground present across the entirety of the Site. This is consistent with the historical review and environmental searches which indicate that the Site is located within an historical (now restored) landfill.

Superficial Deposits

The BGS indicate that the whole of the Site is underlain by Raised Marine Deposits, described by the BGS as "*Gravel (shingle), sand, silt and clay; commonly charged with organic debris (plant and shell)*". The area shown as underlain by these deposits is coincident with the area within the bund constructed in the 1960s.

The land immediately north of the Site is shown to be underlain by River Terrace Deposits, described by the BGS as "*Sand and gravel, locally with lenses of silt, clay or peat*".

The land immediately east of the Site is shown to be underlain by Alluvium, described by the BGS as "*Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel*".

To the south of the bund constructed in the 1960s the land is shown to be underlain by Tidal Flat Deposits, described by the BGS as "*commonly silt and clay with sand and gravel layers*".

Solid Geology

The entire Site area is shown to be underlain entirely by the undifferentiated chalk deposits of the White Chalk Subgroup, described by the BGS as "*chalk with flints. With discrete marl seams, nodular chalk, sponge-rich and flint seams throughout*".

4.2 Hydrogeological Setting

The superficial Alluvium, and River Terrace Deposits are classified as Secondary A Aquifers[7].

The superficial Tidal Flat Deposits and Raised Marine Deposits are classified as Secondary Undifferentiated Aquifers[8].

The Chalk bedrock is classified as a Principal Aquifer[9].

The EA's Catchment Data Explorer indicates that the groundwater beneath the Site is part of the "*East Hants Chalk Water Body*" (EA, 2023). This water body received an Overall Water Framework Directive (WFD) classification of Poor in 2019. This can be further broken down to classifications of Poor for both quantitative supply and chemical quality.

Groundwater flow within the aquifers beneath the site is anticipated to be towards the south, following the topography and leading towards the English Channel immediately south of the site. Locally to the coastline there may be daily reversals in groundwater flow direction due to tidal influences.

The Site is not located within a groundwater Source Protection Zone (SPZ) (DEFRA, 2023). The nearest such zone, an SPZ 1, is located approximately 400 m to the north.

The Site is not located within a groundwater Drinking Water Safeguard Zone. Such a zone is present approximately 400 m north of the Site, coincident with the groundwater SPZ 1.

The Groundsure Report (Groundsure Ltd., 2021) records the presence of three licenced groundwater abstractions within 1.0 km of the Site. The nearest of these is an abstraction from groundwater for potable water supply by Portsmouth Water Ltd, located approximately 500 m north of the Site.

The Site is indicated (Groundsure Ltd., 2021) to be at High vulnerability[10] to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties within a single square kilometre.

The Site is located within groundwater Nitrate Vulnerable Zone (NVZ), Ref: 2 – Chichester, Langstone and Portsmouth Harbours Eutrophic NVZ.

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[7] Secondary A aquifers are defined by the Environment Agency (EA) as "*permeable layers that can support local water supplies and may form an important source of base flow to rivers*".

[8] Secondary Undifferentiated aquifers are applied by the EA "*where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. These have only a minor value*".

[9] Principal aquifers are defined by the EA as layers that "*provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands*". Such strata typically have high intergranular and/or fracture permeability capable of a high level of water storage.

[10] High vulnerability is defined by the EA as "*Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits*".

The Site is located within reclaimed former marine land where saline groundwater conditions are likely to be prevalent. It is therefore considered that potable abstraction is highly unlikely to be a future consideration and on this basis hydrogeology (resource) will not be taken forwards as a receptor for consideration in this assessment. This is consistent with the EA's view in an earlier consultation[11] where the EA stated, in regard to the chalk "*While it is notionally a principal aquifer, we recognise that given the site setting, it is unlikely to have significant resource potential*".

4.3 Hydrological Setting

The Hermitage Stream flows southwards immediately east of the Site towards Langstone Harbour. It is noted that this is not the original course of the stream, which was moved eastwards from its original position within the Site as part of land reclamation carried out in the 1960s.

The EA's Catchment Data Explorer (Environment Agency, 2023) indicates that the Hermitage Stream received a Water Framework Directive (WFD) classification of Moderate for Ecological Quality and Fail for chemical quality in 2019.

The Site is not located within a surface water Drinking Water Safeguard Zone (DEFRA, 2023).

The Groundsure Report (Groundsure, 2021) does not record the presence of licenced surface water abstractions within 1 km of the Site.

Several permitted discharges to controlled waters are present within 1 km of the Site. These relate principally to trade discharges and treated sewage effluent discharges (non-water company) from nearby industrial/commercial properties to either the Brockhampton Stream (a further nearby watercourse flowing into Langstone Harbour), the Hermitage Stream or Langstone Harbour, or to storm sewage overflow from Budds Farm WTW to Langstone Harbour.

Due to the presence of both Langstone Harbour approximately 200 m south of the Site, and the Hermitage Stream immediately adjacent to the east of the Site, surface water (biodiversity) will be taken forward in this assessment and will be considered a sensitive receptor.

On the basis that surface waters are not indicated to be utilised on or in the vicinity of the Site, surface water (resource) will not be taken forward as a receptor for consideration in this assessment.

4.4 Ecologically Sensitive Sites

The site is not located within 1.0 km of any National Nature Reserve (NNR) or designated area of ancient woodland.

Langstone Harbour, located approximately 200 m south of the Site is a tidal inlet of the English Channel. Langstone Harbour is a designated Site of Special Scientific Interest (SSSI), Special Area of Conservation

[11] Email from Tom Wickens (EA) to David Jackson (DS) dated 12th January 2021

(SAC), Special Protection Area (SPA), a wetland of international importance designated under the Ramsar Convention and a WFD safeguarded Groundwater Dependent Terrestrial Ecosystem (GWDTE) (DEFRA, 2023).

A local nature reserve (Southmoor Nature Reserve) is present approximately 780 m south-east of the Site. A further local nature reserve (Farlington Marshes) is located approximately 900 m west of the Site.

Due to the nearby presence of the SSSI, SAC, SPA, GWDTE and Ramsar Site ecologically sensitive sites will be taken forward and considered as a plausible receptor in this assessment.

4.5 Geological Designations

Geodiversity can be defined as "*The natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (landforms, topography, physical processes), soil and hydrological features. It includes their assemblages, structures, systems and contributions to landscapes*" (Gray, 2019). These protected sites include geological sites of SSSIs, NNRs and Regionally Important Geological and Geomorphological Sites (RIGS) also known as Local Geology Sites.

DEFRA's MAGIC (DEFRA, 2023) indicates that the Site is not located within 1.0 km of any geologically designated SSSI.

Information relating to Regionally Important Geological Sites (RIGS) in Hampshire[12] is held by the Hampshire Biodiversity Information Centre (HBIC). During a telephone conversation with HBIC it was confirmed that of the five RIGS in Hampshire, none are located within 1.0 km of the Site.

On this basis geodiversity will not be taken forward as a receptor for consideration in this assessment.

4.6 Archaeological Setting and Buildings

A preliminary appraisal of readily available sources of information has been undertaken to determine whether archaeological settings and property requires consideration within the ground condition assessment. It should be noted the statement regarding the archaeological setting does not purport to be an archaeological risk assessment which would require a separate commission.

The Historic England website (Historic England, 2023), UNESCO world heritage interactive map (UNESCO, 2023) and National Association for Areas of Outstanding Natural Beauty website (AONB, 2023) have been reviewed and pertinent features are noted below:

- A single listed structure is present within 250 m of the Site boundary. The Old Mill House is located approximately 190 m north-east of the Site.
- There are no Areas of Outstanding Natural Beauty, scheduled monuments, registered parks and gardens, world heritage sites or conservation areas located on or within 500 m the site.

[12] Havant Borough Council's Biodiversity Action Plan (2011) states that RIGS are equivalent to Sites of Importance for Nature Conservation

On the basis that a heritage receptor has been identified approximately 190 m to the north of the Site, Property (buildings) and archaeological receptors will be taken forwards in this assessment as a receptor for consideration. Old Mill House is located adjacent to the tidal Hermitage Stream, and it is considered that upgradient migration of contamination via tidal action and migration of landfill gases are the only credible pathways by which this property could be affected.

5 Tier 1 Preliminary Risk Assessment (Land Contamination)

5.1 Approach and Outline Conceptual Model

The land contamination risk assessment presented in this section is a Tier 1 Preliminary Risk Assessment (PRA). A summary of the guidance for the assessment of land contamination and the approach developed and adopted is presented in **Appendix A**.

A conceptual model identifies the types and locations of potential contamination sources, the identification of potential receptors and the identification of potential transport/migration pathways. The guidance requires a risk assessment to include the following steps:

- Identify the hazard - establish contaminant sources.
- Assess the hazard - use a source-pathway-receptor (S-P-R) pollutant linkage approach to find out if there is the potential for unacceptable risk.
- Estimate the risk - predict what degree of harm or pollution might result and how likely it is to occur.
- Evaluate the risk - decide whether a risk is unacceptable.

The findings for each step are summarised in the following subsections.

The underlying principle is the evaluation of *pollutant linkages* in order to assess whether the presence of a source of contamination could potentially lead to harmful consequences. A pollutant linkage consists of the following three elements:

- A source of contamination or hazard that has the potential to cause harm or pollution.
- A pathway for the hazard to move along / generate exposure; and
- A receptor which is affected by the hazard.

Each tier of risk assessment comprises the following four stages:

- Hazard Identification – identifying potential contaminant sources on and off site.
- Hazard Assessment – assessing the potential for unacceptable risks by identifying what pathways and receptors could be present, and what pollutant linkages could result (forming the Conceptual Site Model (CSM)).
- Risk Estimation – estimating the magnitude and probability of the possible consequences (what degree of harm might result to a defined receptor and how likely); and
- Risk Evaluation – evaluating whether the risk needs to be, and can be, managed.

5.2 Identification of Potential Sources of Contamination

The on-site and off-site Potential Sources of Contamination (PSCs) identified and associated potential contaminants of concern (PCOC) are presented in **Table 5.1**.

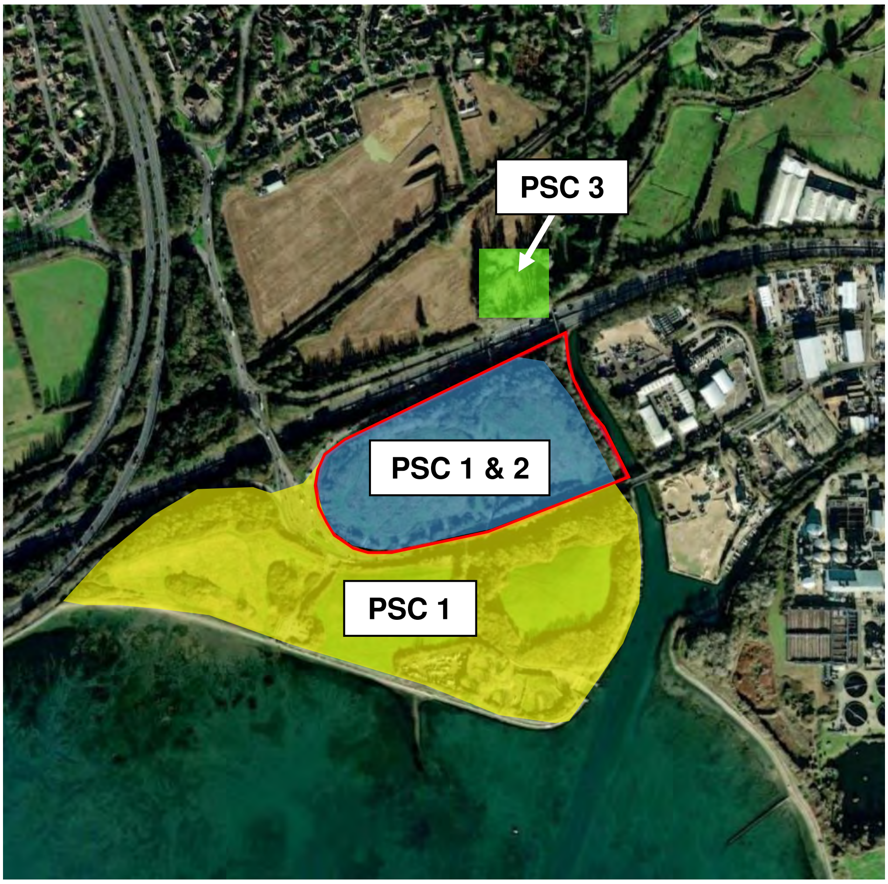
The potential contaminants identified for each land use are derived based on professional judgement and reference to published guidance. The nature of the land-use has been used to assign a hazard classification score indicating the potential contamination level.

Off-Site potential sources of contamination such as the nearby former incinerator, depots, electricity substation, household waste recycling centre, Budds Farm WWTW etc., have not been included in this assessment as the Site's historical use as a domestic, commercial and industrial waste landfill is considered likely to overwhelm any contamination migrating from the off-site sources.

Table 5.1 - Potential Sources of Contamination

PSC Reference	Description	Potential Contaminants of Concern (PCOC)
1	Landfill waste within former (now closed and restored) landfill that received domestic, commercial, and industrial wastes between 1969 and 1987 before being restored to grassland. PSC is both an on-Site and off-Site source.	Landfill leachate containing elevated concentrations of inorganic compounds including ammoniacal nitrogen. The landfill waste mass could include a variety of materials, with PCOC including asbestos, metals and metalloids, hydrocarbons (total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAHs), volatile and semi-volatile organic compounds (VOCs and SVOCs), poly- and per-fluoroalkyl substances (PFAS). Whilst there is potential for hydrocarbons present within the fill to migrate via the groundwater to the adjacent surface waters, there is no evidence to date that this is the case (e.g., hydrocarbon plumes have not been recorded). Landfill gases (methane, carbon dioxide, hydrogen sulphide, carbon monoxide, depleted oxygen concentrations)
2	Made Ground (restoration soils and soils imported to the western half of the Site in the late 1990s as part of land raising works to create playing fields. On-Site source.	Asbestos, metals, and metalloids, TPH, PAHs.
3	Former sewage works located approximately 50 m north of the Site. Constructed by 1930, demolished by 1972. Comprised four filter beds and a row of tanks. Off-Site source.	Metals, TPH, PAHs, VOCs, SVOCs, pathogens, phenols, ammonia, asbestos, cyanide, PFAS and ground gas (from infilled former tanks).

Figure 5.1 PSC Location Plan



5.3 Identification of Potential Pathways

To determine whether the identified hazards pose a risk it is necessary to identify the presence of potential receptors and pathways by which these receptors can be exposed to the hazard.

Potential hazards require a pathway connecting the source (if present) to potential receptors to impact upon the receptors. These pathways are capable of conveying the potential contaminants identified. Pathways may be anthropogenic (artificial) or natural.

Anthropogenic pathways are artificial routes capable of conveying contaminants and include such routes as surface water drains, high permeability backfill materials, poorly consolidated Made Ground, mine workings, mining induced fissures from subsidence, foundations, and persons disturbing contamination sources in such a way as to liberate contaminants.

Natural pathways are naturally occurring routes capable of conveying contaminants such as permeable strata, fractures and fissures, wind-blown material etc.

The pathways considered relevant to this assessment are described in Table 5.2.

Table 5.2 - Relevant Pathways

Receptor	Details
Human health	Ingestion of soil / dust indoors, e.g., in site cabins or in completed structures
	Ingestion of soil / dust outdoors
	Inhalation of particles (dust / soil) – outdoor
	Inhalation of particles (dust / soil) – indoor
	Vapours – outdoor – migration via natural or anthropogenic pathways
	Vapours – indoor – migration via natural or anthropogenic pathways
	Dermal absorption via direct contact with soil
Groundwater	Groundwater within permeable natural strata as a pathway allowing migration of mobile contamination leached from contaminated soils.
	Groundwater migrating via anthropogenic routes e.g., boreholes, landfill waste mass etc.
Surface Water	Runoff or discharges to surface water via existing drainage network, e.g., historical land drains, highway drainage
	Recharge of surface water via contaminated groundwater
	Deposition of wind-blown dust
Buildings	Direct contact – Sulphate attack on concrete, hydrocarbon corrosion / permeation of plastic pipes
	Migration of gases / vapours through permeable natural strata, fissures or fractures etc. Migration of gases / vapours through permeable backfill materials, buried service corridors, cracks in floor slabs.
Ecologically Sensitive Sites	Runoff or discharges to surface water via existing drainage network, e.g., historical land drains, highway drainage.
	Deposition of wind-blown dust
	Recharge of surface water via contaminated groundwater

5.4 Receptor Identification

Potential receptors identified by this assessment are presented in Table 5.3. Receptors are identified at the baseline phase (i.e., the current situation, pre-construction), the construction phase of the development, and the operational phase of the development.

Table 5.3 - Potential Receptors

Receptor	Comment
Human Health – On-site	Baseline – Not Applicable. Site is vacant with no public footpaths. Construction – Ground workers constructing the proposed development. Operation – Workers at proposed WRP. Maintenance workers undertaking in-ground works.
Human Health – Off-site	Baseline, Construction and Operation – Workers at adjacent business park, yard, aggregates wharf etc.
Groundwater (resource)	Baseline, Construction and Operation – Eliminated. Potable abstractions have not been identified within 250 m of the Site. The Site is located within reclaimed former marine land where saline groundwater

Receptor	Comment
	conditions are likely to be prevalent and potable abstraction is unlikely to be viable.
Groundwater (biodiversity)	Baseline, Construction and Operation – The EA's Catchment Data Explorer indicates that the groundwater beneath the Site received an WFD classification of Poor in 2019 for chemical quality.
Surface Water (resource)	Baseline, Construction and Operation – Eliminated. Surface water abstractions have not been identified within 250 m of the Site. Both Langstone Harbour and Hermitage Stream are tidal (saline).
Surface Water (biodiversity)	Baseline, Construction and Operation - The Hermitage Stream received a WFD classification of Moderate for Ecological Quality in 2019.
Ecologically Sensitive Sites	Baseline, Construction and Operation - Langstone Harbour, is a designated SSSI, SAC, SPA, wetland of international importance designated under the Ramsar Convention and a WFD safeguarded Groundwater Dependent Terrestrial Ecosystem (GWDTE).
Geodiversity	The site is not located within 1.0 km of any geologically designated SSSI or geologically designated Local Site (RIGS).
Property – Buildings	A single listed structure (Old Mill House) is present, approximately 190 m north (i.e., hydraulically upgradient) of the Site. It is considered highly unlikely that this property would experience any impacts due to the construction of the proposed development, e.g., migration of contamination. A safeguarded mineral wharf is present approximately 100 m east of the Site. Assorted commercial properties and a gas peaking plant are also present within 250 m of the Site. Archaeological receptors, e.g., scheduled monuments etc., have not been identified within 500 m of the Site.

5.5 Risk Estimation

When there is a pollutant linkage (and therefore some measure of risk) it is necessary to determine whether the risk matters and therefore whether further action is required.

Risk estimation involves predicting the likely consequence (what degree of harm the receptor might suffer) and the probability that the consequences will arise (how likely the outcome is given the likely scale of contamination and the probability of exposure).

Preliminary risk estimation is based on the evaluation of publicly available data (which has been summarised and presented in this report).

Based on the current and known historical land uses, the Site has been assigned a score 4 out of 5 for the potential for generating contamination (as defined in Table 1 of **Appendix A**), as follows:

The estimated risk for each of the receptors is summarised in **Table 5.4.** This should be read in conjunction with the tables in **Appendix D** which set out the classification of risk which is a combination of consequence and probability for each potential pollutant linkage identified for the sources in **Table 5.2**. Definitions for probability and consequence are in Table 4 and Table 5 of **Appendix A** (respectively).

Table 2.4 - Summary of Estimated Risk (Preliminary Risk Assessment

Receptor	Baseline	Construction (without Mitigation)	Completed Development (without Mitigation)
Human Health – On-Site	Not Applicable	Very High	Very High
Human Health – Off-Site	Low	High	High
Groundwater (resource)	Moderate	Moderate	Moderate
Groundwater (biodiversity)	High	High	High
Surface Water (resource)	Not Applicable	Not Applicable	Not Applicable
Surface Water (biodiversity)	Very High	Very High	Very High
Ecologically Sensitive Sites	Moderate	Moderate	Moderate
Geodiversity	Not Applicable	Not Applicable	Not Applicable
Property – Buildings and Archaeology	Low / Moderate	High	High

5.6 Risk Evaluation

The potential for the above sources of potential contamination to affect receptors (human health, surface water, ecology, buildings) has been assessed during each phase of the development (baseline, construction phase, operational phase) and a number of plausible pollutant linkages have been identified with potentially unacceptable risk associated with each. It should be noted that the risks above have been determined in the absence of any mitigation measures.

It should also be noted that the assessed risks to groundwater, surface water and terrestrial ecology are a result of the Site's use as a 'dilute and disperse' landfill which, by design, releases landfill leachate to the groundwater and the spread of contamination from the site is "working as intended". This would of course be unacceptable in the construction of a new landfill but was common and accepted practice at the time the landfill within the Site was filled.

Additional commentary is provided below relating to the potential for readily available risk mitigation measures, before the report progresses to a review of the geo-environmental conditions recorded during the ground investigation and the refinement of the Conceptual Site Model that can be undertaken as a result.

Possible pollutant linkages are determined using professional judgement. If a linkage is considered plausible with some associated risk, even if estimated to be low, it is considered that this represents a potentially 'unacceptable risk' and therefore requires further consideration.

- For risks assessed as **Low** it is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would normally be mild.
- For risks assessed as **Moderate** it is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer-term.
- For risks assessed as **High** harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short-term and are likely over the longer-term.
- For risks assessed as **Very High** there is a high probability that severe harm could arise to a designated receptor from an identified hazard. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation is likely to be required in the short term.

5.7 Risk Reduction

Risk reduction can be achieved through implementation of remediation or mitigation measures or through further tiers of assessment following collection of site-specific data. Mitigation might comprise removal of the source as well as managing the pathway.

Construction Phase

Human Health

The **High** to **Very High** assessed risks to Human Health during the construction phase are principally driven by the increased exposure to soils during construction works and the associated possibility of the dermal contact and inhalation / ingestion pathways being realised. During the construction phase, mitigation measures to limit the risk to site workers and neighbours from any potential contaminants in the ground will be implemented. Specification of appropriate measures will be the responsibility of the Principal Contractor and should be based on understanding of the site-specific assessments contained in this report and subsequent recommended assessments.

There are considered to be readily available solutions for the management of the exposure pathways including, but not limited to:

- Informing the site workers of potential contamination on the site and the potential health effects from exposure through site induction and ‘tool box talks’.
- Methods of dust control and selection of appropriate methods of working to limit the potential for air-borne dust to arise associated with the excavation and disturbance of the soils present on the site.
- An emergency / contingency plan for dealing with unexpected exposure of contamination (including asbestos) during the works should be agree prior to commencement.
- Operational good practice (PPE, hygiene facilities, safe methods of work).

Surface Water, Groundwater and Ecologically Sensitive Sites

The **Moderate** to **Very High** assessed risks to surface water, groundwater and ecologically sensitive sites during the construction phase mirror those assessed at the baseline phase on the basis that the probability of the pollutant linkage being realised is already at the maximum assessed level (High) at baseline due to the Site's historical use as a dilute and disperse landfill.

It is however recognised that construction works could influence the proportion of precipitation that infiltrates into the landfill, and the rate at which the infiltration occurs, e.g., through the removal of any cover soils as part of any cut/fill works.

In addition, the potential for new sources of contamination such as leaks or spills of fuels etc., within a contractor's compound is introduced during the construction phase.

There are considered to be readily available solutions for the management of the exposure pathways including:

- Planning of works phasing to reduce and manage the amount of exposed soils at any given time.
- Appropriate measures could be included in the Construction Environmental Management Plan (CEMP) for the development, such as:
  - The use of a Soil Management Plan and a Materials Management Plan to control the on-Site use of soils. These could include requirements to locate stockpiles of contaminated soils away from watercourses, either cover stockpiles of contaminated soils or place the stockpiles within bunded areas and pump any potentially contaminated perched water from excavations for off-site treatment and disposal.
- The use of bunded fuel storage and the maintenance and use of spill kits.

Whilst the adoption of above are unlikely to provide mitigation against the long-term migration of landfill leachate from the site and the surrounding area, it will provide mitigation against the factors within the developer's control during the construction phase.

Construction Phase – Property

The **High** risk to property identified at the construction phase is principally driven by the potential for the migration of landfill gases from the Site.

Whilst the contractor's compound will likely include site cabins, these are typically temporary and are elevated above the ground surface either on blocks or 'legs', providing a ventilated void space and mitigating against the build-up of gases within the cabins. Storage containers may also be used on the Site, however these are not 'air-tight' and will usually be opened every day, preventing the build-up of gases during construction works.

It is not considered that the risks to off-site properties from migrating landfill gases will be altered during the construction phase as it is likely that the majority of gases will likely vent to the surface through the cover soils as is anticipated to be the baseline situation.

Operational Phase

Surface Water, Groundwater and Ecologically Sensitive Sites

The **Moderate** to **Very High** assessed risks to surface water, groundwater and ecologically sensitive sites during the operational phase are similar to those assessed at the baseline phase. A reduction in the probability of the relevant contaminant linkages being realised has been applied on the basis that the construction of impermeable built environment across the site (buildings, infrastructure, roads, yards etc.) and the design of the drainage to capture and treat run-off will result in a reduction in infiltration through the landfill surface and a corresponding reduction in the generation of leachate within the landfill.

Operational Phase – Property

The assessed during the operational phases is principally driven by the construction of new structures within the site, rather than an increase in the level of risk experienced by the off-site receptors (e.g., listed buildings, commercial properties etc.).

There are readily available mitigation measures such as the inclusion of gas protection measures in new enclosed structures.

6 Ground Conditions

6.1 General

The ground conditions at the Site, as revealed by the ground investigations undertaken by White Young Green (White Young Green, 2017), Delta Simons (Delta Simons, 2022) and SOCOTEC (SOCOTEC, 2023), comprise the following which are described in more detail below:

- Cover soils (restoration materials comprising inert waste).
- Domestic and commercial landfill wastes.
- Superficial deposits comprising Alluvium and River Terrace / Raised Marine Deposits.
- Chalk bedrock.

The locations of the exploratory holes undertaken as part of the ground investigations undertaken by others are presented on Figures 3a and 3b.

6.2 West 'Cell'

The exploratory holes considered to be in the west 'cell' (on the basis of the landfill waste type recorded – see below) are Delta Simons (2021) exploratory holes RO101, RO102, RO103, RO107, RO108 and TP101 to TP106, White Young Green (2017) exploratory holes CP01, CP02, CP04, CP05, TP01 to TP04, TP07 and WS01 to WS07 and SOCOTEC (2022) exploratory hole BHRP02.

A summary of the ground conditions encountered in the west 'cell' is presented in the table below:

Table 3 - Summary of Ground Conditions Encountered - West 'Cell'

Stratum	Depth to Top (m bgl)	Depth to Bottom (m bgl)	Thickness (m)	Typical Description
Cover Soils	Ground Level	1.3 to 3.5. Typically, between 2.0 and 3.0.	1.5 to 3.5	A limited thickness of TOPSOIL, overlying: Soft to firm, light grey to dark grey to brown slightly sandy to sandy variably gravelly CLAY with a low cobble content. Gravel is fine to coarse, subrounded to angular of brick, concrete, sandstone, chalk, limestone, and flint, rarely with pieces of plastic and clinker. Cobbles are brick and concrete. Occasional organic odour.
Landfill Waste	1.3 to 3.5	8.2 to 11.5 (Where full thickness proved)	4.7 to 9.0 (Where full thickness proved)	Landfill waste comprising glass, paper, wood, plastic, metal, brick, concrete, occasional fabric, rubber, ceramics, ash, and sponge and rarely carpet and steel in a matrix of very soft to soft, black slightly sandy, slightly gravelly clay or grey silty sand. Tyres recorded in TP105 and TP106. Matrix proportion varies from 95% to 10%. 'Waste' odour commonly recorded, occasional hydrocarbon odour.

Stratum	Depth to Top (m bgl)	Depth to Bottom (m bgl)	Thickness (m)	Typical Description
Alluvium	8.2 to 10.7	11.1 to 13.0 (Where full thickness proved)	0.4 to 3.5 (Where full thickness proved)	Encountered in RO101, RO107, CP02A, CP04 only. Soft to very soft brown and mottled grey, occasionally gravelly SILT. Gravel is subangular to rounded, fine to medium of chalk.
River Terrace / Raised Marine Deposits	8.9 to 11.5	11.1 to 13.0 (Where full thickness proved)	1.6 to 3.3 (Where full thickness proved)	Encountered in RO102, RO103, RO108 and CP01 only. Yellowish-brown to orangish-brown, sandy to slightly sandy and occasionally slightly clayey angular to subangular fine to medium GRAVEL of flint.
Lewes Nodular Chalk Formation	11.1 to 13.0	Proved to a maximum of 35.0 in CP01 and CPO2A	Proved to a maximum of 22.0 in CP01 andCP02A	Encountered in all exploratory holes where the full thickness of superficial deposits was proved. recovered as gravel or silt of cream to white, very weak to weak, low to medium density structureless CHALK. With occasional fine to coarse subrounded flints. Typically grades Dm to Dc, becoming C2 – B2 with depth.

Table 4 - Summary of Groundwater / Leachate Strikes and Spot Monitoring Records - West 'Cell'

Exploratory Hole	Strike During Drilling – Depth and Elevation	Stratum Within Which Strike Was Recorded	Spot Monitoring – Depth and Elevation
RO101*	11.50 m bgl -0.47 m AOD	Chalk	(Shallow response zone in waste) 7.93 to 8.25 m bgl 2.78 to 3.10 m AOD (Deep response zone in chalk) 7.57 to 8.15 m bgl 1.89 to 2.47 m AOD
RO102*	1.00 m bgl 9.04 m AOD	Cover Soils	(Shallow response zone in waste) 7.25 to 7.95 m bgl 2.50 to 3.20 m AOD (Deep response zone in chalk) 8.38 to 8.40 m bgl 2.48 to 2.50 m AOD
	9.00 m bgl 1.04 m AOD	River Terrace Deposits	
RO103*	7.60 m bgl 2.85 m AOD	Landfill Waste	(Shallow response zone in waste) 2.54 to 8.50 m bgl 1.89 to 7.85 m AOD (Deep response zone in chalk) 10.54 to 11.05 m bgl 1.63 to 2.14 m AOD

Exploratory Hole	Strike During Drilling – Depth and Elevation	Stratum Within Which Strike Was Recorded	Spot Monitoring – Depth and Elevation
RO107*	No groundwater strike	n/a	(Deep response zone in chalk) 9.57 to 9.72 m bgl 1.02 to 1.17 m AOD
RO108*	No groundwater strike	n/a	(Deep response zone in chalk) 7.43 to 7.94 m bgl 1.06 to 1.57 m AOD
TP104*	1.80 m bgl 8.19 m AOD	Cover Soils	n/a
CP01**	11.5 m bgl -0.96 m AOD	Landfill Waste / River Terrace Deposits boundary	(Shallow response zone in waste) 7.07 to 8.02 m bgl 2.52 to 2.87 m AOD (Deep response zone in chalk) 8.56 to 9.29 m bgl 1.25 to 1.98 m AOD
CP02A**	9.6 m bgl 1.19 m AOD	Alluvium	(Shallow response zone in waste) 7.98 to 8.79 m bgl 2.00 to 2.81 m AOD (Deep response zone in chalk) 9.25 to 9.54 m bgl 1.25 to 1.54 m AOD
CP04**	6.30 m bgl 5.22 m AOD	Landfill Waste	n/a
CP05**	5.90 m bgl 3.66 m AOD	Landfill Waste	(Shallow response zone in waste) 6.72 to 7.63 m bgl 1.93 to 2.84 m AOD
BHRP02***	8.5 m bgl 1.77 m AOD	Landfill Waste	(Deep response zone in chalk) 7.46 to 9.32 m bgl 0.94 to 2.81 m AOD

* = Delta Simons 2021 exploratory hole

** = White Young Green, 2017, exploratory hole

*** = SOCOTEC, 2022, exploratory hole

Groundwater levels in RO101, RO108 and BHRP02 were also monitored with a datalogger / continuous gas monitoring equipment across several tidal cycles, as summarised in the table below.

Table 6.3 - Summary of Groundwater Datalogger Levels – West 'Cell'

Exploratory Hole	Maximum Groundwater Elevation (m AOD)	Minimum Groundwater Elevation (m AOD)	Average Tidal Range (m)
RO101 (S)	1.935	0.343	1.0
RO108	2.207	0.728	1.3

It is evident from measurements recorded in RO101 in the north-western corner of the western cell, and RO108 in the south-eastern corner of the western cell, that groundwater within the west 'cell' is tidally influenced across its entire area.

The water levels recorded in the boreholes screened within the waste mass may represent individual perched bodies of groundwater or landfill leachate. The water / leachate levels recorded appear to be broadly consistent, typically between 2.0 and 3.0 m bgl, suggesting that there may be a degree of interconnectedness between individual perches or that a wider groundwater / leachate table is present at this level.

Cover Soils – Comments

Given that the cover soils contain a large proportion of granular material it is considered unlikely that they are functioning as a typical landfill 'cap', i.e., the cover is likely to be permeable, allowing both precipitation to infiltrate into the waste mass and landfill gases to escape the waste mass.

Landfill Waste – Contact with Leachate / Groundwater

The 'groundwater' recorded within the cover soils is likely to be perched water within more permeable, granular layers and is unlikely to represent a laterally consistent water table.

Groundwater / leachate levels within the waste in the west cell have been recorded between mAOD 0.34 and 2.85 m AOD, the groundwater appears to be tidally influenced with a tidal range of up to 1.30 m. The elevation of the base of the waste deposit in the western cell (where the full thickness of the waste mass was proved) is between -1.94 and 3.32 m AOD. This indicates that base of the waste mass is likely to be in contact with groundwater.

Landfill Waste – Provenance

DS, 2022 state that the waste in the western cell "comprised less common household items and notably more 'industrial' items including large tyres, wood, metal, and large-scale deposits of metal baby-powder containers. No 'black bag' waste or intact newspapers etc. were encountered within the west cell". Whilst the logs do not convey the prevalence of larger 'industrial' items, and photos from the west cell trial pits have not been provided, Stantec recognise that DS, having logged the wastes, will have a more nuanced assessment of the potential waste provenance than we can gain from logs and photographs alone, and in this regard, we accept their assessment.

WYG encountered a newspaper dated 1976 in the west cell. DS suggest that "the west cell was active during the 1970s and the east cell was filled until the 1980s". Whilst the historical aerial photographs in the University of Cambridge archive are undated, they do suggest that filling and restoration of the western cell was completed whilst filling of the eastern cell was ongoing.

Landfill Waste - Extent

Whilst the depth of fill within the landfill have been investigated, the extent of the fill is unknown, i.e., no exploratory holes have been undertaken outside of the waste mass.

The historical aerial photographs and 2020 topographical survey appear to indicate that the waste mass may extend northwards up to the embankment of the A27 slip road, westwards and southwards to the Harts Farm Way embankment, and eastwards to the eastern 'cell'.

There does not appear to be any structure separating the eastern and western cells. In reality the landfill can be considered as a single waste mass, with the western half and eastern half containing different waste types.

The vegetation along the boundaries appears to have established after filling, restoration and subsequent land-raising was completed.

6.3 East 'Cell'

The exploratory holes considered to be in the east 'cell' (on the basis of the landfill waste type recorded – see below) are SOCOTEC (2022) exploratory holes BHW001, BHW002, BHRP01, Delta Simons (2021) exploratory holes RO104, RO105, RO106, RO109, TP107 to TP120, DS101 to DS103 and White Young Green (2017) exploratory holes CP03, CP06, WS08 to WS10, TP05, TP06, TP08 and TP09

A summary the ground conditions encountered in the east 'cell' is presented in the table below:

Table 6.4 - Summary of Ground Conditions Encountered - East 'Cell'

Stratum	Depth to Top (m bgl)	Depth to Bottom (m bgl)	Thickness (m)	Typical Description
Cover Soils	Ground Level	0.9 to >4.0. Typically between 0.9 and 1.5.	0.9 to >4.0. Typically between 0.9 and 1.5.	Encountered in all exploratory holes except TP05 (WYG). A limited thickness of TOPSOIL, overlying layers of… Soft to firm brown to orangish brown slightly sandy and occasionally slightly gravelly CLAY. Gravel is subrounded to subangular, fine to coarse of "*natural lithologies*", sandstone, chalk, limestone, flint and brick, rarely with fragments of glass. Greenish brown to yellowish brown, gravelly fine to coarse SAND. Gravel is fine to coarse of brick, flint, limestone Potential Asbestos Containing Material (ACM) fragment noted in RO104 between 0.0 m and 0.39 m bgl.
Landfill Waste	0.0 to 4.0	8.2 to 16.65 (Where full thickness proved)	6.8 to 15.15 (Where full thickness proved)	Typically, paper, plastic, wood, glass, ceramics, Styrofoam, textiles, newspaper (1986), cardboard, with occasional "*organic material*", wool, metal, aluminium, concrete, leather, "*possible animal fur*" and rarely with brick and ash, carpet, rubber, cobbles of concrete. Within a matrix of very soft to soft, dark grey to black slightly sandy, slightly gravelly clay or grey silty sand. Matrix proportion varies from 10% to 90%. 'Waste' odour commonly recorded, occasional solvent and hydrocarbon odour
Alluvium / River Terrace /	8.2 to 10.7	10.5 to 14.0	0.9 to 5.8 (Where full	Encountered in RO104, RO105, RO109, CP03, CP06, DS101, DS102 and DS103 only.

Stratum	Depth to Top (m bgl)	Depth to Bottom (m bgl)	Thickness (m)	Typical Description
Raised Marine Deposits		(Where full thickness proved)	thickness proved)	Medium dense to dense brown to cream sandy, slightly clayey subangular to angular, fine to coarse GRAVEL of flint and occasional chalk.
Lewes Nodular Chalk Formation	10.5 to 16.6	Proved to a maximum of 65.25 in BHRP01	Proved to a maximum of 48.6 in BHRP01	Encountered in all exploratory holes where the full thickness of superficial deposits was proved. recovered as gravel or silt of cream to white, very weak to weak, low to medium density structureless CHALK. With occasional fine to coarse subrounded flints. Typically grades Dm to Dc increasing to B3 to C3 with depth.

Table 6.5 - Summary of Groundwater / Leachate Strikes and Spot Monitoring Records – East 'Cell'

Exploratory Hole	Strike During Drilling – Date, Depth and Elevation	Stratum Within Which Strike Was Recorded	Spot Monitoring – Depth and Elevation
TP09**	10/05/2017 3.9 m bgl 4.27 m AOD	Landfill Waste	n/a
RO104*	No strike recorded	n/a	(Shallow response zone in waste) 8.78 to 9.92 m bgl 1.11 to 2.25 m AOD
RO105*	09/03/2021 2.5 m bgl (fast inflow) 7.89 m AOD	Landfill Waste	(Shallow response zone in waste) 8.72 to 9.6 m bgl 0.76 to 1.73 mAOD
	09/03/2021 17.00 m bgl (fast inflow) - 6.61 m AOD	Chalk	(Deep response zone in chalk) 9.32 to 9.63 m bgl 1.25 to 1.56 m AOD
RO106*	No strike recorded	n/a	(Shallow response zone in waste) 8.72 to 9.70 m bgl 0.69 to 1.67 m AOD
RO109*	No strike recorded	n/a	8.71 to 8.84 m bgl 0.95 to 1.08 m AOD
TP112*	31/03/2021 3.50 m bgl 5.44 m AOD	Landfill Waste	n/a
TP117*	31/03/2021 2.4 m bgl (fast inflow) 7.91 m AOD	Landfill Waste	n/a
TP119*	01/04/2021 2.75 m bgl 6.63 m AOD	Landfill Waste	n/a
CP03**	09/05/2023 10.5 m bgl -1.83 m AOD	Landfill Waste	5.19 to 7.34 m bgl 1.33 to 3.48 m AOD
CP06**	11/05/2017	Landfill Waste	n/a

Exploratory Hole	Strike During Drilling – Date, Depth and Elevation	Stratum Within Which Strike Was Recorded	Spot Monitoring – Depth and Elevation
	4.3 m bgl 8.1 m AOD		
DS101*	No strike recorded	n/a	8.36 to 8.84 m bgl 0.58 to 1.06 m AOD
DS102*	No strike recorded	n/a	9.25 to 9.73 m bgl 1.12 to 1.60 m AOD
DS103*	No strike recorded	n/a	8.10 to 9.10 m bgl 0.82 to 1.82 m AOD
BHRP01***	08/11/2022 13.60 m bgl -0.20 m AOD	Landfill Waste	10.58 to 12.02 m bgl 1.38 to 2.82 m AOD
BHW001***	20/07/2022 7.20 m bgl 0.92 m AOD	Landfill Waste	5.75 to 6.98 m bgl 1.14 to 2.37 m AOD
BHW002***	22/07/2022 7.30 m bgl 1.13 m AOD	Landfill Waste	6.41 to 7.20 m bgl 1.23 to 2.02 m AOD

* = Delta Simons 2021 exploratory hole

** = White Young Green, 2017, exploratory hole

*** = SOCOTEC, 2022, exploratory hole

Groundwater levels in DS101, DS103, RO105 and RO109 were monitored with a datalogger or continuous gas monitoring equipment (which also recorded water levels) across several tidal cycles, as summarised in the table below.

Table 6.6 - Summary of Groundwater Datalogger Levels – East Cell

Exploratory Hole and Monitoring Period	Minimum Groundwater Elevation (m AOD)	Maximum Groundwater Elevation (m AOD)	Average Tidal Range (m)
RO105 (D) 22/03/21 to 19/04/21	2.473	1.031	1.30
RO109 22/03/21 to 19/05/21	2.129	0.528	1.50
DS101 19/04/21 to 19/05/21	1.836	0.725	0.90
DS103 19/04/21 to 19/05/21	1.009	0.657	0.10
RO104 (S) 23/03/21 to 19/05/21	2.840	2.820	N/A – Not tidally influenced
RO105 (S) 23/03/21 to 19/05/21	5.470	4.740	0.16
RO106 (S) 23/03/21 to 19/05/21	2.500	2.150	0.07

It is evident from the table above that groundwater within the east ‘cell’ is tidally influenced, noting however that all four monitored boreholes are located near the eastern boundary of the eastern ‘cell’, near the Hermitage Stream.

Cover Soils – Comments

The cover thickness in the eastern cell (typically 0.9 to 1.5 m) is less than that recorded in the western cell (typically between 2.0 and 3.0 m). It is possible that the “land raising by one metre” undertaken in the late 1990s / early 2000s may have only applied to the western cell, possibly for amenity purposes due to this area being used as playing fields, leaving the eastern cell with its original thickness of final cover. The historical aerial photograph dated 1999 shows cover soils being placed in the western cell, whereas the eastern cell does not appear to be disturbed and has well established vegetation. The subsequent photograph dated 2004 shows the eastern cell in the same configuration, suggesting that works had not taken place.

The cover soils are likely to be of variable permeability, with both cohesive and granular materials described. Unlike an engineered impermeable landfill cap, there is potential for precipitation to infiltrate through the cover soils into the waste mass and landfill gases to escape the waste mass.

Landfill Waste – Contact with Leachate / Groundwater

Groundwater / leachate levels within the waste in the east cell have been recorded between 0.657 m AOD and 3.48 m AOD, the groundwater appears to be tidally influenced with a tidal range of up to 1.50 m. The elevation of the base of the waste deposit in the eastern cell (where the full thickness of the waste mass was proved) is between -3.25 and 3.10 m AOD.

This indicates that base of the waste mass is likely to be in contact with groundwater.

Landfill Waste – Provenance

DS, 2022 states that the waste in the eastern cell “appeared to consist of more ‘household waste’ items including plastic containers, kitchen waste, glass bottles, newspapers, and books”. Whilst the exploratory hole logs do not record all of these items, the photographs of waste arisings from the eastern cell do appear to be of a more domestic waste type. Stantec recognises that DS, having logged the wastes, will have a more nuanced assessment of the potential waste provenance than we can gain from logs and photographs alone, and in this regard we accept their assessment.

Landfill Waste - Extent

Whilst the depth of fill within the landfill has been investigated, the extent of the fill is unknown, i.e., no exploratory holes have been undertaken outside of the waste mass. The historical aerial photographs and 2020 topographical survey appear to indicate that the waste mass may extend north to the embankment of the A27 slip road, east to the bund adjacent to the Hermitage Stream and south to the Harts Farm Way embankment. The vegetation along the northern and eastern boundaries appears to have established after filling and restoration was completed.

6.4 Visual and Olfactory Evidence of Contamination

Visual evidence of contamination was limited within the cover soils to:

- Asbestos Containing Materials (ACMs) - a fragment of material suspected to be ACM was recorded in RO104 (east 'cell') in the cover soils between ground level and 0.39 m bgl.
- A "slight hydrocarbon sheen" was noted on the landfill waste recovered from RO104 between 5.00 m and 6.00 m bgl.
- Occasional black organic "staining" noted in the cover soils in RO101, RO103, RO108, RO109 and TP105.

Odours were encountered within the waste mass and cover soils, as detailed in the table below. (E) Denotes an odour in the East 'Cell' and (W) denotes an odour in the west cell.

Table 6.7 - Summary of Odours Encountered

Odour	Locations
Waste	Throughout waste mass in east and west cells.
Putrid / Foul / Rotten	(E) BHRP01, "Slight putrid" odour recorded between 1.50 and 2.65 m bgl within waste. (W) CP01, "Slight rotten" odour noted throughout waste. (E) CP06, "Rotten-type" odour noted throughout waste. (W) TP101, "Slight rotten" odour noted throughout waste. (W) TP04, "Moderate rotten" odour noted in waste from 3.00 m bgl to base of pit at 3.30 m bgl. (E) TP06, "Foul / rotten type" odour noted throughout waste. (W) TP07, "Rotten-type" odour noted in waste at base of pit at 3.30 m bgl. (E) TP108, "Slight rotten" odour noted throughout waste. (W) TP111, "Rotten" and "Foul" odours noted throughout waste. (E) TP114, "strong waste odour" recorded between 0.85 and 3.9m bgl within waste.
Solvent	(E) RO106, "Strong sweet solvent" odour recorded between 11.00 and 11.50 m bgl within waste. (E) TP108, "Moderate solvent" odour recorded between 1.40 and 4.00 m bgl within waste. (E) TP109, "Strong solvent" odour recorded between 0.90 and 3.90 m bgl within waste. (E) TP113, "Strong solvent" odour recorded between 2.00 and 3.85 m bgl within waste.
Ashy / Burnt	(E) TP05, "Ashy / burnt odour" noted between 1.40 and 3.10 m bgl in waste (ash present in waste)
Hydrocarbon	(E) BHW001, "Moderate hydrocarbon odour" recorded at 2.00 m bgl within waste. (W) RO101, "Moderate hydrocarbon odour" recorded between 3.00 and 7.00 m bgl within waste. (W) RO102, "Moderate" to "slight" hydrocarbon odour recorded between 2.20 and 3.00 m bgl within waste. (W) RO103, "Strong" to "Moderate" hydrocarbon odour recorded between 3.00 and 3.80 m bgl within waste. (W) RO103, "Moderate" to "slight" hydrocarbon odour recorded between 13.00 and 14.20 m bgl within CHALK. (E) RO104, "Moderate hydrocarbon odour" recorded between 5.00 and 7.00 m bgl within waste.

Odour	Locations
	(E) RO105, "Moderate hydrocarbon odour" recorded between 6.00 and 10.70 m bgl within waste. (E) RO106, "Slight hydrocarbon odour" recorded between 1.50 and 4.00 m bgl within waste. (W) TP102, "Slight hydrocarbon odour" recorded between 1.50 and 3.60 m bgl within waste. (E) TP112, "Slight hydrocarbon odour" recorded between 3.50 and 3.70 m bgl within waste
Organic	(E) BHRP01, "Slight organic odour" recorded between 3.20 and 4.20 m and 8.90 bgl within waste. "Moderate organic odour" recorded between 10.60 and 11.45 m bgl within waste. "Strong organic odour" recorded between 13.70 and 14.35 m bgl within waste. (E) BHW001, "Organic odour" recorded at 7.00 m bgl within waste

6.5 Design of Buried Concrete

For the mobile groundwater conditions in the brownfield soils (cover soils and landfill waste) across the site, the sulphate concentrations and pH values typically corresponded to either Design Sulphate Class DS-1 or DS2 and ACEC Class AC-1 or AC-2, respectively.

Two samples of the landfill waste (CP04 at 7.0 m bgl, in the north-west of the western cell, and BHRP01 at 13.80 m bgl in the north of the eastern cell) recorded values that correspond to Design Sulphate Class DS-4 and ACEC Class AC-4.

One sample of the cover soils (BHRP02 at 0.3 m bgl in the north-east of the western cell) recorded values that correspond to Design Sulphate Class DS-5 and ACEC Class AC-4s.

Overall, it is recommended that a Design Sulphate Class DS-2 and ACEC class AC-2 is likely to be appropriate for the majority of the buried concrete.

The recommendations of BRE (2017) should be followed in the design of mixes for buried concrete for the classifications given.

7 Geo-Environmental Conditions

7.1 Approach

In accordance with the guidance given in LCRM the results of the geoenvironmental laboratory testing undertaken on the samples of soil and groundwater recovered during the Delta Simons and WYG ground investigations (Delta Simons, 2021) (White Young Green, 2017) have been compared to current published generic assessment criteria (GAC) to identify potential hazards to the plausible receptors.

LCRM refers to this as a Tier 2 or Generic Quantitative Risk Assessment).

If the result of an analysis is below the screening criterion (selected GAC), the parameter is deemed not to be a potential hazard and is not considered further. A concentration above the screening criterion identifies the parameter is considered as a possible hazard and indicates that either further assessment or risk management is required.

Our guide entitled Rationale for Selection of Criteria Used in Tier 2 (Generic) Risk Assessment (England) is presented in **Appendix E** and further information relating to the specific GAC selected for this assessment and the justification for their selection is provided in **Appendix F.**

7.2 Cover Soils

Thirty eight samples of the cover soils were submitted for laboratory analysis, the results of these analyses are tabulated in **Appendix G.1**.

GQRA - Protection of Human Health

The notable results are summarised below:

- None of the 38 samples recorded concentrations of metals, petroleum hydrocarbons, BTEX[13], VOCs, or SVOCs greater than the adopted GAC.
- Benzo(a)pyrene – one of the 38 samples (TP09 at 0.40 m bgl) recorded a concentration of 36.63 mg/kg, greater than the 35 mg/kg GAC.
- Dibenzo(a,h)anthracene – One of the 38 samples (TP09 at 0.40 m bgl) recorded a concentration of 4.72 mg/kg, greater than the 3.5 mg/kg GAC.
  - TP09 is located in the centre of the site, beneath the former ‘yard’. The log for this trial pit records a layer of asphalt and sub-base to 0.35 m bgl. On the basis that TP09 was the only location to record asphalt, and the only location to record elevated PAHs at a shallow depth, it is considered possible that fragments of asphalt may have been included in the sample, resulting in the elevated PAH concentrations.
- Asbestos – 33 samples were analysed and two (TP03 at 0.4 m bgl and CP04 at 0.5 m bgl) returned positive detections. Both exploratory holes were located in approximately the centre-north of the west ‘cell’. The asbestos was recorded as insulation board and fibre bundles, and as both chrysotile and

[13] Benzene, Toluene, Ethylbenzene, Xylenes

amosite. Quantification of the insulation board from TP09 at 0.40 m bgl was not possible. The sample from CP04 at 0.5 m bgl returned a quantification result of <0.1%.
- A "potential ACM fragment" was encountered in the cover soils in RO104 in the north of the east 'cell' between ground level and 0.39 m bgl. Laboratory analysis does not appear to have been undertaken to confirm whether this material was ACM.

7.3 Waste Mass

GQRA – Protection of Human Health

Laboratory analyses were undertaken on 61 samples of the waste mass (noting that not all samples had the same suite of testing), the results of these analyses are tabulated in **Appendix G.2**. The results are summarised below:

- Concentrations of metals, petroleum hydrocarbons, BTEX, VOCs, and SVOCs were below the adopted GAC in all samples.
- Concentrations of PAHs were below the adopted GAC in all samples with the exception of BHW001 at 2.1 m bgl which recorded concentrations of dibenzo(a,h)anthracene in excess of the GAC[14].
  - Whilst not in excess of a GAC, it is noted that the samples recovered from TP01 at 1.9 m bgl and TP04 at 3.3 m bgl recorded elevated TPH concentrations of 11,589 mg/kg and 9,850 mg/kg respectively.
- Asbestos (Screening & quantification) – 14 of 50 samples tested recorded the presence of asbestos. Asbestos was most commonly recorded as fibre bundles, loose fibres, insulation board, cement debris and insulation debris were also encountered in one sample each. Where quantification was undertaken, the maximum result was <0.1%.

7.4 Natural Soils

GQRA - Protection of Human Health

Laboratory analyses were undertaken on one sample of the Raised Marine Deposits, two samples of the Alluvium and six samples of the Lewes Nodular Chalk Formation (noting that not all samples had the same suite of testing), the results of these analyses are tabulated in **Appendix G.3**.

- None of the nine samples recorded concentrations of metals, petroleum hydrocarbons, PAHs, BTEX, VOCs or SVOCs greater than the adopted GAC, and asbestos was not detected in any of the 5 samples analysed.

[14] The sample recovered from BHW001 at 2.1 m recorded a dibenzo(a,h)anthracene concentration of 8.53 mg/kg, equal to this sample's method detection limit which is well in excess of the limit for other similar samples. A review of the laboratory's report for this sample indicates that "*a non-standard volume or mass has been used for this test which has resulted in a raised detection limit"*. On this basis, it is considered that the 8.53 mg/kg concentration recorded in this sample is a 'true' detection, and this sample should be disregarded.

7.5 Groundwater / Landfill Leachate

GQRA - Protection of Controlled Waters

Laboratory analyses were undertaken on 26 samples of groundwater and landfill leachate recovered during four rounds of sampling from boreholes with installation response zones within the waste mass, and 50 samples of water recovered from boreholes with installation response zones within the natural strata beneath the landfill. The results of these analyses are tabulated in Appendix H.1.

It is noted that many boreholes have multiple monitoring installations at different depths, and in different strata, in the same borehole, therefore the same borehole number may appear in both of the tables. Summaries of the results are presented below:

Table 7.1 – Summary of Groundwater / Landfill Leachate Results – EQS Exceedances, Samples Recovered from Response Zones in Waste Mass

Determinand	EQS (µg/l)	Number of Tests	Number of Exceedances	Maximum Result (µg/l)
Copper	3.76	26	19	37.0 (RO101)
Nickel	8.6	26	16	52.0 (RO102)
Zinc	6.8	26	14	38.0 (RO103)
Ammoniacal Nitrogen as NH_3 (Ammonia)	21	25	25	250,000 (RO102)
Benzene	8	26	2	10.5 (RO101)
Naphthalene	2	26	7	10.20 (RO101)
Anthracene	0.1	26	4	0.69 (RO106)
Fluoranthene	0.0063	26	4	1.30 (RO106)
Benzo(b)fluoranthene	0.017	26	1	0.28 (RO106)
Benzo(a)pyrene	0.00017	26	1	0.47 (RO106)

Table 7.2 – Summary of Groundwater Results – EQS Exceedances, Samples Recovered from Response Zones in Superficial Deposits (Raised Marine / River Terrace Deposits and Alluvium)

Determinand	EQS (µg/l)	Number of Tests	Number of Exceedances	Maximum Result (µg/l)
Copper	3.76	12	9	30.0 (DS102)
Nickel	8.6	12	11	130 (DS102)
Zinc	6.8	12	3	13.0 (DS103)
Ammoniacal Nitrogen as NH_3 (Ammonia)	21	12	12	190,000 (DS102)
Naphthalene	2	12	2	14.8 (DS101)
Anthracene	0.1	12	2	0.45 (DS101)
Fluoranthene	0.0063	12	2	0.71 (DS101)
Mercury	0.07	12	1	0.19 (DS103

DS101, DS102 and DS103 (the wells with the highest exceedances) are screened in the River Terrace / Raised Marine Deposits, with response zones only 0.5 m below the base of the waste mass. It appears likely from the Table 7.2 and **Appendix H.2** that the water in these strata, at such a shallow depth below the base of the waste, may be impacted by the waste mass.

Table 7.3 and **Appendix H.3** summarise the concentrations recorded with groundwater recovered from response zones installed within the chalk at depth below the waste.

Table 7.3 - Summary of Groundwater Results - EQS Exceedances for Response Zones in Chalk

Determinand	EQS (µg/l)	Number of Tests	Number of Exceedances	Maximum Result (µg/l)
Copper	3.76	38	28	17.0 (RO101)
Nickel	8.6	38	28	60.0 (RO101)
Zinc	6.8	38	17	540 (RO106)
Lead	1.3	38	3	19.0 (RO104)
Ammoniacal Nitrogen as NH_3 (Ammonia)	21	38	37	140,000 (RO101)
Naphthalene	2	38	1	2.02 (RO106)
Fluoranthene	0.0063	38	1	0.29 (RO106)

Volatile and Semi-Volatile Organic Compounds

Concentrations of VOCs and SVOCs in excess of the laboratory limit of detection, but for which there are no defined GAC are presented in Table 7.4.

Table 7.4- Summary of VOC / SVOC Positive Detections

Determinand	Number of Positive Detections	Stratum within which Positive Detections were Recorded	Maximum Concentration (µg/l)
1,2-Dichlorobenzene	2 (RO101 x 2)	1 x landfill waste 1 x Chalk	8.7 (RO101)
1,4-Dichlorobenzene	3 (RO101 x 2 and DS102)	1 x landfill waste 1 x Raised Marine Deposits 1 x Chalk	2.5 (RO101)
1,2,4-Trimethylbenzene	2 (RO101 and RO103)	2 x landfill waste	15.0 (RO103)
1,3,5-Trimethylbenzene	2 (RO101 and RO103)	2 x landfill waste	7.2 (RO103)
2,4-Dimethylphenol	3 (RO101 x 2 and RO103	2 x landfill waste 1 x Chalk	5.2 (RO101)

On the basis of the above, groundwater in both the shallow superficial deposits and the chalk bedrock aquifers appears to be impacted by the landfill, albeit to differing degrees.

- Concentrations of copper and nickel from the groundwater in the chalk are approximately half of the concentrations recorded in the groundwater from the superficial deposits.
- Concentrations of zinc are similar in both the superficial and chalk aquifers, noting that three (out of 76 samples) significant exceedances were recorded in the chalk at depth.
- Ammonia concentrations are significantly elevated in both the chalk and the superficial deposits, albeit concentrations in the chalk appear to be approximately 25% lower than in the superficial deposits.
- PAH concentrations are not significantly elevated in either the chalk or the superficial deposits. Elevated concentrations in the chalk were recorded in one sample only, and the concentrations recorded in this sample were only marginally elevated above the GAC.

- Overall, there does not appear to be a spatial bias to where NAPL may be present, and it may be present within both the east cell and the west cell.
- Concentrations of chloride (normally an indicator of landfill contamination) have not been treated as diagnostic due to the likely presence of saline groundwater, i.e., water that is naturally elevated in sodium chloride.

7.6 Surface Water

GQRA - Protection of Controlled Waters

Laboratory analyses were undertaken on 12 samples of water recovered from the Hermitage Stream during two separate monitoring rounds. Four samples were recovered from a sampling point upgradient of the Site, four samples at a sampling point downgradient of the Site and four samples at a sampling point between the upgradient and downgradient sampling points.

The sampling locations were not provided within the Delta Simons reports, however a marked up aerial image was subsequently provided by Delta Simons to show the locations, and is presented as Figure 7.1 below.

Figure 7.1 – Delta Simons Surface Water Sample Locations

The results of these analyses are tabulated in **Appendix H.4**. The results are summarised below.

Upstream Sampling Point – GAC Exceedances

Table 7.5 - Summary of Surface Water Results – GAC Exceedances, Upstream Sampling Point

Determinand	GAC (µg/l)	Number of Tests	Number of Exceedances	Maximum Result (µg/l)
Copper	3.76	4	4	6.8
Ammoniacal Nitrogen as NH_3 (Ammonia)	21	4	2	48.0

All four samples recorded elevated concentrations of copper. The concentrations recorded are noted to be similar on the high and low tide. This indicates that copper concentrations in the Hermitage Stream may be elevated prior to reaching the Site and that either an off-site source of copper may be present, or concentrations of copper may be naturally elevated.

The elevated ammonia concentrations were both recorded in the high-tide samples, with both low tide samples recording concentrations below the laboratory LOD of 15 µg/l. This suggests that elevated ammonia concentrations upgradient of the site may be a result of ammonia-rich waters (potentially a result of leaks of leachate from the landfill into the downgradient water, or from ammonia rich waters within Langstone Harbour) being washed up the Hermitage Stream on the rising tide. Once the tide has receded the concentrations of ammonia then fall within the Stream as the upgradient water would be principally comprised of flows from further upgradient of the Site.

Concentrations of hydrocarbons (both TPHs and PAHs) were below the laboratory LOD in all samples.

Midstream Sampling Point – GAC Exceedances

Table 7.6 - Summary of Surface Water Results – GAC Exceedances, Midstream Sampling Point

Determinand	GAC (µg/l)	Number of Tests	Number of Exceedances	Maximum Result (µg/l)
Copper	3.76	4	2	11.0
Zinc	6.8	4	1	31.0
Ammoniacal Nitrogen as NH_3 (Ammonia)	21	4	3	130.0

The elevated concentrations of copper were recorded in samples recovered at both low and high tide with concentrations of 5.1 µg/l (low tide) and 11.0 µg/l (high tide) recorded.
The elevated concentration of zinc was recorded at low tide.

The exceedances of ammonia were recorded in samples recovered at both high tide (31.0 µg/l) and low tide (100 µg/l and 130 µg/l). Elevated concentrations at low tide adjacent to the Site, but not upgradient of the Site, may indicate a source of ammonia being released into the Stream, close to the Site.

It is considered likely that leachate from within the landfill is being released to the Hermitage Stream. It should be noted that this is the expected behaviour for an un-lined “dilute and disperse” landfill.

Concentrations of TPHs and PAHs were below the laboratory LOD in all samples.

Downstream Sampling Point – GAC Exceedances

Table 7.7 - Summary of Surface Water Results – GAC Exceedances, Downstream Sampling Point

Determinand	GAC (µg/l)	Number of Tests	Number of Exceedances	Maximum Result (µg/l)
Copper	3.76	4	4	9.4
Ammoniacal Nitrogen as NH_3 (Ammonia)	21	4	2	92

Elevated concentrations of copper downgradient of the Site were recorded at both high and low tide with concentrations between 5.0 µg/l and 9.4 µg/l recorded.

Elevated concentrations of ammonia were recorded downgradient of the Site at low tide only, with concentrations between 87 µg/l and 92 µg/l recorded. This suggests that either a) there is a source of ammonia downgradient of the Site or b) water flowing downgradient from the Site is enriched in ammonia.

It is considered that both options are likely to be happening, noting that the land to the south of the site, within the bund, has also been used for landfilling and is also of the same “dilute and disperse” type.

Concentrations of TPHs and PAHs were below the laboratory LOD in all samples.

8 Landfill Gas Risk Assessment

8.1 Review of Spot Monitoring Information

Spot Monitoring - Monitoring Rounds Undertaken

As part of their 2017 ground investigation, WYG undertook six rounds of spot monitoring on boreholes CP01 (S) and (D), CP02 (S) and (D), CP03 (S) and (D), CP04 to CP06 and WS01 to WS10. Following completion of their 2021 ground investigation Delta Simons (DS) undertook ground gas 'spot monitoring'. Monitoring was undertaken both on DS's newly installed boreholes and WYG's earlier boreholes.

Whilst DS reported that six rounds of monitoring were undertaken, two of the rounds appeared to be repeat rounds undertaken on certain boreholes by the provider of the continuous monitoring equipment (Ground Gas Solutions [GGS]) on the same day that DS undertook their monitoring.

Table 8.1shows which boreholes were monitored during which monitoring rounds.

Table 8.1 - Summary of Delta Simons Gas Spot Monitoring

Borehole	Monitoring Round					
	22-23 March 2022 (DS)	23 March 2021 (GGS)	20 April 2021 (DS)	20 April 2021 (GGS)	4 May 2021 (DS)	18-20 May 2021 (DS)
RO101 (S)	✓	✓	✓	✓		✓
RO102 (S)	✓	✓	✓	✓		✓
RO103 (S)	✓	✓	✓	✓		✓
RO104 (S)	✓	✓	✓	✓		✓
RO105 (S)	✓	✓	✓	✓		✓
RO106 (S)	✓	✓	✓	✓		✓
RO107 (D)	✓		✓		✓	✓
RO108 (D)	✓		✓		✓	✓
RO109 (D)	✓		✓		✓	✓
DS101	✓		✓		✓	✓
DS102	✓		✓		✓	✓
DS103	✓		✓		✓	✓
CP02A (S)	✓		✓		✓	✓
CP02A (D)	✓		✓		✓	✓
CP03 (S)	✓		✓		✓	✓
CP03 (D)	✓		✓		✓	✓
CP05 (S)	✓		✓		✓	✓

DS reported that the atmospheric pressure trends during five of their six monitoring rounds were of falling pressure (the visit on 18/05/2021 being falling, then rising pressure). Falling atmospheric pressure is associated with gas migration potential as it causes gas to expand and come out of the ground. However, this is only likely to occur where there are open pathways in the ground and not for soils with low permeability (Card, 2019)

Spot Monitoring - Review of Water Levels

A review of the water levels in the boreholes indicates that:

- During the WYG monitoring, the water level in boreholes CP01(D), CP02A(D) and CP03A(D) was above the top of the response zone.
- During the Delta Simons monitoring, the water level in boreholes CP02A(D), CP03A(D), DS101, DS102, DS103, RO107(D), RO108(D) and RO109(D) was above the top of the response zone.

The data from these boreholes has therefore been disregarded from this ground gas risk assessment as "*The response zone of the gas monitoring standpipe should be wholly or partly above groundwater level to provide valid data...* [and] *gas standpipes with flooded response zones might exhibit measurements of elevated methane or carbon dioxide… due to dissolved gases or the presence of biodegradable material in the groundwater*" (BS8485: 2015 + A1: 2019).

It is noted that all boreholes which recorded completely flooded response zones were screened within the chalk underlying the waste mass. Therefore, the absence of this data from the assessment is not considered to impact the assessment.

Spot Monitoring – Concentrations and Flow Rates

The steady-state concentrations of ground gases and ground gas flow rates measured over six monitoring occasions (May-June 2021) in the gas monitoring wells installed in the boreholes are summarised in the following table.

For the purposes of the assessment below, a gas concentration or flow rate of less than the limit of detection (LOD) of the monitoring instrument is treated as 100 per cent of the LOD (i.e., 0.1 %v/v or 0.1 l/hr).

Table 8.2 - Summary of Delta Simons & WYG Spot Monitoring (May-June 2021)

Exploratory Hole	Flow (l/hr)	Carbon Dioxide (%v/v)	Methane (%v/v)
CP01 (S)	0.3 to 0.6	28.2 to 30.1	67.5 to 70.6
CP02A (S)	0.1 to 0.4	0.2 to 24.6	0.1 to 35.9
CP03 (S)	0.1 to 0.6	14.2 to 27.4	15.1 to 48.1
CP04	0.3 to 0.5	30.1 to 31.2	61.0 to 63.9
CP05 (S)	0.1 to 0.5	16.6 to 28.0	22.0 to 52.1
CP06	0.1 to 0.6	21.5 to 23.2	55.0 to 60.1
RO101 (S)	0.1 to 3.1	20.4 to 25.5	37.1 to 65.0
RO102 (S)	0.1 to 0.4	15.5 to 25.1	57.6 to 62.8
RO103 (S)	0.1 to 0.7	21.3 to 28.0	58.4 to 67.4
RO104 (S)	0.1	9.4 to 22.2	14.3 to 36.0
RO105 (S)	0.1 to 0.2	0.7 to 13.2	0.1 to 19.3
RO106 (S)	0.1 to 3.5	14.4 to 24.6	28.5 to 53.7

Spot Monitoring – Calculation of Gas Screening Values

Initial Calculation Stage

Using the procedure for classifying gassing sites proposed by BS 8485:2015 + A1:2019, Gas Screening Values (GSVs) have been calculated for both carbon dioxide and methane for each monitoring visit to each borehole.

Table 8.3 - Calculated GSVs (Per Borehole, Per Visit)

Exploratory Hole	Carbon Dioxide GSV	Methane GSV	Corresponding Characteristic Situation
CP01 (S)	0.0849 to 0.1746	0.2118 to 0.4086	CS2
CP02A (S)	0.0006 to 0.0492	0.0001 to 0.0718	CS1 to CS2
CP03 (S)	0.0142 to 0.1170	0.0151 to 0.1428	CS1 to CS2
CP04	0.0903 to 0.1545	0.1881 to 0.3195	CS2
CP05 (S)	0.0166 to 0.1310	0.0220 to 0.2200	CS1 to CS2
CP06	0.0223 to 0.1392	0.0561 to 0.3480	CS1 to CS2
RO101 (S)	0.0204 to 0.7378	0.0371 to 1.5469	CS1 to CS3
RO102 (S)	0.0155 to 0.0940	0.0576 to 0.2368	CS1 to CS2
RO103 (S)	0.0213 to 0.1960	0.0584 to 0.4718	CS1 to CS2
RO104 (S)	0.0094 to 0.0222	0.0143 to 0.0360	CS1
RO105 (S)	0.0007 to 0.0132	0.0001 to 0.0202	CS1
RO106 (S)	0.0144 to 0.8610	0.0285 to 1.8795	CS1 to CS3
Notes: As per Table 2 of BS 8485:2015 + A1:2019 CS1 = <0.07 CS2 = 0.07 to 0.7 CS3 = 0.7 to 3.5 CS4 = 3.5 to 15.0			

Table 2 of BS 8485 notes, in the additional factors for a CS1 classification that this requires "*typically <1% methane concentration and <5% carbon dioxide concentration, otherwise consider an increase to CS2*". Methane and carbon dioxide concentrations have been recorded consistently above these threshold concentrations across all monitoring visits, and therefore the increase from CS1 to CS2 is considered appropriate.

On this basis, the calculated GSVs correspond to a low to moderate hazard potential.

Additional Checks

As advocated by BS8485, further assessment has been undertaken using the highest flow rates and gas concentrations recorded within each borehole across all visits.

Table 8.4 - Calculated GSVs (Per Borehole, Across All Visits)

Exploratory Hole	Carbon Dioxide GSV	Methane GSV	Corresponding Characteristic Situation
CP01 (S)	0.1806	0.4236	CS2
CP02A (S)	0.0984	0.1436	CS2
CP03 (S)	0.1644	0.2886	CS2

Exploratory Hole	Carbon Dioxide GSV	Methane GSV	Corresponding Characteristic Situation
CP04	0.1560	0.3195	CS2
CP05 (S)	0.1400	0.2605	CS2
CP06	0.1392	0.3606	CS2
RO101 (S)	0.7905	2.0150	CS3
RO102 (S)	0.1004	0.2512	CS2
RO103 (S)	0.1960	0.4718	CS2
RO104 (S)	0.0222	0.0360	CS2*
RO105 (S)	0.0264	0.0386	CS2*
RO106 (S)	0.8610	1.8795	CS3
* Denotes an increase from CS1 to CS2 on the basis of recorded concentrations as per Table 2 of BS 8485			

As shown in the table above, the majority of boreholes recorded per-borehole worst-case GSVs equivalent to a characteristic situation of CS2, with only two boreholes (RO101 (S) and RO106 (S)) recording worst-case GSVs equivalent to a characteristic situation of CS3.

On the basis of the spot monitoring, it is considered appropriate to adopt the worst-case classification of CS3 across the whole of the site. Whilst RO101 and RO106 are both located in the eastern 'cell', there is no barrier to gases from the eastern cell migrating westwards to the immediately adjacent western 'cell' and therefore it is not considered appropriate to zone the site.

Worst Case Check

Finally, as also advocated by BS8485, a 'worst-case' check has been undertaken using the highest flow rates and gas concentrations recorded across all monitoring visits combined and in any borehole across all monitoring visits combined.

Using the maximum flow rate of 3.5 l/hr, the maximum carbon dioxide concentration of 31.2 %v/v and the maximum methane concentration of 70.6 %v/v GSVs of 1.092 and 2.471 are calculated, both equivalent to CS3.

On the basis that CS3 conditions have been recorded in two boreholes during the spot monitoring, it is considered that the worst-case classification of CS3 is appropriate and suitably precautionary.

This classification means that gas protection measures will be required.

8.2 Review of Continuous Monitoring Information

As part of their 2021 investigation, Delta Simons installed continuous gas monitoring systems on boreholes RO101 to RO106 as shown in the table below.

The monitoring equipment were configured to record at an hourly monitoring frequency, with instruments recording atmospheric pressure, temperature and gas concentrations; methane (CH4), carbon dioxide (CO2), oxygen (O2), carbon monoxide (CO) and hydrogen sulphide (H2S). Continuous gas flow was also recorded.

Table 8.5 - Continuous Gas Monitoring Time Periods

Borehole	Time Period
RO101 (S)	20/04/21 to 19/05/21 (4 weeks)
RO102 (S)	20/04/21 to 19/05/21 (4 weeks)
RO103 (S)	20/04/21 to 19/05/21 (4 weeks)
RO104 (S)	23/03/21 to 19/05/21 (8 weeks)
RO105 (S)	23/03/21 to 19/05/21 (8 weeks)
RO106 (S)	23/03/21 to 19/05/21 (8 weeks)

Continuous Monitoring – Purge and Recovery Tests

Purge and Recovery Tests (PRTs) were undertaken in RO101 (S), RO103 (S), RO104 (S) and RO106 (S). The PRT allows the recovery rate of ground-gas into a monitoring well to be recorded following displacement of gases within the monitoring well with nitrogen gas, from which a ground-gas flux is calculated.

A ground-gas flux is an indication of the rate of gas entering the purged well void; typically, a slow recovery indicates low generation or the presence of a low pressure 'reservoir'. Rapid recovery can either indicate high generation or the presence of a pressurised 'reservoir' of ground-gas held within the pore spacing and voids of the vadose zone which immediately refills the borehole space after purging.

The permeability of the surrounding geology also effects recovery rates; a highly permeable media such as gravel and sand surrounding the borehole will allow faster gas recovery than a less permeable media such as silt and clay.

The calculated gas flux rates for methane and carbon dioxide, and the equivalent characteristic situations, are presented in Table 8.6 below.

Table 8.6 - Carbon Dioxide and Methane Flux Comparison

Borehole	Methane Flux (l/hr)	Characteristic Situation - Methane	Carbon Dioxide Flux (l/hr)	Characteristic Situation – Carbon Dioxide
RO101 (S)	7.06	CS4	4.04	CS4
RO103 (S)	8.05	CS4	3.85	CS4
RO104 (S)	0.03	CS1	0.03	CS1
RO106 (S)	3.41	CS2 / CS3	1.80	CS2

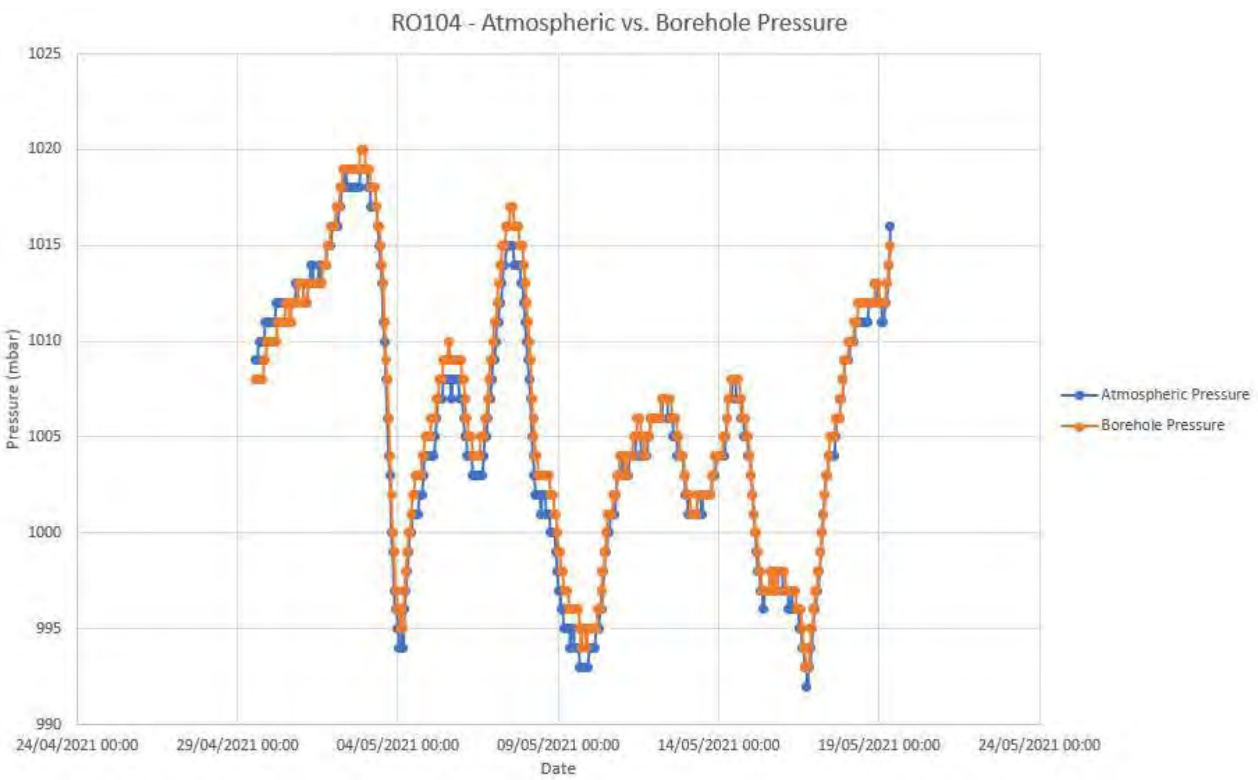
Continuous Monitoring – Borehole Pressure vs. Atmospheric Pressure

The pressure within a borehole is not always equal to the atmospheric pressure outside of the borehole. In absence of outside factors (e.g., groundwater level change, barometric pumping etc.), within a borehole that is adequately sealed at the surface, and with a closed gas valve, borehole pressure will typically lag behind atmospheric pressure.

In general, when the atmospheric pressure is higher than the borehole pressure, gas flow from the borehole will be supressed. When borehole pressure is higher than atmospheric pressure, gas flow from the borehole will be increased.

Atmospheric pressure and borehole pressure readings were taken at one-hour intervals as part of the continuous monitoring, with the exception of borehole RO102 where borehole pressure was not recorded. When the two datasets are compared it is evident that there is very little difference between the two, as shown in the example graph below from borehole RO104.

Figure 8.1 - RO104 - Graph of Atmospheric Pressure vs. Borehole Pressure



This suggests that either:

a) The borehole is not sealed and that atmospheric pressure external to the borehole is able to equilibrate with the pressure within the borehole.
b) The ground surrounding the boreholes is very highly permeable, such that pressure changes are rapidly conveyed through the subsurface into the borehole.

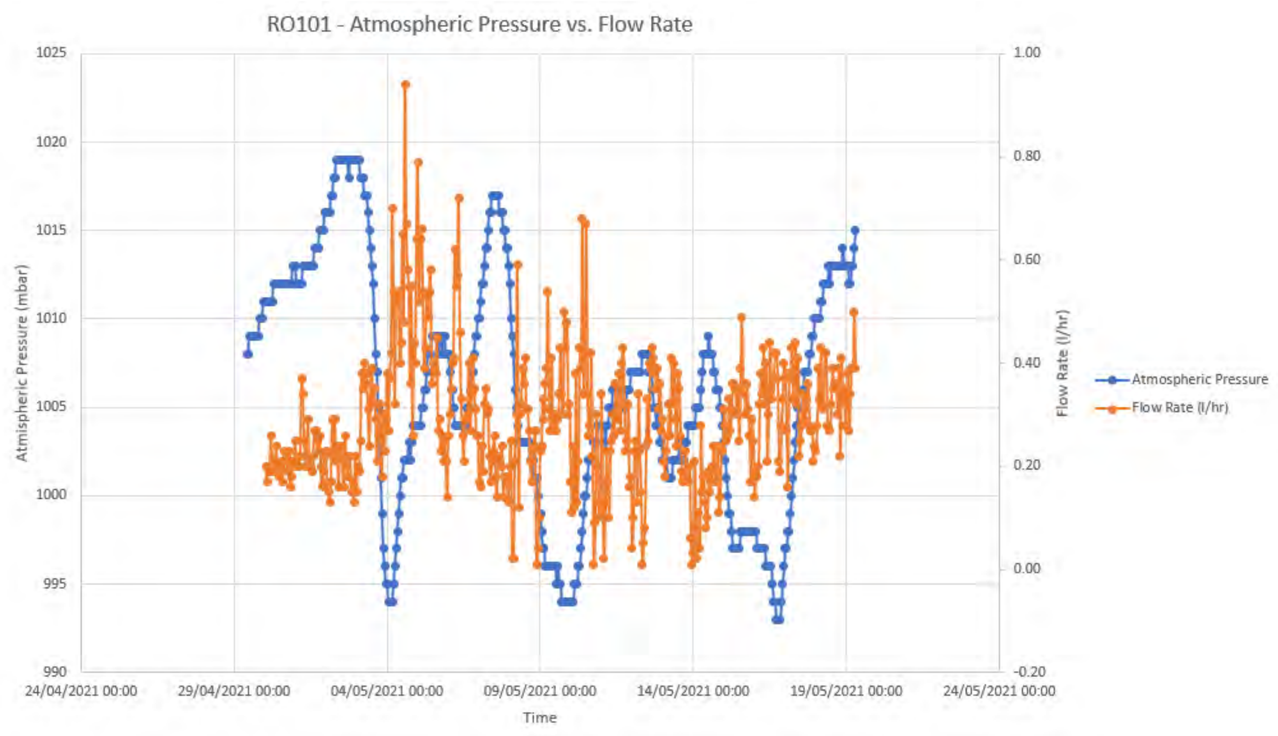
It is considered that option a) is the most likely – however this does not affect the integrity of this assessment as gas flows will reflect atmospheric pressure changes.

Continuous Monitoring – Flow Rate and Flow Drivers

For each of the continuously monitored boreholes the gas flow rate has been compared individually against the groundwater level and the atmospheric pressure (noted above to be practically indistinguishable from the borehole pressure). This comparison allows for an assessment to be made of the influences on gas flow.

Within boreholes RO101 (S) to RO104 (S) and RO105 (S) it appears that there is a slight correlation between falling atmospheric pressure and increased gas flow rate. The example graph from RO101 (S) (Figure 5) shows that spikes in gas flow rate (orange) tend to correlate with rapid drops in atmospheric pressure (blue).

Figure 8.2 – Graph Comparing Atmospheric Pressure with Gas Flow Rate in Borehole RO101 (S)



It does not appear that groundwater (or landfill leachate) level is an influencing factor on ground gas flow rate. This is true in situations where the groundwater is tidally influenced (RO105 (S) and RO106 (S)) and where it does not appear to be tidally influenced (RO101 (S) to RO104 (S)). As shown on the example graphs below (Figures 6 and 7), there does not appear to be an obvious correlation between gas flow rate (orange) and water level (blue).

Figure 8.3 - Graph Comparing Gas Flow Rate and Water Level in RO103 (Non-Tidal)

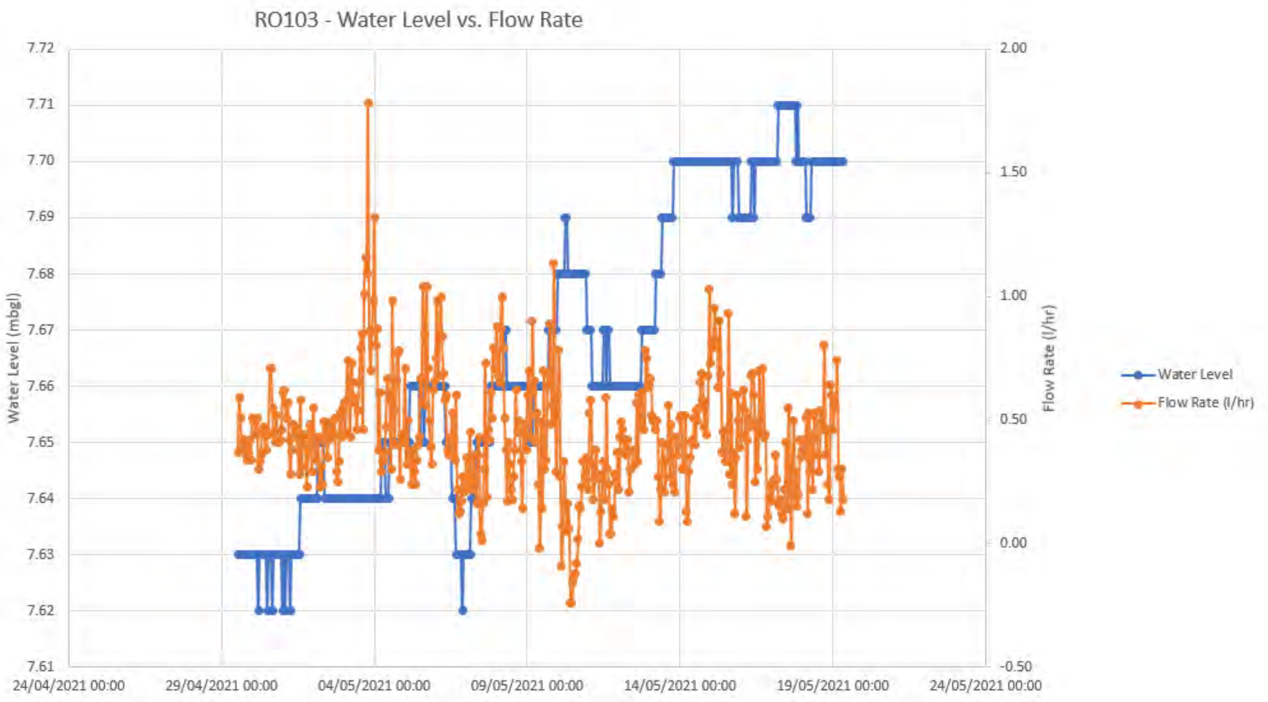
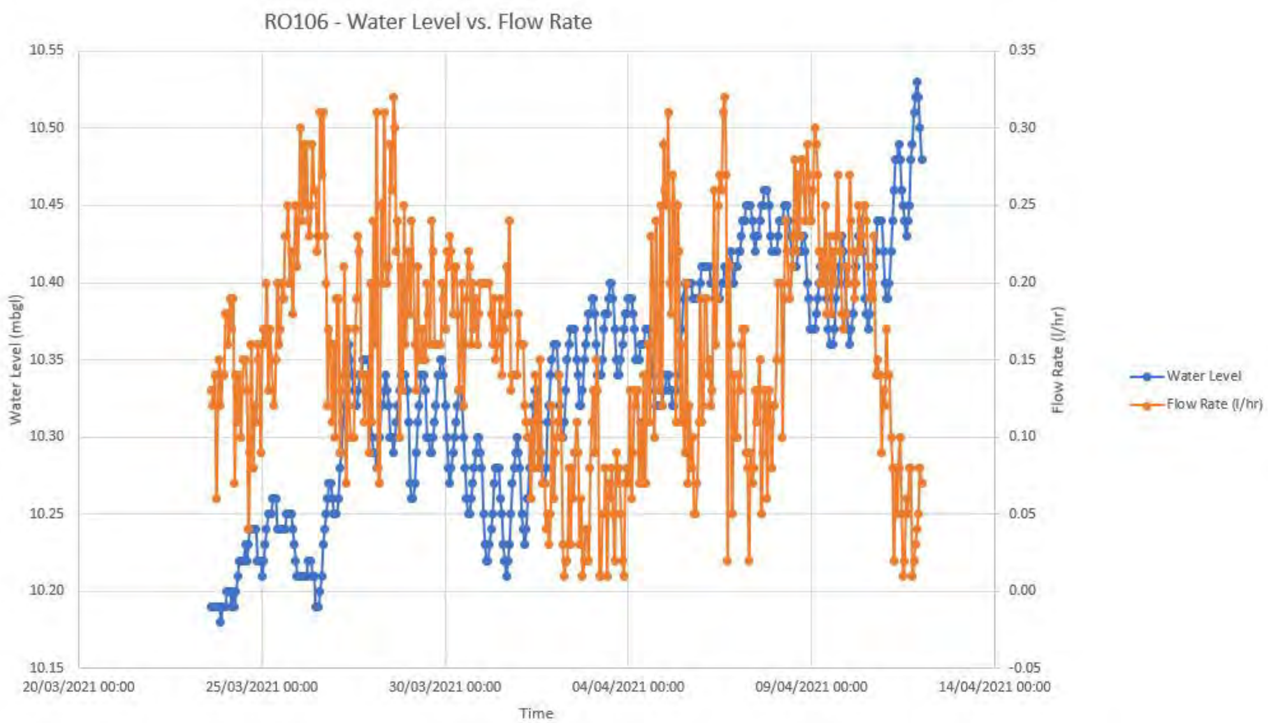


Figure 8.4 - Graph Comparing Gas Flow Rate and Water Level in RO106 (Tidal)



Continuous Monitoring – Calculation of Gas Screening Values

Using the procedure for classifying gassing sites proposed by BS 8485:2015 + A1:2019, Gas Screening Values (GSVs) have been calculated for both carbon dioxide and methane for each of the individual continuous monitoring readings.

Table 8.7 shows the number of readings in each continuous monitoring dataset, the number of readings within each Characteristic Situation bracket and the percentage of the total readings that each bracket represents.

Table 8.7 - Summary of Continuous Monitoring Dataset

Borehole	# of Readings	CS1 Readings		CS2 Readings		CS3 Readings		% of Dataset Equal to CS1		% of Dataset Equal to CS2		% of Dataset Equal to CS3	
		CH_4	CO_2	CH_4	CO_2	CH_4	CH_4	CO_2	CO_2	CH_4	CO_2	CH_4	CO_2
RO101 (S)	478	146	250	332	228	0	0	31	52	69	48	0	0
RO102 (S)	475	58	99	343	376	71	0	12.5	21	75.5	79	15	0
RO103 (S)	476	26	114	447	362	3	0	5.5	24	94	76	1	0
RO104 (S)	356	356	356	0	0	0	0	100	100	0	0	0	0
RO105 (S)	449	448	449	1	0	0	0	99.8	100	0.2	0	0	0
RO106 (S)	CH_4 = 293 CO_2 = 433	149	433	144	0	0	0	51	100	49	0	0	0

Where CS1 conditions have been recorded, this is typically due to the negligible flow rates. A review of the actual gas concentrations indicates that the concentrations are consistently above (typically by between 10 to 40 percentage points) the threshold concentrations for CS1 as suggested by Table 2 of BS 8485, and on this basis, it is considered appropriate to increase all calculated CS1 conditions to CS2.

CS3 conditions were recorded only within boreholes RO102 and RO103, with 71 of the 475 and 3 of the 476 readings respectively being equivalent to CS3 conditions.

Characteristic Situation – Summary

The assessment undertaken on the spot monitoring and continuous monitoring results shows whilst both boreholes typically exhibit CS2 conditions, CS3 conditions have been recorded in four boreholes, and within one of these borehole CS3 conditions were prevalent for approximately 15% of the monitoring period.

It is considered that a classification of CS3 is appropriate and suitably (but not overly) precautionary.

8.3 Possible Gas Protection Measures

The proposed buildings at the site are considered to be of "Type C" as described in Table 3 of BS 8485. "Type C" buildings are under commercial/public ownership, where there is full control over the change of use / structural alterations / ventilation of the structures, and where internal rooms are small to large.

Table 4 of BS 8485 shows that "Type C" buildings on a site with a classification of CS3 need to include gas protection measures to achieve a minimum score of 3.0.

When the minimum gas protection score has been determined for the building as a whole, or for each part of the building, then a combination of two or more of the following three types of protection measures should be used to achieve that score:

- The structural barrier of the floor slab, or of the basement slab and walls if a basement is present.
- Ventilation measures.
- Gas resistant membrane.

It is recommended that a specialist gas protection measures designer is engaged to provide a design for the landfill gas protection measures.

9 Generic Quantitative Risk Assessment (GQRA) - Summary

9.1 Potential Hazards to Human Health

In the cover soils, the identified human health hazards in the solid phase are limited to asbestos which was visually identified in one exploratory hole and detected by the laboratory in 2 out of 33 samples, and marginally elevated (vs. the GAC for a commercial / industrial end use) concentrations of benzo(a)pyrene and dibenzo(a,h)anthracene which were recorded in one sample of the cover soils only.

In the waste mass, the identified human health hazards in the solid phase are principally limited to asbestos which was detected by the laboratory in 14 of the 50 samples analysed. Concentrations of metals, petroleum hydrocarbons, BTEX, VOCs and SVOCs were below the adopted GAC in all samples. Concentrations of PAHs were below the adopted GAC in all samples with the exception of BHW001 at 2.1 m bgl which recorded concentrations of dibenzo(a,h)anthracene in excess of the GAC[15].

There were no exceedances of the commercial/industrial GAC within the natural soils.

The ground gas risk assessment undertaken on the landfill gas spot monitoring and continuous monitoring results shows whilst the boreholes typically exhibit CS2 conditions, CS3 conditions have been recorded in four boreholes, and within one of these borehole CS3 conditions were prevalent for approximately 15% of the monitoring period. It is considered that a classification of CS3 is appropriate and suitably (but not overly) precautionary.

Mitigation measures will be required to mitigate the identified asbestos and PAH hazards to human health within the cover soils and landfill waste. Ground gas protection measures will be required in the construction of any proposed enclosed buildings. The proposed mitigation measures are detailed in the Outline Remediation Strategy in **Section 11**.

9.2 Potential Hazards to Controlled Waters (including Aquatic Ecology)

The elevated concentrations (vs. the saltwater EQS) of metals (copper, nickel, lead and zinc, as well as a single elevated concentration of mercury) and ammoniacal nitrogen identified in the groundwater within the shallow superficial deposits and the chalk and the elevated concentrations of ammoniacal nitrogen, copper and zinc identified in the surface waters within the Hermitage Stream present a potential hazard to aquatic

[15] The sample recovered from BHW001 at 2.1 m recorded a dibenzo(a,h)anthracene concentration of 8.53 mg/kg, equal to this sample's method detection limit which is well in excess of the limit for other similar samples. A review of the laboratory's report for this sample indicates that "*a non-standard volume or mass has been used for this test which has resulted in a raised detection limit*". On this basis, it is considered that the 8.53 mg/kg concentration recorded in this sample is a 'true' detection, and this sample should be disregarded.

ecology within both the groundwater, surface water and within the adjacent Langstone Harbour SSSI, SPA, SAC etc.

It is noted that these concentrations are compared to the saltwater EQS without an adjustment for bioaccessibility.

Ammonia concentrations are significantly elevated in the waste mass and also highly elevated within the groundwater recovered from both the chalk and the superficial deposits. The surface water within the Hermitage Stream appears to be slightly impacted with ammonia and it is suggested that leachate from the Site and the other 'dilute and disperse' type landfills within the reclaimed land is entering these waters. It is also possible that an off-site source of copper is present upgradient of the Site. It should be noted that release of leachate to the surrounding environment is the expected behaviour for an un-lined 'dilute and disperse' type landfill.

Elevated concentrations of certain PAHs have been recorded within the waters recovered from boreholes screened within the waste mass. Groundwater within the underlying River Terrace Deposits / Raised Marine Deposits Secondary A Aquifer appears to be marginally impacted by PAHs, with two of the twelve samples analysed recording elevated concentrations. One of the 38 samples of groundwater from the chalk recorded a single marginally elevated PAH concentration, suggesting that groundwater within the Principal Aquifer is not significantly impacted by PAHs.

Mitigation against the release of leachate from the landfill would require either the removal of the source (i.e., the landfill waste) from the Site, or the temporary removal of all the landfill waste followed by the installation of a landfill liner, and the replacement of the waste. This is neither sustainable or economically viable, and both could result in the release of a significant volume of landfill leachate leading to significant harm of the surrounding water environment. Measures to mitigate against any additional risks introduced through the development of the Site can however be undertaken, and these are detailed in the Outline Remediation Strategy presented in **Section 11**.

10 Outline Remediation Options Appraisal

10.1 Introduction

The purpose of this Section is to outline the general principles for reducing the potential risks to the specific receptors from the hazards identified. It should be noted that changes to the design and layout of the development could affect the approaches in the outline remedial strategy.

The Site comprises a restored landfill, with wastes placed directly onto the natural underlying soils and retained (above the former marshland level) by a bund wall. The landfill within the Site is only one of several present within the wider area of reclaimed land used for landfilling.

The Site has been subjected to three separate phases of intrusive investigation which have revealed both impacted ground and groundwater beneath the Site – this is not unexpected given the Site's historical use and, in the case of groundwater, is 'by design' given the 'dilute and disperse' type of the landfill.

On the basis of the data review and generic quantitative risk assessments presented in the sections above, the following hazards have been identified for the plausible receptors:

- Human Health (Construction Phase) – Asbestos, PAHs, landfill gases, unexpected contamination including known and potential hazards such as metals, TPHs, PAHs, asbestos, VOCs, SVOCs, PFAS etc. via dermal contact, ingestion and inhalation (indoor and outdoor) of dusts, soil particles and landfill gases.
- Human Health (Operational Phase) – Asbestos, PAHs via dermal contact, ingestion and inhalation (indoor and outdoor) of dusts, soil particles and landfill gases, ingestion of contaminated drinking water due to permeation by organics into water supply pipe.
- Controlled Waters – Groundwater (Construction and Operational Phase) – Metals (copper, nickel, lead, zinc), mercury, ammonia, PAHs
- Controlled Waters – Surface Water (Construction Phase and Operational Phase) – Metals (copper, nickel, lead, zinc), ammonia
- Ecologically Sensitive Sites – Metals (copper, nickel, lead, zinc), ammonia
- Buildings/Construction Materials – Ground conditions aggressive to concrete and plastics may be present.

10.2 Embedded Mitigation

The following actions provide mitigation against the identified hazards either as a result of already existing conditions, or as a consequence of their construction as part of the proposed development.

- The construction of new areas of built development and hardstanding will create a barrier, breaking the direct contact and inhalation human health exposure pathways in the completed development.
- The construction of the proposed development is likely to provide betterment through a reduction in infiltration through the cover soils of the landfill via the introduction of new areas of impermeable development. Infiltration drainage is not proposed. A reduction in infiltration will correspond to a reduction in leachate generation and therefore a corresponding reduction in contaminant load being released to controlled waters.

Following the grant of planning permission in 1968 it appears that a sheet pile wall was added to the design of the bund wall that retains the landfills within and adjacent to the Site, below the seaward face. Details of the length of the sheet-piles are unclear and appear to vary along different points in the bund, with various lengths of between approximately 1.8 m to 6.0 m (Drawing 639/92, **Appendix B**). The bund is indicated to be constructed of "chalk fill" (drawing 639/87, **Appendix B**). Depending upon the depth the sheet piled wall is constructed to, the wall may provide an element of 'cut off', preventing lateral migration of landfill leachate through the more permeable near-surface soils and into the Hermitage Stream and Langstone Harbour.

10.3 Options Appraisal

The options appraisal stage of risk management comprises the following three steps:

- Identify feasible remediation options.
- Do a detailed evaluation of options.
- Select the final remediation option.

Before identifying options, the technical and management objectives to be achieved are defined below.

Project Development Objectives

The technical objectives are to construct a new water recycling plant at the Site. The majority of the process plant and tanks will be located within the western half of the Site, with more lightly loaded structures located in the east.

Management Objectives

It is anticipated that the remediation outcomes would achieve the following:

- Secure regulator agreement and approval of a Development Consent Order.
- Avoid unacceptable environmental impacts, health and safety issues and minimise long term liabilities.
- Avoid the requirement for long term monitoring or maintenance.
- Meet timescales and budgets.

Remediation Objectives

The Remediation Objective is to break the identified contaminant linkages, with the options for risk management comprising one or more of the following:

Option 1 Treatment of the source – remediation of soil and/or groundwater to decrease contaminant mass, concentration, mobility or toxicity and/or remove the source.

Option 2 Manipulation of the pathway such as containment of the contaminant.

Option 3 Management of the receptor and /or exposure pathway.

We have considered the relative ability of each option to achieve the remedial objective in a safe and timely manner whilst optimising the environmental, social and economic value of the work.

Option 1 is not considered to be viable because mitigation against the release of leachate from the landfill would require either the removal of the source (i.e., the landfill waste) from the Site, or the temporary removal of all the landfill waste followed by the installation of a landfill liner, and the replacement of the waste. This is neither sustainable or economically viable, and both could result in the release of a significant volume of landfill leachate leading to significant harm of the surrounding water environment.

Options 2 and 3 have been retained for further consideration and the contaminant linkages requiring management via these Options are summarised in Table 10.1.

Table 10.1 Summary of Contaminant Linkages Requiring Risk Management

Contaminant Linkage (CL)	Hazard	Receptor & Pathway	Risk Reduction Measures
CL1	Cover soils and landfill waste – Asbestos, PAHs, Landfill Gases	Construction workers, workers at adjacent commercial development, members of the public using the footpath adjacent to the Hermitage Stream / nearby green spaces - Inhalation	Placement of a piling mat at the prepared formation level (pathway break). Compliance with Health & Safety legislation Preparation of a Construction Environmental Management Plan Watching brief and discovery strategy in place during groundworks. Landfill gas protection measures
CL2	Unforeseen Ground Conditions	Construction workers & Neighbouring - All	Compliance with Health & Safety legislation Preparation of a CEMP Preparation of a Watching Brief and Discovery Strategy
CL3	Made Ground – Asbestos, PAHs.	Future Maintenance/Service workers - All	Service trenches to be lined with a marker geotextile and backfilled with clean, imported aggregate around services. Compliance with Health & Safety legislation.
CL4	Made Ground – Asbestos, PAHs, Landfill gases	Future Users – All	Watching brief and discovery strategy implemented during construction of any landscaping. Any proposed areas of soft landscaping should include a clean cover system. The presence of the cover system and marker membrane should be recorded in the completed development's Health and Safety file. Compliance with Health & Safety legislation. Landfill gas protection measures.

Contaminant Linkage (CL)	Hazard	Receptor & Pathway	Risk Reduction Measures
CL5	Made Ground - Hydrocarbons	Future Users Permeation of Water Supply Pipe	Design - provision of barrier pipe if unexpected hydrocarbon contamination is encountered. Watching Brief and Discovery Strategy
CL6	Made Ground – aggressive ground conditions	Concrete Direct Contact	Design – appropriate specification of concrete mix and selection of appropriate in-ground materials
CL7	Metals, ammonia	Controlled Waters & Ecologically Sensitive Sites – Migration via natural and anthropogenic routes, direct recharge	CEMP which would include the following: – Surface Water Management Plan, Water quality monitoring requirements – Definition of control measures should the agreed threshold concentrations be exceeded – Foundation Works Risk Assessment Selection of appropriate piling methodology.

11 Outline Remediation Strategy

11.1 Health & Safety Legislation - Contaminant Linkages 1, 2, 3 and 4

The Construction (Design & Management) Regulations (CDM 2015) are the main regulations for managing the health, safety and welfare on construction projects and will apply to the proposed development. A Principal Designer (PD) and Principal Contractor will be appointed by the client to plan, manage, monitor and coordinate health and safety during the pre-construction and construction phases respectively. The PD role includes identifying, eliminating or controlling foreseeable risks.

All persons engaged in earthworks and construction will be made aware of the findings of the intrusive ground investigation and the potential for contamination to be present. A Site-specific health and safety plan will be produced in accordance with CDM 2015 Regulations.

The Principal Contractor (PC) will have responsibility for ensuring legislative compliance and obtaining all permits/licenses as required. The following are highlighted but should not be considered the only aspects to be addressed.

It will be the responsibility of the Principal Contractor to ensure that a safe working system is in place including measures to manage the presence of asbestos identified on Site.

The Control of Asbestos Regulations (CAR), 2012 require that where there is a potential for asbestos containing materials (ACMs) including soils to be disturbed, an assessment of risk is required. The person undertaking the Risk Assessment must be competent to do so in line with Regulation 10.

The Principal Contractor will be responsible for the provision of an appropriate risk assessment, in line with Regulation 6, which must include the following:

- Description of work including type and duration.
- Type, quantity and condition of ACMs.
- Steps to reduce exposure to the lowest level reasonably practicable including detail of how stockpiles will be conditioned/ managed to prohibit dust migration during periods of high wind.
- The reasons for the chosen work methods; Steps taken to control the release of asbestos into the environment.
- Details of expected exposure and number of people affected.
- Details on the type and use of Respiratory Protective Equipment (RPE) and Personal Protective Equipment (PPE).
- Details of decontamination procedures.
- Procedures for waste removal.
- How to deal with emergencies.
- Other information relating to safe working.

11.2 Construction Environmental Management Plan – Contaminant Linkages 1, 2 and 7

The purpose of a Construction Environmental Management Plan (CEMP) is to outline how a construction project will avoid, minimise, or mitigate effects on the environment and surrounding area. The CEMP will present:

- Environmental requirements and controls to cover policy and planning, environmental impacts, risks and mitigation, procedures for monitoring construction processes against environmental objectives, pollution control measures, environmental risk register.
- Consents, commitments, and permissions considering all appropriate environmental legislation, planning conditions and any other consents or licensing.
- An asbestos management plan detailing the measures to be adopted during the construction phase for the control of asbestos hazards, and the procedures/protocols to be followed in the event of unexpected asbestos contamination being encountered.
- A dust management plan will be prepared to support the CEMP, this plan will include measures to be adopted during the construction phase for the control of any dust that might emanate from the development site and will be in accordance with the guidance as laid out BRE Report 465 – Control of Dust from Construction and Demolition Activities. Such measures could include the use of dust suppression systems, keeping of haul roads (and areas where construction plant regularly track over) damp during dry weather conditions and the use of wheel washes to prevent mud being tracked onto the adjacent highway.
- A surface water management plan will be prepared to support the CEMP, this plan will include the measures to be adopted during the construction phase and will describe measures to prevent overland runoff from construction/stripped areas reaching surface waters, or surface water drains (including highway drains), e.g., the use of French drains, ditching, planting of filter strips, silt fencing etc. Provisions will account for site topography, existing surface-water drainage, planned service installation, and planned groundworks / processing.
- Investigation / survey to determine the presence / condition of any existing drainage that crosses the Site. DWG 639.84 (**Appendix B**) records a potential drainage run between the "*12" diameter porous pipe*" within the drainage ditch on the Site's northern boundary, which links to a manhole (MH5) before crossing the Site's north-eastern corner to an outfall to the Hermitage Stream. Where the condition of this drainage is such that it could represent a potential pathway for contaminant migration, e.g., through settlement induced damage causing a breach in integrity of the conduit, repairs should be undertaken. Sampling of the water conveyed by the drain, at the outfall to the Hermitage Stream could also be undertaken to determine whether the water within the drain exhibits any of the characteristics of landfill leachate.
- A vibration management plan will be prepared to support the CEMP, this plan will include measures for ground-borne vibration control as per BS5228:2009+A1:2014 Part 2: Vibration.
- Environmental controls to be enacted during construction to limit leachate generation. Such measures could include the pumping out of excavations during inclement weather (and the capture and treatment of the waters removed), management of construction to limit the number of open excavations wherever possible, or the covering of open excavations (where possible) during site down-time e.g., weekends, when inclement weather is forecast.

The CEMP will contain measures to minimise the potential for generating contamination during construction phase likely to include, but not limited to, the following:

- The provision of spill kits and appropriate training of all Site personnel.
- The specification of dust minimisation measures to be implemented.
- The siting of chemicals, fuel and oil stores on impervious hardstanding and within bunded areas at a location away from surface water bodies.

- A requirement for standing machinery to have drip trays placed underneath to prevent oil or fuel leaks causing pollution.
- A requirement for the refuelling of vehicles and machinery to be carried out in one designated area with spill kits located close by in the event of a spill on an impermeable surface a suitable distance away from surface water bodies.
- A prohibition on the burning of any materials on-Site.
- Protocol for soil re-use.
- A Discovery Strategy including a requirement for a geo-environmental watching brief for contamination during in-ground works.

11.3 Discovery Strategy (Unexpected Ground Conditions) – Contaminant Linkages 1, 2, 4 and 5

A discovery strategy will be written that defines how any unusual materials (solids, liquids or gases/odours) will be managed if encountered during the construction works. The strategy awareness establishes protocols to be implemented (and by whom) and will include the following:

- All personnel working on site will undergo a site induction and toolbox talks which will include references to potential environmental hazards such as contamination.
- Training and Maintaining Awareness Programme – mechanisms such as posters or monthly repeat inductions to reinforce the procedure and highlighting the key steps to be followed should contamination be identified.
- Watching Brief – including competent person definition
- Communication protocol.
- Assignment of a Specialist Contamination Advisor.

11.4 Service Trenches – Contaminant Linkage 3

To mitigate the hazard to future maintenance / service workers associated with the inhalation/ingestion/contact with contamination in the Made Ground the following will be undertaken.

- Remove all Made Ground from within the trenches and replace with “clean” imported material.
- Incorporate a marker membrane within all service trenches to identify the presence of potentially asbestos contaminated Made Ground below.

Any imported soil for any purpose will conform to an importation criteria specification.

11.5 Aggressive Ground Conditions – Contaminant Linkages 5 and 6

The identification of risks to the development associated with ground conditions by the PD and implementation by the PC will be informed by the available reports.

Water supply pipes will be specified to address the Site-specific ground conditions.

The design of the proposed development will incorporate specification of construction materials to mitigate aggressive ground conditions. The guidance (BRE, 2005) should be followed in the design of mixes for buried concrete for the classifications given.

11.6 Landfill Gas Protection Measures – Contaminant Linkages 1 and 4

During the construction phase, it will be necessary to provide landfill gas protection measures to all temporary structures at the Site. This includes offices, stores, drying rooms, welfare facilities etc. It is envisaged that this will be most readily accomplished by placing such structures on blocks to raise them above ground level and provide a ventilated void, allowing any gases migrating upwards from the landfill to vent to the atmosphere rather than to collect within enclosed spaces.

The proposed buildings at the site are considered to be of "Type C" i.e., are under commercial/public ownership, where there is full control over the change of use / structural alterations / ventilation of the structures, and where internal rooms are small to large. Any buildings containing fully enclosed rooms constructed as part of the proposed development should be constructed with gas protection measures sufficient for a site categorised as Characteristic Situation 3 and could comprise:

- The structural barrier of the floor slab, or of the basement slab and walls if a basement is present.
- Ventilation measures.
- Gas resistant membrane.

It is recommended that a specialist gas protection measures designer is engaged to provide a design for the landfill gas protection measures. The recommendations of the gas protection measures designer should be followed, and a verification report demonstrating the correct installation of the protection measures should be prepared and signed off by the Local Planning Authority.

If / where ventilation and passive venting options are considered, these measures must be designed to ensure that they do not compromise the overarching objective of reducing infiltration, e.g., if venting trenches are to be used, these should be capped with impermeable material and fitted with a gas collection system to convey the migrating gases to cowled vent stacks.

Whilst permeable paving would provide venting for landfill gases it is not compatible with the expectation of a reduction in infiltration and will only be used in areas where an underlying collection/attenuation system is proposed.

11.7 Clean Cover System – Contaminant Linkage 4

To mitigate the hazard to end-users associated with the inhalation of asbestos and PAHs in the Made Ground the following will be adopted.

All proposed areas of soft landscaping will be capped with a "clean cover" system comprising a marker membrane overlain by 600mm thickness of "clean" imported subsoil and topsoil. It is considered that a 600mm thickness will provide sufficient mitigation against the disturbance through regular landscaping activities, (e.g., shrub planting etc.) of the underlying Made Ground though care should be taken to ensure that the rooting depths of the selected plants will not exceed the cover system thickness. The presence of the clean cover system incl. marker membrane should be recorded in the completed development's Health and Safety file.

Any imported soil for any purpose will conform to an importation criteria specification.

It is noted that on the basis of the commercial/industrial land use at the site, existing vegetated areas that are not proposed to be excavated during the development and are not to be used in new areas of soft landscaping are not anticipated to require a clean cover system. The potential presence within the near-surface soils should be recorded in the completed development's Health and Safety file.

11.8 Selection of Piling Methodology – Contaminant Linkage 7

A Foundation Works Risk Assessment will be prepared as part of the CEMP. The purpose of this assessment will be to identify potential ground or environmental related risks associated with piling and any penetrative ground improvement (if it were to be required) through landfill and contaminated soils and to identify appropriate risk management approaches that will be adopted to limit the risks arising from the works.

It is anticipated that Continuous Flight Auger (CFA) piles will be utilised as this method allows for intimate contact between the cast-in-place pile and the surrounding landfill waste, reducing the potential for the creation of additional pathways by which contamination could migrate into the underlying aquifers and laterally into adjacent surface waters.

Following approval of the FWRA and the detailed design of the proposed development, details of the proposed method/s to be employed, and the probable duration of these operations will be provided to the LPA, for approval.

11.9 Other Actions - Soil Excavation, Re-Use and Disposal Protocol

The Contractor will prepare a procedure for identifying where waste will be generated, any additional testing to confirm the classification and measures to be adopted to address the requirements of the European Waste Directive that all waste needs to be pre-treated prior to disposal.

If material is proposed to be removed or re-used off-Site or reused on-Site as part of the works, it will require appropriate classification and / or sorting to demonstrate suitability. The actual material to be excavated should be analysed and assessed as suitable for reuse by assessing potential risk to human and controlled water receptors.

There should also be a clear requirement for reuse in the scheme design and may require consideration as part of a materials management plan or U1 exemption. It is the Contractor's responsibility to appropriately classify material excavated and ensure adequate testing is completed.

It is the position of the Environment Agency that re-use of soils within an historical landfill is outside of the scope of the Definition of Waste: Development Industry Code of Practice (CL:AIRE, 2011). It will therefore not be possible to use this protocol to manage the movement and re-use of soils on-Site.

Off-Site disposal requires an accurate written description of the waste and must include:

- The waste classification code, also referred to as LoW (List of Waste) or EWC (European Waste Catalogue) code - classification codes for common types of waste are in the relevant parts of this guidance.
- Whether it's hazardous or Persistent organic pollutant (POPs) waste.
- The type of premises or business where the waste was produced.
- The name of the substance or substances.
- The process that produced the waste.
- A chemical and physical analysis of the waste and its components.

- Any special problems, requirements or knowledge related to the waste.

For controlled waste that is classified as 'non-hazardous' this will be a waste transfer note and for waste classified as 'hazardous' this will be a consignment note. In both cases the record will require a waste code and classification.

Failure to comply with the duty of care requirements is a criminal offence and could lead to prosecution.

Dewatering of Excavations

If dewatering[16] is required, abstraction and discharge licences will be sought from the Environment Agency under the terms of the Environmental Permitting Regulations 2010. On the basis that any waters pumped from excavations may be contaminated with landfill leachate, infiltration of the waters or disposal to surface water will not be possible without treatment. Discharge to sewer may be possible subject to the utility provider approval. It should be noted that if free product is present then separation prior to discharge to sewer might be necessary.

[16] Dewatering as stated here does not include the short term, temporary discharge of uncontaminated water (wholly or mainly rainwater) from an excavation to surface water, as covered by EA Regulatory Position Statement 261. Noting that this would not be applicable to excavations within the landfill waste mass.

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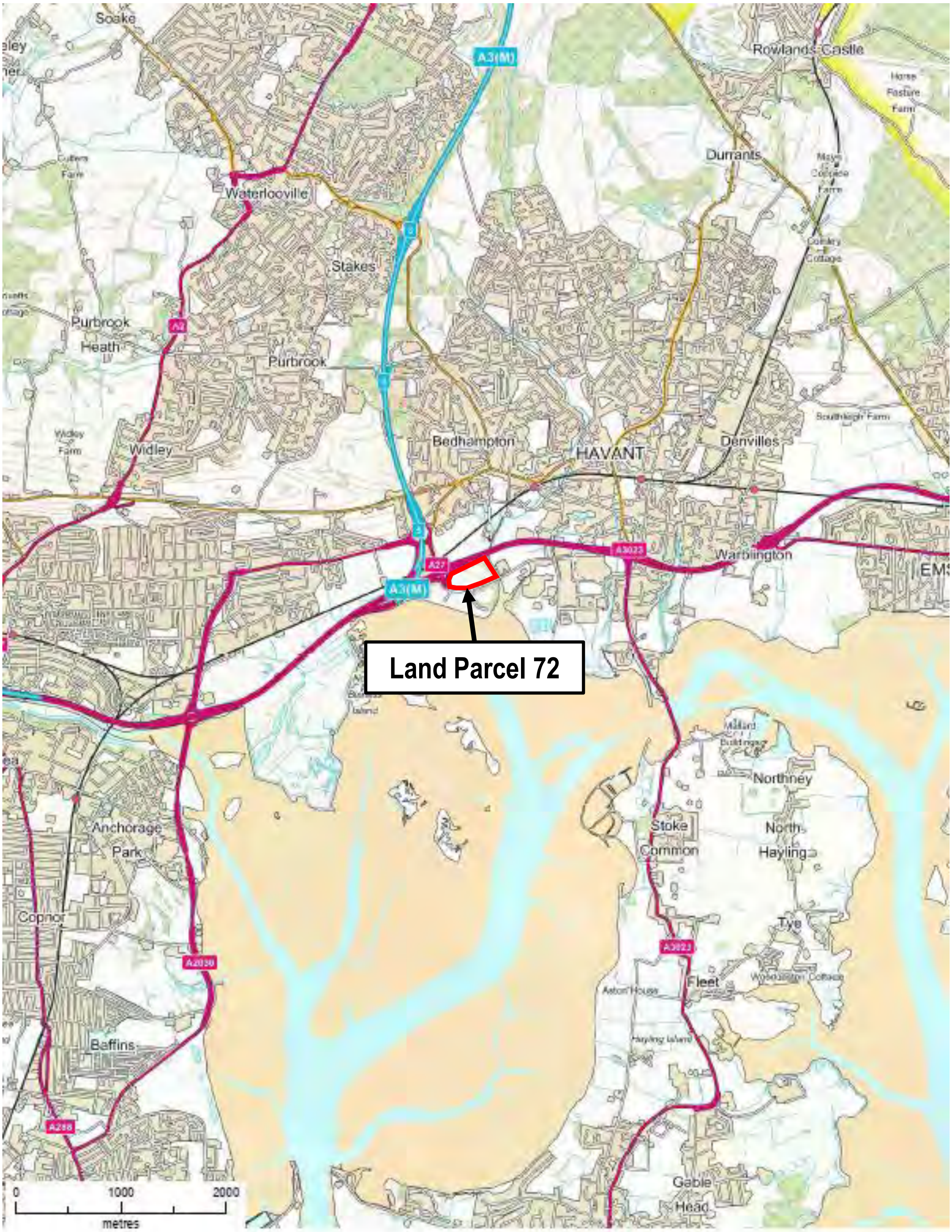
Figures



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Drawing Title:

Site Location Plan

Prepared: NH

Checked: SP

Date: 14/02/2023

Revision: 0 Figure: 1

Client:

Southern Water Services Ltd.

Havant Water Recycling Plant – Land Parcel 72

WATER for LIFE from Southern Water

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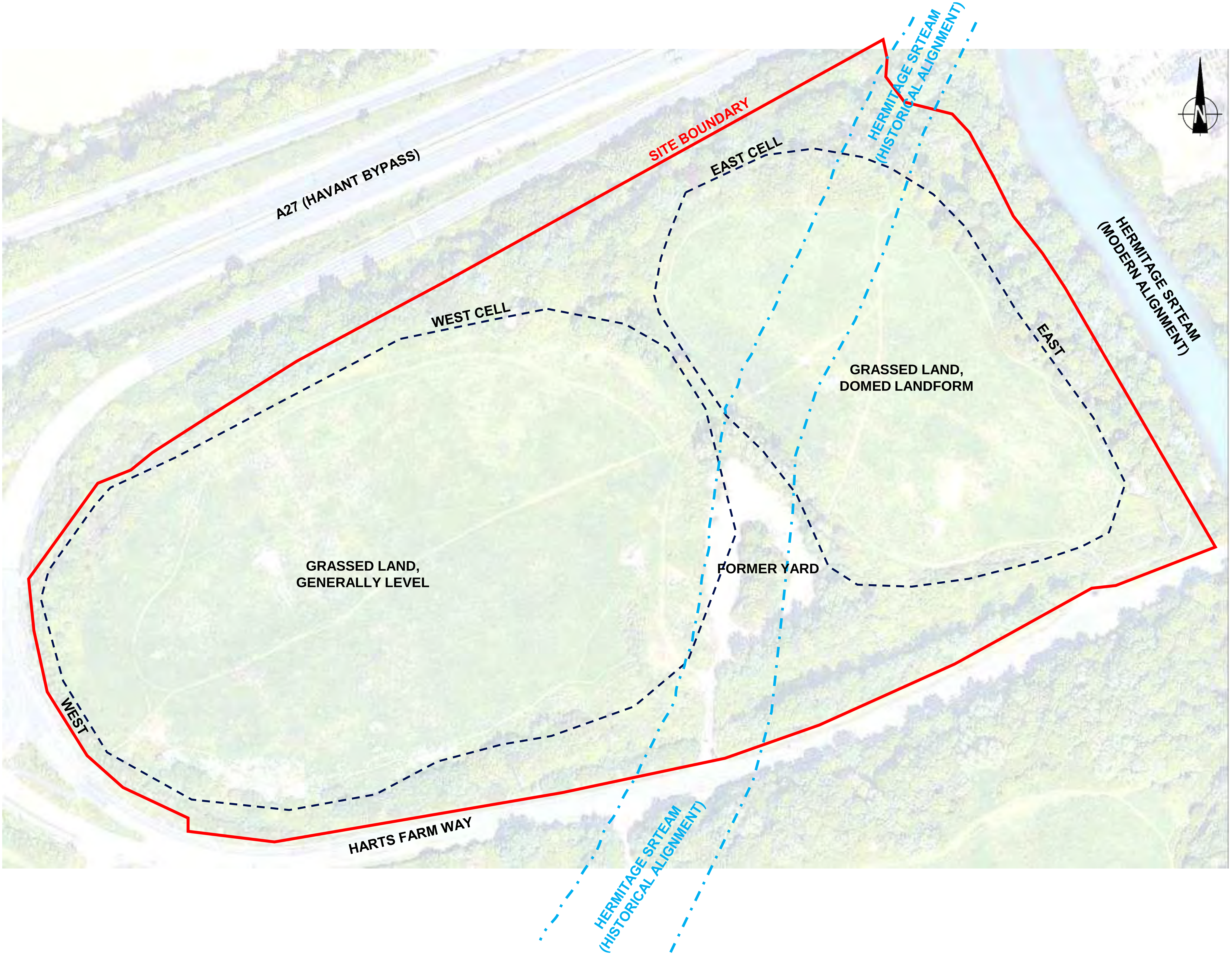

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Southern Water
Havant Water Recycling
Plant – Land Parcel 72

Prepared:	Checked:	Date:
NH	SP	03/2023

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Site Layout Plan

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Client/Project:

Southern Water
Havant Water Recycling Plant – Land Parcel 72

Prepared:	Checked:	Date:
NH	SP	03/2023

Title

Exploratory Hole Location Plan – Delta Simons, 2022

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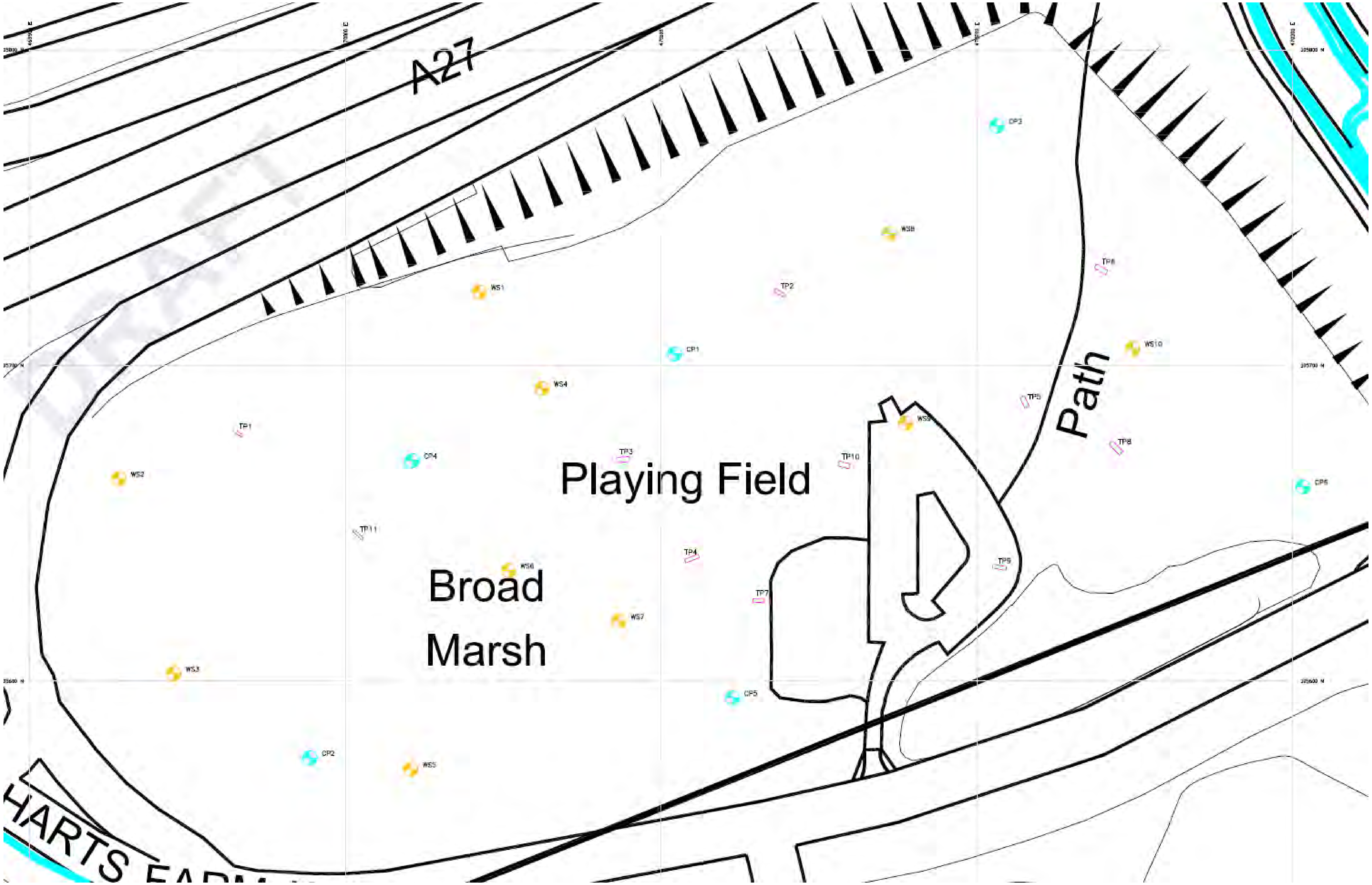

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Utilities Note: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. Persons referring to this drawing are therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

Client/Project:

Southern Water
Havant Water Recycling
Plant – Land Parcel 72

Prepared:	Checked:	Date:
NH	SP	03/2023

Title

Exploratory Hole Location
Plan – WYG, 2017

Not to Scale

Revision:	Figure:
0	3b

Appendix A Methodology for Assessment of Land Contamination (England)

1 INTRODUCTION

This document defines the approach adopted by Stantec in relation to the assessment of land contamination in England. The aim is for the approach to (i) be systematic and objective, (ii) provide for the assessment of uncertainty and (iii) provide a rational, consistent, transparent framework.

When preparing our methodology, we have made reference to various technical guidance documents and legislation referenced in Section 7 of which the principal documents are (I) Contaminated Land Statutory Guidance (Defra 2012), (ii) online guidance Land Contamination: Risk Management (LC:RM) accessed from GOV.UK which is expected to replace Contaminated Land Research (CLR) Report 11: Model Procedures for the Management of Contamination (EA 2004). It should be noted that LCRM is currently due to be revised following consultation and CLR 11 is archived, (iii) Contaminated land risk assessment: A guide to good practice (C552) (CIRIA 2001) (iv) National Planning Policy Framework (NPPF, 2019) (v) BS 10175 Investigation of potentially contaminated sites - Code of Practice (BSI 2017) and (vi) The series of British Standards on Soil Quality BS 18400.

2 DEALING WITH LAND CONTAMINATION

Government policy on land contamination aims to prevent new contaminated land from being created and promotes a risk-based approach to addressing historical contamination. For historical contamination, regulatory intervention is held in reserve for land that meets the legal definition and cannot be dealt with through any other means, including through planning. Land is only considered to be "*contaminated land*" in the legal sense if it poses an unacceptable risk.

UK legislation on contaminated land is principally contained in Part 2A of the Environmental Protection Act, 1990 (which was inserted into the 1990 Act by section 57 of the Environment Act 1995). Part 2A was introduced in England on 1 April 2000 and provides a risk-based approach to the identification and remediation of land where contamination poses an unacceptable risk to human health or the environment.

The Model Procedures for the Management of Land Contamination (CLR 11), were 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. The approach, concepts and principles for land contamination management promoted by LC:RM (and its predecessor CLR 11) are applied to the determination of planning applications. The guidance given in LC:RM follows the same principles.

Other legislative regimes may also provide a means of dealing with land contamination issues, such as the regimes for waste, water, environmental permitting, and environmental damage. Further, the law of statutory nuisance may result in contaminants being unacceptable to third parties whilst not attracting action under Part 2A or other environmental legislation.

2.1 Part 2A

The Regulations and Statutory Guidance that accompanied the Act, including the Contaminated Land (England) Regulations 2006, has been revised with the issue of The Contaminated Land (England) (Amendment) Regulations 2012 (SI 2012/263) and the Contaminated Land Statutory Guidance for England 2012.

Part 2A defines contaminated land as "*land which appears to the Local Authority in whose area it is situated to be in such a condition, that, by reason of substances in, on or under the land that significant harm is being caused, or there is a significant possibility that such significant harm (SPOSH) could be caused, or significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution (SPOSP) being caused*".

Harm is defined as "*harm to the health of living organisms or other interference with the ecological systems of which they form part, and in the case of man, includes harm to his property*".

Part 2A provides a means of dealing with unacceptable risks posed by land contamination to human health and the environment, and under the guidance enforcing authorities should seek to find and deal with such land. It states that "*under Part 2A the starting point should be that land is not contaminated land unless there is reason to consider otherwise. Only land where unacceptable risks are clearly identified, after a risk assessment has been undertaken in accordance with the Guidance, should be considered as meeting the Part 2A definition of contaminated land*". Further, the guidance makes it clear that *"regulatory decisions should be based on what is reasonably likely, not what is hypothetically possible".*

The overarching objectives of the Government's policy on contaminated land and the Part 2A regime are:

"(a) To identify and remove unacceptable risks to human health and the environment.

(a) To seek to ensure that contaminated land is made suitable for its current use.

(b) To ensure that the burdens faced by individuals, companies and society as a whole are proportionate, manageable and compatible with the principles of

sustainable development".

The enforcing authority may need to decide whether and how to act in situations where decisions are not straight forward, and where there is uncertainty. "*In so doing, the authority should use its judgement to strike a reasonable balance between: (a) dealing with risks raised by contaminants in land and the benefits of remediating land to remove or reduce those risks; and (b) the potential impacts of regulatory intervention including financial costs to whoever will pay for remediation, health and environmental impacts of taking action, property blight, and burdens on affected people".*

The authority is required to "*take a precautionary approach to the risks raised by contamination, whilst avoiding a disproportionate approach given the circumstances of each case".* The aim is "*that the regime produces net benefits, taking account of local circumstances*".

The guidance recognises that *"normal levels of contaminants in soils should not be considered to cause land to qualify as contaminated land, unless there is a particular reason to consider otherwise".* Normal levels are quoted as:

"a) *natural presence of contaminants'* such as from underlying geology *'that have not been shown to pose an unacceptable risk to health and the environment*

b) *…low level diffuse pollution, and common human activity…"*

Similarly the guidance states that significant pollution or significant possibility of significant pollution of controlled waters is required for land to be considered contaminated and the "*fact that substances are merely entering water"* or "*where discharge from land is not discernible at a location immediately downstream"* does not constitute contaminated land.

To help achieve a more targeted approach to identifying and managing contaminated land in relation to the risk (or possibility) of harm to human health, the revised Statutory Guidance presented a new four category system for considering land under Part 2A, ranging from Category 4, where there is no risk that land poses a significant possibility of significant harm (SPOSH), or the level of risk is low, to Category 1, where the risk that land poses a significant possibility of significant harm (SPOSH) is unacceptably high.

For land that cannot be readily placed into Categories 1 or 4 further assessment is required. If there is sufficient concern that the risks could cause significant harm or have the significant possibility of significant harm the land is to be placed into Category 2. If the concern is not met land is considered Category 3.

The technical guidance clearly states that the currently published Soil Guidance Values (SGV's) and Generic Assessment Criteria (GAC's) represent *"cautious estimates of level of contaminants in soils"* which should be considered *"no risk to health or, at most, a minimal risk"*. These values do not represent the boundary between categories 3 and 4 and "*should be considered to be comfortably within Category 4".*

At the end of 2013 technical guidance in support of Defra's revised Statutory Guidance (SG) was published and then revised in 2014 (CL: AIRE 2014) which provided:

- A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
- A demonstration of the methodology, via the derivation of C4SLs for six substances – arsenic, benzene, benzo(a)pyrene, cadmium, chromium (VI) and lead.

For controlled waters, the revised Statutory Guidance states that the following types of pollution should be considered to constitute significant pollution of controlled waters:

"(a) Pollution equivalent to "environmental damage" to surface water or groundwater as defined by The Environmental Damage (Prevention and Remediation) Regulations 2009, but which cannot be dealt with under those Regulations.

(b) Inputs resulting in deterioration of the quality of water abstracted, or intended to be used in the future, for human consumption such that additional treatment would be required to enable that use.

(c) A breach of a statutory surface water Environment Quality Standard, either directly or via a groundwater pathway.

(d) Input of a substance into groundwater resulting in a significant and sustained upward trend in concentration of contaminants (as defined in Article 2(3) of the Groundwater Daughter Directive (2006/118/EC)".

The guidance also states that, in some circumstances, significant concentrations at a compliance point (in groundwater or surface water) may constitute pollution of controlled waters.

As with SPOSH for human health, the revised Statutory Guidance presents a four-category system for Significant Pollution of controlled waters. Category 1 covers land where there is a strong and compelling case for SPOSP, for example where significant pollution would almost certainly occur if no action was taken to avoid it. Category 4 covers land where there is no risk or the risk is low, for example, where the land contamination is having no discernible impact on groundwater or surface water quality. Category 2 is for land where the risks posed to controlled waters are not high enough to consider the land as Category 1 but nonetheless are of sufficient concern to constitute SPOSP, Category 3 is for land where the risks posed to controlled waters are higher than low but not of sufficient concern to constitute SPOSP.

2.2 Planning

The Local Planning Authority (LPA) is responsible for the control of development, and in doing so it has a duty to take account of all material considerations, including contamination.

The principal planning objective is to ensure that any unacceptable risks to human health, buildings and other property and the natural and historical environment from the contaminated condition of the land are identified so that appropriate action can be considered and taken to address those risks.

The National Planning Policy Framework (NPPF, 2021), includes the following.

Paragraph 120 states that planning policies and decisions should "*(c) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land*."

Paragraph 184 states "*Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner*".

Paragraph 174 states "*planning policies and decisions should contribute to and enhance the natural and local environment by:*

(e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; *and*

(f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Paragraph 183 describes the policy considerations the Government expects LPA's to have in regard to land affected by contamination when preparing policies for development plans and in taking decisions on applications.

Paragraph 183 states "*planning policies and decisions should ensure that:*

(a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

(b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and

c) adequate site investigation information, prepared by a competent person, is available to inform these assessments."

Paragraph 187 states "*The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.*"

The Glossary in Annex 2 provides the following:

***Brownfield land registers**: Registers of previously developed land that local planning authorities consider to be appropriate for residential development, having regard to criteria in the Town and Country Planning (Brownfield Land Registers) Regulations 2017. Local planning authorities will be able to trigger a grant of permission in principle for residential development on suitable sites in their registers where they follow the required procedures.*

***Competent person (to prepare site investigation information)**: A person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation.*

***Previously developed land**: Land which is or was occupied by a permanent structure, including the curtilage of the developed land (although it should not be assumed that the whole of the curtilage should be developed) and any associated fixed surface infrastructure. This excludes: land that is or was last occupied by agricultural or forestry buildings; land that has been developed for minerals extraction or waste disposal by landfill, where provision for restoration has been made through development management procedures; land in built-up areas such as residential gardens, parks, recreation grounds and allotments; and land that was previously developed but where the* *remains of the permanent structure or fixed surface structure have blended into the landscape.*

***Site investigation information**: Includes a risk assessment of land potentially affected by contamination, or ground stability and slope stability reports, as appropriate. All investigations of land potentially affected by contamination should be carried out in accordance with established procedures (such as BS10175 Investigation of Potentially Contaminated Sites – Code of Practice).*

Stantec adopt the principle that a Preliminary Investigation (Desk Study and Site Reconnaissance) and Preliminary Risk Assessment (see below) is the minimum assessment requirement to support a planning application.

The level at which contamination is deemed to be unacceptable, or, gives rise to adverse effects under a planning context has not been identified but is envisaged to be more precautionary than the level required to determine land as contaminated under Part 2A.

2.3 Building Control

The building control department of the local authority or private sector approved inspectors are responsible for the operation and enforcement of the Building Regulations (DCLG 2010) to protect the health, safety and welfare of people in and around buildings. Approved Document C requires the protection of buildings and associated land from the effects of contamination, to be applied (non-exclusively) in all changes of use from commercial or industrial premises, to residential property.

3 APPROACH

As with CLR11 the guidance given in LC:RM presents three stages of land contamination management: -

(a) Stage 1 - Risk Assessment;

(b) Stage 2 - Options Appraisal; and

(c) Stage 3 - Remediation.

Each stage has three tiers. The three tiers of Stage 1 Risk Assessment are: -

- Tier 1 - Preliminary Risk Assessment (PRA) - first tier of RA that develops the outline conceptual model (CM) and establishes whether there are any potentially unacceptable risks.

- Tier 2 - Generic Quantitative Risk Assessment (GQRA) - carried out using generic assessment criteria and assumptions to estimate risk.

- Tier 3 - Detailed Quantitative Risk Assessment (DQRA) - carried out using detailed site-specific information to generate Site Specific Assessment Criteria (SSAC) as risk evaluation criteria.

For each tier of a Stage 1 - Risk Assessment you must:

1. Identify the hazard - establish contaminant sources.

2. Assess the hazard - use a source-pathway-receptor (S-P-R) pollutant linkage approach to find out if there is the potential for unacceptable risk.

3. Estimate the risk - predict what degree of harm or pollution might result and how likely it is to occur.

4. Evaluate the risk - decide whether a risk is unacceptable.

A Stantec Preliminary Investigation report normally comprises a desk study, walkover site reconnaissance and preliminary risk assessment (PRA). The project specific proposal defines the actual scope of work which might include review of ground investigation data in which case the report includes a GQRA.

Risk estimation involves identifying the magnitude of the potential consequence (taking into account both the potential severity of the hazard and the sensitivity of the receptor) and the magnitude of the likelihood i.e. the probability (taking into account the presence of the hazard and the receptor and the integrity of the pathway). This approach is promoted in current guidance such as R&D 66 (NHBC 2008).

For a PRA, Stantec's approach is that if a pollution linkage is identified then it represents a potentially unacceptable risk which either (1) remediation / direct risk management or (2) progression to further tiers of risk assessment (GQRA and GQRA) requiring additional data collection and enabling refinement of the CM using the site specific data.

4 IDENTIFICATION OF POLLUTANT LINKAGES AND DEVELOPMENT OF A CONCEPTUAL MODEL (CM)

For all Tiers of a Stage 1 Risk Assessment, the underlying principle to ground condition assessment is the identification of *pollutant linkages* in order to evaluate whether the presence of a source of contamination could potentially lead to harmful consequences. A pollutant linkage consists of the following three elements: -

- A source/hazard – a substance or situation which has the potential to cause harm or pollution;
- A pathway – a means by which the hazard moves along / generates exposure; and
- A receptor/target – an entity which is vulnerable to the potential adverse effects of the hazard.

The *Conceptual Model* identifies the types and locations of potential contaminant sources/hazards and potential receptors and potential migration/transportation pathway(s). The CM is refined through progression to further tiers of risk assessment (GQRA and GQRA) requiring additional data collection.

4.1 Hazard Identification

A hazard is a substance or situation that has the potential to cause harm. Hazards may be chemical, biological or physical.

In a PRA the potential for hazards to be present is determined from consideration of the previous or ongoing activities on or near to the site in accordance with the criteria presented in the **Table 1**.

Based on the land use information Contaminants of Potential Concern (COPC) are identified. The COPC direct the scope of the collection of site-specific data and the analytical testing selected for subsequent Tiers.

At Tier 2 the site-specific data is evaluated using appropriate published assessment criteria (refer to Stantec document entitled Rationale for the Selection of Evaluation Criteria for a Generic Quantitative Risk Assessment (GQRA)). In general, published criteria have been developed using highly conservative assumptions and therefore if the screening criterion is not exceeded (and if enough samples from appropriate locations have been analysed) then the COPC is eliminated as a potential Hazard. It should be noted that exceedance does not necessarily indicate that a site is contaminated and/or unsuitable for use only that the COPC is retained as a potential Hazard. Published criteria are generated using models based on numerous and complex assumptions. Whether or not these assumptions are appropriate or sufficiently protective requires confirmation on a project by project basis. Manipulation of the default assumptions would normally form part of a Tier 3 Detailed Quantitative Risk Assessment (DQRA).

When reviewing or assessing site specific data Stantec utilise published guidance on comparing contamination data with a critical concentration (CL:AIRE/CIEH 2008) which presents a structured process for employing statistical techniques for data assessment purposes.

4.2 Receptor and Pathway Identification

For all Tiers the potential receptors (for both on site and adjoining land) that will be considered are:

- Human Health – including current and future occupiers, construction and future maintenance workers, and neighbouring properties/third parties;
- Ecological Systems; [1]
- Controlled Waters [2] – Under section 78A(9) of Part 2A the term "pollution of controlled waters" means the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter. The term "controlled waters" in relation to England has the same meaning as in Part 3 of the Water Resources Act 1991, except that "ground waters" does not include waters contained in underground strata but above the saturation zone.
- Property - Animal or Crop (including timber; produce grown domestically, or on allotments, for consumption; livestock; other owned or domesticated animals; wild animals which are the subject of shooting or fishing rights); and
- Property - Buildings (any structure or erection, and any part of a building including any part below ground level, but does not include plant or machinery comprised in a building, or buried services such as sewers, water pipes or electricity cables including archaeological sites and ancient monuments).

If a receptor is taken forward for further assessment it will be classified in terms of its sensitivity, the criteria for which are presented in **Table 2**. Table 2 has been generated using descriptions of environmental receptor importance/value given in various guidance documents including R&D 66 (NHBC 2008), EA 2017 and Transport Analysis Guidance (based on DETR 2000). Human health and buildings classifications have been generated by Stantec using the attribute description for each class. Surface water sensitivity is classified using the Water Framework Directive (WFD) status for the River Basin obtained from: https://environment.data.gov.uk/catchment-planning/

[1] International or nationally designated sites (as defined in the statutory guidance (Defra Circular 04/12)) "*in the local area*" will be identified as potential ecological receptors. A search radius of 1, 2 or 5km will be utilised depending on the site-specific circumstances (see also pathway identification). The Environment Agency has published an ecological risk assessment framework (EA 2008) which promotes (as opposed to statutorily enforces) consideration of additional receptors to include locally protected sites and protected or notable species. These additional potential receptors will only be considered if a Phase 1 habitat survey, undertaken in accordance with guidance (JNCC 1993), is commissioned and the data provided to Stantec. It should be noted that without such a survey a Land Contamination risk assessment may conclude that the identification of potential ecological receptors is inconclusive (refer to Stantec Specification for a Preliminary Investigation (Desk Study and Site Reconnaissance).

[2] The definition of "pollution of controlled water" was amended by the introduction of Section 86 of the Water Act 2003. For the purposes of Part 2A groundwater does not include waters above the saturated zone and our assessment does not therefore address perched water other than where development causes a pathway to develop.

The exposure pathway and modes of transport that will be considered are presented in **Table 3**.

4.3 Note regarding Ecological Systems

The Environment Agency (EA) has developed an ecological risk assessment framework which aims to provide a structured approach for assessing the risks to ecology from chemical contaminants in soils (EA 2008). In circumstances where contaminants in water represent a potential risk to aquatic ecosystems then risk assessors will need to consider this separately.

The framework consists of a three-tiered process: -

- Tier 1 is a screening step where the site soils chemical data is compared to a soil screening value (SSV)
- Tier 2 uses various tools (including surveys and biological testing) to gather evidence for any harm to the ecological receptors
- Tier 3 seeks to attribute the harm to the chemical contamination

Tier 1 is preceded by a desk study to collate information about the site and the nature of the contamination to assess whether pollutant linkages are feasible. The framework presents ten steps for ecological desk studies and development of a conceptual model as follows.

1. Establish Regulatory Context
2. Collate and Assess Documentary Information
3. Summarise Documentary Information
4. Identify Contaminants of Potential Concern
5. Identify Likely Fate Transport of Contaminants
6. Identify Potential Receptors of Concern
7. Identify Potential Pathways of Concern
8. Create a Conceptual Model
9. Identify Assessment and Measurement Endpoints
10. Identify Gaps and Uncertainties

The information in a standard PRA report covers Steps 1 to 4 inclusive. Step 5 considers fate and transport of contaminants and it should be noted that our standard report adopts a simplified approach considering only transport mechanisms. A simplified approach has also been adopted in respect of Steps 6 and 7 receptors (a detailed review of the ecological attributes has not been undertaken) and pathways (a food chain assessment has not been undertaken). Step 9 is outside the scope of our standard PRA report.

It should be noted that the PRA report will present an assessment for ecological systems (where identified as a receptor for a land contamination assessment) considering the viability of the mode of transport given the site-specific circumstances and not specific pathways. The PRA may conclude that the risk to potential ecological receptors is inconclusive.

4.4 Note regarding controlled waters

Controlled waters are rivers, estuaries, coastal waters, lakes and groundwaters, but not perched waters.

The EU Water Framework Directive (WFD) 2000/60/EC provides for the protection of sub-surface, surface, coastal and territorial waters through a framework of river basin management. The EU Updated Water Framework Standards Directive 2014/101/EU amended the EU WFD to update the international standards therein; it entered into force on 20 November 2014 with the requirements for its provisions to be transposed in Member State law by 20 May 2016. Other EU Directives in the European water management framework include:

- the EU Priority Substances Directive 2013/39/EU;
- EU Groundwater Pollutants Threshold Values Directive 2014/80/EU amending the EU Groundwater Directive 2006/118/EC; and
- EU Biological Monitoring Directive 2014/101/EU.

The Ground Water Daughter Directive (GWDD) was enacted by the Groundwater Regulations (2009), which were subsumed by the Environmental Permitting Regulations (2010) which provide essential clarification including on the four objectives specifically for groundwater quality in the WFD: -

Achieve ‘Good’ groundwater chemical status by 2015, commonly referred to as ‘status objective’;
Achieve Drinking Water Protected Area Objectives;
Implement measures to reverse any significant and sustained upward trend in groundwater quality, referred to as ‘trend objective’; and

Prevent or limit the inputs of pollutants into groundwater, commonly referred to as ‘prevent or limit’ objectives

The Water Act 2003 (Commencement No.11) Order 2012 amends the test for 'contaminated land' which relates to water pollution so that pollution of controlled waters must now be "significant" to meet the definition of contaminated land.

The Water Framework Directive (WFD) requires the preparation, implementation and review of River Basin Management Plans (RBMP) on a six-year cycle. River basins are made up of lakes, rivers, groundwaters, estuaries and coastal waters, together with the land they drain. River Basin Districts (RBD) and the WFD Waterbodies that they comprise are important spatial management units, regularly used in catchment management studies. River Basin Management Plans (RBMP) have been developed for the 11 River Basin Districts in England and Wales.

These were released by Defra in 2009 (Defra 2009) and updated in 2015.

These RBMP's establish the current status of waters within the catchments of the respective Districts and the current status of adjoining waters identified. As part of a Tier 2 risk assessment water quality data is screened against the WFD assessment criteria. Comparison with the RBMP's current status of waters for the catchment under consideration would form part of a Tier 3 assessment.

5 RISK ESTIMATION

Risk estimation classifies what degree of harm might result to a receptor (defined as consequence) and how likely it is that such harm might arise (probability).
At Tier 1 the consequence classification is generated by multiplying the hazard classification score and the receptor sensitivity score. This approach follows that presented in the republished R&D 66 (NHBC 2008).

The criteria for classifying probability are set out in **Table 4** and have been taken directly from Table 6.4 CIRIA C552 (CIRIA 2001). Probability considers the integrity of the exposure pathway.

The consequence classifications detailed in **Table 5** have been adapted from Table 6.3 presented in C552 and R&D 66 (Annex 4 Table A4.3).

The Tier 1 risk classification is estimated for each pollutant linkage using the matrix given in **Table 6** which is taken directly from C552 (Table 6.5).

Subsequent Tiers refine the CM through retention or elimination of potential hazards and pollutant linkages.

6 RISK EVALUATION

Evaluation criteria are the parameters used to judge whether harm or pollution needs further assessment or is unacceptable. The evaluation criteria used will depend on:

- the reasons for doing the RA and the regulatory context such as Part 2A or planning;
- the CM and pollutant linkages present;
- any criteria set by regulators;
- any advisory requirements such as from Public Health England;
- the degree of confidence and precaution required;
- the level of confidence required to judge whether a risk is unacceptable;
- how you've used or developed more detailed assessment criteria in the later tiers of RA;
- the availability of robust scientific data;
- how much is known - for example, about the pathway mechanism and how the contaminants affect receptors; and
- any practical reasons such as being able to measure or predict against the criteria.

In order to put the Tier 1 risk classification into context the likely actions are described in **Table 7** which is taken directly from Table 6.6 of C552 (CIRIA 2001).

REFERENCES

BSI 2017 BS 10175:2011+A2:2017 Investigation of potentially contaminated sites - Code of Practice

BSI 2019 BS 8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings

CIRIA 2001: Contaminated land risk assessment – a guide to good practice C552.

CIRIA 2008: Assessing risks posed by hazardous ground gases to buildings C655

CL: AIRE/CIEH 2008 Guidance on Comparing Soil Contamination Data with a Critical Concentration. Published by Contaminated Land: Applications in Real Environments (CL: AIRE) and the Chartered Institute of Environmental Health (CIEH)

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Defra '2009 Water for Life and Livelihoods. River Basin Management Plan. (11 Districts: Anglia, Dee, Humber, Northumbria, Northwest, Severn, Solway and Tweed, Southeast, Thames, Western Wales) December 2009

EA 2004: Contaminated Land Research (CLR) Report 11: The Model Procedures for the Management of Land Contamination CRL 11 by the Environment Agency (EA).

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EA 2017 New groundwater vulnerability mapping methodology in England and Wales Report – SC040016/R Environment Agency (EA) September 2017

JNCC 1993 Handbook for Phase 1 Habitat Survey – A Technical for Environmental Audit prepared by the Joint Nature Conservancy Council (JNCC)

NHBC/EA/CIEH 2008: R&D Publication 66 Guidance for the safe development of housing on land affected by contamination.

National Planning Policy Framework (February 2019 revised), published by the Ministry of Housing, Communities and Local Government (MHCLG) at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

Table 1: Criteria for Classifying Hazards / Potential for Generating Contamination

Classification/Score	Potential for generating contamination/gas based on land use
Very Low 1	Land Use: Residential, retail or office use, agriculture Contamination: Limited. Gas generation potential: Soils with low organic content
Low 2	Land Use: Recent small scale industrial and light industry Contamination: locally slightly elevated concentrations. Gas generation potential: Soils with high organic content (limited thickness)
Moderate 3	Land Use: Railway yards, collieries, scrap yards, engineering works. Contamination: Possible widespread slightly elevated concentrations and locally elevated concentrations. Gas generation potential: Dock silt and substantial thickness of organic alluvium/peat
High 4	Land Use: Heavy industry, non-hazardous landfills. Contamination: Possible widespread elevated concentrations. Gas generation potential: Shallow mine workings Pre 1960s landfill
Very High 5	Land Use: Hazardous waste landfills, gas works, chemical works, Contamination: Likely widespread elevated concentrations. Gas generation potential: Landfill post 1960

"Greenfield" is land which has not been developed and there has been no use of agrochemicals

Table 2: Criteria for Classifying Receptor Sensitivity/Value

Classification	Definition
Very Low 1	Receptor of limited importance • Groundwater: Unproductive strata (Strata with negligible significance for water supply or river baseflow) (previously Non-aquifer), Secondary B (water-bearing parts of non-aquifers), Secondary undifferentiated (previously minor or non-aquifer, but information insufficient to classify as secondary A or B) • Surface water: WFD Surface Water status Bad • Ecology: No local designation • Buildings: Replaceable • Human health: Unoccupied/limited access
Low 2	Receptor of local or county importance with potential for replacement • Groundwater: Secondary A aquifer • Surface water: WFD Surface Water status Poor • Ecology: local habitat resources • Buildings: Local value • Human health: Minimum score 4 where human health identified as potential receptor
Moderate 3	Receptor of local or county importance with potential for replacement • Groundwater: Principal aquifer • Surface water: WFD Surface Water status Moderate • Ecology: County wildlife sites, Areas of Outstanding Natural Beauty (AONB) • Buildings: Area of Historic Character • Human health: Minimum score 4 where human health identified as potential receptor
High 4	Receptor of county or regional importance with limited potential for replacement • Groundwater: Source Protection Zone 2 or 3 • Surface water: WFD Surface Water status Good • Ecology: SSSI, National or Marine Nature Reserve (NNR or MNR) • Buildings: Conservation Area • Human health: Minimum score 4 where human health identified as potential receptor
Very High 5	Receptor of national or international importance • Groundwater: Source Protection Zone (SPZ) 1 • Surface water: WFD Surface Water status High • Ecology: Special Areas of Conservation (SAC and candidates), Special Protection Areas (SPA and potentials) or wetlands of international importance (RAMSAR) • Buildings: World Heritage site • Human health: Residential, open spaces and uses where children are present

Table 3: Exposure Pathway and Modes of Transport

Receptor	Pathway	Mode of transport
Human health	Ingestion	Fruit or vegetable leaf or roots
		Contaminated water
		Soil/dust indoors
		Soil/dust outdoors
	Inhalation	Particles (dust / soil) – outdoor
		Particles (dust / soil) - indoor
		Vapours – outdoor - migration via natural or anthropogenic pathways
		Vapours - indoor - migration via natural or anthropogenic pathways
	Dermal absorption	Direct contact with soil
		Direct contact with waters (swimming / showering)
		Irradiation
Groundwater	Leaching	Gravity / permeation
	Migration	Natural – groundwater as pathway Anthropogenic (e.g. boreholes, culverts, pipelines etc.)
Surface Water	Direct	Runoff or discharges from pipes
	Indirect	Recharge from groundwater
	Indirect	Deposition of windblown dust
Buildings	Direct contact	Sulphate attack on concrete, hydrocarbon corrosion of plastics
	Gas ingress	Migration via natural or anthropogenic paths
Ecological systems	See Notes	Runoff/discharge to surface water body
	See Notes	Windblown dust
	See Notes	Groundwater migration
	See Notes	At point of contaminant source
Animal and crop	Direct	Windblown or flood deposited particles / dust / sediments
	Indirect	Plants via root up take or irrigation. Animals through watering
	Inhalation	By livestock / fish - gas / vapour / particulates / dust
	Ingestion	Consumption of vegetation / water / soil by animals

Table 4: Classification of Probability

Classification	Definition
High likelihood	There is a pollution linkage and an event either appears very likely in the short-term and almost inevitable over the long-term, or there is already evidence at the receptor of harm / pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter-term.
Unlikely	There is a pollution linkage, but circumstances are such that it is improbable that an event would occur even in the very long-term.

Table 5: Classification of Consequence (score = magnitude of hazard and sensitivity of receptor)

Classification / Score	Examples
Severe **17-25** **(3 out of 25 outcomes)**	Human health effect - exposure likely to result in "significant harm" as defined in the Defra (2012) Part 2A Statutory Guidance [1.] Controlled water effect - short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Equivalent to EA Category 1 incident (persistent and/or extensive effects on water quality leading to closure of potable abstraction point or loss of amenity, agriculture or commercial value. Major fish kill. Ecological effect - short-term exposure likely to result in a substantial adverse effect. Catastrophic damage to crops, buildings or property
Medium **10-16** **(7 out of 25 outcomes)**	Human health effect - exposure could result in "significant harm" [1]. Controlled water effect - equivalent to EA Category 2 incident requiring notification of abstractor Ecological effect - short-term exposure may result in a substantial adverse effect. Damage to crops, buildings or property
Mild **5-9** **(7 out of 25 outcomes)**	Human health effect - exposure may result in "significant harm" [1]. Controlled water effect - equivalent to EA Category 3 incident (short lived and/or minimal effects on water quality). Ecological effect - unlikely to result in a substantial adverse effect. Minor damage to crops, buildings or property. Damage to building rendering it unsafe to occupy (for example foundation damage resulting in instability).
Minor **1-4** **(8 out of 25 outcomes)**	No measurable effect on humans. Protective equipment is not required during site works. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects to crops, buildings or property. The loss of plants in a landscaping scheme. Discolouration of concrete.

[1] Significant harm includes death, disease, serious injury, genetic mutation, birth defects or impairment of reproductive function. The local authority may also consider other health effects to constitute significant harm such as physical injury; gastrointestinal disturbances; respiratory tract effects; cardio-vascular effects; central nervous system effects; skin ailments; effects on organs such as the liver or kidneys; or a wide range of other health impacts. Whether or not these would constitute significant harm would depend on the seriousness of harm including impact on health, quality of life and scale of impact.

Table 6: Classification of Risk (Combination of Consequence Table 5 and Probability Table 4)

	Consequence			
Probability	***Severe***	***Medium***	***Mild***	***Minor***
High likelihood	Very high	High	Moderate	Low
Likely	High	Moderate	Moderate/	Low
Low likelihood	Moderate	Moderate	Low	Very low
Unlikely	Low	Low	Very low	Very low

Table 7: Description of Risks and Likely Action Required

Risk Classification	Description
Very high risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation is likely to be required in the short term.
High risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short-term and are likely over the longer-term.
Moderate risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer-term.
Low risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very low risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Appendix B Havant Borough Council Information

500471/9

HAVANT AND WATERLOO
URBAN DISTRICT COUNCIL

I PARK ROAD NORTH
HAVANT

REPORT ON SITE INVESTIGATION

FOR

PROPOSED URBAN DEVELOPMENT

PHASE ONE

PROPOSED REFUSE TIP STOREHOUSE LAKE

Report No. 4195

AUGUST 1967

F. J. JOHNSON, A.M.I.C.E., M.I.Mun.E.,
A.M.I.Struct.E.
ENGINEER AND SURVEYOR

STRUCTURAL SOILS LIMITED
68 OLD MARKET STREET
BRISTOL 2
Telephone Bristol 26265

HAVANT AND WATERLOO
URBAN DISTRICT COUNCIL
1 PARK ROAD NORTH
HAVANT

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Site Investigation

for

Proposed Land Reclamation Scheme

Storehouse Lake

Havant

INTRODUCTION

As part of the local area development scheme it is proposed to divert the navigable channel of Storehouse Lake and to reclaim land in the Storehouse Lake inlet, by the construction of a bund wall across those parts of the lake to be reclaimed. When the bund walls have been completed the land no longer washed by the sea will be used for controlled tipping and eventually will be suitable for industrial development or recreational areas.

In order to assist in the design of both the permanent and temporary works to be carried out on the site, a general site investigation was undertaken at the request of the Havant and Waterloo Urban District Council.

The objects of this investigation were as follows:-

(a) To determine the nature and general engineering characteristics of the sub soil.

(b) To determine the nature, depth and distribution of any silt present on the site.

(c) To discuss the general engineering problems that may be encountered during construction work.

(d) To comment on the general topography and to give an overall appraisal of the site.

The site is located to the South of the South Coast Road, and consists of a tidal foreshore containing a navigable channel and is bordered on its landward sides by low lying marshy terrain. Under normal tides the majority of the site is washed by the sea, but on occasions of high spring, or storm tides the adjoining marshland is also affected.

FIELDWORK

(a) Boreholes 38 to 46

These boreholes were drilled utilising standard shell and auger boring techniques from a mobile but securely anchored barge. Using 8" diameter equipment these boreholes were drilled to a depth of approximately 40'0" to 45'0", to prove a sufficient penetration into the underlying chalk.

(b) Boreholes 36, 37, 49 and 50

These borings were carried out adjacent to the tidal foreshore with 6" diameter shell and auger equipment, and in the case of boreholes 49 and 50 passed through recently tipped refuse on the expanding West Marsh tipping area. Borehole 36 was drilled through the embankment to the South Coast Road, and borehole 37 was undertaken on the foreshore with drilling suitably phased between tides.

(c) Probings

In order to determine the depth of the softer silts and tidal muds in the Storehouse Lake inlet, a grid of probes was placed across the site at a 200'0" spacing. These probes were completed with a cone attachment of the Mackintosh probe apparatus. In all 68 determinations were made and full details are recorded in the appendix to this report.

(d) Hand Augering and Ancillary Boreholes

Hand augers were made on the North Western foreshore of the lake to determine the depth and nature of the clay located at these points, and to establish its suitability for recompaction in the construction of the bund wall. Two further boreholes were carried out on North Hayling Island to evaluate the possibility of importing a further source of clay for use in the bund wall core.

RESULTS OF FIELDWORK

The detailed succession of boreholes varied across the site and in general can be classified as follows:-

(a) Boreholes 38 to 46

0'0"	-	2'0"	-	Silt.
2'0"	-	20'0"	-	A combination of medium to course shingle with flint and traces of chalk and sand.
20'0"	-	40'0"	-	Medium to hard chalk.

(b) Boreholes 36, 37, 49 and 50

These boreholes confirmed the above classification but contained overlying filled material as shown on the appended borehole log sheets.

(c) Probes and Augers

These determinations were satisfactorily completed and confirmed the results of adjacent boreholes. They are fully detailed on the report sheet and plotted on a contoured plan contained in the appendix to this report, showing the level of the silt, shingle interface.

Boreholes 100 and 101 on Hayling Island proved the clay to be a suitable material to a depth of 11'0" below ground level.

Throughout the site the material encountered at various depths, although similar in composition, was not suitable for undisturbed sampling, but disturbed samples were obtained wherever possible and returned to the laboratory for examination and testing. The groundwater table across the site could not be determined accurately and varied in the land-drilled boreholes with the rise and fall of the tide. The location of all the boreholes, probes and augers are shown on the site location plans and full details of all the drilling characteristics are recorded on the appropriate borehole log sheets, trial pit log sheets and penetration-depth graphs contained in the appendix to this report.

LABORATORY TESTING

The laboratory work on this project fell into the following categories:-

1. **Particle Size Analysis**

   Samples of the shingle and flint overlying the chalk were tested by mechanical analysis utilising British Standard sieves and normal particle size analysis techniques.

2. **Compaction Tests**

   Standard Proctor compaction tests were carried out on both the shingle and chalk exposed by the boreholes, to determine its characteristics in relation to compaction. The soil was compacted in the standard manner using a 2" diameter rammer, weighing $5\frac{1}{2}$ lbs, and 25 blows from this rammer were applied to each of 3 layers. The test was repeated at numerous moisture content values and the optimum moisture content for the maximum dry density was found in all cases.

3. Permeability Tests

Samples of the shingle and flint overlying the chalk were tested using the constant head permeameter. Water is allowed to flow through the required sample under a constant head, and the hydraulic gradient under difficult flows was determined to enable the coefficient of permeability to be calculated.

4. Chemical Tests

Sulphate and Acid contamination levels in the silts have been evaluated and are appended to this report.

RESULTS OF LABORATORY TESTING

The different layers of material across the site were proved to be similar in nature and as the results obtained showed good compatibility they can be applied to almost all the areas under consideration.

1. Particle Size Analysis

These tests showed the gravel content (over $\frac{1}{8}$" in diameter) in the shingle to be high. The percentage of sand increased with depth to a maximum of 20% by weight below a depth of 15'0". Above 10'0" below sea level the percentage of sand rarely exceeded 10%, and of the sand present a good grading was apparent.

In the shingle below the surface silt, there was an extremely small amount of material in or below the fine sand range.

2. Compaction Tests

The Proctor Tests carried out on the material gave in general higher optimum dry densities in the upper layers of the site. Generally samples of the shingle and sand tested gave maximum dry densities of approximately 111 lb/cu.ft. at optimum moisture contents of between 10% and 16%. In practice the dry density varied with the ratio of the large gravel and sand contained in the sample.

It was found to be difficult to obtain a representative sample for the compaction tests on the upper shingle, but a bulk sample from borehole number 49 gave a corrected maximum dry density of 134 lb/cu.ft. with a moisture content of 10%.

It must be noted, however, that because of the presence of this large shingle the value obtained in this confined test would in practice be considerably reduced owing to washing and leaching action of the sand by the sea from the voids that will be created during the compaction of the shingle.

3. Permeability Tests

Permeability tests on the overlying deposits showed high variations between the samples tested, but a coefficient of permeability of between 500 and 2000 feet per day, comparable to that of gravel was recorded.

During laboratory tests the percentage of sand present was insufficient to completely fill all the voids and under head the fine to medium sand was redistributed and in some cases leached out of the sample.

4. Chemical Tests

It is not possible to determine the sulphate and Acid contamination levels in the shingle and chalk, but tests on the silt obtained from the site showed a high level of sulphates present. The silt is definitely organic and has an acidic pH value.

GEOLOGICAL APPRAISAL

Geologically the site consists of superficial deposits of the pleistocene or recent eras, mainly consisting of shingle and estuarine muds, silts and clays. These superficial deposits overlie the Portsdown Anticline.

The crest of this major fold lies between Farlington and Copham with the upper chalk actually outcropping just North of Farlington outside the site area. The deposits on the foreshore of the lake apart from the muds and silts, mainly consist of medium to coarse gravels and flints with flint sands. The upper chalk underlying this material is a typical pure white chalk varying from medium to hard, usually homogeneous in nature but assuming a greyish tint towards the base. The horizon contains flints throughout and is generally stratified into thin layers of differing hardnesses.

GENERAL APPRAISAL OF THE SITE

The inlet which forms Storehouse Lake is subjected to the normal tide influences, but at low water the tide area is left dry except for the navigable channel. In addition to the normal sea outfall for the river eventually forming Storehouse Lake, it is the tidal outfall for the Brockhampton Mill Lake and its current watershed. Under the scheme it is proposed to divert the Storehouse Lake Channel towards the East of the Storehouse Lake inlet, and to create a joint outfall with the Brockhampton Mill Lake adjacent to West Marsh. It is then proposed to enclose the new Storehouse Lake channel with a suitable bund wall allowing the inlet with the exception of the new channel to become eventually (after controlled tipping) reclaimed land suitable for redevelopment.

From the boreholes carried out the scheme can be satisfactorily completed but several engineering problems are apparent and these must be taken into consideration, to ensure that the method of construction is an economic proposition.

The shingle underlying the silt, although permeable should create a satisfactory bearing strata for any bund wall, assuming that any overlying silt is firstly removed and that the bund wall is founded at a depth into the base shingle of between 3'0" and 5'0" depending upon location.

It is considered important that the core to the bund wall should be formed of sufficiently impermeable material to restrict the flow of sea water through the bund wall. This material could either consist of chalk or clay, provided that this fill material is compacted under dry conditions to its maximum dry density. Care must be taken to ensure that the core to the bund wall is not affected by the sea during compaction, as any increase in the moisture content above the optimum will result in consequent settlement and possible slurrying of the clay and chalk, causing seepage paths in the wall construction.

The bund wall if founded on shingle will allow water to pass under it to the area inside the wall during high tides. By constructing the core to a depth of 3'0" or 4'0" below the shingle and constructing the wall in totally impermeable material the water path will be as long as is economically possible, allowing the minimum of water to flow under the wall. Under the coefficient of permeability values obtained, the flow is expected to be 100 - 350 cu.ft./tide/ft. width at Spring tides and 33 - 115 cu.ft./tide/ft. width at Neap tides. This figure represents a depth of up to 6" of water inside the bund wall, and as soon as the tide drops below the inside surface level, the direction of flow will be reversed. It is anticipated that nearly all of the water passing into the inside area will percolate out at low tide, but as the mean of tides is above 0'0" O.D. the ponding inside the bund may on some occasions be present for a number of consecutive tides. It is strongly recommended that an outlet pipe with a tidal flap is constructed through the bund wall in the base of the existing Storehouse Lake Channel, to facilitate the immediate draining of any water in the area after each high tide.

It is considered that the clay of Broad Marsh will prove a satisfactory core to the wall, and similarly the clay on Hayling Island (borehole numbers 100, 101) could be used if the cost of transport is permissive. A further alternative is imported natural chalk which if properly compacted will form a near impermeable core.

The shingle and sand from the sea bed is well graded and free from silt. If mixed with concrete this material could be used to create a 2'0" to 3'0" wide strip of weak mix concrete along the face of the wall, to act as a direct protective seal against the sea or as a base for placing jointed facing slabs on the seaward side of the bund. It is suggested that the core of the wall is constructed, at least 40'0" in width, to the seaward side of the bund wall, adjacent to the protective strip. It should be possible to utilise shingle and sand from the landward side of the bund to complete the wall, but it should be noted that this action will decrease the water path under the wall, and to some extent the excavation of borrow pits immediately behind the wall, will in addition to permanent ponding, affect the overall stability of the structure.

It is suggested that any concrete in the protective facing on the bund wall should be keyed to some extent into the impermeable core, and this strip should be continued to the top of the wall, or another alternative preventative measure utilised to prevent percolation behind this concrete and its consequent spalling.

It is important to use fill material at its optimum moisture content and excavations below water table in borrow pits would allow the material to become slurried, and only the coarse particles would be removed together with excess water, and it should be noted that surplus sea water can only have detrimental effects. In the final analysis it is believed to be advantageous to maintain the lake bed at its present undisturbed state.

With regard to other structures, it is proposed to create the quay, shown on the enclosed drawings by the utilisation of sheet piles driven to maintain a toe in the chalk, below the proposed deepened channel and to securely anchor the pile face outside the potential failure wedge, by means of tie rods and anchor blocks. A further alternative would be the use of precast driven piles supporting a reinforced concrete quay. In this case a protective fendering would have to be utilised and some form of retention for the filled material created to maintain satisfactory access from the quay. In this case it would appear that a sheet piled wall using a fixed earth support will not only support the filled material, but will if properly consolidated, support indirectly, the actual quay structure.

It is considered that the underlying chalk will satisfactorily support an end bearing pile with a loading of 10 - 12 tons/sq.ft. but to ensure that penetration through the shingle by sheet or precast piles is possible, it is recommended that a test drive be carried out prior to contract.

The proposed Bailey Bridge depending upon the type, span and loading could possibly be supported on a spread foundation at a depth of 4'0" on the compacted chalk of the bund wall, providing that a degree of settlement can be tollerated in the bridge construction. For the central piers it should be possible to support the bridge on square spread foundations, at a depth of 4'0" to 5'0" into the shingle, providing that the foundation material is contained and protected by sheeting or other approved method from any possible scour in the channel. The shingle under these conditions is expected to sustain a loading of 2 tons/sq.ft. with some settlement. If settlement cannot be tolerated or if this load bearing capacity is to be exceeded, it is recommended that the bases are supported on end bearing piles taken down to a depth of 4'0" to 5'0" into the underlying chalk.

CONCLUSIONS

1. The site is considered suitable for the proposed scheme assuming that normal precautions for marine work are adopted in the design and construction.

2. The bund wall may be founded on the shingle, and should be filled with a properly compacted impermeable core. The seaward face should be properly protected against the sea to prevent spalling of the seaward face or deterioration of the core. It is recommended that the protective facing and bund wall construction be continued to a depth of at least 3'0" to 5'0", and attention is drawn to other recommendations contained in the general appraisal of the site.

3. The ancillary foundations required depend on the actual loading and the functional design of the structures, but it is expected that the Bailey Bridge could be founded on the compacted chalk of the core of the bund wall, 4'0" below its surface on normal pad foundations. The two central span supports could be founded on a square suitably designed foundation, on a gravel base, which is adequately confined and protected from any possible scour.

The proposed quay should be supported at least indirectly upon the underlying chalk, and it is suggested that a fixed earth supported sheet piled wall toed into the underlying chalk could be a feasible possibility.

4. It is recommended that any concrete in contact with the silt present on the site should be constructed of sulphate resisting cement, together with any structural reinforced members forming or supporting any of the functional buildings.

5. It is considered that the leakage of undesirable liquor from the tipped material inside the bund wall will either be negligible or very small, and should not create any potential polution problem. The shingle will act as a filtration medium and any percolation will be reduced with time.

APPENDIX

BOREHOLE LOG SHEETS

TRUCTURAL SOILS LTD.

SHEET No. 13 OF 13

CONTRACT No. 4195

BOREHOLE RECORD

ONTRACT Havant
OREHOLE No. 50
RDNANCE DATUM LEVEL 21.0
YPE OF BORING Shell & Auger
IAMETER OF BORING 8"
EMARKS

DATE STARTED 31/10 FINISHED 3/11/67
OPERATOR D. Smith
TYPE OF PENETRATION TEST S.P.T.
WEIGHT 140lbs DROP 2'6"
STANDING WATER LEVEL 8'6"
(24 hours)

Depth Feet	O.D. Level	Type & No. of Sample	Boring Details: Penetration	Lining	Water	Legend	Description of Material and Observations
0–21		D			S.W.L; Entry		General fill material
21–23							Silt & Shingle
23–39		D, D					Fine medium shingle chalk traces.
39–47		D					Shingle, fine & medium & chalk
47–60		S.P.T.; D; S.P.T.; S.P.T.	80 for 12"; 95 for 12"; 84 for 12"				Medium to hard Chalk
60			Borehole terminated				

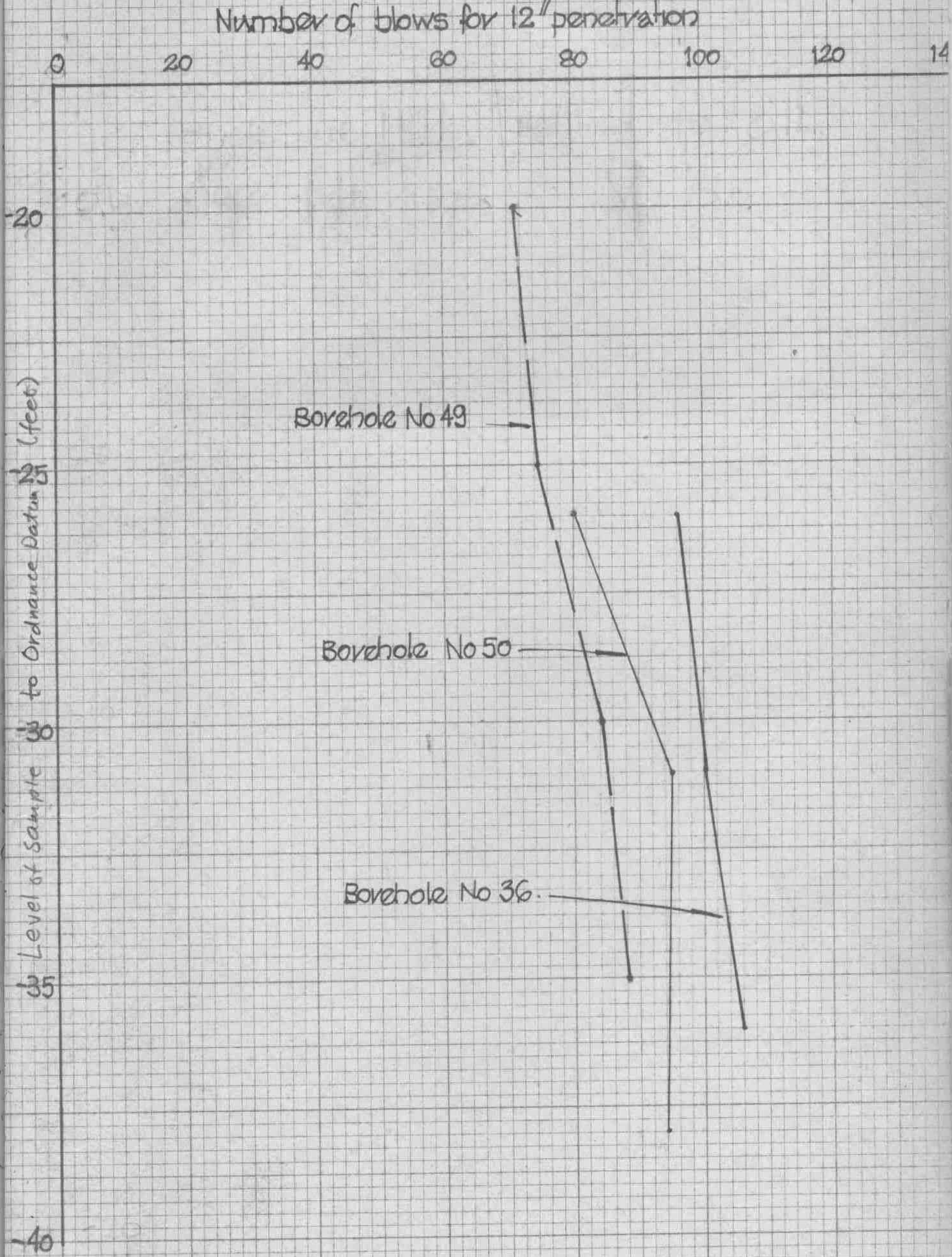
LW

Samples shown: U - Undisturbed. D - Disturbed. W - Water

PENETRATION GRAPHS

Contract No 4195

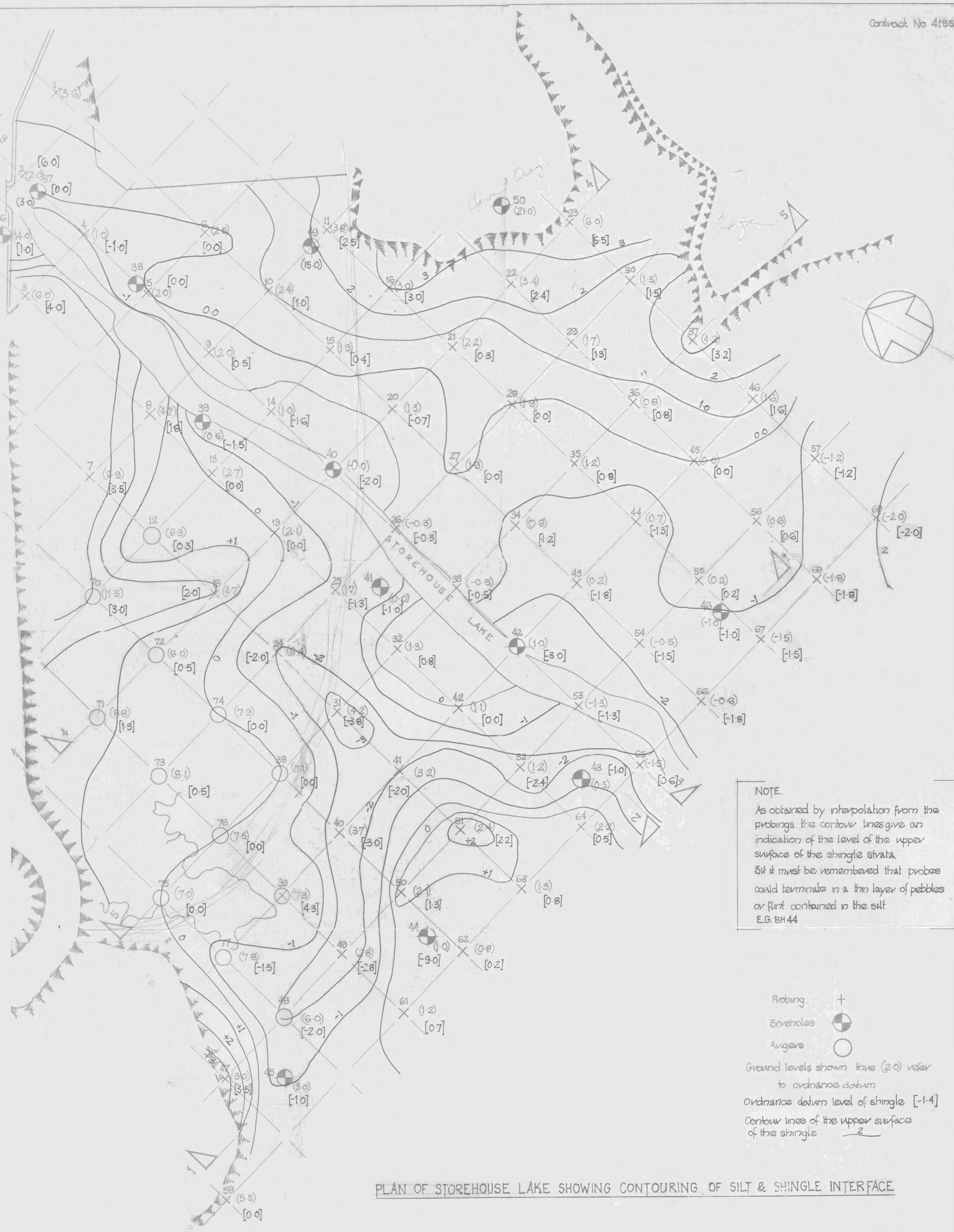
PENETRATION/DEPTH GRAPH



Borehole Nos 36, 49, & 50.

This graph is corrected to O.D.

Contract No 4195.



NOTE.

As obtained by interpolation from the probings the contour lines give an indication of the level of the upper surface of the shingle strata.
But it must be remembered that probes could terminate in a thin layer of pebbles or flint contained in the silt
E.G. BH 44

Probing +

Boreholes

Augers

Ground levels shown thus (2·0) refer to ordnance datum

Ordnance datum level of shingle [-1·4]

Contour lines of the upper surface of the shingle 2

PLAN OF STOREHOUSE LAKE SHOWING CONTOURING OF SILT & SHINGLE INTERFACE

Structural Soils LTD.

Scale 1:1250

Contract No 4195

PROPOSED BUND WALL LOCATION PLAN- STOREHOUSE LAKE

Scale 1:2500

...aval Soils LTD.

Contract No 4195

DIAGRAMMATIC SECTION THROUGH 1~1

Scale.
Horizontal ~ 1:1250
Vertical ~ 1/8" ~ 1'-0"

Structural Soils LTD

DIAGRAMMATIC SECTION THROUGH 2~2

Structural Soils LTD.

Scale
Vertical 1/8" ~ 1'0"
Horizontal 1:1250

DIAGRAMMATIC SECTION THROUGH 3~3.

Scale
Horizontal 1:1250
Vertical 1/8" ~ 1'-0"

Contract No 4195

DIAGRAMMATIC SECTION THROUGH 4~4

Structural Soils LTD

Scale.
Vertical 1/4" ~ 1'-0"

Contract No 4195.

DIAGRAMMATIC SECTION THROUGH 5~5

Scale
Vertical 1/4" ~ 1'-0"
Horizontal 1:1250

Structural Soils LTD

1760/1/13/4

11325-6

Reference No:	WASTE DISPOSAL SECTION COUNTY SURVEYOR'S DEPT THE CASTLE WINCHESTER SO23 8UD	Date and Time: 8.3.79 A 14.30 B.

Sample From:	Description:
HARTSTARM WAY. HAVANT	SAMPLES OF SURFACE WATER.

Physical Appearance:	A	B
	straw coloured liquid containing a trace of straw coloured sediment. Vegetable-like odour.	charcoal grey liquid with charcoal grey sediment. The sample had a strong odour of hydrogen sulphide

ANALYSIS

Analysis Required	A. STANDING WATER	Result B. DISCHARGE FROM SLUICE
pH.	8.3	7.4
C.O.D	510 mg/l	795 mg/l.
Amm. Nitrogen (as N)	5.95 "	28.80 "
Alb. Nitrogen (as N)	3.09 "	5.36 "
Sulphide (as S)	<0.05 "	41 "

[redacted] 15.3.79.

Comments:	Accounting
	INVOICE TO [redacted] COUNTY SURVEYOR, WASTE DISPOSAL SECTION.

Taken By: [redacted]

1760/1/13/4

SOUTHERN WATER AUTHORITY

HAMPSHIRE RIVER AND WATER DIVISION

R. W. Brett, B.Sc., C.Chem, M.R.I.C., M.I.W.E.S.
Chief Chemist

Tel: TOTTON 2389

Physical and Chemical Examination of Water

Chemical Results in mg/1 unless otherwise stated

Testwood Treatment Works,
Nutsey Lane,
Totton, Southampton.

Report No. ____________

Date 12th March 1979

Sample Origin		Tip at Harts Farm			
Consent Conditions	B.O.D.				
Quality Standards	S.S.				
No.		SP 929 79			
ate Sampled		8/9.3.79			
Appearance/Odour		Black, extremely turbid H_2S smell			
Temperature	°C				
Dissolved Oxygen	% Saturation				
pH		7.03			
Turbidity	J.T.U.				
Suspended Solids at 105°C					
B.O.D., 5 days, 20°C	O				
O_2 Absorbed, 4 hr. 27°C	O	87.5			
Conductivity	uS/cm	19,000			
Hardness	as $CaCO_3$				
arbonate					
Non-Carbonate					
Total					
Calcium					
Magnesium					
Chloride	Cl	7,800			
Free Ammonia	N	44			
Nitrite	N	<0.1			
Nitrate	N	7.1			
Phosphate	P	1.1			
O_2 Absorbed 3 min 27°C	O	90			

Total metals results:-

Iron	Fe	9.95
Copper	Cu	0.02
Manganese	Mn	2.95
Nickel	Ni	0.11
Lead	Pb	0.146
Zinc	Zn	0.446
Cadmium	Cd	<0.001
Chromium	Cr	0.03

Remarks: The similar oxygen absorbed values show the easily chemically oxidisable matter present - very probably sulphide.

P.210

[redacted]

Chief Chemist

Copy to: Director of Technical Services (For the attention of R Cooper)
Havant Borough Council

PGK/CJW/1760/1/13/4 SLW/MHF2.2.1(5) P G Kelly 698

17th April 1979

Dear Sir

DISCHARGE TO LANGSTONE HARBOUR FROM BROADMARSH REFUSE TIP HAVANT

Further to my letter of the 21 March concerning the above, I can now confirm that Havant Borough Council as agents to the County Council will be undertaking certain remedial works on the site to abate the discharge of leachate into Langstone Harbour.

I anticipate that these works will be completed within the next 2-3 weeks and will involve the prevention of the major discharge of leachate through the main sluices by means of steel shuttering placed round the sluices and backfilling of the present anaerobic lagoon with earth spoils. Moreover this work will be supplemented by completely covering the Eastern portion of the site with earth spoils to minimise percolation of rainfall through the deposited wastes.

I am hopeful that these measures will go along way to remedy the present difficulties but should this not be the case I will consult with your Authority to determine what further measures may be necessary.

Yours faithfully

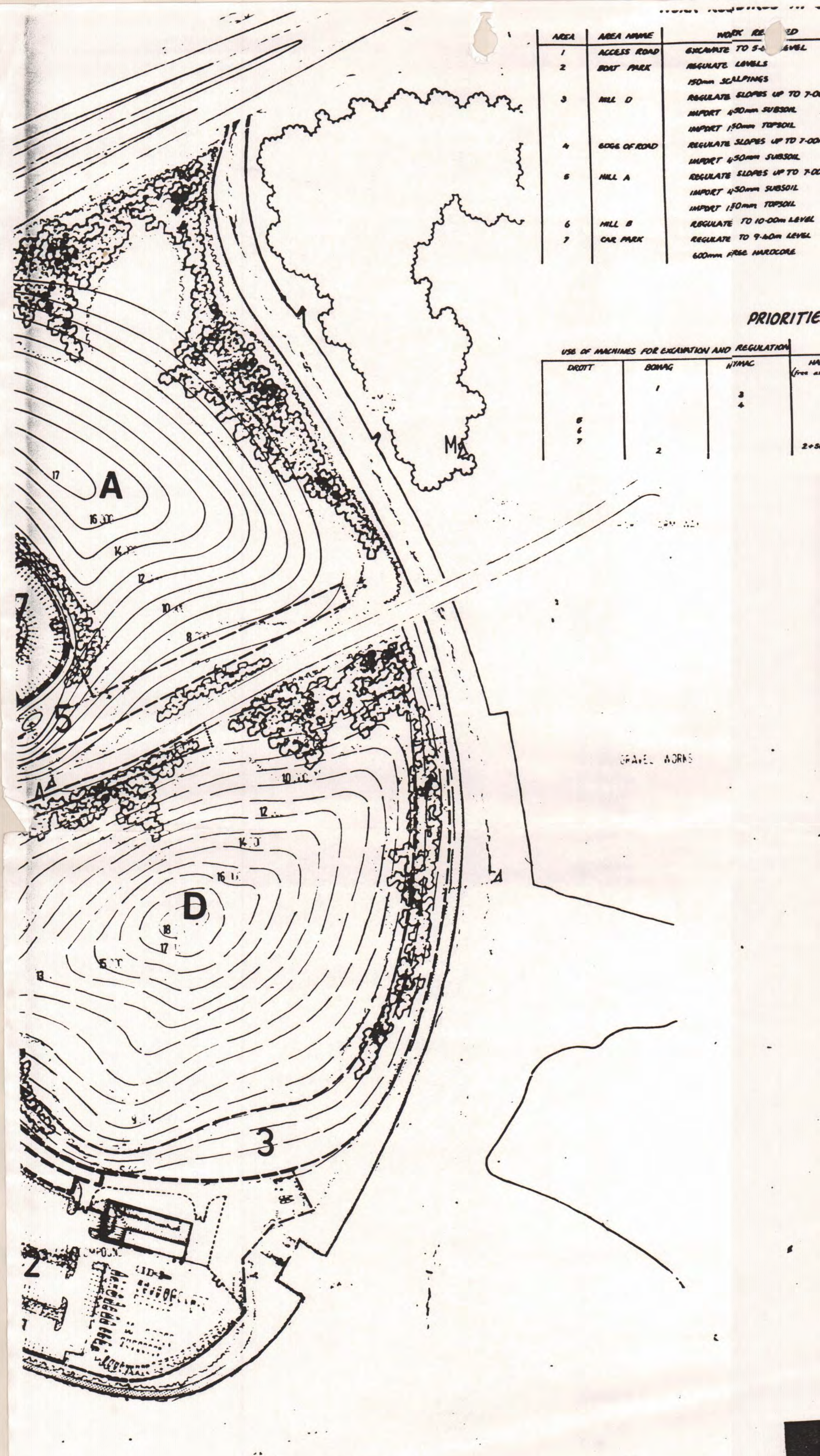
[redacted]or County Surveyor

Divisional Manager
Southern Water Authority
Otterbourne Waterworks
Waterworks Road
Otterbourne
Nr Winchester

AREA	AREA NAME	WORK RE[illegible]ED	BEST MACHINE FOR THE JOB
1	ACCESS ROAD	EXCAVATE TO 5-[illegible] LEVEL	BOMAG/DROTT
2	BOAT PARK	REGULATE LEVELS 150mm SCALPINGS	
3	HILL D	REGULATE SLOPES UP TO 7-00m IMPORT 450mm SUBSOIL IMPORT 150mm TOPSOIL	HYMAC
4	EDGE OF ROAD	REGULATE SLOPES UP TO 7-00m IMPORT 450mm SUBSOIL	HYMAC
5	HILL A	REGULATE SLOPES UP TO 7-00m IMPORT 450mm SUBSOIL IMPORT 150mm TOPSOIL	DROTT
6	HILL B	REGULATE TO 10-00m LEVEL	DROTT
7	CAR PARK	REGULATE TO 9-40m LEVEL 600mm FREE HARDCORE	DROTT

PRIORITIES

USE OF MACHINES FOR EXCAVATION AND REGULATION			IMPORT OF FILL MATERIALS		
DROTT	BOMAG	HYMAC	HARDCORE (free as available)	SUBSOIL (free as available)	TOPSOIL (to be paid for)
	1		1		
		3		3	3
		4		4	
5				5	5
6				6	
7			7		
	2		2+SCALPINGS		



A Sept ... Access Road to Slipway

AMENDMENTS

LANDSCAPE MASTER PLAN

EASTERN SECTION

Negative No. 69/2 19012

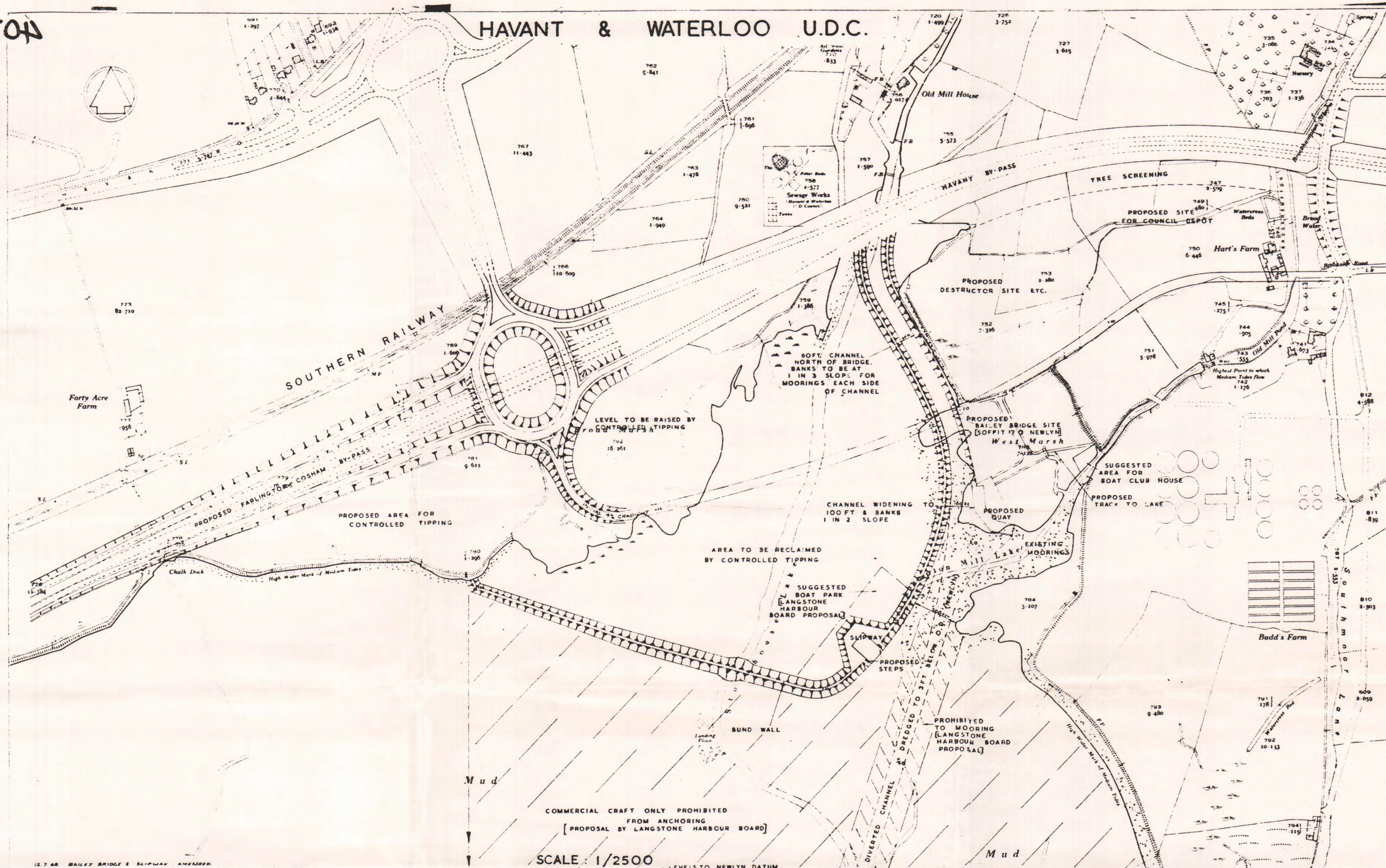
1 1250

Amendment 'A' ~ contours added to areas C2 and D.

A LANDSCAPE PLAN FOR BROADMARSH HAVANT

J W HANCOCK CEng FICE FIMunE MINE MISstructE

TIP ~ PROGRAMME OF WORK.

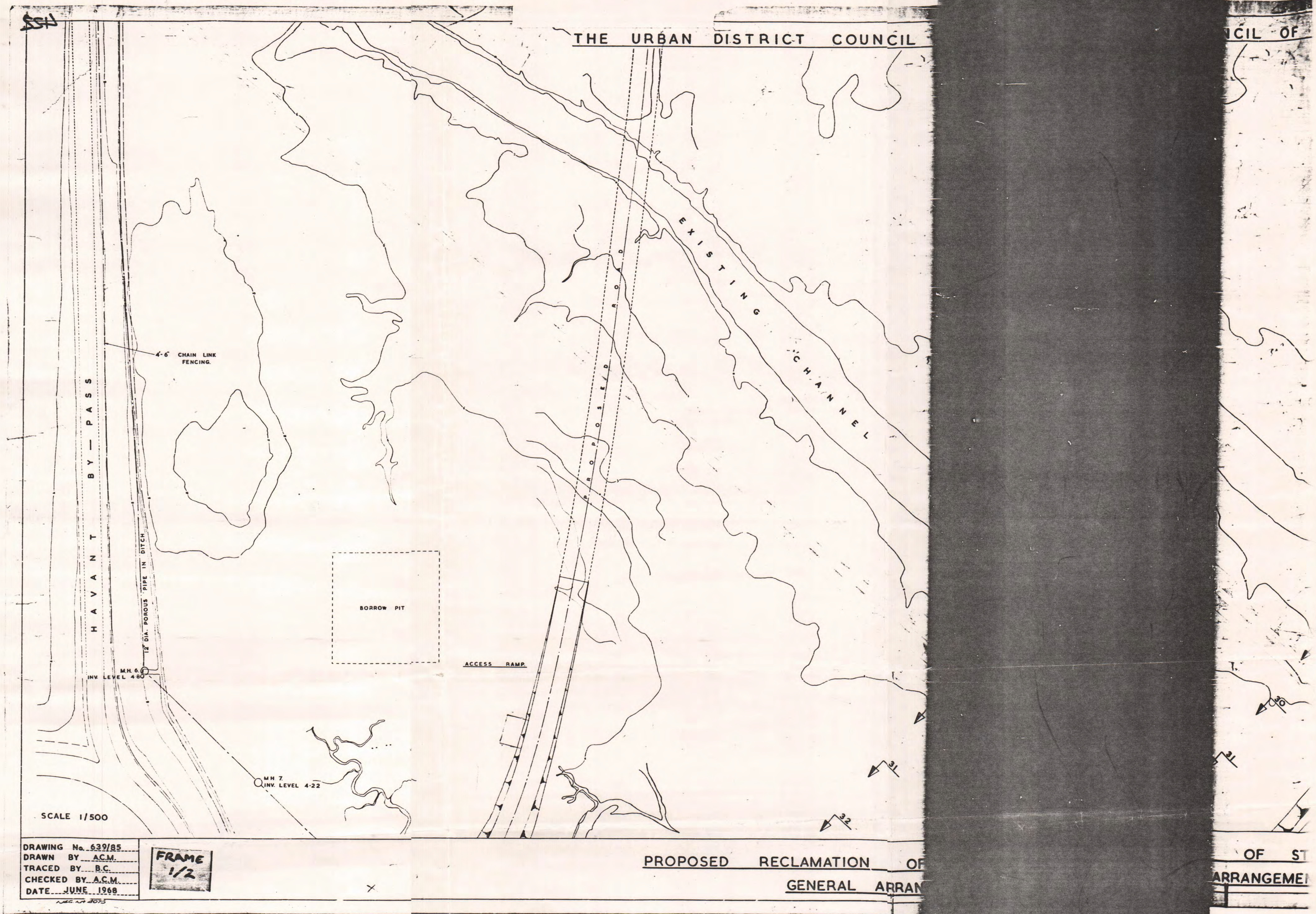


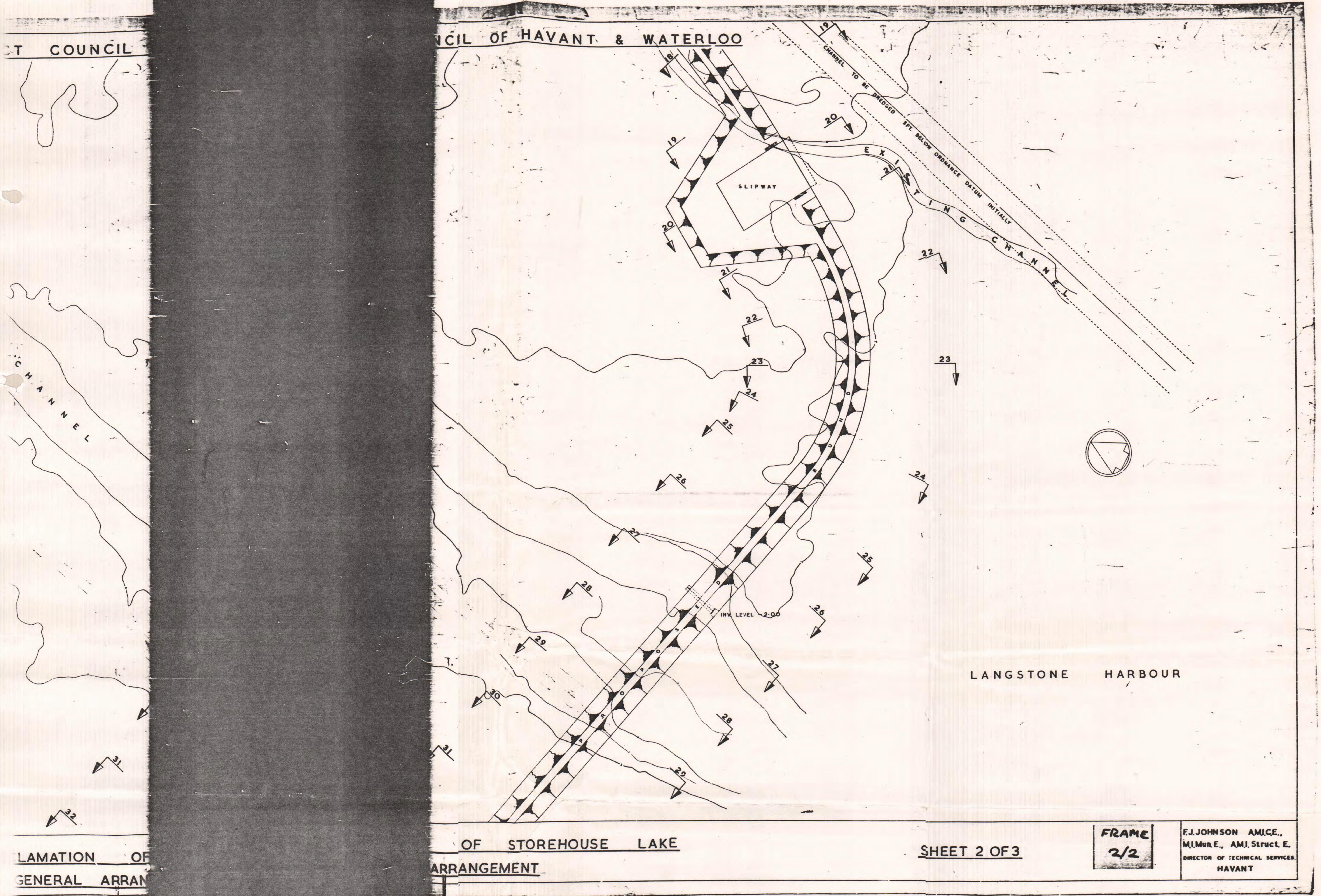
PROPOSED RECLAMATION OF STOREHOUSE LAKE.

DRAWING No. 639/54
DRAWN BY
TRACED BY
CHECKED BY
DATE

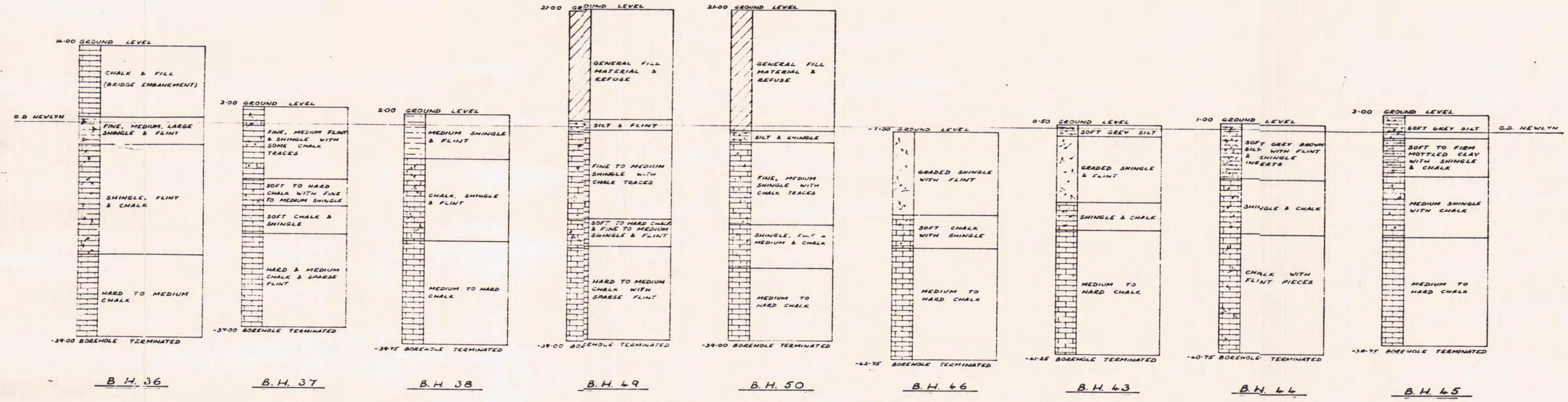
F. J. JOHNSON M.I.C.E. M.I.MUN.E. A.M.I.STRUCT.E.
ENGINEER & SURVEYOR
HAVANT.

NEG. No 4060

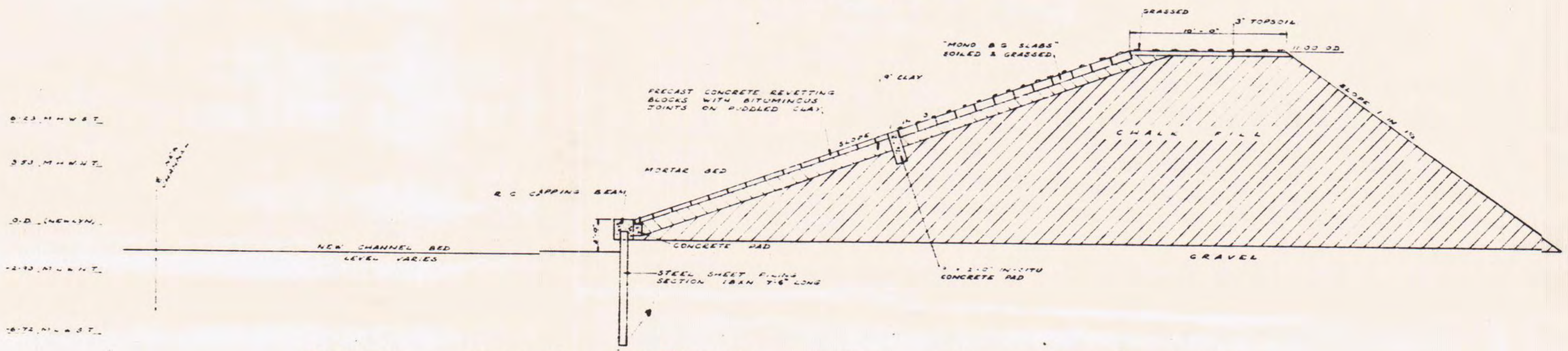

THE URBAN DISTRICT COUNCIL
NCIL OF
HAVANT BY — PASS
4-6' CHAIN LINK FENCING.
12" DIA. POROUS PIPE IN DITCH
EXISTING CHANNEL
PROPOSED ROAD
BORROW PIT
ACCESS RAMP
M.H. 6.
INV. LEVEL 4·80
M.H. 7.
INV. LEVEL 4·22
31
32
30
SCALE 1/500
DRAWING No. 639/85
DRAWN BY A.C.M.
TRACED BY B.C.
CHECKED BY A.C.M.
DATE JUNE 1968
FRAME 1/2
PROPOSED RECLAMATION OF
OF ST
GENERAL ARRAN
ARRANGEME


CT COUNCIL
NCIL OF HAVANT & WATERLOO
CHANNEL TO BE DREDGED 3FT. BELOW ORDNANCE DATUM INITIALLY
EXISTING CHANNEL
SLIPWAY
CHANNEL
INV. LEVEL -2.00
LANGSTONE HARBOUR
LAMATION OF
OF STOREHOUSE LAKE
GENERAL ARRAN
ARRANGEMENT
SHEET 2 OF 3
FRAME 2/2
F.J. JOHNSON A.M.I.C.E., M.I.Mun.E., A.M.I.Struct.E.
DIRECTOR OF TECHNICAL SERVICES.
HAVANT

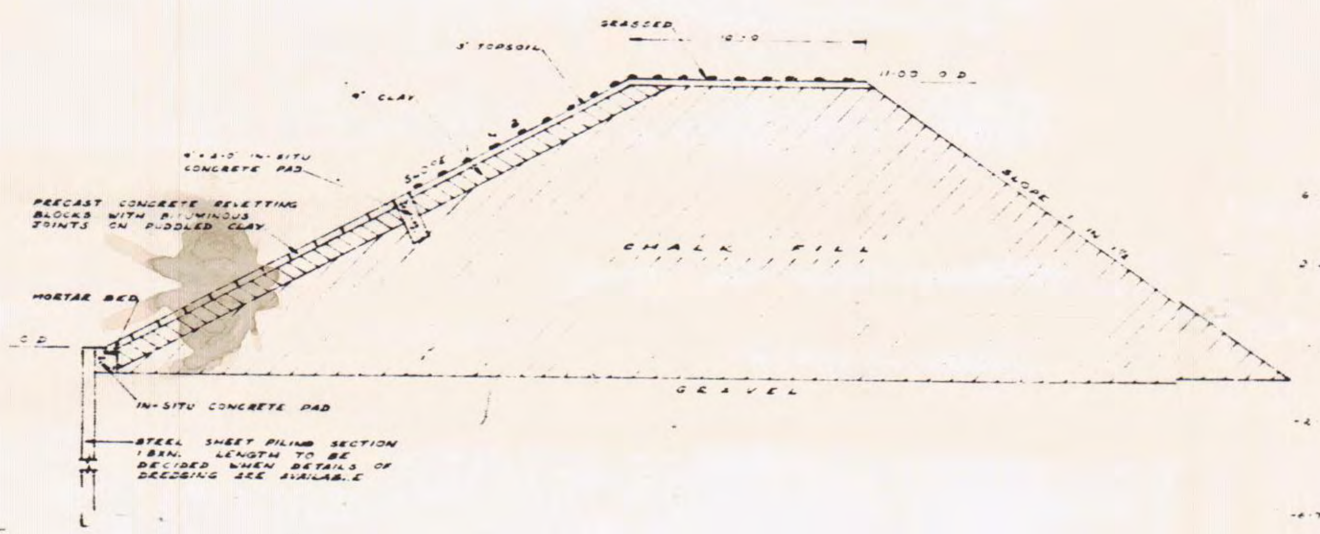
THE URBAN DISTRICT COUNCIL OF HAVANT & WATERLOO.



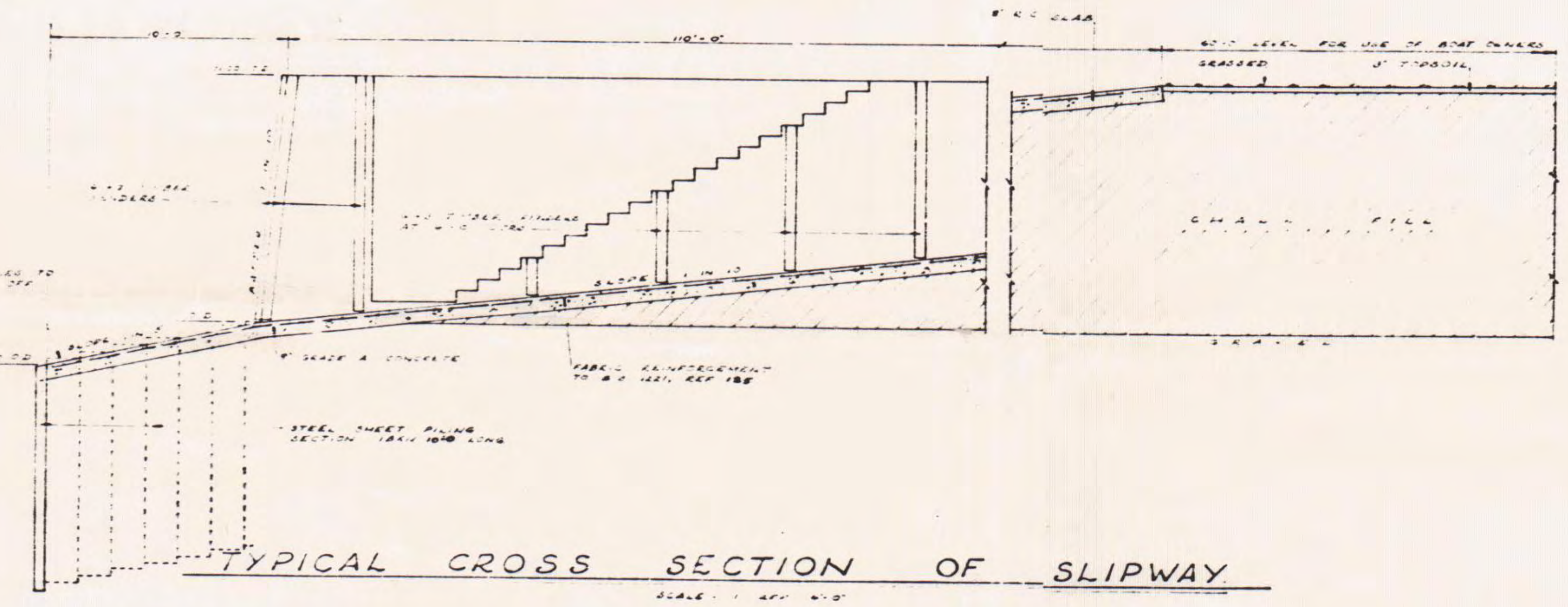
BOREHOLE RECORDS



TYPICAL CROSS SECTION NORTH OF BRIDGE SITE



TYPICAL CROSS SECTION SOUTH OF BRIDGE SITE



TYPICAL CROSS SECTION OF SLIPWAY

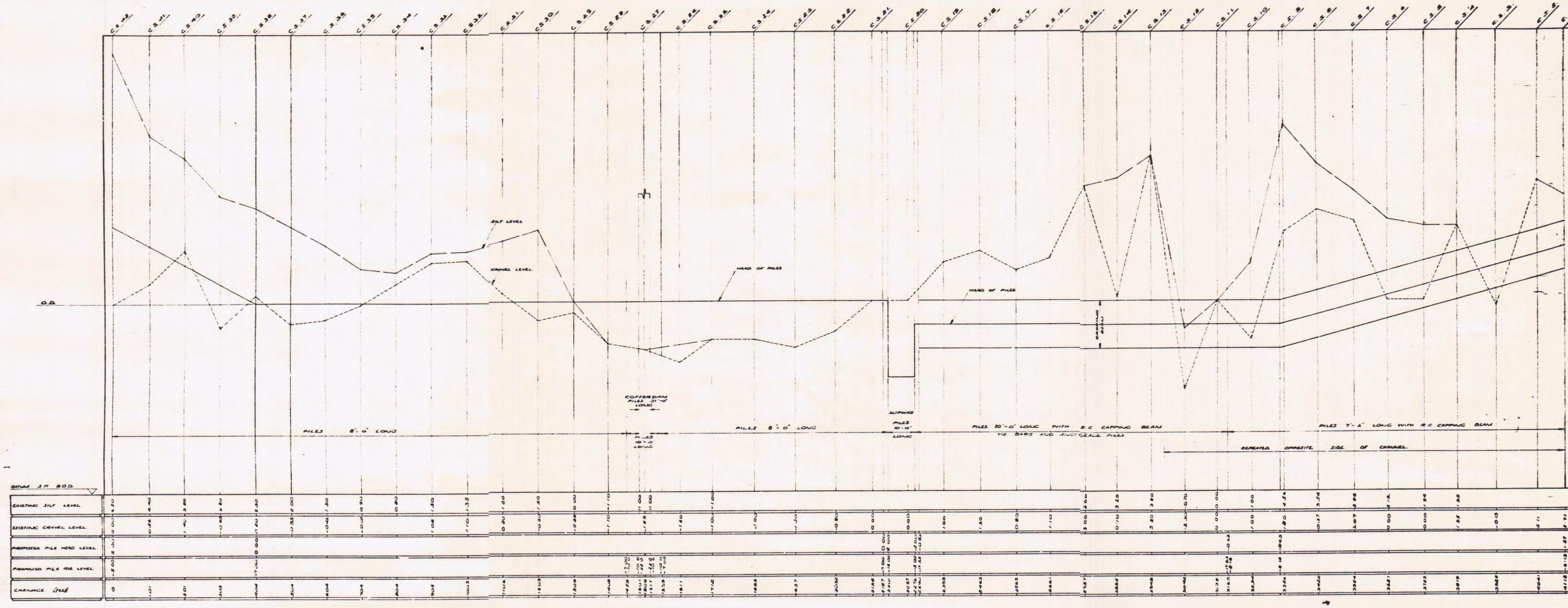
DRAWING No. 639/87
DRAWN BY A.G.H.
TRACED BY A.G.H.
CHECKED BY
DATE APRIL 1968

MEC No 4077

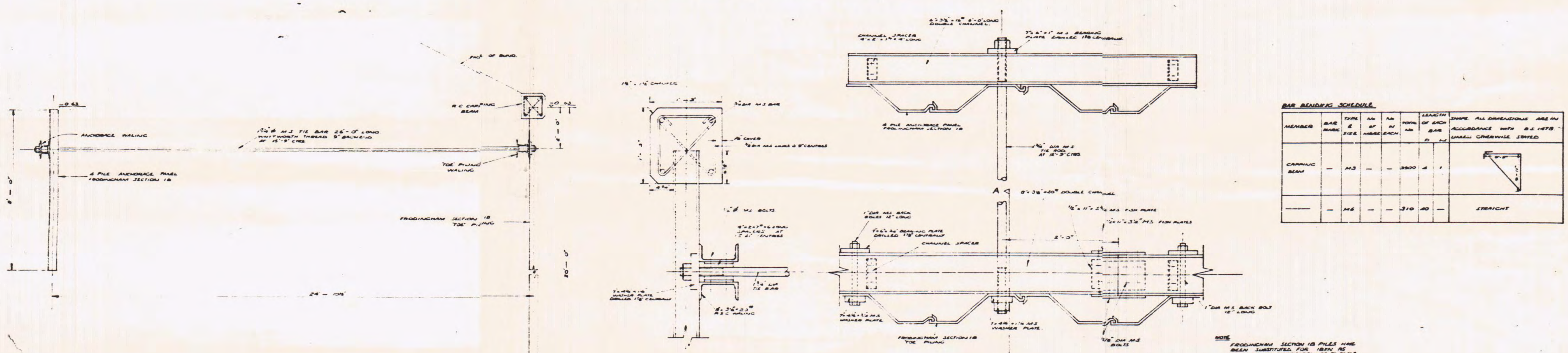
PROPOSED RECLAMATION OF STOREHOUSE LAKE
BOREHOLE RECORDS & TYPICAL CROSS SECTIONS

F. J. JOHNSON, A.M.I.C.E., M.I.Mun.E., A.M.I.Struct.E.
ENGINEER & SURVEYOR
HAVANT.

THE URBAN DISTRICT COUNCIL OF HAVANT & WATERLOO.



ELEVATION OF TOE PILING FRODINGHAM SECTION 1B



SECTION A-A

PROPOSED RECLAMATION OF STOREHOUSE LAKE

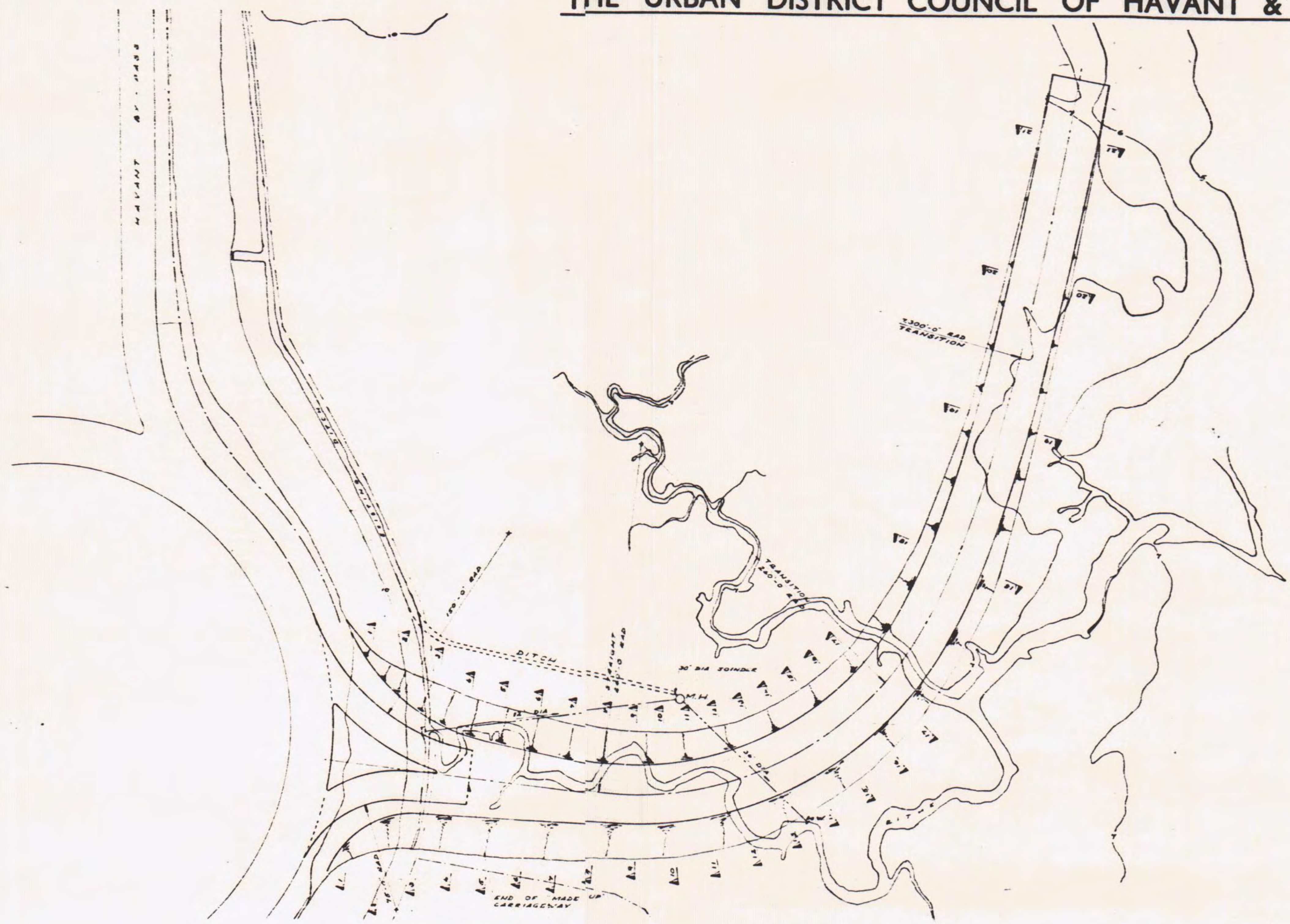
STEEL SHEET TOE PILING — ELEVATION AND DETAILS

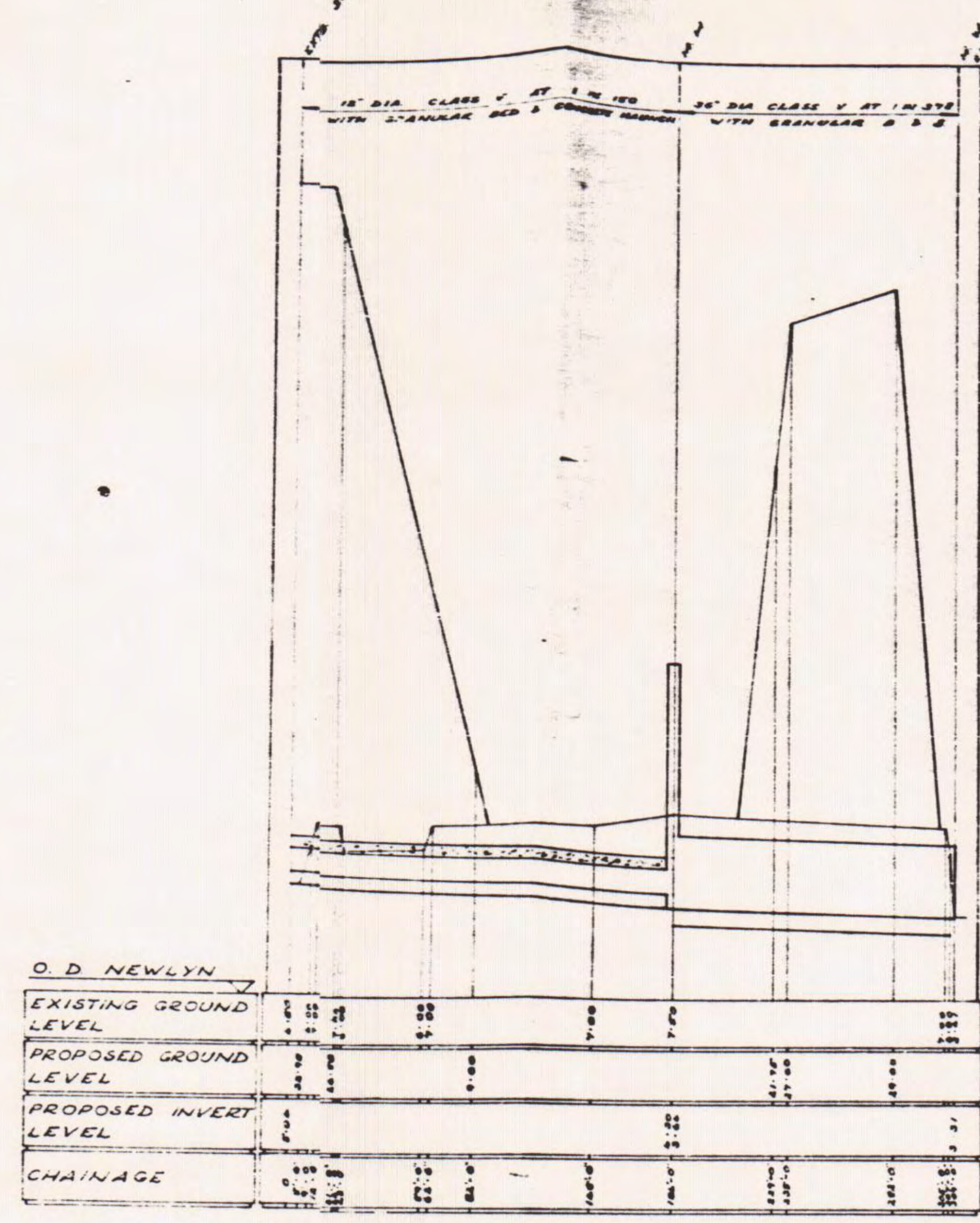
F. J. JOHNSON, M.I.C.E., M.I.Mun.E., A.M.I.Struct.E.
DIRECTOR OF TECHNICAL SERVICES
HAVANT.

DRAWING No 637/32
DRAWN BY
TRACED BY
CHECKED BY
DATE AUGUST 1968

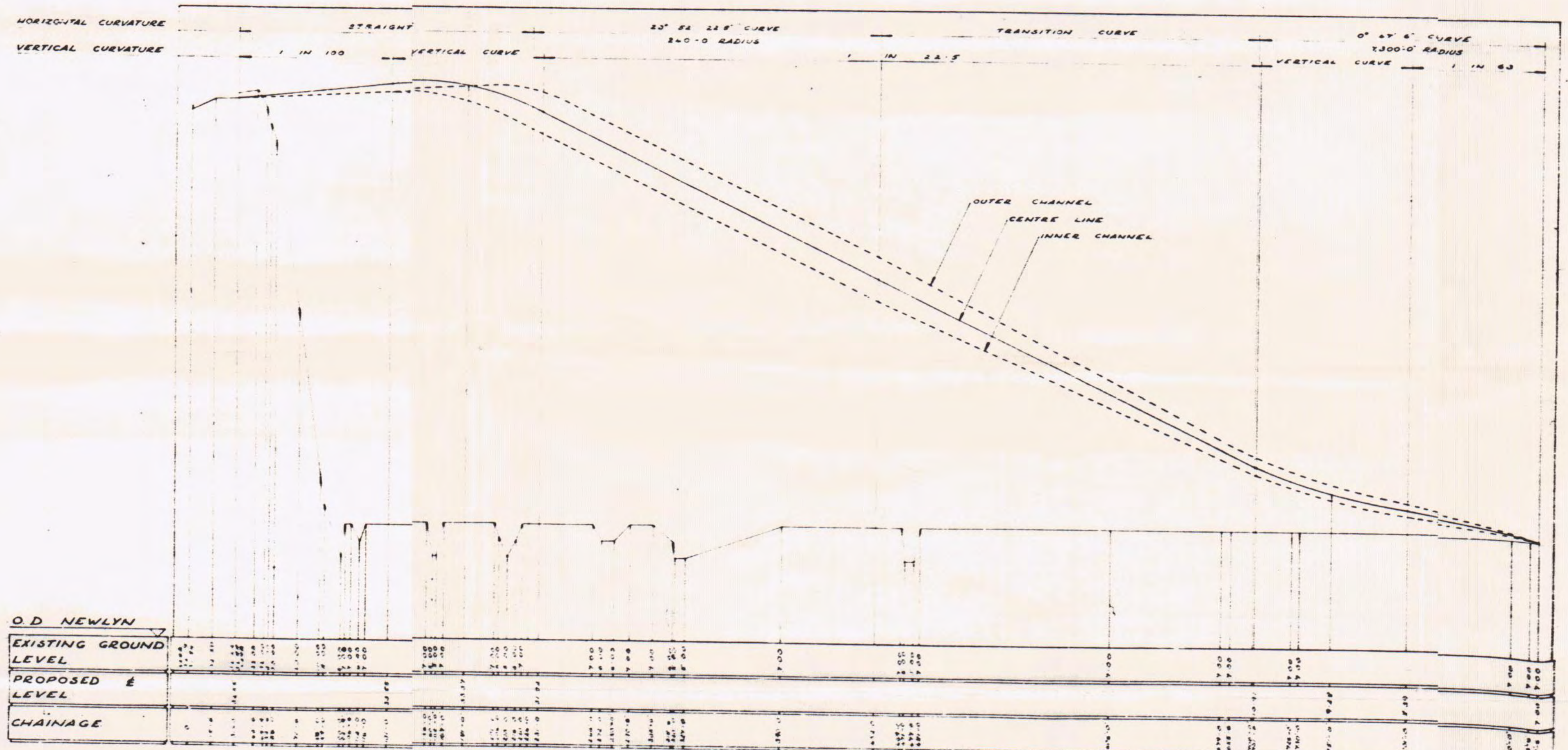
437

THE URBAN DISTRICT COUNCIL OF HAVANT & WATERLOO.

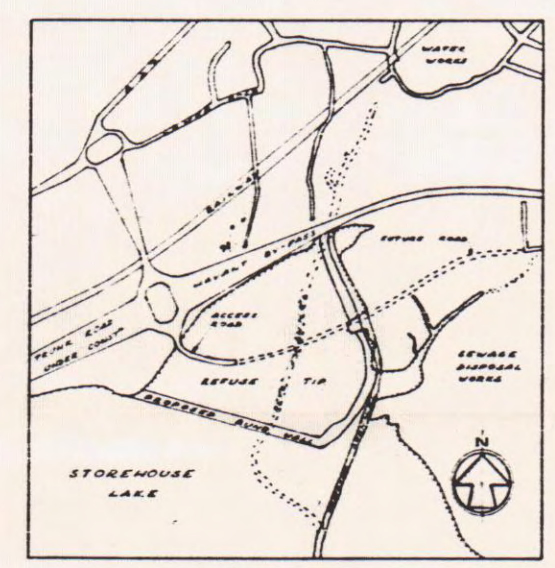




LONGITUDINAL SECTION OF S. W. S.



LONGITUDINAL SECTION OF ACCESS ROAD



SITE PLAN

SCALES:-
HORIZONTAL - 1/500
VERTICAL - 1" REP 4'-0"

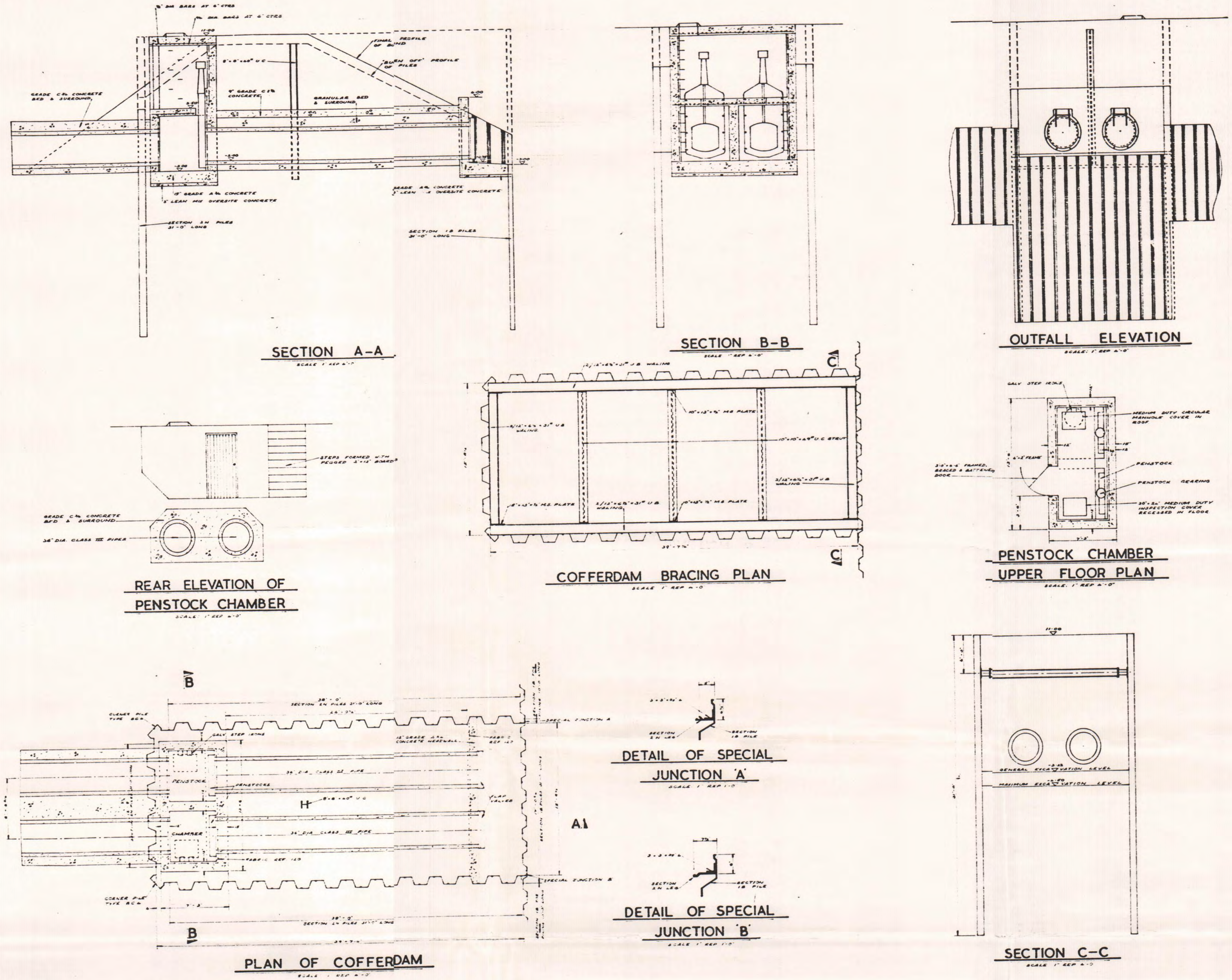
DRAWING No. 639/98
DRAWN BY A. C. M.
TRACED BY A. C. M.
CHECKED BY
DATE APRIL 1968

NEG. No 4086

PROPOSED RECLAMATION OF STOREHOUSE LAKE ACCESS ROAD - INITIAL WORKS

F. J. JOHNSON, A.M.I.C.E., M.I.Mun.E., A.M.I.Struct.E.
ENGINEER & SURVEYOR
HAVANT.

THE URBAN DISTRICT COUNCIL OF HAVANT & WATERLOO.



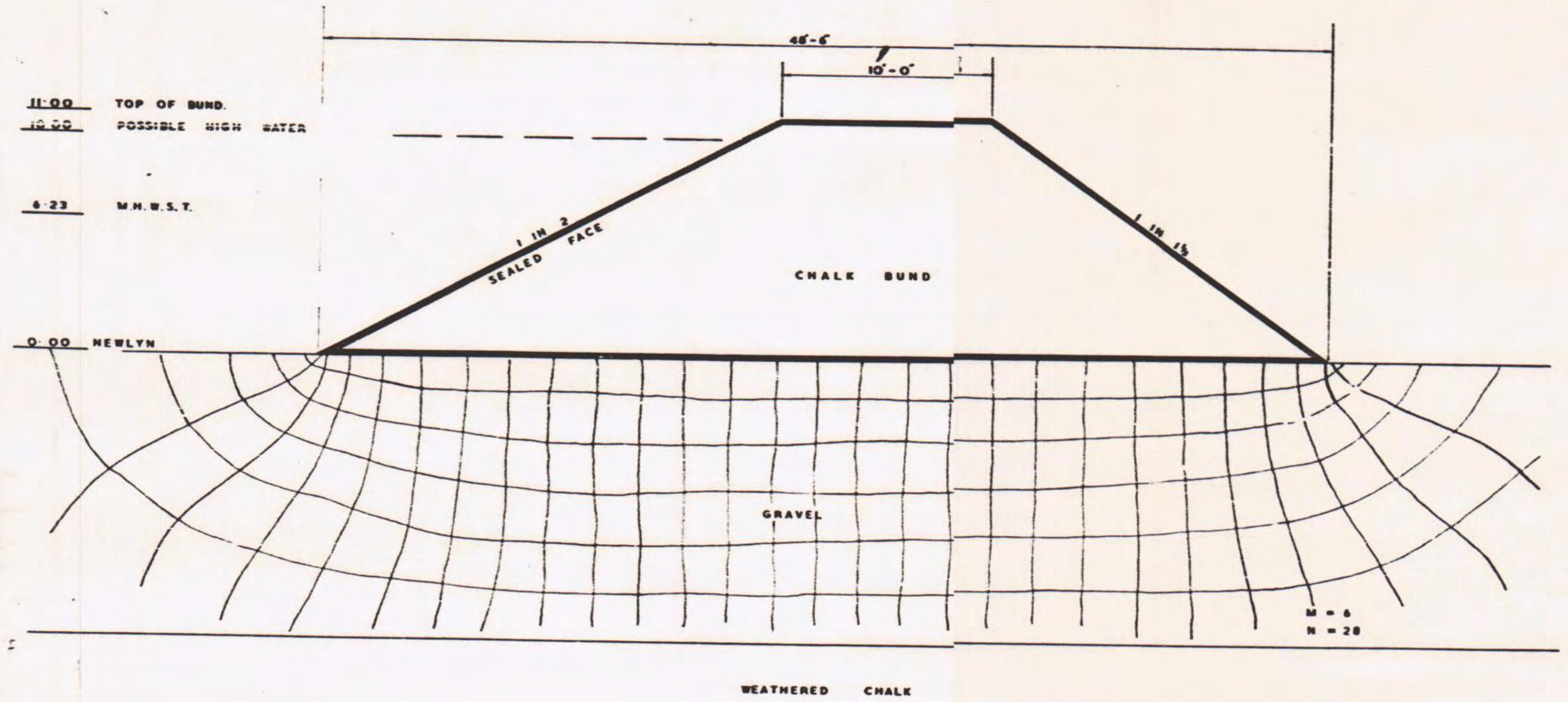
DRAWING No. 639/108
DRAWN BY A.C.M.
TRACED BY A.C.1.
CHECKED BY
DATE OCTOBER 1968

NCC. No 4096

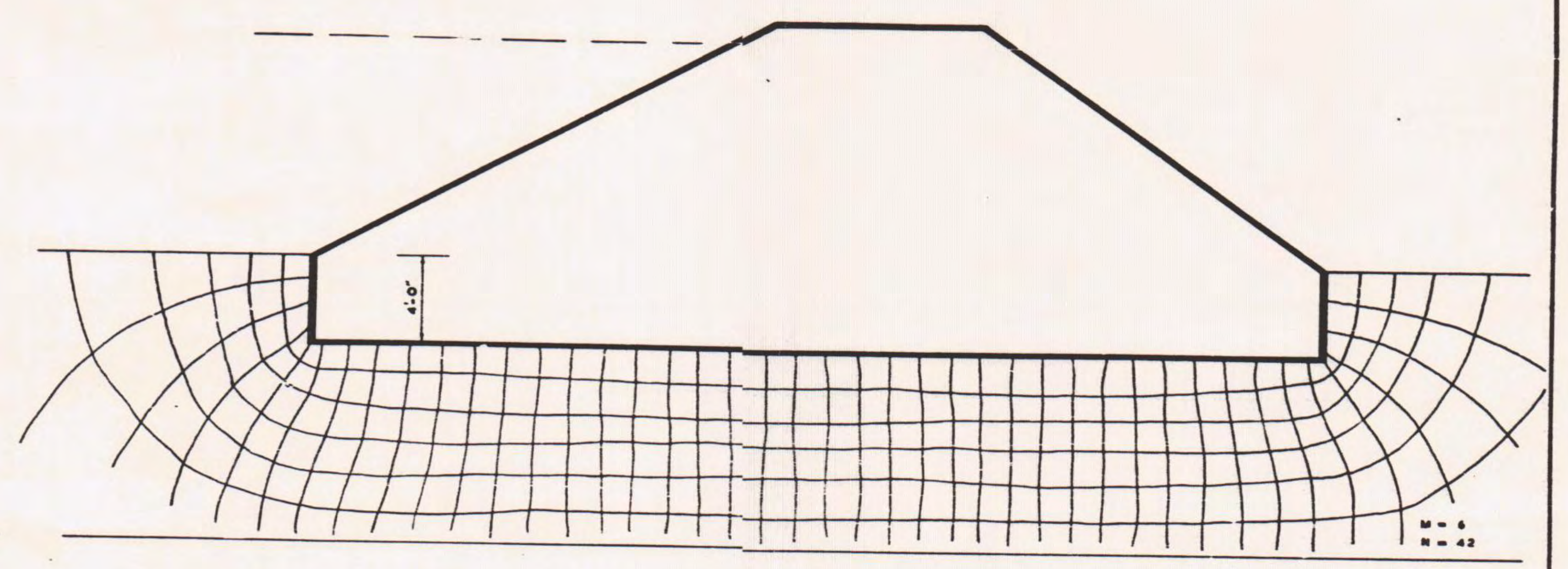
PROPOSED RECLAMATION OF STOREHOUSE LAKE
OUTFALL WORKS IN COFFERDAM

F. J. JOHNSON, A.M.I.C.E., M.I.Mun.E., A.M.I.Struct.E.
ENGINEER & SURVEYOR
HAVANT.

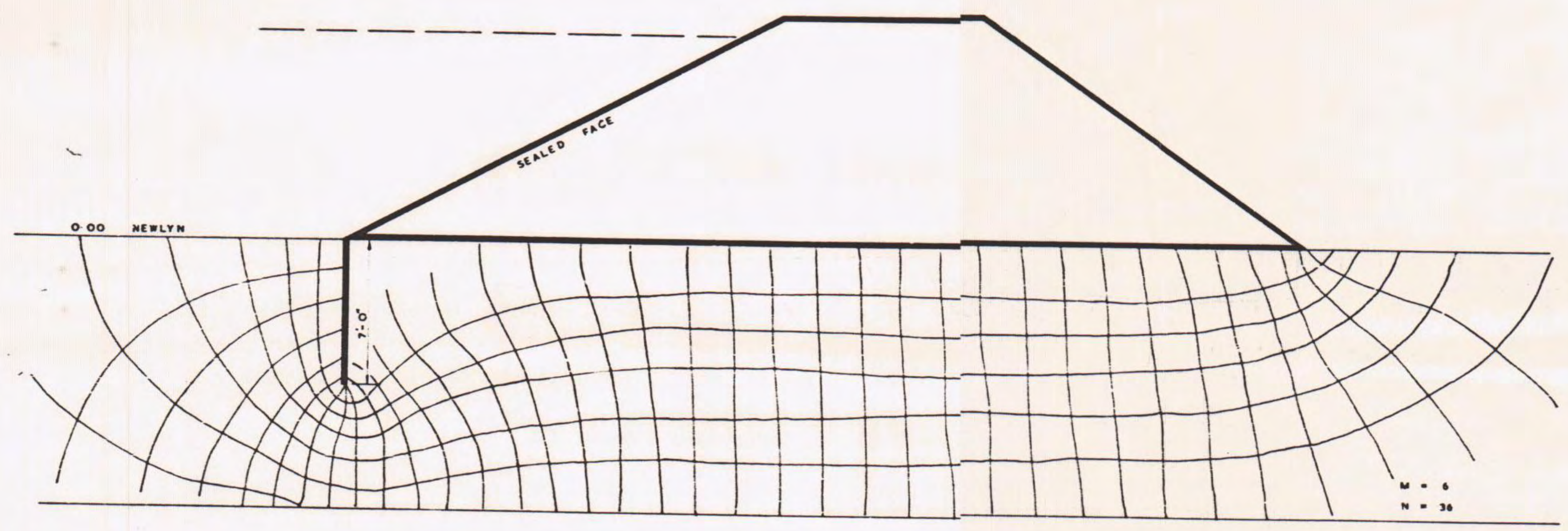
THE URBAN DISTRICT COUNCIL OF HAVANT & WATERLOO.



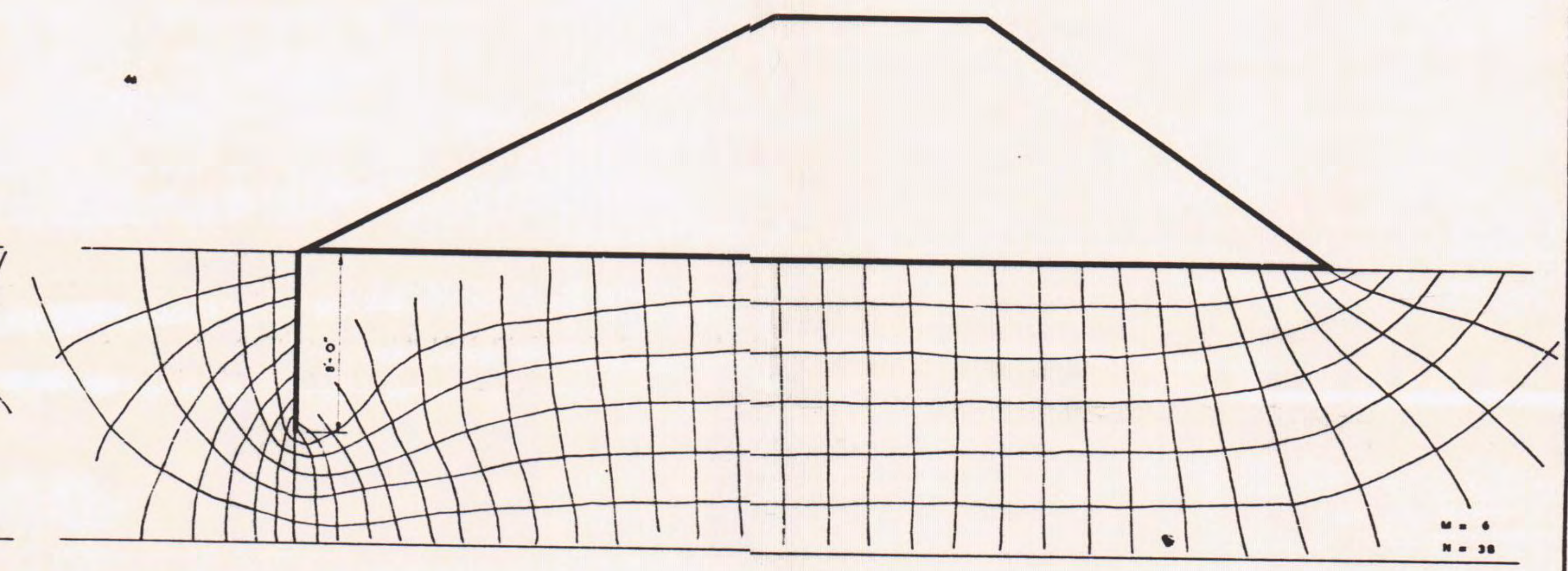
① BUND CONSTRUCTED ON SHINGLE — $\frac{M}{N} = \frac{6}{28} = 0{\cdot}215$



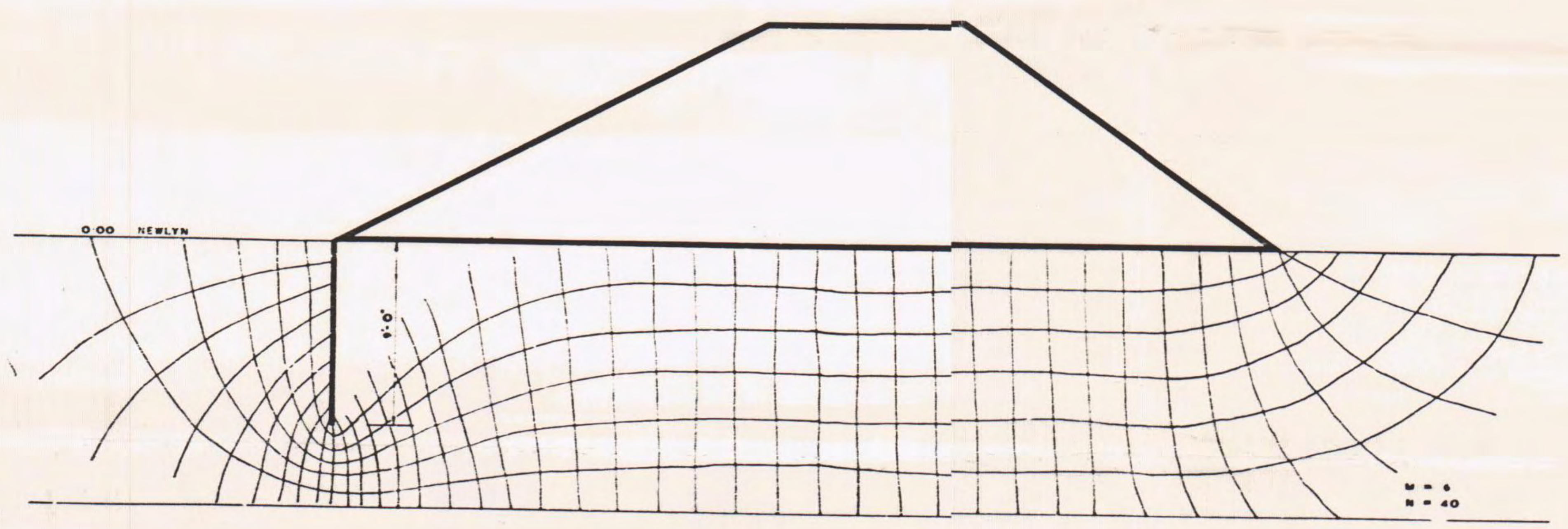
② BUND KEYED 4FT. INTO SHINGLE — $\frac{M}{N} = \frac{6}{42} = 0{\cdot}143$



③ BUND CONSTUCTED ON SHINGLE WITH 7FT SHEET PILE CUT OFF — $\frac{M}{N} = \frac{6}{36} = 0{\cdot}167$

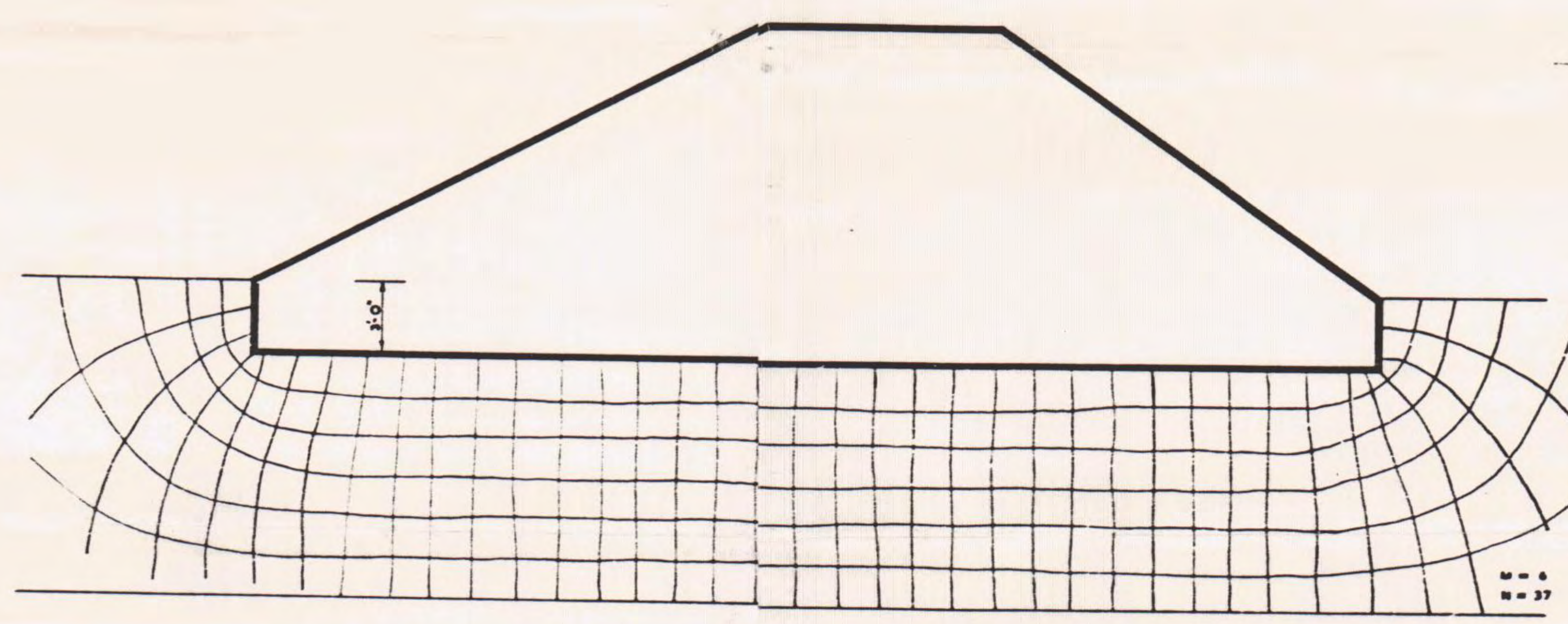


④ BUND CONSTRUCTED ON SHINGLE WITH 8FT. SHEET PILE CUT OFF — $\frac{M}{N} = \frac{6}{38} = 0{\cdot}158$



SCALE 1" to 4'-0" NATURAL

⑤ BUND CONSTRUCTED ON SHINGLE WITH 9FT SHEET PILE CUT OFF — $\frac{M}{N} = \frac{6}{40} = 0{\cdot}150$

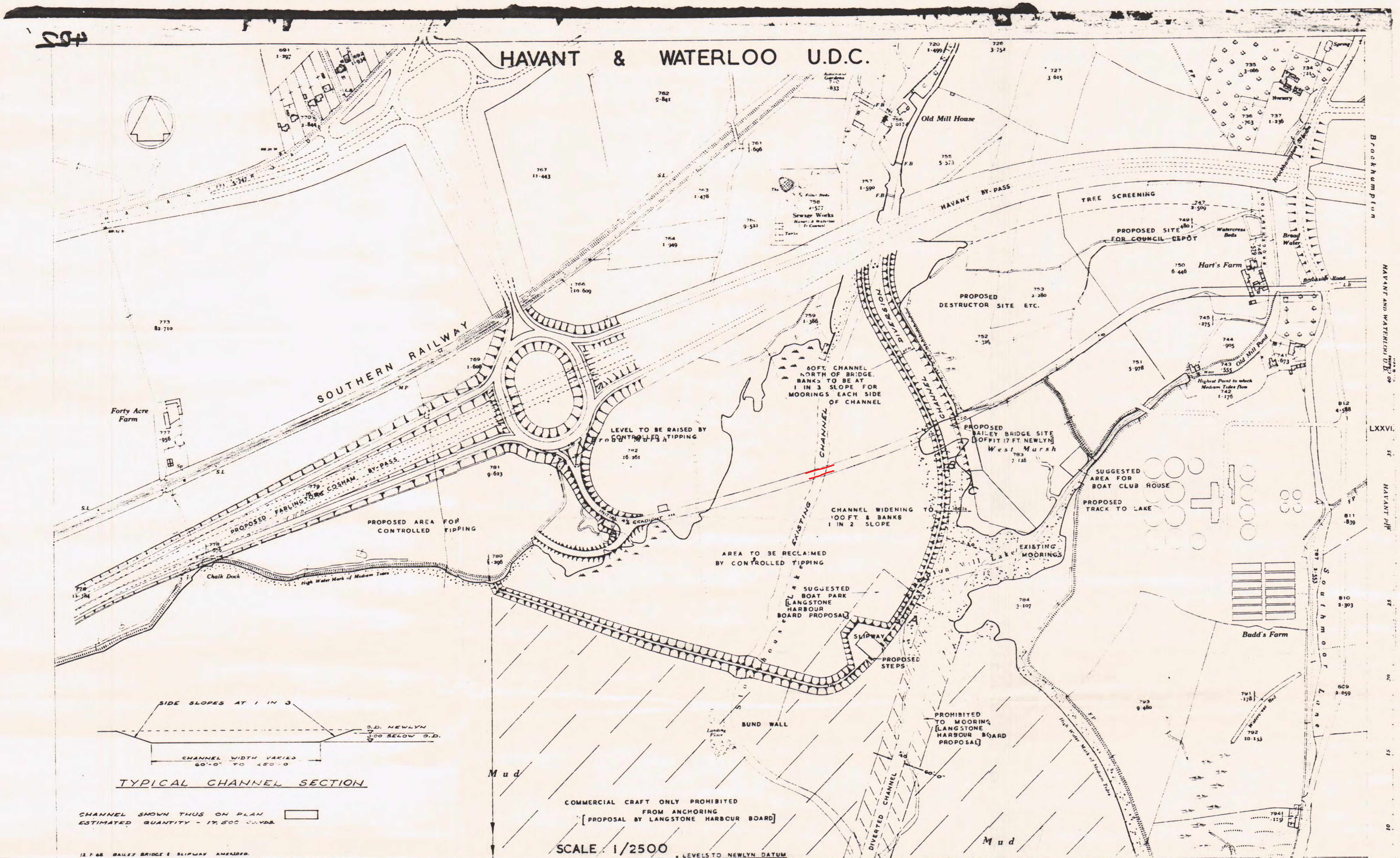


⑥ BUND KEYED 3FT. INTO SHINGLE — $\frac{M}{N} = \frac{6}{37} = 0{\cdot}162$

DRAWING No. 639/112
DRAWN BY G.R.
TRACED BY B.C.
CHECKED BY
DATE OCTOBER 1949
N.E.C. No 408

PROPOSED RECLAMATION OF STOREHOUSE LAKE
BUND WALL – FLOW NETS

F. J. JOHNSON, A.M.I.C.E., M.I.Mun.E., A.M.I.Struct.E.
ENGINEER & SURVEYOR
HAVANT.



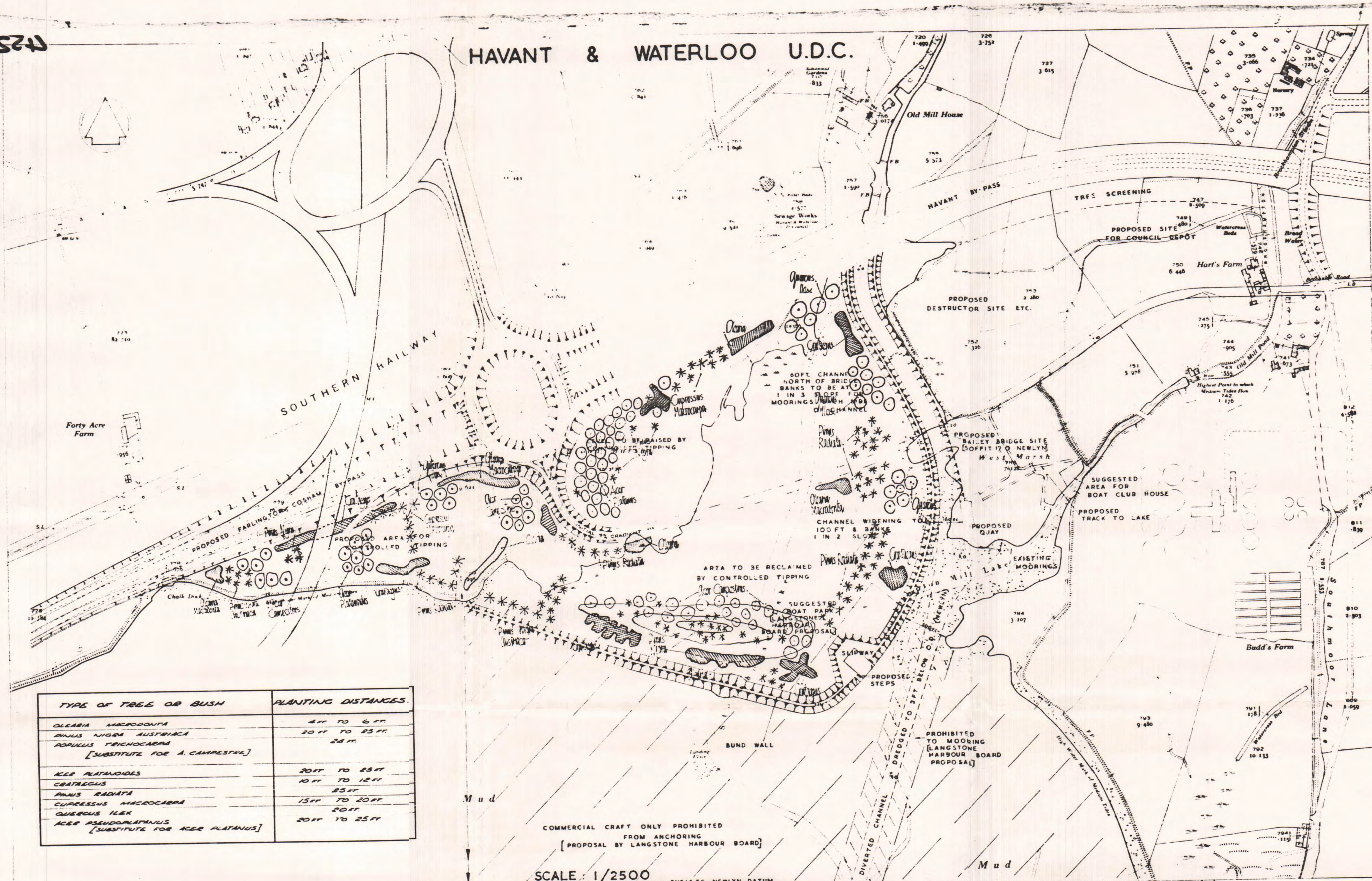
DRAWING No. 638/136
DRAWN BY
TRACED BY
CHECKED BY
DATE. JANUARY, 1969

PROPOSED RECLAMATION OF STOREHOUSE LAKE.
CHANNEL DIVERSION

F. J. JOHNSON. M.I.C.E. M.I.MUN.E. A.M.I.STRUCT.E.
ENGINEER & SURVEYOR
HAVANT.

4752

HAVANT & WATERLOO U.D.C.



TYPE OF TREE OR BUSH	PLANTING DISTANCES.
OLEARIA MACRODONTA	4 FT TO 6 FT.
PINUS NIGRA AUSTRIACA	20 FT TO 25 FT.
POPULUS TRICHOCARPA [SUBSTITUTE FOR A. CAMPESTRE]	24 FT.
ACER PLATANOIDES	20 FT TO 25 FT
CRATAEGUS	10 FT TO 12 FT
PINUS RADIATA	25 FT.
CUPRESSUS MACROCARPA	15 FT TO 20 FT.
QUERCUS ILEX	20 FT.
ACER PSEUDOPLATANUS [SUBSTITUTE FOR ACER PLATANUS]	20 FT TO 25 FT

SCALE : 1/2500

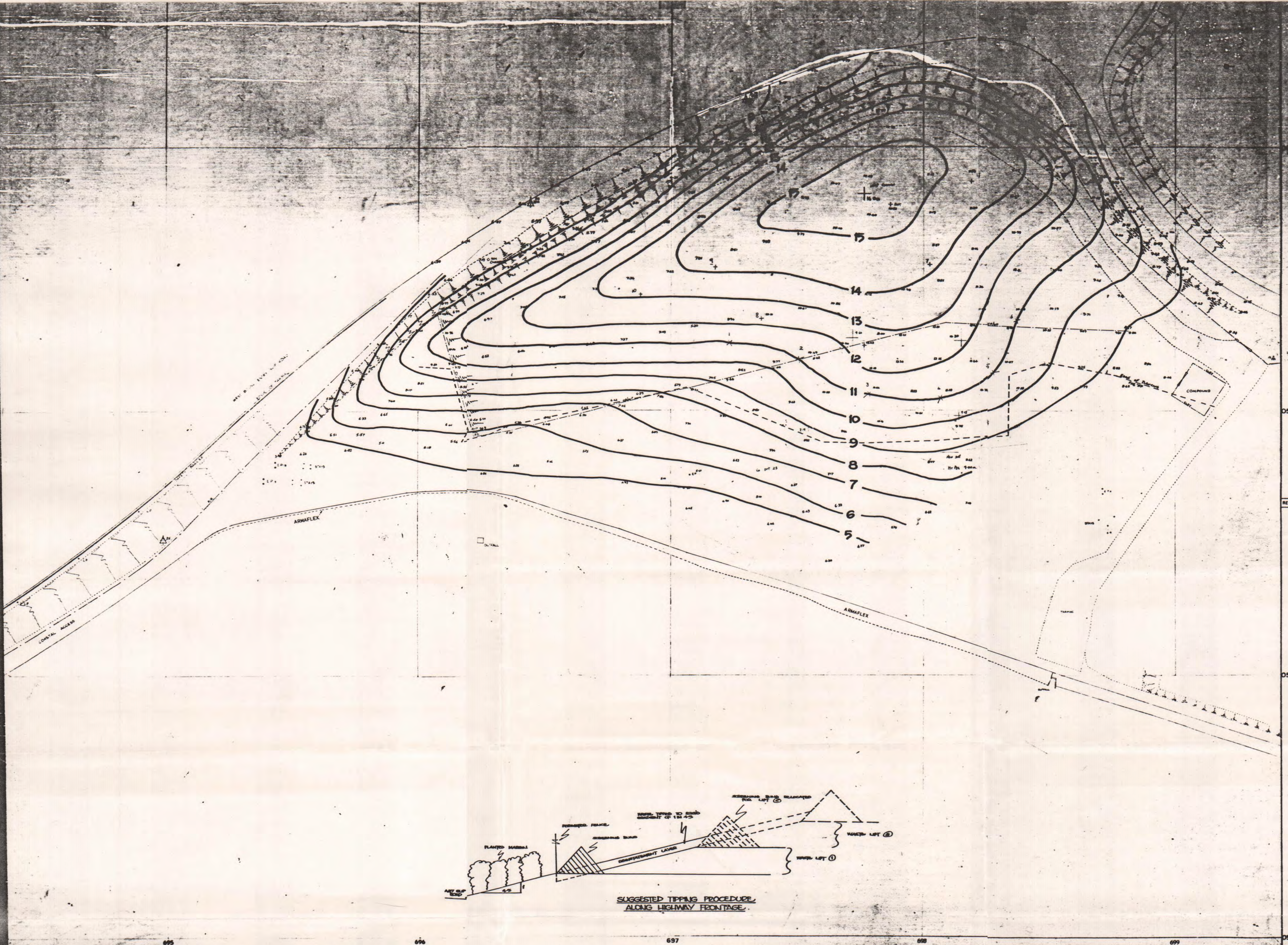
LEVELS TO NEWLYN DATUM

DRAWING No. 639/163
DRAWN BY D. F.
TRACED BY
CHECKED BY
DATE. DECEMBER 1968

NEG. No. 4104

PROPOSED RECLAMATION OF STOREHOUSE LAKE.
REVISED LAYOUT. - LANDSCAPING

F. J. JOHNSON A.M.I.C.E. M.I.MUN.E. A.M.I.STRUCT.E.
ENGINEER & SURVEYOR
HAVANT.



BOROUGH OF HAVANT

BROADMARSH C1: TIPPING DETAILS.

J. W. HANCOCK, C. Eng., F.I.C.E., F.I.Mun.E., M.I.H.E., M.I. Struct. E.

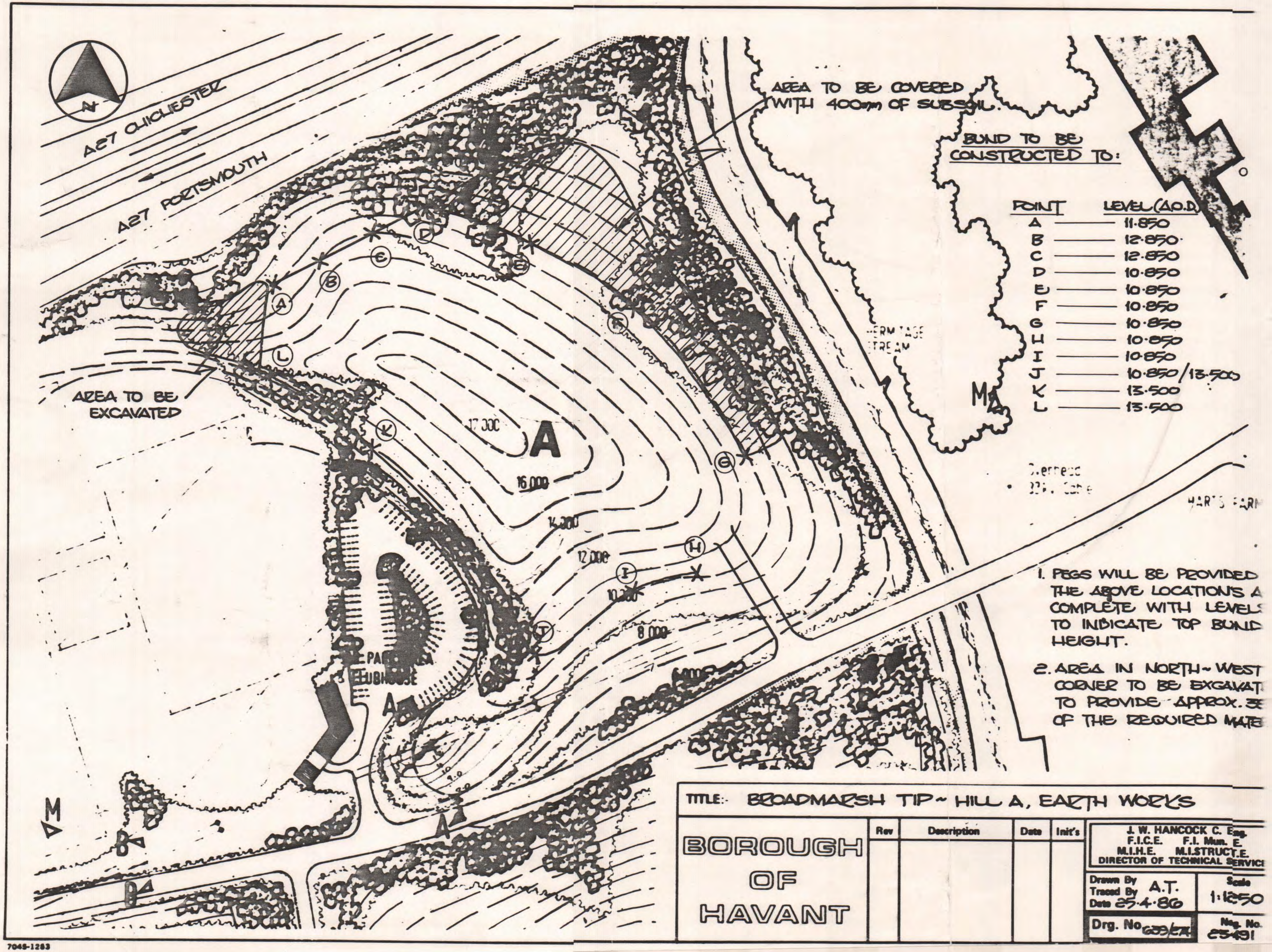
DIRECTOR OF TECHNICAL SERVICES

DRAWN BY :- A.T.
TRACED BY :- A.T.
DATE :- 20-3-85.
SCALE :- 1/500

N

DRG. NO. 639/273

REG. NO. 22057


A27 CHICHESTER
A27 PORTSMOUTH
AREA TO BE COVERED WITH 400mm OF SUBSOIL.
BUND TO BE CONSTRUCTED TO:
POINT LEVEL (A.O.D.)
A 11.850
B 12.850
C 12.850
D 10.850
E 10.850
F 10.850
G 10.850
H 10.850
I 10.850
J 10.850/13.500
K 13.500
L 13.500
AREA TO BE EXCAVATED
17.000
16.000
14.000
12.000
10.000
8.000
6.000
A
HARTS FARM
1. PEGS WILL BE PROVIDED THE ABOVE LOCATIONS A COMPLETE WITH LEVELS TO INDICATE TOP BUND HEIGHT.
2. AREA IN NORTH-WEST CORNER TO BE EXCAVAT TO PROVIDE APPROX. 3 OF THE REQUIRED MATE
TITLE:- BROADMARSH TIP ~ HILL A, EARTH WORKS
BOROUGH OF HAVANT
Rev
Description
Date
Init's
J. W. HANCOCK C. Eng. F.I.C.E. F.I. Mun. E. M.I.H.E. M.I.STRUCT.E. DIRECTOR OF TECHNICAL SERVICE
Drawn By
Traced By A.T.
Date 25.4.86
Scale 1:1250
Drg. No
Neg. No. 25491

7045-1283

NOTES

REV	DESCRIPTION	DATE	INTS
A.	SEWER ROUTE ALTERED	APRIL 1984	P.P.

DRAWN BY - P.G.P.
TRACED BY - M.B.
DATE - JULY 1983
SCALE - 1 : 1250

BOROUGH OF HAVANT

BROADMARSH ~ PHASE II
CLUBHOUSE & SAILING CLUB
FOUL WATER DRAINAGE SCHEME ~ PLAN

DRG NO 1003/4/136
NEG NO 19751

Appendix C Environment Agency and Hampshire County Council Consultation Responses

Hills, Nick

From:	Smith, David <david.smith@hants.gov.uk>
Sent:	21 March 2023 16:41
To:	Hills, Nick
Cc:	Development Management; Kirby-Hawkes, Lisa
Subject:	RE: Former Brockhampton West Landfill - Information Enquiry
Attachments:	Decision Notice.pdf; Revised Layout - Landscaping.pdf

Hi Nick,

I'm happy to say that this is a bit before my time, or anyone here to be honest. The EA are correct to say that the site was never licensed or permitted by themselves and any activity from the mid 1970s would have been Licenced by the County Council (under the old Control of Pollution Act I think). However, that part of the County Council, the Waste Regulation Section, actually became the Environment Agency in 1996 (along with the old National Rivers Authority and HM Inspectorate of Pollution) and they took responsibility for the regulation and licencing/permitting of waste activities, and, consequently, took all the relevant files with them.

We, as Planning Authority, retained the planning files relevant to the actual planning permissions, however, given the age of the site these were all archived many years ago. I have had a look at the planning history for the site and, along with the ones you sent copies for, there was a further permission in 1970 for Landscaping Proposals for Storehouse Lake. I have attached the decision and plan attached to this permission in case they are of any use.

From a Planning perspective this site has now been completed for such a long time that there are no outstanding planning requirements. In terms of Licences, as the EA commented there was no modern Permit for the site so no modern conditions or surrender requirements, so again I do not think there will be any outstanding matters.

I hope this helps.

Regards,

David Smith
Enforcement Officer
07810 162684
David.smith@hants.gov.uk

Development Management and Minerals and Waste Policy
Universal Services
EII Court West
The Castle
Winchester
Hampshire
SO23 8UD

Strategic Planning offers a pre-application service to help improve the quality of applications and speed up decision-making. Information on the Council's pre-application service is available here.

In support of the e-government agenda, the County Council welcomes the online submission of planning applications which can be submitted **here.**

From: Hills, Nick <nick.hills@stantec.com>
Sent: 20 March 2023 16:01
To: Development Management <planning@hants.gov.uk>
Cc: Pierce, Sofia <Sofia.Pierce@stantec.com>
Subject: Former Brockhampton West Landfill - Information Enquiry

Caution: This is an external email and could contain malicious content. Do not open any links or attachments if you were not expecting them. If the e-mail looks suspicious, please report via the 'Report Phishing' Button found on your toolbar.

Good Afternoon,

We are currently preparing a geo-environmental study for a parcel of land located immediately north of Harts Farm Way in Havant. The site can be located approximately by NGR 470160 E, 105685 N, and by postcode PO9 1HS. A screenshot of the 'red line' boundary is shown below.

The site forms part of the former Brockhampton West landfill, with the wider area having been reclaimed in the late 1960s through the construction of a bund-wall and the infilling of the area within the bund with waste. Havant Borough Council have provided the attached scans of planning consents for tipping at the site. The Environment Agency have indicated that landfilling took place between 1969 and 1987.

The EA have stated "*Given that it ceased active operation in 1987, I don't think it ever licenced/permitted by the Environment Agency, and was probably regulated by Hampshire County Council*".

Beyond the planning permissions (attached) are you aware of any other Waste Management Licences / permissions / permits relating to this landfill, and if so do you know if said licences have been revoked / discharged / surrendered etc.?

Kind regards,

Nicholas Hills
Senior Geoenvironmental Scientist
Caversham Bridge House, Waterman Place, Reading, RG1 8DN
Direct: 0118 952 3162
Mobile: 07801 998791
Nick.Hills@Stantec.com

Stantec

FORM P.3(Details)CC.

HAMPSHIRE COUNTY COUNCIL

TOWN AND COUNTRY PLANNING ACT, 1962

TOWN AND COUNTRY PLANNING GENERAL DEVELOPMENT ORDER, 1963

PLOTTED	✓
B.I. CARD	✓
REGR.	✓
STATS.	X
FILE	

To:— Havant & Waterloo Urban District Council,
c/o The Director of Technical Services,
Elmleigh Road,
HAVANT,
Hants.

Plan No. HWU.14239/8

In pursuance of their powers under the above-mentioned Act and Order, the Council, as the local planning authority, hereby approve the detailed plans, drawings and particulars relating to Landscaping proposals for Storehouse Lake, Bedhampton,

submitted on 5th November, 1969, in accordance with the conditions subject to which outline planning permission was granted under Article 5(2) of the Town and Country Planning General Development Order, 1963, under Plan No. HWU.14239/3 L, in respect of the use of land at Storehouse Lake, Bedhampton, as a controlled tip, quay, slipway and dinghy park and construction of channel diversion and road. (as amended by plans received 14.1.70

This approval is granted subject to due compliance with the conditions imposed on the grant of the aforementioned outline planning permission~~and to the following:-~~

~~The reasons for the foregoing conditions are:-~~

A. W. M. Smith
Clerk of County Council
On behalf of the Local Planning Authority.

THE CASTLE,
WINCHESTER.

Date 13 FEB 1970

NOTES: (1) Notwithstanding the terms of the condition attached to the outline permission, requiring detailed plans to be submitted before development commences, the approval hereby granted authorises the commencement of so much of the development as is specified above. Attention is, however, drawn to the need to submit such further detailed plans, if any, as are required by the outline permission before any development other than that specified above is commenced.

(2) It is essential that this approval is read in conjunction with the outline planning permission originally granted for the development in question and with any conditions then imposed.

(3) This approval does not purport to convey any approval or consent which may be required under the Town and Country Planning Act, 1962, otherwise than under Sections 17—20 of that Act, or which may be required under any other Acts, including any Byelaws, Orders or Regulations made under such other Acts.

(4) **Public Rights of Way.** Developers are reminded that the grant of planning permission does not entitle them to obstruct a right of way and that, if it is necessary to stop up or divert a right of way in order to enable the development to be carried out, they should apply without delay to the Minister of Transport for an Order under Section 153 of the Town and Country Planning Act, 1962; development must not be started until this has been obtained.

P.T.O.

1/65.

NOTIFICATION

(1) If the applicant is aggrieved by the decision to refuse permission or approval for the proposed development, or to grant permission or approval subject to conditions, he may, by notice served within one month of receipt of this notice, appeal to the Minister of Housing and Local Government in accordance with Section 23 of the Town and Country Planning Act, 1962.

The Minister has power to allow a longer period for the giving of a Notice of Appeal and he will exercise his power in cases where he is satisfied that the applicant has deferred the giving of notice because negotiations with the local planning authority in regard to the proposed development are in progress. The Minister is not, however, required to entertain such an appeal if it appears to him that permission for the proposed development could not have been granted by or on behalf of the local planning authority, or could not have been so granted otherwise than subject to the conditions imposed by them, having regard to the provisions of the development order and to any directions given under the order.

(2) If permission to develop the land is refused, or granted subject to conditions, whether by or on behalf of the local planning authority or by the Minister of Housing and Local Government, and the owner of the land claims that the land has become incapable of reasonably beneficial use in its existing state and cannot be rendered capable of reasonably beneficial use by the carrying out of any development which has been or would be permitted, he may serve on the Council of the county borough or county district in which the land is situated a purchase notice requiring that Council to purchase his interest in the land in accordance with the provisions of Part VIII of the Town and Country Planning Act, 1962.

(3) In certain circumstances, a claim may be made against the local planning authority for compensation, where permission is refused, or granted subject to conditions by the Minister on appeal or on a reference of the application to him. The circumstances in which such compensation is payable are set out in Section 123 of the Town and Country Planning Act, 1962.

(4) An applicant who wishes to appeal against a decision should write to the Minister of Housing and Local Government, Whitehall, London, S.W.1.

(5) The applicant is recommended to retain this form with the title deeds of the property.

(6) In cases where a Government Department has expressed views on the proposals which are incorporated in the reasons for refusal or for the imposition of conditions and the applicant wishes to lodge an appeal against such decision then a representative from that Government Department will attend any Planning Inquiry and be available to give evidence if the appellant asks for the presence of such a witness at the Inquiry. In such cases the appellant should notify the Council at the address given on the front of this form without delay. The representative would not be liable to cross-examination on questions of Ministerial policy but only on matters of fact and expert opinion.

NOTICE

Attention is drawn to the fact that any failure to adhere to the details of the plans hereby approved or to comply with any conditions detailed in this notice would constitute a contravention of the provisions of the Town and Country Planning Act, 1962, in respect of which enforcement action might be taken.

If it is desired to depart in any way from the proposals as approved, an amended application should be made to the Council at the address overleaf.

HAVANT & WATERLOO U.D.C.

DRAWING No. 639/11.7
DRAWN BY D.F.
TRACED BY
CHECKED BY
DATE DECEMBER 1968
NEGNo 4104

PROPOSED RECLAMATION OF STOREHOUSE LAKE.
REVISED LAYOUT. - LANDSCAPING

F. J. JOHNSON. A.M.I.C.E. M.I.MUN.E. A.M.I.STRUCT.E.
ENGINEER & SURVEYOR.
HAVANT.

Hills, Nick

From:	Wickens, Tom <tom.wickens@environment-agency.gov.uk>
Sent:	07 February 2023 15:53
To:	Hills, Nick
Cc:	Pierce, Sofia; SSD Enquiries
Subject:	RE: Harts Farm Way / Brockhampton West Landfill - Permit History

Good afternoon Nick,

Many apologies if we have not responded to your earlier request. Our enquiries team should be able to update you on the situation with this request.

I do have some knowledge of this site, but that is largely based on the site investigation that have taken place in association with the proposed redevelopment of part of the historic landfill. I believe these all should be on the Havant District council planning portal under the reference - APP/21/00189. I assume though you are already familiar with these reports.

According to our records the site was infilled (or deposited as land raise) between around 1969 and 1987. Although planning permission was stated as being granted in 1958, so some waste may have been deposited before 1969. The site is also recorded as being a dilute and disperse facility, so any engineering is likely to be minimal. The sea wall though adjacent to the site, may offer some barriers limiting migration. In terms of waste, the site is known to have taken household waste, as was as some commercial/industrial waste.

Given that it ceased active operation in 1987, I don't think it ever licenced/permitted by the Environment Agency, and was probably regulated by Hampshire County Council. As such I don't think we would have any waste licencing/permit files.

The only other thing I can see on our records is that it was operated by "The Castle, Winchester, Hampshire".

I would though suggest, that if you not already done so to contact Jonathan Drive and Havant District Council. I believe the site is owned by Havant District Council and Jonathon has pulled out a various information on the site from their archives. Jonathan E-mail is given below.

Jonathan.Driver@havant.gov.uk

Kind Regards

Tom

Tom Wickens
Technical Specialist - (Groundwater Quality and Contaminated Land)
Solent and South Downs
Environment Agency

Romsey Office, Canal Walk, Romsey ,Hampshire,SO51 8DU
Tel - 07867 200775

tom.wickens@environment-agency.gov.uk

Appendix D Tables of Estimated Risk

PSC No. 1 & 2	Harts Farm Way Landfill; Site Reference FHA15, 1760/1/13/6 – BASELINE PHASE					
Potential Source of Contamination	**Potential Contaminants of Concern**	**Potential Receptors**	**Potential Pathways**	**Potential Consequence of Pollutant Linkage**	**Probability of Pollutant Linkage**	**Risk (without mitigation measures)**
Household, commercial and industrial waste types. The depth to the base of the waste material (where encountered) ranges between 5.5m bgl to 13.9m bgl (east area) and 8.2-11.5m bgl (west area).	Metals, inorganics, asbestos, petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) (including phenols), per-and polyfluorinated alkyl substances (PFAS).	**Human Health – On-site:** Not Applicable as receptor is not present at baseline. Site is vacant with no public footpaths.	Not Applicable	Not Applicable	Not Applicable	Not Applicable
		Human Health – Off-site: Workers at adjacent business park, yard, aggregates wharf etc.	Ingestion and inhalation of dusts, and particles	Medium	Unlikely	Low
		Groundwater (resource): Raised Marine Deposits (Secondary Undifferentiated Aquifer) over Chalk (Principal Aquifer). Alluvium (land immediately east of the landfill) (Secondary A Aquifer). Potable abstractions have not been identified within 250 m of the Site. The Site is located within reclaimed former marine land where saline groundwater conditions are likely to be prevalent and potable abstraction is unlikely to be viable.	Groundwater within permeable natural strata as a pathway allowing migration of mobile contamination leached from contaminated soils. Groundwater migrating via anthropogenic routes e.g., boreholes, landfill waste mass etc.	Severe	Low (unlikely that aquifer will be utilised)	Moderate
		Groundwater (biodiversity): The EA's Catchment Data Explorer indicates that the groundwater beneath the Site received an WFD classification of Poor in 2019 for chemical quality.		Medium	High	High
		Surface Water (resource): Not Applicable as surface water abstractions have not been identified within 250 m of the Site.	Not Applicable	Not Applicable	Not Applicable	Not Applicable
		Surface Water (biodiversity): The Hermitage Stream, located immediately east of the Site, received a WFD classification of Moderate for Ecological Quality in 2019.	Runoff or discharges to surface water via existing drainage network, e.g., historical land drains, highway drainage. Deposition of wind-blown dust Recharge of surface water via contaminated groundwater	Severe	High	Very High
		Ecologically Sensitive Sites: Langstone Harbour (Special Protected Area, Ramsar and SSSI) located approximately 200 m to the south of the Site.	Runoff or discharges to surface water via existing drainage network, e.g., historical land drains, highway drainage. Deposition of wind-blown dust Recharge of surface water via contaminated groundwater	Medium	Likely	Moderate
		Geodiversity: Not Applicable as the Site is not located within 1.0 km of any geologically designated SSSI or geologically designated Local Site (RIGS).	Not Applicable	Not Applicable	Not Applicable	Not Applicable

PSC No. 1 & 2	Harts Farm Way Landfill; Site Reference FHA15, 1760/1/13/6 – BASELINE PHASE					
Potential Source of Contamination	**Potential Contaminants of Concern**	**Potential Receptors**	**Potential Pathways**	**Potential Consequence of Pollutant Linkage**	**Probability of Pollutant Linkage**	**Risk (without mitigation measures)**
		Property – Buildings and Archaeology: A single listed structure is present, approximately 190 m north (i.e., hydraulically upgradient) of the Site. It is considered highly unlikely that this property would experience any impacts due to the construction of the proposed development, e.g., migration of contamination. A safeguarded mineral wharf is present approximately 100 m east of the Site. Assorted commercial properties and a gas peaking plant are also present within 250 m of the Site.	Direct contact – Sulphate attack on concrete, hydrocarbon corrosion / permeation of plastic pipes.	Medium	Low	Low / Moderate
	Landfill gas (methane, carbon dioxide, carbon monoxide, hydrogen sulphide)	**Human Health – On-site:** Not Applicable as receptor is not present at baseline. Site is vacant with no public footpaths.	Not Applicable	Not Applicable	Not Applicable	Not Applicable
		Human Health – Off-site: Workers at adjacent business park, yard, aggregates wharf etc.	Inhalation of gases and vapours within buildings.	Severe	Likely	High

Appendix D – Risk Assessment Tables (PSC1 & 2 – Harts Farm Way Landfill)

PSC No. 1 & 2	Harts Farm Way Landfill; Site Reference FHA15, 1760/1/13/6 – CONSTRUCTION PHASE					
Potential Source of Contamination	**Potential Contaminants of Concern**	**Potential Receptors**	**Potential Pathways**	**Potential Consequence of Pollutant Linkage**	**Probability of Pollutant Linkage**	**Risk (without mitigation measures)**
Household, commercial and industrial waste types. The depth to the base of the waste material (where encountered) ranges between 5.5m bgl to 13.9m bgl (east area) and 8.2-11.5m bgl (west area).	Metals, inorganics, asbestos, petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) (including phenols), per-and polyfluorinated alkyl substances (PFAS).	**Human Health – On-site:** Construction workers during excavations/construction of WRP and associated shafts and infrastructure.	Direct dermal contact, ingestion and inhalation of dusts.	Severe	High	Very High
		Human Health – Off-site: Workers at adjacent business park, yard, aggregates wharf etc.	Ingestion and inhalation of dusts and particles	Medium	Low	Low / Moderate
		Groundwater (resource): Raised Marine Deposits (Secondary Undifferentiated Aquifer) over Chalk (Principal Aquifer). Alluvium (land immediately east of the landfill) (Secondary A Aquifer). Potable abstractions have not been identified within 250 m of the Site. The Site is located within reclaimed former marine land where saline groundwater conditions are likely to be prevalent and potable abstraction is unlikely to be viable.	Groundwater within permeable natural strata as a pathway allowing migration of mobile contamination leached from contaminated soils. Groundwater migrating via anthropogenic routes e.g., boreholes, landfill waste mass etc.	Severe	Low (unlikely that aquifer will be utilised)	Moderate
		Groundwater (biodiversity): The EA's Catchment Data Explorer indicates that the groundwater beneath the Site received an WFD classification of Poor in 2019 for chemical quality.		Medium	High	High
		Surface Water (resource): Not Applicable as surface water abstractions have not been identified within 250 m of the Site.	Not Applicable	Not Applicable	Not Applicable	Not Applicable
		Surface Water (biodiversity): The Hermitage Stream, located immediately east of the Site, received a WFD classification of Moderate for Ecological Quality in 2019.	Runoff or discharges to surface water via existing drainage network, e.g., historical land drains, highway drainage. Deposition of wind-blown dust Recharge of surface water via contaminated groundwater	Severe	High	Very High
		Ecologically Sensitive Sites: Langstone Harbour (Special Protected Area, Ramsar and SSSI) located approximately 200 m to the south of the Site.	Runoff or discharges to surface water via existing drainage network, e.g., historical land drains, highway drainage. Deposition of wind-blown dust Recharge of surface water via contaminated groundwater	Medium	Likely	Moderate
		Geodiversity: Not Applicable as the site is not located within 1.0 km of any geologically designated SSSI or geologically designated Local Site (RIGS).	Not Applicable	Not Applicable	Not Applicable	Not Applicable
		Property – Buildings and Archaeology: WRP and associated infrastructure, alongside off-site receptors identified ay baseline.	Direct contact – Sulphate attack on concrete, hydrocarbon corrosion / permeation of plastic pipes.	Medium	High	High

Appendix D – Risk Assessment Tables (PSC1 & 2 – Harts Farm Way Landfill)

PSC No. 1 & 2	**Harts Farm Way Landfill; Site Reference FHA15, 1760/1/13/6 – CONSTRUCTION PHASE**					
Potential Source of Contamination	**Potential Contaminants of Concern**	**Potential Receptors**	**Potential Pathways**	**Potential Consequence of Pollutant Linkage**	**Probability of Pollutant Linkage**	**Risk (without mitigation measures)**
	Landfill gas (methane, carbon dioxide, carbon monoxide, hydrogen sulphide)	**Human Health – On-site:** Construction workers during excavations/construction of WRP and associated shafts and infrastructure.	Inhalation of gases and vapours within excavations, site cabins and temporary buildings.	Severe	High	Very High
		Human Health – Off-site: Workers at adjacent business park, yard, aggregates wharf etc.	Inhalation of gases and vapours within buildings.	Severe	Likely	High

Appendix D – Risk Assessment Tables (PSC1 & 2 – Harts Farm Way Landfill)

PSC No. 1 & 2	Harts Farm Way Landfill; Site Reference FHA15, 1760/1/13/6 – OPERATIONAL PHASE					
Potential Source of Contamination	**Potential Contaminants of Concern**	**Potential Receptors**	**Potential Pathways**	**Potential Consequence of Pollutant Linkage**	**Probability of Pollutant Linkage**	**Risk (without mitigation measures)**
Household, commercial and industrial waste types. The depth to the base of the waste material (where encountered) ranges between 5.5m bgl to 13.9m bgl (east area) and 8.2-11.5m bgl (west area).	Metals, inorganics, asbestos, petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) (including phenols), per-and polyfluorinated alkyl substances (PFAS).	**Human Health – On-site:** Workers at completed development, groundworkers undertaking in-ground maintenance work	Direct dermal contact, ingestion and inhalation of dusts.	Medium	Unlikely	Low
		Human Health – Off-site: Workers at adjacent business park, yard, aggregates wharf etc.	Ingestion and inhalation of dusts and particles	Medium	Unlikely	Low
		Groundwater (resource): Raised Marine Deposits (Secondary Undifferentiated Aquifer) over Chalk (Principal Aquifer). Alluvium (land immediately east of the landfill) (Secondary A Aquifer). Potable abstractions have not been identified within 250 m of the Site. The Site is located within reclaimed former marine land where saline groundwater conditions are likely to be prevalent and potable abstraction is unlikely to be viable.	Groundwater within permeable natural strata as a pathway allowing migration of mobile contamination leached from contaminated soils. Groundwater migrating via anthropogenic routes e.g., boreholes, landfill waste mass etc.	Severe	Low (unlikely that aquifer will be utilised)	Moderate
		Groundwater (biodiversity): The EA's Catchment Data Explorer indicates that the groundwater beneath the Site received an WFD classification of Poor in 2019 for chemical quality.		Medium	High	High
		Surface Water (resource): Not Applicable as surface water abstractions have not been identified within 250 m of the Site.	Not Applicable	Not Applicable	Not Applicable	Not Applicable
		Surface Water (biodiversity): The Hermitage Stream, located immediately east of the Site, received a WFD classification of Moderate for Ecological Quality in 2019.	Runoff or discharges to surface water via existing drainage network, e.g., historical land drains, highway drainage. Deposition of wind-blown dust Recharge of surface water via contaminated groundwater	Severe	High	Very High
		Ecologically Sensitive Sites: Langstone Harbour (Special Protected Area, Ramsar and SSSI) located approximately 200 m to the south of the Site.	Runoff or discharges to surface water via existing drainage network, e.g., historical land drains, highway drainage. Deposition of wind-blown dust Recharge of surface water via contaminated groundwater	Medium	Likely	Moderate
		Geodiversity: Not Applicable as the Site is not located within 1.0 km of any geologically designated SSSI or geologically designated Local Site (RIGS).	Not Applicable	Not Applicable	Not Applicable	Not Applicable
		Property – Buildings and Archaeology: Completed WRP and associated infrastructure, alongside off-site receptors identified ay baseline.	Direct contact – Sulphate attack on concrete, hydrocarbon corrosion / permeation of plastic pipes.	Medium	High	High

Appendix D – Risk Assessment Tables (PSC1 & 2 – Harts Farm Way Landfill)

PSC No. 1 & 2	**Harts Farm Way Landfill; Site Reference FHA15, 1760/1/13/6 – OPERATIONAL PHASE**					
Potential Source of Contamination	**Potential Contaminants of Concern**	**Potential Receptors**	**Potential Pathways**	**Potential Consequence of Pollutant Linkage**	**Probability of Pollutant Linkage**	**Risk (without mitigation measures)**
	Landfill gas (methane, carbon dioxide, carbon monoxide, hydrogen sulphide)	**Human Health – On-site:** Workers at the completed development.	Inhalation of gases and vapours within enclosed spaces / buildings.	Severe	High	Very High
		Human Health – Off-site: Workers at adjacent business park, yard, aggregates wharf etc.	Inhalation of gases and vapours within buildings.	Severe	Likely	High

PSC No. 3	Former Sewage Works (off-site, approximately 50 m to the north) – BASELINE PHASE					
Potential Source of Contamination	**Potential Contaminants of Concern**	**Potential Receptors**	**Potential Pathways**	**Potential Consequence of Pollutant Linkage**	**Probability of Pollutant Linkage**	**Risk (without mitigation measures)**
Former sewage works, infrastructure no longer shown apart from circular tank bases. Area is shown as green on aerial mapping and potentially overgrown. Mature vegetation on boundary	Metals, inorganics, asbestos, petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene (BTEX), total phenols polychlorinated biphenyls (PCBs), PFAS and pathogens.	**Human Health – On-site:** Not Applicable as receptor is not present at baseline. Site is vacant with no public footpaths.	Not Applicable	Not Applicable	Not Applicable	Not Applicable
		Groundwater (resource): Raised Marine Deposits (Secondary Undifferentiated Aquifer) over Chalk (Principal Aquifer). Alluvium (land immediately east of the landfill) (Secondary A Aquifer). Potable abstractions have not been identified within 250 m of the Site. The Site is located within reclaimed former marine land where saline groundwater conditions are likely to be prevalent and potable abstraction is unlikely to be viable.	Groundwater within permeable natural strata as a pathway allowing migration of mobile contamination leached from contaminated soils. Groundwater migrating via anthropogenic routes e.g., boreholes, landfill waste mass etc.	Medium	Low (unlikely that aquifer will be utilised) Contaminant concentrations in groundwater are likely to be reduced due to dilution / dispersion.	Low / Moderate
		Groundwater (biodiversity): The EA's Catchment Data Explorer indicates that the groundwater beneath the Site received an WFD classification of Poor in 2019 for chemical quality.		Medium	Low Contaminant concentrations in groundwater are likely to be reduced due to dilution / dispersion.	Low / Moderate
		Property – Buildings and Archaeology: Not Applicable. Structures are not present on the Site at baseline.	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Landfill gas (methane, carbon dioxide, carbon monoxide, hydrogen sulphide)	**Human Health – On-site:** Not Applicable as receptor is not present at baseline. Site is vacant with no public footpaths.	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Note: This table only includes assessment of the risk presented by the off-site source to the on-site receptors. Assessment of the risk presented by the off-site source to the off-site receptors is beyond the scope of this assessment.

PSC No. 3	Former Sewage Works (off-site, approximately 50 m to the north) – CONSTRUCTION PHASE					
Potential Source of Contamination	**Potential Contaminants of Concern**	**Potential Receptors**	**Potential Pathways**	**Potential Consequence of Pollutant Linkage**	**Probability of Pollutant Linkage**	**Risk (without mitigation measures)**
Former sewage works, infrastructure no longer shown apart from circular tank bases. Area is shown as green on aerial mapping and potentially overgrown. Mature vegetation on boundary	Metals, inorganics, asbestos, petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene (BTEX), total phenols polychlorinated biphenyls (PCBs), PFAS and pathogens.	**Human Health – On-site:** Construction workers during excavations/construction of WRP and associated shafts and infrastructure.	Ingestion and inhalation of dusts and particles.	Severe	Low	Moderate
		Groundwater (resource): Raised Marine Deposits (Secondary Undifferentiated Aquifer) over Chalk (Principal Aquifer). Alluvium (land immediately east of the landfill) (Secondary A Aquifer). Potable abstractions have not been identified within 250 m of the Site. The Site is located within reclaimed former marine land where saline groundwater conditions are likely to be prevalent and potable abstraction is unlikely to be viable.	Groundwater within permeable natural strata as a pathway allowing migration of mobile contamination leached from contaminated soils. Groundwater migrating via anthropogenic routes e.g., boreholes, landfill waste mass etc.	Medium	Low (unlikely that aquifer will be utilised) Contaminant concentrations in groundwater are likely to be reduced due to dilution / dispersion.	Low / Moderate
		Groundwater (biodiversity): The EA's Catchment Data Explorer indicates that the groundwater beneath the Site received an WFD classification of Poor in 2019 for chemical quality.		Medium	Low Contaminant concentrations in groundwater are likely to be reduced due to dilution / dispersion.	Low / Moderate
		Property – Buildings and Archaeology: WRP and associated infrastructure.	Direct contact – Sulphate attack on concrete, hydrocarbon corrosion / permeation of plastic pipes.	Medium	Low Contaminant concentrations migrating onto site within in groundwater are likely to be reduced due to dilution / dispersion.	Low / Moderate
	Landfill gas (methane, carbon dioxide, carbon monoxide, hydrogen sulphide)	**Human Health – On-site:** Construction workers during excavations/construction of WRP and associated shafts and infrastructure.	Inhalation of gases and vapours within excavations, site cabins and temporary buildings.	Severe	Low	Moderate

Note: This table only includes assessment of the risk presented by the off-site source to the on-site receptors. Assessment of the risk presented by the off-site source to the off-site receptors is beyond the scope of this assessment.

<table>
<tr><th>PSC No. 3</th><th colspan="6">Former Sewage Works (off-site, approximately 50 m to the north) – OPERATIONAL PHASE</th></tr>
<tr><th>Potential Source of Contamination</th><th>Potential Contaminants of Concern</th><th>Potential Receptors</th><th>Potential Pathways</th><th>Potential Consequence of Pollutant Linkage</th><th>Probability of Pollutant Linkage</th><th>Risk (without mitigation measures)</th></tr>
<tr><td rowspan="5">Former sewage works, infrastructure no longer shown apart from circular tank bases. Area is shown as green on aerial mapping and potentially overgrown. Mature vegetation on boundary</td><td rowspan="4">Metals, inorganics, asbestos, petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene (BTEX), total phenols polychlorinated biphenyls (PCBs), PFAS and pathogens.</td><td>Human Health – On-site: Workers at completed development, groundworkers undertaking in-ground maintenance work</td><td>Ingestion and inhalation of dusts and particles.</td><td>Severe</td><td>Low</td><td>Moderate</td></tr>
<tr><td>Groundwater (resource): Raised Marine Deposits (Secondary Undifferentiated Aquifer) over Chalk (Principal Aquifer). Alluvium (land immediately east of the landfill) (Secondary A Aquifer).

Potable abstractions have not been identified within 250 m of the Site. The Site is located within reclaimed former marine land where saline groundwater conditions are likely to be prevalent and potable abstraction is unlikely to be viable.</td><td rowspan="2">Groundwater within permeable natural strata as a pathway allowing migration of mobile contamination leached from contaminated soils.

Groundwater migrating via anthropogenic routes e.g., boreholes, landfill waste mass etc.</td><td>Medium</td><td>Low (unlikely that aquifer will be utilised) Contaminant concentrations in groundwater are likely to be reduced due to dilution / dispersion.</td><td>Low / Moderate</td></tr>
<tr><td>Groundwater (biodiversity): The EA’s Catchment Data Explorer indicates that the groundwater beneath the Site received an WFD classification of Poor in 2019 for chemical quality.</td><td>Medium</td><td>Low
Contaminant concentrations in groundwater are likely to be reduced due to dilution / dispersion.</td><td>Low / Moderate</td></tr>
<tr><td>Property – Buildings and Archaeology: WRP and associated infrastructure.</td><td>Direct contact – Sulphate attack on concrete, hydrocarbon corrosion / permeation of plastic pipes.</td><td>Medium</td><td>Low
Contaminant concentrations migrating onto site within in groundwater are likely to be reduced due to dilution / dispersion.</td><td>Low / Moderate</td></tr>
<tr><td>Landfill gas (methane, carbon dioxide, carbon monoxide, hydrogen sulphide)</td><td>Human Health – On-site: Workers at the completed development.</td><td>Inhalation of gases and vapours within enclosed spaces / buildings.</td><td>Severe</td><td>Low</td><td>Moderate</td></tr>
<tr><td colspan="7">Note: This table only includes assessment of the risk presented by the off-site source to the on-site receptors. Assessment of the risk presented by the off-site source to the off-site receptors is beyond the scope of this assessment.</td></tr>
</table>

Appendix E Rationale for Selection of Evaluation Criteria for Generic Quantitative Risk Assessment

1 INTRODUCTION

The aim of this document is to present an explanation for the selection of the evaluation criteria routinely used by Stantec UK Ltd when undertaking a land contamination Tier 2 Generic Quantitative Risk Assessment (GQRA).

A GQRA uses published criteria to screen the site-specific contamination testing data and identify potential hazards to specific receptors. Generic criteria are typically conservative in derivation and exceedance does not indicate that a site is statutorily contaminated and/or unsuitable for use in the planning context. These criteria are used to identify situations where further assessment and/or action may be required. This document is divided into general introductory text and sections on soils, waters and gases.

2 GENERAL NOTES

This document should be read in conjunction with another entitled "Stantec Methodology for Assessment of Land Contamination" which summarises the legislative regime and our approach to ground contamination and risk assessment.

Any Stantec interpretation of contamination test results is based on a scientific and engineering appraisal. The perceptions of, for example, banks, insurers, lay people etc are not taken into account.

Any tables included in this document are produced for ease of reference to the criteria, they do not in any way replace the documents of origin (which are fully referenced) and which should be read to ensure appropriate use and interpretation of the data.

Generic criteria provide an aid to decision-making, but they do not replace the need for sound professional judgement in risk assessment (EA, 2006). The criteria are based on numerous and complex assumptions. The appropriateness of these assumptions in a site-specific context requires confirmation on a project by project basis. Our interpretative report will comment on the appropriateness of the routine criteria for project objectives or ground conditions. In some cases the published criteria whilst typically conservative may in some circumstances not be suitable for the site being assessed, either because they do not address the identified pollutant linkages or because they may not be sufficiently precautionary in the context of the site. Under these circumstances it may be necessary to recommend deriving site-specific assessment criteria. Any deviation from the routine criteria and/or selection of criteria for parameters not covered in this document will be described in the report text.

3 CRITERIA FOR EVALUATING SOIL RESULTS

3.1 Potential Harm to Human Health

The criteria used by Stantec UK Ltd to assess the potential for harm to human health are:-

- Category 4 Screening Levels (C4SLs) (Phase 1 substances DEFRA, 2014 and Phase 2 substances CLAIRE, 2021).
- Suitable 4 Use Levels (S4ULs) (Nathanail *et al*, 2015).
- CL:AIRE/EIC/AGS Generic Assessment Criteria (GAC) (CL:AIRE, 2010).
- Soil Guideline Values (SGVs) (EA, 2009a).

These criteria have been generated using the Contaminated Land Exposure Assessment model (CLEA) and supporting technical guidance (EA, 2009b, 2009c, 2009d, 2009e). The CLEA model uses generic assumptions about the fate and transport of chemicals in the environment and a generic conceptual model for site conditions and human behaviour to estimate child and adult exposures to soil contaminants for those potentially living, working, and/or playing on contaminated sites over long time periods (EA, 2009c).

The S4ULs, SGVs and GACs are all based on use of minimal/tolerable risk Health Criteria Values (HCVs) as the toxicological benchmark whereas the C4SL are based on use of a "low level of toxicological concern" (LLTC) as the toxicological benchmark. The LLTC represents a slightly higher level of risk than the HCV.

An update to the software (1.071) was published on 04/09/2015 (the handbook (EA 2009f) referring to version 1.05 is still valid). The update includes the library data sets from the DEFRA research project SP1010 (Development of Category 4 Screening Levels for assessment of land affected by contamination).

The CLEA model uses ten exposure pathways (Ingestion (outdoor soil, indoor dust, homegrown vegetables and soil attached to homegrown vegetables), Dermal Contact (outdoor soil and indoor dust) and Inhalation (outdoor dust, indoor dust, outdoor vapours and indoor vapours)). There are exposure pathways not included in the CLEA model such as the permeation of organics into plastic water supply pipes.

The presence and/or significance of each of the potential exposure pathways is dependent on the land use being considered. The model uses standard land use scenarios as follows:-

Residential – habitation of a dwelling up to two storeys high with various default material and design parameters, access to either private or nearby community open space with soil track back to form indoor dust. Assumes ingestion of homegrown produce.

Allotments – the model has default parameters for use and consumption of vegetables but not animals or their products (eggs).

Industrial/Commercial – assumes office or light physical work in a permanent three storey structure with breaks taken outside and that the site is NOT covered in hardstanding.

Public Open Space – two public open space (POS) scenarios are considered: POS_{resi} is shared communal space within a residential development where tracking back of soil into the home is assumed to occur. POS_{park} is intended for a public park sufficiently distant from housing (i.e. not adjacent to housing) such that tracking back of soil into the home is negligible. Note that the POS assessment criteria may not be appropriate for assessing sports fields.

The assessment criteria generated using CLEA can be used as a conservative starting point for evaluating long-term risks to human health from chemicals in soil.

It is important to note that the model does not assess all the potential exposure scenarios, for example risk to workers in excavations (short term exposure) or diffusion of contaminants through drinking water pipes.

Recent guidance (DEFRA 2012) introduces a four stage classification system where Category 1 sites are clearly contaminated land and Category 4 sites are definitely not contaminated land as defined by EPA 1990. Outside of these categories further specific risk assessment is required to determine if the site should fall into Category 2 (contaminated land) or Category 3 (not contaminated land). Category 4 screening values are considered to be more pragmatic than the current published SGV/GAC criteria but still strongly precautionary with the aim of allowing rapid identification of sites where the risk is above minimal but still low/acceptable.

Category 4 Screening Levels (C4SLs)

At the end of 2013, technical guidance in support of DEFRA's revised Statutory Guidance (SG) was published and then revised in 2014 (CL:AIRE 2014) which provided:

- A methodology for deriving C4SLs for the standard land-uses and two new public open space scenarios using the updated assumptions relating to the modelling of human exposure to soil contaminants; and
- A demonstration of the methodology, via the derivation of C4SLs for six substances – arsenic, benzene, benzo(a)pyrene, cadmium, chromium (VI) and lead.

Following issue of an Erratum in December 2014, a Policy Companion Document was published (DEFRA 2014).

A letter from Lord de Mauley dated 3rd September 2014 provides more explicit direction to local authorities on the use of the C4SL in a planning context. The letter identifies four key points:

1) that the screening values were developed expressly with the planning regime in mind

2) their use is recommended in DCLG's planning guidance

3) soil concentrations below a C4SL limit are considered to be 'definitely not contaminated' under Part IIA of the 1990 Environmental Protection Act and pose at most a 'low level of toxicological concern' and,

4) exceedance of a C4SL screening value does not mean that land is definitely contaminated land, just that further investigation may be warranted.

Stantec use the C4SLs as the Tier 2 soil screening criteria protective of human health for substances with C4SL available. Table 1 summarises the C4SL for each of the published substances.

Note that, with the exception of benzene, the DEFRA published C4SL are not dependent on soil organic matter content (SOM) ("*Given that BaP is non volatile and that empirical soil to plant concentration factors have been used, soil organic matter content has a negligible influence on the C4SLs for this chemical"*). The DEFRA published C4SL for benzene is based on an SOM of 6%. Stantec has used the CLEA model (v1.071) to derive C4SL for benzene for 1% and 2.5% SOM which are also shown in Table 1.

Note that an industry led project to derive C4SL for a further 20 substances has commenced (CL:AIRE, 2018). The project is being project managed by CL:AIRE and is funded by the Soil and Groundwater Technology Association (SAGTA), the Society of Brownfield Briefing (SoBRA) and others. A dedicated steering group, made up of representatives from SAGTA, DEFRA, Welsh Government, Public Health England, Environment Agency, Natural Resources Wales, Food Standards Agency, Homes England and further Land Forum representatives, has been set up to oversee the project. The new C4SL will be added to this document as they are published.

Suitable 4 Use Levels (S4ULs)

In July 2009, Generic Assessment Criteria (GACs) for 82 substances were published (LQM and CIEH, 2009) using the then current version of the CLEA software v1.04 and replaced those generated in 2006 using the original version of the model CLEA UK *beta*. In 2015 S4ULs were published by LQM/CIEH (Nathanail *et al*, 2015) to replace the second edition GACs. Table 2 summarises the S4ULs which are reproduced with permission; Publication Number S4UL3202.

Soil Guideline Values (SGVs) and Generic Assessment Criteria (GAC)

In 2009, Soil Guideline Values (SGVs) were published by the Environment Agency for arsenic, cadmium, mercury, nickel, selenium, benzene, toluene, ethyl benzene, xylenes, phenol and dioxins, furans and dioxin-like PCBs. These were derived using the CLEA model for residential, allotments and commercial land-uses.

These SGVs have now largely been superseded by the C4SLs and the S4ULs, with the exception of the SGVs for dioxins, furans and dioxin-like PCBs which are shown in Table 3.

In January 2010, Generic Assessment Criteria (GAC) derived using CLEA were published by CL:AIRE for 35 substances. These GAC are listed in Table 4.

Note that the SGVs for dioxins, furans and dioxin like PCBs and CL:AIRE GAC were derived using an older version of CLEA (v1.06) than used to derive the S4UL and C4SL (v1.07). This older version used slightly more conservative values for some exposure parameters and therefore the derived SGVs/GAC are still considered suitably precautionary for use as screening criteria.

Note on Mercury, Chromium and Arsenic

The analytical testing routinely undertaken by Stantec determines total concentration, however, the toxicity depends on the form of the contaminant.

If a source of Mercury, Chromium or Arsenic is identified or the total concentration exceeds the relevant worst case speciated criteria it will be desirable/necessary to undertake additional speciated testing and further assessment.

Note on Polycyclic Aromatic Hydrocarbons

Polycyclic Aromatic Hydrocarbons (PAHs) are a family of hundreds of different congeners whose chemical structures contain two or more fused aromatic rings. Whilst it is recognised that there is an ongoing debate on the most appropriate method to assess health effects of PAH mixtures, in 2010 the Health Protection Agency recommended the use of benzo[a]pyrene (BaP) as a surrogate marker approach in the assessment of carcinogenic risks posed by PAHs in soils (HPA, 2010).

In most cases, BaP is chosen as the surrogate marker (SM) due to its ubiquitous nature and the vast amount of data available and has been used by various authoritative bodies to assess the carcinogenic risk of PAHs in food. The SM approach estimates the carcinogenic toxicity of a mixture of PAHs in an environmental matrix by using toxicity data for a PAH mixture for which the composition is known.

Exposure to the SM is assumed to represent exposure to all PAHs in that matrix therefore the toxicity of the SM represents the toxicity of the mixture. The SM approach relies on a number of assumptions (HPA, 2010).

- The SM (BaP) must be present in all the samples.
- The profile of the different PAH relative to BaP should be similar in all samples.
- The PAH profile in the soil samples should be sufficiently similar to that used in the pivotal toxicity study on which HBGV was based i.e. the Culp study (Culp et al. (1998)).

In order to justify the use of a surrogate marker assessment criterion (C4SL for benzo(a)pyrene and S4UL coal tar) the LQM PAH Profiling Tool is used by Stantec to assess the similarity of the PAH profile in a soil sample to that of the toxicity study. The spreadsheet calculates the relative proportions of the genotoxic PAHs and plots them relative to the composition of the two coal mixtures used by Culp et al. Provided that the relative proportions are within an order of magnitude of those from the Culp Study (as suggested by HPA) Stantec will use the C4SL for benzo(a)pyrene as a surrogate marker for the carcinogenic PAHs, i.e. benzo(a)pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(ah)anthracene, indeno(123-cd)pyrene and benzo(ghi)perylene. For projects where this approach is appropriate the results will be assessed using the Coal Tar criterion (BAP C4SL) and the criteria for non-carcinogenic PAHs (S4ULs), i.e. naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene and pyrene.

Note on Total Petroleum Hydrocarbons

The S4UL for Total Petroleum Hydrocarbon (TPH) fractions are based on ‘threshold’ health effects. In accordance with Environment Agency guidance (EA, 2005) and the S4UL report (Nathanail *et al*, 2015) the potential for additivity of toxicological effects between fractions should be considered. Practically, to address this issue the hazard quotient (HQ) for each fraction should be calculated by dividing the measured concentration of the fraction by the GAC. The HQs are then added to form a hazard index (HI) for that sample. An HI greater than 1 indicates an exceedance.

Note on Dioxins, Furans and Dioxin-like PCBs

The SGVs for dioxins, furans and dioxin-like PCBs are based on an assumed congener profile for urban soils. The total measured concentration of dioxin, furan and dioxin-like PCB congeners listed in the SGV report (EA, 2009a) should be compared with the SGVs to make an initial assessment of risk. A more accurate assessment can be made using the Environment Agency's site specific worksheet for dioxins, furans and dioxin like PCBs available from https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/77-risk-assessment-info-ra/199-dioxins-site-specific-worksheets.

Note on Asbestos

Asbestos in soil and made ground is currently under review by a number of bodies. There are no current published guidance values for asbestos in soil other than the waste classification values given in the EA's Technical Guidance WM3, Hazardous Waste – Interpretation of the definition and classification of hazard waste (EA, 2015). This guidance is only appropriate for soils that are being discarded as waste.

Testing for asbestos will be carried out on selected samples of made ground encountered during investigation, initially samples will be subjected to an asbestos screen and, if asbestos is found to be present, subjected to quantification depending on the project specific requirements. The reader is directed to the report text for guidance on the approach adopted in respect to any asbestos found to be present.

Further guidance is also available in publication C733, Asbestos in soil and made ground: a guide to understanding and managing risks (CIRIA 2014).

Note on Soil Saturation Concentration

The soil saturation concentration is the concentration of an organic constituent in soil at which either the pore water or soil vapour has theoretically become saturated with the substance, i.e. the substance concentration has reached its maximum aqueous solubility or vapour pressure. The soil saturation concentration is related to the properties of the substance as well as the properties of the soil (including soil organic matter content).

The soil saturation concentrations are shown in Table 2 in brackets where exceeded by the assessment criteria and in Table 4 for all substances. Measured concentrations in excess of the soil saturation concentration have various potential implications as discussed below.

Firstly, where measured concentrations exceed the soil saturation concentration, the risk from vapour inhalation and/or consumption of produce may be limited. The CLEA model calculates the soil saturation concentration but it does not limit exposure where this concentration is exceeded. This adds an additional level of conservatism for CLEA derived assessment criteria where these exceed the calculated soil saturation concentration. Secondly, the soil saturation concentration is sometimes used to flag the potential presence of non-aqueous phase liquid (NAPL, a.k.a. free phase) in soil. The presence of NAPL is an important consideration in the Tier 2 assessment because, where present, the risks from NAPL may need to be considered separately. Theoretically, where a measured concentration exceeds the soil saturation concentration NAPL could be present. However, using theoretical saturation values is not always reliable for the following reasons: The soil saturation concentration is based on the aqueous solubility and vapour pressure of a pure substance and not a mixture, of which NAPLs are often comprised; and

The soil saturation concentration does not account for the sorption capacity of the soil. As a result, exceedance of the soil saturation concentration does not necessarily imply that NAPL is present. This is particularly the case for longer chain hydrocarbons such as PAHs which have low solubility and vapour pressure and hence a low soil saturation concentration but that are strongly sorbed to soil.

The measured concentrations will be compared to the soil saturation concentrations shown in Tables 2 and 4. Where exceeded Stantec will use additional lines of evidence (such as visual evidence and concentration of total TPH) to determine whether or not NAPL is likely to be present. If the presence of NAPL is deemed plausible the implications will be considered in the risk assessment.

3.2 Potential Harm to the Built Environment

Land contamination can pose risks to buildings, building materials and services (BBM&S) in a number of ways. Volatile contaminants and gases can accumulate and cause explosion or fire. Foundations and buried services can be damaged by corrosive substances and contaminants such as steel slags can create unstable ground conditions through expansion causing structural damage.

Stantec use the following primary guidance to assess the significance of soil chemistry with respect to its potential to harm the built environment.

i) Approved Document C - Site Preparation and Resistance to Contaminants and Moisture. (DCLG, 2013);
ii) Concrete in aggressive ground SD1 (BRE 2005);
iii) Guidance for the selection of water supply pipes to be used in brownfield sites (UK WIR 2011);

iv) Protocols published by agreement between Water UK and the Home Builders Federation providing supplementary guidance which includes the Risk Assessment for Water Pipes (the 'RA') (Water UK 2014).
v) Performance of Building Materials in Contaminated Land report BR255 (BRE 1994).
vi) Risks of Contaminated Land to Buildings, Building Materials and Services. A Literature Review - Technical Report P331 (EA, 2000).
vii) Guidance on assessing and managing risks to buildings from land contamination - Technical Report P5 035/TR/01 (EA, 2001).

3.3 Potential to Harm Ecosystems, Animals, Crops etc

The criteria routinely used by Stantec as Tier 2 screening values to assess the potential of soil chemistry to harm ecosystems are taken from the following guidance and are summarised in Table 5.

i) Derivation and Use of Soil Screening Values for assessing ecological risks (EA, 2017a);
ii) The Restoration and Aftercare of Metalliferous Mining Sites for Pasture and Grazing (ICRCL 70/90, 1990);
iii) Sewage sludge on farmland: code of practice for England, Wales and Northern Ireland (DEFRA, 2018); and
iv) BS 3882:2015 Specification for topsoil and requirements for use (BSI, 2015).

Unless stated in the report the assessment is solely for phytotoxic parameters and additional assessment is required to determine suitability as a growing medium.

4 CRITERIA FOR EVALUATING LIQUID RESULTS

4.1 Potential Harm to Human Health via Ingestion

The Tier 2 water screening values routinely adopted by Stantec for assessing the potential for harm to human health via ingestion (presented as Table 6) are taken from The Water Supply (Water Quality) Regulations (S.I. 2018/647) unless otherwise indicated.

It should be noted that some of the prescribed concentrations listed in the Water Supply Regulations have been set for reasons other than their potential to cause harm to human health. The concentrations of iron and manganese are controlled because they may taint potable water with an undesirable taste, odour or colour or may potentially deposit precipitates in water supply pipes.

4.2 Potential Harm to Human Health via Inhalation of Vapours

The Tier 2 water screening values adopted by Stantec for assessing the potential for chronic human health risk from the inhalation of vapours from volatile contaminants in groundwater are presented in Table 7. These generic assessment criteria have been taken from a report published by the Society of Brownfield Risk Assessment (SoBRA) (SoBRA, 2017). The methodology adopted in their generation is considered compatible with the UK approach to deriving GAC and adopts a precautionary approach. As with all published GAC the suitability for use on the site being assessed has to be decided by the assessor based on a thorough understanding of the methodology and assumptions used in their derivation. Note, that the SoBRA groundwater vapour GAC are not intended for assessing risks to ground workers from short-term exposure.

Note that Table 7 shows the theoretical maximum aqueous solubility for each contaminant and indicates the GAC that exceed solubility. Measured concentrations in excess of solubility may be an indication that NAPL is present. As for the assessment of soils, if the presence of NAPL is deemed plausible the implications will be considered in the risk assessment.

4.3 Potential to Harm Controlled Waters

When assessing ground condition data and the potential to harm Controlled Waters Stantec uses the approach presented in the groundwater protection position statements published 14.03.17 (EA, 2017b) which describe the Environment Agency's approach to managing and protecting groundwater. They update and replace Groundwater Protection: principles and practice (GP3). Controlled Waters are rivers, estuaries, coastal waters, lakes and groundwaters. Water in the unsaturated zone is not groundwater but does come within the scope of the term "ground waters" as used and defined in the Water Resources Act 1991. It will continue to be a technical decision for the Environment Agency to determine what is groundwater in certain circumstances for the purposes of the Regulations. As discussed in our Methodology for Assessment of Land Contamination perched water is not considered a receptor in Stantec assessments.

The EU Water Framework Directive (WFD) 2000/60/EC provides for the protection of sub-surface, surface, coastal and territorial waters through a framework of river basin management.

The EU Updated Water Framework Standards Directive 2014/101/EU amended the EU WFD to update the international standards therein; it entered into force on 20 November 2014 with the requirement for its provisions to be transposed in Member State law by 20 May 2016.

Member States are required under the EU WFD to update their river basin management plans every six years. The first river basin management plans for England and Wales, Scotland and Northern Ireland were published in December 2009, and these were updated in 2015.

Other EU Directives in the European water management framework include:

- the EU Priority Substances Directive 2013/39/EU;
- EU Groundwater Pollutants Threshold Values Directive 2014/80/EU amending the EU Groundwater Daughter Directive (GWDD) 2006/118/EC; and
- the EU Biological Monitoring Directive 2014/101/EU.

The Priority Substances Directive set environmental quality standards (EQS) for the substances in surface waters (river, lake, transitional and coastal) and confirmed their designation as priority or priority hazardous substances (PS), the latter being a subset of particular concern. Environmental Quality Standards for PS are determined at the European level and apply to all Member States. Member States identify and develop standards for 'Specific Pollutants'. Specific Pollutants (SP) are defined as substances that can have a harmful effect on biological quality.

The Water Framework Directive (Standards and Classification) Directions (England and Wales) (DEFRA, 2015) were issued to the Environment Agency as an associated document of the Water Environment (WFD) (England and Wales) Regulations 2015 (S.I. 2015/1623) and provide directions for the classification of surface water and groundwater bodies. Schedule 3 parts 2 and 3 relate to surface water standards for specific pollutants in fresh or salt water bodies and priority substances in inland (rivers, lakes and related modified/artificial bodies) or other surface waters respectively. Although Schedule 5 presents threshold values for groundwater the Direction specifically excludes their use as part of site-specific investigations.

Table 6 presents the criteria routinely used by Stantec as Tier 2 screening values. This table only presents a selection of the more commonly analysed parameters and the source documents should be consulted for other chemicals. For screening groundwater the criteria selected are the standards for surface water and/or human consumption as appropriate together with the following:-

For a **hazardous substance** Stantec adopts the approach that, if the concentration in a discharge to groundwater is less than the Minimum Reporting Value (MRV), the input is regarded as automatically meeting the Article 2 (b) 'de-minimus' requirement of exemption 6 (3) (b) of the GWDD. Stantec has selected hazardous substances from the latest list published by the Joint Agencies Groundwater Directive Advisory Group (JAGDAG, 2018). MRV is the lowest concentration of a substance that can be routinely determined with a known degree of confidence, and may not be equivalent to limit of detection. MRVs have been identified from DEFRA's guidance on Hazardous Substances to Groundwater: Minimum Reporting Values (DEFRA, 2017), and are shown in Table 6.

Note that for land contamination assessments, where hazardous substances have already entered groundwater, remediation targets would typically be based on achieving appropriate water quality standards (e.g. drinking water standard or EQS) at a compliance point rather than an MRV. For this reason, when assessing measured groundwater or soil leachate concentrations, the values for human consumption, fresh water and salt water shown in Table 6 (whichever is appropriate for the context of the site) will be used as the Tier 2 assessment criteria rather than MRV. For hazardous substances with no water quality standard the laboratory method detection limit will be used as the assessment criteria.

For **non-hazardous substances** the GWDD requires that inputs be limited to avoid deterioration. UKTAG guidance equates deterioration with pollution. Non-hazardous substances are all substances not classified as hazardous. For Stantec assessments the values for human consumption, fresh water and salt water shown in Table 6 (whichever is appropriate for the context of the site) are used as the assessment criteria for non-hazardous substances.

Note on Copper, Lead, Manganese, Nickel and Zinc

$EQS_{bioavailable}$ have been developed for UK Specific Pollutants copper, zinc and manganese and the EU priority substances lead and nickel. An EQS is the concentration of a chemical in the environment below which there is not expected to be an adverse effect on the specific endpoint being considered, e.g. the protection of aquatic life.

It is very difficult to measure the bioavailable concentration of a metal directly. The UK has developed simplified Metal Bioavailability Assessment Tool (M-BAT) for copper, zinc, nickel and manganese which uses local water chemistry data, specifically pH, dissolved organic carbon (DOC) (mg/L) and Calcium (Ca) (mg/L).

Where the recorded total dissolved concentration exceeds the screening criteria for these parameters ($EQS_{bioavailable}$) further assessment will be undertaken using the tools downloaded from http://www.wfduk.org/resources/rivers-lakes-metal-bioavailability-assessment-tool-m-bat

The models calculate a risk characterisation ratio

(RCR) and where this is greater than 1 this indicates the bioavailable concentration is above the EQS and the parameter is then identified as a potential hazard. The report will discuss this identified hazard noting that the pH, calcium and, in particular, the dissolved organic carbon (DOC) in groundwater may be quite different to the receiving water (e.g. due to the presence to leaf litter or organic sediments dissolving in the water).

5 CRITERIA FOR EVALUATING GAS RESULTS

Stantec use the following primary guidance on gas monitoring methods and investigation, the assessment of risk posed by soil gases (including Volatile Organic Compounds (VOCs)) and mitigation measures/risk reduction during site development.

i) BS 8576:2013 – Guidance on Ground Gas Investigations: Permanent gases and Volatile Organic Compounds (VOCs) (BSI, 2013);
ii) TB18 Continuous Ground-Gas Monitoring and the Lines of Evidence Approach to Risk Assessment CL:AIRE Technical Bulletin TB18 (CL:AIRE 2019)
iii) RB17 A pragmatic approach to Ground Gas Risk Assessment. CL:AIRE Research Bulletin RB17 (Card et al, 2012);
iv) The VOCs Handbook. C682 (CIRIA, 2009).
v) Assessing risks posed by hazardous gases to buildings C665 (CIRIA, 2007);
vi) Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present. (NHBC, 2007); and
vii) BS 8485:2015+A1:2019- Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (BSI, 2019).

Gas and borehole flow data are used to obtain the gas screening value (GSV) for methane and carbon dioxide. The GSV is used to establish the characteristic situation and to make recommendations for gas protection measures for buildings if required.

Radon

Stantec use the following primary guidance to assess the significance of the radon content of soil gas.

i) Radon: guidance on protective measures for new dwellings. Report BR211 (BRE, 2015); and
ii) Indicative Atlas of Radon in England and Wales (HPA & BGS, 2007).

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Table 1: Category 4 Screening Levels (C4SL)

	Allotments	Residential (with home-grown produce)	Residential (without home-grown produce)	Commercial	Public Open Space 1	Public Open Space 2
Arsenic	49	37	40	640	79	170
Benzene - 1% SOM* - 2.5% SOM* - 6% SOM	 0.039 0.081 0.18	 0.20 0.41 0.87	 0.89 1.6 3.3	 27 50 98	 140 140 140	 190 210 230
Benzo(a)pyrene (as a surrogate marker for carcinogenic PAHs)	5.7	5.0	5.3	77	10	21
Cadmium	3.9	22	150	410	220	880
Chromium VI	170	21	21	49	21	250
Lead	80	200	310	2300	630	1300
Vinyl Chloride/ Chloroethene/ Chloroethylene, (CAS No. 75-01-4)	 0.0017 0.0031 0.0058	 0.0064 0.010 0.017	 0.015 0.019 0.029	 1.1 1.4 2.2	 7.8 7.8 7.8	 18 19 19
Trichloroethene / Trichloroethylene/ TCE or 'Trike' (CAS No. 79-01-06)	 0.032 0.072 0.16	 0.0093 0.020 0.043	 0.0097 0.020 0.045	 0.73 1.5 3.4	 76 78 79	 41 54 69
Tetrachloroethene/ Tetrachloroethylene/ Perchloroethylene, PCE or 'perc', (CAS No. 127-18-4)	 2.0 4.8 11.0	 0.31 0.70 1.60	 0.32 0.71 1.60	 24 55 130	 3,200 3,300 3,400	 1,400 1,900 2,500

Units mg/kg dry weight

Values taken from SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document (Department for Environment, Food and Rural Affairs December 2014), unless stated otherwise
Public Open Space 1 – for grassed area adjacent to residential housing
Public Open Space 2 - Park Type Public Open Space Scenario
Based on a sandy loam as defined in SR3 (Environment Agency, 2009b)
Note that, with the exception of benzene, these C4SL are not SOM dependent
* - Stantec derived C4SL using CLEA v1.071

Table 2: Suitable 4 Use Levels (S4UL)

Determinand	Allotment	$R_{\underline{W}}$HP	$R_{\underline{WO}}$HP	Commercial/ Industrial	POSresi	POSpark
Metals						
Arsenic (**Inorganic**)[a, b, c]	43	37	40	640	79	170
Beryllium [a, b, d, e]	35	1.7	1.7	12	2.2	63
Boron [a, b, d]	45	290	11000	240000	21000	46000
Cadmium (**pH6-8**) [a, b, d, f]	1.9	11	85	190	120	560
Chromium (trivalent) [a, b, d, g]	18000	910	910	8600	1500	33000
Chromium (hexavalent) [a, b, c]	1.8[h]	6[i]	6[i]	33[i]	7.7[i]	220[i]
Copper [a, b, c]	520	2400	7100	68000	12000	44000
Mercury (elemental) [a, b, c, j]	21	1.2	1.2	58[vap] (25.8)	16	30[vap] (25.8)
Mercury (inorganic) [a, b, c]	19	40	56	1100	120	240
Methylmercury [a, b, c]	6	11	15	320	40	68
Nickel [a, b, c]	53[k]	130[e]	180[e]	980[e]	230[e]	800[k]
Selenium [a, b, c]	88	250	430	12000	1100	1800
Vanadium [a, b, c, i, j]	91	410	1200	9000	2000	5000
Zinc [a, b, c]	620	3700	40000	730000	81000	170000
BTEX Compounds (SOM 1%/ 2.5%/ 6%)						
Benzene [a, b, l, m]	0.017/0.034/ 0.075	0.087/0.17/ 0.37	0.38/0.7/1.4	27 / 47 / 90	72 / 72 / 73	90 / 100 / 110
Toluene [a, b, l, m]	22 / 51 / 120	130 / 290 / 660	880[vap] (869) /1900/3900	56000[vap] (869) / 110000[vap] (1920)/ 180000[vap] (4360)	56000 / 56000 / 56000	87000[vap](869)/ 95000[vap](1920)/ 100000[vap](4360)
Ethylbenzene [a, b, l, m]	16 / 39 / 91	47 / 110 / 260	83 / 190 / 440	5700[vap] (518) / 13000[vap] (1220) / 27000[vap] (2840)	24000 / 24000 / 25000	17000[vap] (518) / 22000[vap](1220) / 27000[vap] (2840)
O – Xylene [a, b, l, m, n]	28 / 67 / 160	60 / 140 / 330	88 / 210 / 480	6600[sol] (478) / 15000[sol] (1120) / 33000[sol] (2620)	41000 / 42000 / 43000	17000[sol] (478) / 24000[sol] (1120) / 33000[sol] (2620)
M – Xylene [a, b, l, m, n]	31 / 74 / 170	59 / 140 / 320	82 / 190 / 450	6200[vap] (625) / 14000[vap] (1470) / 31000[vap] (3460)	41000 / 42000 / 43000	17000[vap] (625) / 24000[vap](1470) / 32000[vap] (3460)
P – Xylene [a, b, l, m, n]	29 / 69 / 160	56 / 130 / 310	79 / 180 / 430	5900[sol] (576) / 14000[sol] (1350) / 30000[sol] (3170)	41000 / 42000 / 43000	17000[sol] (576) / 23000[sol] (1350) / 31000[sol] (3170)

Determinand	Allotment	$R_{\underline{W}}$HP	$R_{\underline{WO}}$HP	Commercial/ Industrial	POSresi	POSpark
Total xylenes [t]	28 / 67 / 160	56 / 130 / 310	79 / 180 / 430	5900^{sol} (576) / 14000^{sol} (1350) / 30000^{sol} (3170)	41000 / 42000 / 43000	17000^{sol} (576) / 23000^{sol} (1350) / 31000^{sol} (3170)
Polycyclic Aromatic Hydrocarbons (SOM 1%/ 2.5%/ 6%) [a, b, l, p]						
Acenaphthene	34 / 85 / 200	210 / 510 / 1100	3000^{sol}(57.0)/ 4700^{sol} (141)/ 6000^{sol} (336)	84000^{sol} (57.0)/ 97000^{sol} (141)/ 100000	15000 / 15000 / 15000	29000/ 30000/ 30000
Acenaphthylene	28 / 69 / 160	170 / 420 / 920	2900^{sol}(86.1)/ 4600^{sol} (212)/ 6000^{sol} (506)	83000^{sol} (86.1)/ 97000^{sol} (212)/ 100000	15000 / 15000 / 15000	29000 / 30000 / 30000
Anthracene	380 / 950 / 2200	2400 / 5400 / 11000	31000^{sol}(1.17) /35000/ 37000	520000/ 540000/ 540000	74000 / 74000 / 74000	150000 / 150000 / 150000
Benzo(a)anthracene	2.9 / 6.5 / 13	7.2 / 11 / 13	11 / 14 / 15	170 / 170 / 180	29 / 29 / 29	49 / 56 / 62
Benzo(a)pyrene (Bap) [u]	0.97 / 2.0 / 3.5	2.2 / 2.7 / 3.0	3.2 / 3.2 / 3.2	35 / 35 / 36	5.7 / 5.7 / 5.7	11 / 12 / 13
Benzo(b)fluoranthene	0.99 / 2.1 / 3.9	2.6 / 3.3 / 3.7	3.9 / 4.0 / 4.0	44 / 44 / 45	7.1 / 7.2 / 7.2	13 / 15 / 16
Benzo(g,h,i)perylene	290 / 470 / 640	320 / 340 / 350	360 / 360 / 360	3900 / 4000 / 4000	640 / 640 / 640	1400 / 1500 / 1600
Benzo(k)fluoranthene	37 / 75 / 130	77 / 93 / 100	110 / 110 / 110	1200 / 1200 /1200	190 / 190 / 190	370 / 410 / 440
Chrysene	4.1 / 9.4 / 19	15 / 22 / 27	30 / 31 / 32	350 / 350 / 350	57 / 57 / 57	93 / 110 / 120
Dibenzo(ah)anthracene	0.14 / 0.27 / 0.43	0.24 / 0.28 / 0.3	0.31 / 0.32 / 0.32	3.5 / 3.6 / 3.6	0.57 / 0.57 / 0.58	1.1 / 1.3 / 1.4
Fluoranthene	52 / 130 / 290	280 / 560 / 890	1500 / 1600 / 1600	23000 / 23000 / 23000	3100 / 3100 / 3100	6300 / 6300 / 6400
Fluorene	27 / 67 / 160	170 / 400 / 860	2800^{sol} (30.9) /3800^{sol} (76.5) /4500^{sol} (183)	63000^{sol} (30.9) / 68000 / 71000	9900 / 9900 / 9900	20000 / 20000 / 20000
Indeno(1,2,3-cd)pyrene	9.5 / 21 / 39	27 / 36 / 41	45 / 46 / 46	500 / 510 / 510	82 / 82 / 82	150 / 170 / 180
Naphthalene [q]	4.1 / 10 / 24	2.3 / 5.6 / 13	2.3 / 5.6 / 13	190^{sol} (76.4) / 460^{sol} (183) / 1100^{sol} (432)	4900/ 4900/ 4900	1200^{sol} (76.4) / 1900^{sol} (183) / 3000
Phenanthrene	15 / 38 / 90	95 / 220 / 440	1300^{sol}(36.0) / 1500 / 1500	22000 / 22000 / 23000	3100 / 3100 / 3100	6200 / 6200 / 6300
Pyrene	110 / 270 / 620	620 / 1200 / 2000	3700 / 3800 / 3800	54000 / 54000 / 54000	7400 / 7400 / 7400	15000 / 15000 / 15000
Coal Tar (Bap as surrogate marker) [u]	0.32 / 0.67 / 1.2	0.79 / 0.98 / 1.1	1.2 / 1.2 / 1.2	15 / 15 / 15	2.2 / 2.2 / 2.2	4.4 / 4.7 / 4.8
Explosives [a, b, l, p]						
2, 4, 6 Trinitrotoluene	0.24 / 0.58 / 1.40	1.6 / 3.7 / 8.0	65 / 66 / 66	1000 / 1000 / 1000	130 / 130 / 130	260 / 270 / 270
RDX (Royal Demolition Explosive $C_3H_6N_6O_6$)	17 / 38 / 85	120 / 250 / 540	13000 / 13000 / 13000	210000 / 210000 / 210000	26000 / 26000 / 27000	49000^{sol} (18.7) / 51000 / 53000
HMX (High Melting Explosive $C_4H_8N_8O_8$)	0.86 / 1.9 / 3.9	5.7 / 13 / 26	6700 / 6700 / 6700	110000 / 110000 / 110000	13000 / 13000 / 13000	23000^{vap} (0.35) /23000^{vap} (0.39) /24000^{vap} (0.48)
Petroleum Hydrocarbons (SOM 1%/ 2.5%/ 6%) [a, b, l, m]						
Aliphatic EC 5-6	730 / 1700 / 3900	42 / 78 / 160	42 / 78 / 160	3200^{sol} (304) / 5900^{sol} (558) / 12000^{sol} (1150)	570000^{sol}(304) 590000 / 600000	95000^{sol} (304) / 130000^{sol} (558)/ 180000^{sol}(1150)
Aliphatic EC >6-8	2300 / 5600 / 13000	100 / 230 / 530	100 / 230 / 530	7800^{sol} (144) / 17000^{sol} (322) / 40000^{sol} (736)	600000 / 610000 / 620000	150000^{sol} (144) 220000^{sol} (322)/ 320000^{sol} (736)
Aliphatic EC >8-10	320 / 770 / 1700	27 / 65 / 150	27 / 65 / 150	2000^{sol} (78) / 4800^{vap} (190) / 11000^{vap} (451)	13000 / 13000 / 13000	14000^{sol} (78) / 18000^{vap} (190) / 21000^{vap} (451)
Aliphatic EC >10-12	2200 / 4400 / 7300	130v^{ap} (48) / 330^{vap} (118) / 760^{vap} (283)	130v^{ap} (48) / 330^{vap} (118) / 770^{vap} (283)	9700^{sol} (48) / 23000^{vap} (118) / 47000^{vap} (283)	13000 / 13000 / 13000	21000^{sol} (48) / 23000^{vap} (118) / 24000^{vap} (283)
Aliphatic EC >12-16	11000 / 13000 / 13000	1100^{sol} (24) / 2400^{sol} (59) / 4300^{sol} (142)	1100^{sol} (24) / 2400^{sol} (59) / 4400^{sol} (142)	59000^{sol} (24) / 82000^{sol} (59) / 90000^{sol} (142)	13000 / 13000 / 13000	25000^{sol} (24) / 25000^{sol} (59) / 26000^{sol} (142)
Aliphatic EC >16-35 [o]	260000 / 270000 / 270000	65000^{sol}(8.48 92000^{sol} (21) 110000	65000^{sol}(8.48 92000^{sol} (21) 110000	1600000 / 1700000 / 1800000	250000 / 250000 / 250000	450000 / 480000 / 490000
Aliphatic EC >35-44 [o]	260000 / 270000 / 270000	65000^{sol}(8.48 92000^{sol} (21) / 110000	65000^{sol}(8.48 92000^{sol} (21) 110000	1600000 / 1700000 / 1800000	250000 / 250000 / 250000	450000 / 480000 / 490000
Aromatic EC 5-7 (benzene)	13 / 27 / 57	70 / 140 / 300	370 / 690 / 1400	26000^{sol} (1220) / 46000^{sol} (2260) / 86000^{sol} (4710)	56000 / 56000 / 56000	76000^{sol} (1220) /84000^{sol}(2260)/ 92000^{sol} (4710)
Aromatic EC >7-8 (toluene)	22 / 51 / 120	130 / 290 / 660	860 / 1800 / 3900	56000^{vap} (869)/ 110000^{sol} (1920)/ 180000^{vap} (4360)	56000 / 56000 / 56000	87000^{vap}(869) / 95000^{sol} (1920)/ 100000^{vap}(4360)
Aromatic EC >8-10	8.6 / 21 / 51	34 / 83 / 190	47 / 110 / 270	3500^{vap} (613) / 8100^{vap} (1500) / 17000^{vap} (3580)	5000 / 5000 / 5000	7200^{vap}(613) / 8500^{vap} (1500) / 9300^{vap} (3580)

Determinand	Allotment	R_{W}HP	R_{WO}HP	Commercial/ Industrial	POSresi	POSpark
Aromatic EC >10-12	13 / 31 / 74	74 / 180 / 380	250 / 590 / 1200	16000[sol] (364) / 28000[sol] (899) / 34000[sol] (2150)	5000 / 5000 / 5000	9200[sol] (364) / 9700[sol] (899) / 10000
Aromatic EC >12-16	23 / 57 / 130	140 / 330 / 660	1800 / 2300[sol] (419) / 2500	36000[sol] (169) / 37000 / 38000	5100 / 5100 / 5000	10000 / 10000 / 10000
Aromatic EC >16-21 [o]	46 / 110 / 260	260 / 540 / 930	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7600 / 7700 / 7800
Aromatic EC >21-35 [o]	370 / 820 / 1600	1100 / 1500 / 1700	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7800 / 7800 / 7900
Aromatic EC >35-44 [o]	370 / 820 / 1600	1100 / 1500 / 1700	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7800 / 7800 / 7900
Aliphatic + Aromatic EC >44-70 [o]	1200 / 2100 / 3000	1600 / 1800 / 1900	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7800 / 7800 / 7900
Chloroalkanes & Chloroalkenes (SOM 1%/ 2.5%/ 6%) [a, b, l, p]						
1,2-Dichloroethane	0.0046 / 0.0083 / 0.016	0.0071 / 0.011 / 0.019	0.0092 / 0.013 / 0.023	0.67 / 0.97 / 1.7	29 / 29 / 29	21 / 24 / 28
1,1,1 Trichloroethane (TCA)	48 / 110 / 240	8.8 / 18 / 39	9.0 / 18 / 40	660 / 1300 / 3000	140000 / 140000 / 140000	57000[vap](1425) 76000[vap](2915)/ 100000[vap](6392)
1,1,1,2 Tetrachloroethane	0.79 / 1.9 / 4.4	1.2 / 2.8 / 6.4	1.5 / 3.5 / 8.2	110 / 250 / 560	1400 / 1400 / 1400	1500 / 1800 / 2100
1,1,2,2 Tetrachloroethane	0.41 / 0.89 / 2.0	1.6 / 3.4 / 7.5	3.9 / 8.0 / 17	270 / 550 / 1100	1400 / 1400 / 1400	1800 / 2100 / 2300
Tetrachloromethane (Carbon Tetrachloride)	0.45 / 1.0 / 2.4	0.026 / 0.056 / 0.13	0.026 / 0.056 / 0.13	2.9 / 6.3 / 14	890 / 920 / 950	190 / 270 / 400
Trichloromethane (Chloroform)	0.42 / 0.83 / 1.7	0.91 / 1.7 / 3.4	1.2 / 2.1 / 4.2	99 / 170 / 350	2500 / 2500 / 2500	2600 / 2800 / 3100
Phenol & Chlorophenols [a, b, l, p]						
Phenol	23 / 42 / 83	120 / 200 / 380	440 / 690 / 1200	440[dir] (26000) / 690[dir] (30000) / 1300[dir] (34000)	440[dir] (10000)/ 690[dir](10000) 1300[dir](10000)	440[dir] (7600) / 690[dir] (8300) / 1300[dir] (93000)
Chlorophenols (excluding PCP) [r]	0.13[s] / 0.3 / 0.7	0.87[s] / 2.0 / 4.5	94 / 150 / 210	3500 / 4000 / 4300	620 / 620 / 620	1100 / 1100 / 1100
Pentachlorophenol (PCP)	0.03 / 0.08 / 0.19	0.22/ 0.52 / 1.2	27[vap] (16.4) / 29 / 31	400 / 400 / 400	60 / 60 / 60	110 / 120 / 120
Other [a, b, l, p]						
Carbon Disulphide	4.8 / 10 / 23	0.14 / 0.29 / 0.62	0.14 / 0.29 / 0.62	11 / 22 / 47	11000 / 11000 / 12000	1300 / 1900 / 2700
Hexachlorobutadiene (HCBD)	0.25 / 0.61 / 1.4	0.29 / 0.7 / 1.6	0.32 / 0.78 / 1.8	31 / 66 / 120	25 / 25 / 25	48 / 50 / 51
Pesticides (SOM 1%/ 2.5%/ 6%) [a, b, l, p]						
Aldrin	3.2 / 6.1 / 9.6	5.7/ 6.6 /7.1	7.3 / 7.4 / 7.5	170 / 170 / 170	18 / 18 / 18	30 / 31 / 31
Atrazine	0.5 / 1.2 / 2.7	3.3 / 7.6 / 17.4	610 / 620 / 620	9300 / 9400 / 9400	1200 / 1200 / 1200	2300 / 2400 / 2400
Dichlorvos	0.0049 / 0.010 / 0.022	0.032 / 0.066 / 0.14	6.4 / 6.5 / 6.6	140 / 140 / 140	16 / 16 / 16	26 / 26 / 27
Dieldrin	0.17/0.41/0.96	0.97/ 2 / 3.5	7.0 / 7.3 / 7.4	170 / 170 / 170	18 / 18 / 18	30 / 30 / 31
Alpha - Endosulfan	1.2 / 2.9 / 6.8	7.4 / 18 / 41	160[vap] (0.003)/ 280[vap] (0.007)/ 410[vap] (0.016)	5600[vap] (0.003) / 7400[vap] (0.007) / 8400[vap] (0.016)	1200 / 1200 / 1200	2400 / 2400 / 2500
Beta - Endosulfan	1.1 / 2.7 / 6.4	7.0 / 17 / 39	190[vap](0.00007) /320[vap](0.0002) /440[vap](0.0004)	6300[vap](0.00007) /7800[vap](0.0002) / 8700	1200 / 1200 / 1200	2400 / 2400 / 2500
Alpha-Hexachlorocyclohexane	0.035/0.087/ 0.21	0.23/0.55 / 1.2	6.9 / 9.2 / 11	170 / 180 / 180	24 / 24 / 24	47 / 48 / 48
Beta - Hexachlorocyclohexane	0.013 / 0.032 / 0.077	0.085 / 0.2 / 0.46	3.7 / 3.8 / 3.8	65 / 65 / 65	8.1 / 8.1 / 8.1	15 / 15 / 16
Gamma – Hexachlorocyclohexane	0.0092 / 0.023 / 0.054	0.06 / 0.14 / 0.33	2.9 / 3.3 / 3.5	67 / 69 / 70	8.2 / 8.2 / 8.2	14 / 15 / 15
Chlorobenzenes [a, b, l, p]						
Chlorobenzene	5.9 / 14 / 32	0.46 / 1.0 / 2.4	0.46 / 1.0 / 2.4	56 / 130 / 290	11000 / 13000 / 14000	1300[sol](675)/ 2000[sol](1520)/ 2900
1,2-dichlorobenzene (1,2-DCB)	94 / 230 / 540	23 / 55 / 130	24 / 57 / 130	2000[sol] (571) / 4800[sol] (1370) / 11000[sol] (3240)	90000 / 95000 / 98000	24000[sol] (571) / 36000[sol] (1370) /51000[sol] (3240)
1,3-dichlorobenzene (1,3-DCB)	0.25 / 0.6 / 1.5	0.4 / 1.0 / 2.3	0.44 /1.1 / 2.5	30 / 73 / 170	300 / 300 / 300	390 / 440 / 470
1-4-dichlorobenzene (1,4-DCB)	15[i] / 37[i] / 88 [i]	61[q] / 150[q] /350 [q]	61[q] / 150[q] / 350[q]	4400[vap,q] (224) / 10000[vap,q] (540) / 25000[vap,q] (1280)	17000[i] / 17000[i] / 17000[i]	36000[vap,i] (224) 36000[vap, i](540)/ 36000[vap,i](1280)
1,2,3-Trichlorobenzene	4.7 / 12 / 28	1.5 / 3.6 / 8.6	1.5 / 3.7 / 8.8	102 / 250 / 590	1800 / 1800 / 1800	770[vap] (134) / 1100[vap] (330) / 1600[vap] (789)
1,2,4- Trichlorobenzene	55 / 140 / 320	2.6 / 6.4 / 15	2.6 / 6.4 / 15	220 / 530 / 1300	15000 / 17000 / 19000	1700[vap] (318) / 2600[vap] (786) / 4000[vap] (1880)

Determinand	Allotment	RwHP	RwoHP	Commercial/ Industrial	POSresi	POSpark
1,3,5- Trichlorobenzene	4.7 / 12 / 28	0.33 / 0.81 / 1.9	0.33 / 0.81 / 1.9	23 / 55 / 130	1700 / 1700 / 1800	380^{vap} (36.7) / 580^{vap} (90.8) / 860^{vap} (217)
1,2,3,4-Tetrachlorobenzene	4.4 / 11 / 26	15 / 36 / 78	24 / 56 / 120	1700^{vap} (122) / 3080^{vap} (304) / 4400^{vap} (728)	830 / 830 / 830	1500^{vap} (122) / 1600 / 1600
1,2,3,5- Tetrachlorobenzene	0.38 / 0.90 / 2.2	0.66 / 1.6 / 3.7	0.75 / 1.9 / 4.3	49^{vap} (39.4) / 120^{vap} (98.1) / 240^{vap} (235)	78 / 79 / 79	110^{vap} (39.4) / 120 / 130
1,2,4,5- Tetrachlorobenzene	0.06 / 0.16 / 0.37	0.33 / 0.77 / 1.6	0.73 / 1.7 / 3.5	42^{sol} (19.7) / 72^{sol} (49.1) / 96	13 / 13 / 13	25 / 26 / 26
Pentachlorobenzene (P_ECB)	1.2 / 3.1 / 7.0	5.8 / 12 / 22	19 / 30 / 38	640^{sol} (43.0) / 770^{sol} (107) / 830	100 / 100 / 100	190 / 190 / 190
Hexachlorobenzene (HCB)	0.47 / 1.1 / 2.5	1.8^{vap} (0.20) / 3.3^{vap} (0.5) / 4.9	4.1^{vap} (0.20) / 5.7^{vap} (0.5) / 6.7^{vap} (1.2)	110^{vap} (0.20) / 120 / 120	16 / 16 / 16	30 / 30 / 30

Units are mg/kg Dry Weight

RwHP Residential with homegrown produce
RwoHP Residential without homegrown produce
POSresi public open spaces near residential housing
POSpark public open space for recreational use but not dedicated sports pitches
SOM Soil Organic Matter – ***the S4UL for all organic compounds will vary according to SOM***

a Based on a sandy loam soil as defined in SR3 (Environment Agency, 2009b) and 6% soil organic matter (SOM)
b Figures rounded to two significant figures
c Based only on a comparison of oral and dermal soil exposure with oral Index Dose
d The background ADE is limited to being no larger than the contribution from the relevant soil ADE
e Based on comparison of inhalation exposure with inhalation TDI only
f Based on a lifetime exposure via the oral, dermal and inhalation pathways
g Based on localised effects comparing inhalation exposure with inhalation ID only
h Based on comparison of inhalation exposure with inhalation ID
i Based on comparison of oral and dermal exposure with oral TDI
j Based on comparison of oral, dermal and inhalation exposure with inhalation TDI
k Based on comparison of all exposure pathways with oral TDI
l S4ULs assume that free phase contamination is not present
m S4ULs based on a sub-surface soil to indoor air correction factor of 10
n The HCV applied is based on the intake of total Xylene and therefore exposure should not consider an isomer in isolation
o Oral, dermal and inhalation exposure compared with oral HCV
p S4ULs based on a sub-surface soil to indoor air correction factor of 1
q Based on a comparison of inhalation exposure with the inhalation TDI for localised effects
r Based on 2,4-dichlorophenol unless otherwise stated
s Based on 2,3,4,6-tetrachlorophenol
t Based on lowest GAC for all three xylene isomers
u Measured concentrations of benzo(a)pyrene should be compared to the S4UL for benzo(a)pyrene as a single compound and to the S4UL for benzo(a)pyrene as a surrogate marker of genotoxic PAHs.
vap S4UL presented exceeded the vapour saturation limit, which is presented in brackets
sol S4UL presented exceeds the solubility saturation limit, which is presented in brackets
dir S4ULs based on a threshold protective of direct skin contact, guideline in brackets based on the health effects following long term exposure provided for illustration only

Table 3: Soil Guideline Values (SGVs) for dioxins, furans and dioxin like PCBs

Determinand	Allotments	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Commercial
Sum of PCDDs, PCDFs and dioxin-like PCBs	0.008	0.008	0.008	0.24

Units are mg/kg Dry Weight

Table 4: EIC/AGS/CL:AIRE Generic Assessment Criteria (GAC)

	Allotments	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Commercial	Soil Saturation Concentration
Metals					
Antimony	ND	ND	550	7500	NA
Barium	ND	ND	1300	22000	NA
Molybdenum	ND	ND	670	17000	NA
Organics (SOM 1%/ 2.5%/ 6%)					
1,1,2 Trichloroethane	0.28 / 0.61 / 1.4	0.6 / 1.2 / 2.7	0.88 / 1.8 / 3.9	94 / 190 / 400	4030 / 8210 / 18000
1,1-Dichloroethane	9.2 / 17 / 35	2.4 / 3.9 / 7.4	2.5 / 4.1 / 7.7	280 / 450 / 850	1830 / 2960 / 5600
1,1-Dichloroethene	2.8 / 5.6 / 12	0.23 / 0.4 / 0.82	0.23 / 0.41 / 0.82	26 / 46 / 92	2230 / 3940 / 7940
1,2,4-Trimethylbenzene	0.38 / 0.93 / 2.2	0.35 / 0.85 / 2	0.41 / 0.99 / 2.3	42 / 99 / 220	557 / 1360 / 3250
1,2-Dichloropropane	0.62 / 1.2 / 2.6	0.024 / 0.042 / 0.084	0.024 / 0.042 / 0.085	3.3 / 5.9 / 12	1190 / 2110 / 4240
2,4-Dimethylphenol	3.1 / 7.2 / 17	19 / 43 / 97	210 / 410 / 730	16000 / 24000 / 30000	1380 / 3140 / 7240
2,4-Dinitrotoluene	0.22 / 0.49 / 1.1	1.5 / 3.2 / 7.2	170 / 170 / 170	3700 / 3700 / 3800	141 / 299 / 669
2,6-Dinitrotoluene	0.12 / 0.27 / 0.61	0.78 / 1.7 / 3.9	78 / 84 / 87	1900 / 1900 / 1900	287 / 622 / 1400
2-Chloronaphthalene	40 / 98 / 230	3.7 / 9.2 / 22	3.8 / 9.3 / 22	390 / 960 / 2200	114 / 280 / 669
Biphenyl	14 / 35 / 83	66 / 160 / 360	220 / 500 / 980	18000 / 33000 / 48000	34.4 / 84.3 / 201
Bis (2-ethylhexyl) phthalate	47 / 120 / 280	280 / 610 / 1100	2700 / 2800 / 2800	85000 / 86000 / 86000	8.68 / 21.6 / 51.7
Bromobenzene	3.2 / 7.6 / 18	0.87 / 2 / 4.7	0.91 / 2.1 / 4.9	97 / 220 / 520	853 / 1970 / 4580
Bromodichloromethane	0.016 / 0.032 / 0.068	0.016 / 0.03 / 0.061	0.019 / 0.034 / 0.07	2.1 / 3.7 / 7.6	1790 / 3220 / 6570
Bromoform	0.95 / 2.1 / 4.6	2.8 / 5.9 / 13	5.2 / 11 / 23	760 / 1500 / 3100	2690 / 5480 / 12000
Butyl benzyl phthalate	220 / 550 / 1300	1400 / 3300 / 7200	42000 / 44000 / 44000	940000 / 940000 / 950000	26.3 / 64.7 / 154
Chloroethane	110 / 200 / 380	8.3 / 11 / 18	8.4 / 11 / 18	960 / 1300 / 2100	2610 / 3540 / 5710
Chloromethane	0.066 / 0.13 / 0.23	0.0083 / 0.0098 / 0.013	0.0085 / 0.0099 / 0.013	1 / 1.2 / 1.6	1910 / 2240 / 2990
Cis 1,2 Dichloroethene	0.26 / 0.5 / 1	0.11 / 0.19 / 0.37	0.12 / 0.2 / 0.39	14 / 24 / 47	3940 / 6610 / 12900
Dichloromethane	0.1 / 0.19 / 0.34	0.58 / 0.98 / 1.7	2.1 / 2.8 / 4.5	270 / 360 / 560	7270 / 9680 / 15300
Diethyl Phthalate	19 / 41 / 94	120 / 260 / 570	1800 / 3500 / 6300	150000 / 220000 / 290000	13.7 / 29.1 / 65
Di-n-butyl phthalate	2 / 5 / 12	13 / 31 / 67	450 / 450 / 450	15000 / 15000 / 15000	4.65 / 11.4 / 27.3
Di-n-octyl phthalate	940 / 2100 / 3900	2300 / 2800 / 3100	3400 / 3400 / 3400	89000 / 89000 / 89000	32.6 / 81.5 / 196
Hexachloroethane	0.27 / 0.67 / 1.6	0.2 / 0.48 / 1.1	0.22 / 0.54 / 1.3	22 / 53 / 120	8.17 / 20.1 / 48.1
Isopropylbenzene	32 / 79 / 190	11 / 27 / 64	12 / 28 / 67	1400 / 3300 / 7700	390 / 950 / 2250
Methyl tert-butyl ether (MTBE)	23 / 44 / 90	49 / 84 / 160	73 / 120 / 220	7900 / 13000 / 24000	20400 / 33100 / 62700
Propylbenzene	34 / 83 / 200	34 / 82 / 190	40 / 97 / 230	4100 / 9700 / 21000	402 / 981 / 2330
Styrene	1.6 / 3.7 / 8.7	8.1 / 19 / 43	35 / 78 / 170	3300 / 6500 / 11000	626 / 1440 / 3350
Total Cresols (2-, 3- and 4-methylphenol)	12 / 27 / 63	80 / 180 / 400	3700 / 5400 / 6900	160000 / 180000 / 180000	15000 / 32500 / 73300
Trans 1,2 Dichloroethene	0.93 / 1.9 / 4	0.19 / 0.34 / 0.7	0.19 / 0.35 / 0.71	22 / 40 / 81	3420 / 6170 / 12600
Tributyl tin oxide	0.042 / 0.1 / 0.24	0.25 / 0.59 / 1.3	1.4 / 3.1 / 5.7	130 / 180 / 200	41.3 / 101 / 241

Units are mg/kg Dry Weight

Table 5: Tier 2 Criteria for the Assessment of Soils – Protection of Flora and Fauna

Parameter	ICRCL 70/90 [a]		SSVs [b]	Code of Practice for Agricultural Use of Sewage Sludge [c]	BS 3882:2015 Specification for topsoil and requirements for use
	Maximum				Phytotoxic contaminants
	Livestock	Crop Growth			
	mg/kgDW	mg/kgDW	mg/kgDW	mg/kgDW	mg/kgDW
Antimony			37		
Arsenic	500	1000		50	
Cadmium	30	50	0.6	3	
Chromium				400	
Cobalt			4.2		
Copper	500	250	35.1	80/ 100/ 135/ 200 [d]	<100/<135/<200 [e]
Fluoride	1000			500	
Lead	1000			300	
Mercury				1	
Molybdenum			5.1	4	
Nickel			28.2	50/ 60/ 75/ 110 [d]	<60/<75/<110 [e]
Selenium				3	
Silver			0.3		
Vanadium			2.0		

Parameter	ICRCL 70/90 [a]		SSVs [b]	Code of Practice for Agricultural Use of Sewage Sludge [c]	BS 3882:2015 Specification for topsoil and requirements for use
	Maximum				Phytotoxic contaminants
	Livestock	Crop Growth			
	mg/kgDW	mg/kgDW	mg/kgDW	mg/kgDW	mg/kgDW
Zinc	3000	1000	35.6	200/200/200/300 [d]	<200/<200/<300 [e]
Benzo(a)pyrene			0.15		
Bis(2-ethylhexyl) phthalate			13		
Hexachlorobenzene			0.002		
Pentachlorobenzene					
Pentachlorophenol			0.6		
Perfluorooctanoic acid			0.022		
Perfluorooctane sulfonate			0.014		
Polychlorinated alkanes medium chain			11.9		
Tetrachloroethene					
Toluene					
Triclosan			0.13		
Tris(2-chloroethyl)phosphate			1.1		
Tris(2-chloro-1-methylethyl) phosphate			1.8		

a. Interdepartmental Committee on the Redevelopment of Contaminated Land (ICRCL) 70/90 Restoration and Aftercare of Metalliferous Mining Sites for Pasture and Grazing 1st edition 1990.
b. Soil screening values for assessing ecological risks, EA 2017a Report – ShARE id26
c. Maximum permissible concentration of potentially toxic elements for Arable land from the Sewage sludge in agriculture: code of practice.. There are also criteria for Grassland which are higher than for Arable.
d. Where four values are presented, concentrations are for soils with pH values 5.0-5.5/ 5.5-6.0/ 6.0-7.0/ >7.0 (and the soils contain more than 5% calcium carbonate)
e. Where three values are presented, concentrations are for soils with pH values <6.0/ 6.0-7.0/ >7.0

Table 6: Tier 2 Criteria for Screening Liquids

	Screening Concentration (mg/l)			
	Minimum Reporting Value	Human Consumption	Fresh Water/Inland	Salt Water/Other
Arsenic SP	-	0.01	0.05 (2)	0.025 (2)
Boron	-	1	-	-
Cadmium PS	0.0001	0.005	≤0.00008, 0.00008, 0.00009, 0.00015, 0.00025 (14)	0.0002
Chromium (total)	-	0.05	-	-
Chromium (III) SP	-	-	0.0047	-
Chromium (VI) SP	-	-	0.0034	0.0006
Copper SP	-	2	0.001 bioavailable	0.00376 bioavailable
Iron SP	-	0.2	1	1
Lead PS	-	0.01	0.0012 bioavailable	0.0013 bioavailable
Mercury compounds PS	0.00001	0.001	0.00007 max	0.00007 max
Manganese SP	-	0.05	0.123 bioavailable	-
Nickel PS	-	0.02	0.004 bioavailable	0.0086 bioavailable
Selenium	-	0.01	-	-
Zinc SP	-	5(3)	0.0109bioavailable(13)	0.0068bioavailable (13)
Chlorinated Compounds				
C10-13 chloroalkanes PS short chain chlorinated paraffins	-	-	0.0004	0.0004
Dichloromethane PS	-	-	0.02	0.02
1,2-Dichloroethane PS	0.001	0.003	0.01	0.01

	Screening Concentration (mg/l)			
	Minimum Reporting Value	Human Consumption	Fresh Water/Inland	Salt Water/Other
Trichloroethene PS	0.0001	0.01[5]	0.01	0.01
1,1,1-Trichloroethane	0.0001	-	-	-
1,1,2-Trichloroethane	0.0001	-	-	-
Trichloromethanes PS	-	0.1[1]	0.0025	0.0025
1, 2, 4-Trichlorobenzene	0.00001			
Tetrachloroethene PS	0.0001	0.01[5]	0.01	0.01
Tetrachloromethane/ Carbon tetrachloride PS	0.0001	0.003	0.012	0.012
Tetrachloroethane SP	-		0.140	
Vinyl chloride	-	0.0005	-	-
Trichlorobenzene (TCB) PS	-	-	0.0004	0.0004
Chloroform	0.0001			
Chloronitrotoluenes(CNT)[11]	0.001	-	-	-
Hexachlorobutadiene PS	0.000005	-	0.0006 max	0.0006 max
Hexachlorocyclohexanes (HCH) PS	0.000001	-	0.00002	0.000002
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	-	-	-	-
Acenaphthylene	-	-	-	-
Anthracene PS	-	-	0.0001	0.0001
Benzo(a)anthracene	-	-	-	-
Benzo(b)fluoranthene PS	-	0.0001 [10]	0.000017 max [12]	0.000017 max [12]
Benzo(a)pyrene PS	-	0.00001	0.00000017	0.00000017
Benzo(k)fluoranthene PS	-	0.0001 [10]	0.000017 max [12]	0.000017 max [12]
Benzo(g,h,i)perylene PS	-	0.0001 [10]	0.0000082 max [12]	0.00000082 max [12]
Indeno(1,2,3-cd)pyrene PS	-	0.0001 [10]	- [12]	- [12]
Chrysene		-	-	-
Dibenzo(a,h)anthracene		-	-	-
Fluoranthene PS	-	-	0.0000063	0.0000063
Fluorene	-	-	-	-
Phenanthrene	-	-	-	-
Pyrene	-	-	-	-
Naphthalene PS	-	-	0.002	0.002
Polycyclic Aromatic Hydrocarbons		0.0001[10]		
Petroleum hydrocarbons				
Petroleum hydrocarbons/Mineral oil	-	0.01[3]	-	-
Benzene PS	0.001	0.001	0.01	0.008
Toluene SP	0.004	0.7[9]	0.074	0.074
Ethylbenzene	-	0.3[9]	-	-
Xylenes	0.003[4]	0.5[9]		
Methyl tert-butyl ether (MTBE)	-	0.015[7]	-	-
Pesticides and Herbicides				
Alachlor PS	-	-	0.0003	0.0003
Aldrin PS	0.000003	0.00003	0.00001[8]	0.000005[8]
Dieldrin PS	0.000003	0.00003		
Endrin PS	0.000003	0.0006[9]		
Isodrin	0.000003	-	-	-
2,4 dichlorophenol SP	0.0001	-	0.0042	0.00042
2,4 D ester SP	0.0001	-	0.0003	0.0003
op and pp DDT (each) PS	0.000002	0.001[6]	0.000025 [6]	0.000025 [6]
op and pp DDE (each)	0.000002			
op and pp TDE (each)	0.000002			
Dimethoate SP	0.00001	-	0.00048	0.00048
Endosulfan PS	0.000005	-	0.000005	0.0000005
Hexachlorobenzene PS	0.000001		0.00005 max	0.00005 max
Permethrin SP	0.000001	-	0.000001	0.0000002
Atrazine PS	0.00003	-	0.0006	0.0006
Simazine PS	0.00003	-	0.001	0.001
Linuron SP	-	-	0.0005	0.0005
Mecoprop SP		-	0.018	0.018
Trifluralin PS	0.00001	-	0.00003	0.00003
Total pesticides	-	0.0005		

	Screening Concentration (mg/l)			
	Minimum Reporting Value	Human Consumption	Fresh Water/Inland	Salt Water/Other
Miscellaneous				
Ammoniacal nitrogen (as NH4+)	-	0.5	0.26 [16] 0.39 [17]	-
Ammoniacal nitrogen (as N)	-	0.39	0.2 [16] 0.3 [17]	-
Unionised Ammonia (NH3) SP	-	-	-	0.021
Chloride	-	250		
Chlorine SP			0.002	0.01 max
Cyanide SP (hydrogen cyanide)	-	0.05	0.001	0.001
Nitrate (as NO_3)	-	50	-	-
Nitrite (as NO_2)	-	0.1	-	-
Phenol SP	-	0.005 [(3)]	0.0077	0.0077
Pentachlorophenol PS	0.0001	-	0.0004	0.0004
PCBs (individual congeners)	0.000001	-	-	-
Sodium	-	200	-	-
Sulphate	-	250		-
Tributyl and triphenyl tin compounds (each) PS	0.000001	-	0.0000002	0.0000002
Di(2-ethylhexyl)-phthalate PS	-	-	0.0013	0.0013

Substances highlighted in yellow are hazardous substances, PS = Priority Substances, SP = Specific Pollutants, '-' screening concentration is not available, 'max' – maximum allowable concentration used where no annual average provided

Notes:

1. Concentration for trihalomethanes is the sum of chloroform, bromoform, dibromochloromethane and bromodichloromethane.
2. Concentration is the dissolved fraction of a water sample obtained by filtration through a 0.45um filter.
3. Concentration is taken from Statutory Instrument 1989 No. 1147. The Water Supply (Water Quality) Regulations 1989, as amended.
4. Concentration for xylenes is 0.003mg/l each for o-xylene and m/p xylene.
5. Concentration is the Sum of TCE and PCE.
6. Concentration is for Total DDT. Para DDT on its own has a target concentration of 0.00001mg/l.
7. Concentration for MTBE is taken from Environment Agency guidance, dated 2006.
8. Concentration is the sum of aldrin, dieldrin, endrin.
9. Concentration is taken from WHO (2004) guidelines for drinking-water quality.
10. Sum of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene
11. Concentration is for 2,6-CNT, 4,2-CNT, 4,3-CNT, 2,4-CNT, 2,5-CNT
12. BAP can be considered as a marker of the other PAHs for comparison with the annual average
13. Concentration plus ambient background concentration (dissolved)
14. For cadmium and its compounds the EQS depends on the hardness of the water (Class 1: < 40 mg CaCO3/l, Class 2: 40 to < 50 mg CaCO3/l, Class 3: 50 to < 100 mg CaCO3/l, Class 4: 100 to < 200 mg CaCO3/l and Class 5: ≥ 200 mg CaCO3/l).
15. Manufactured and used in industrial applications, such as flame retardants and plasticisers, as additives in metal working fluids, in sealants, paints, adhesives, textiles, leather fat and coatings. Persistent, bioaccumulate and toxic to aquatic life (carcinogen in rat studies). Candidate Persistent Organic Pollutant (POP).
16. Acceptable 90th percentile concentration for a freshwater lake/river with "High" chemical quality standard and alkalinity (as mg/l CaCO3) < 50 mg/L or alkalinity < 200 mg/L where river elevation > 80 m above Ordnance Datum (mAOD). See the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 for further details.
17. Acceptable 90th percentile concentration for a freshwater lake/river with "High" chemical quality standard and alkalinity (as mg/l CaCO3) ≥ 50 mg/L where river elevation < 80 m mAOD or > 200 mg/l where river elevation > 80 mAOD. See the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 for further details.

Table 7: Tier 2 Criteria for Screening Groundwater Vapour Generation Hazard

Chemical	CAS	GAC_{gwvap}(µg/l)[1,2]		Aqueous Solubility (µg/l)
		Residential	Commercial	
Petroleum Hydrocarbons				
1,2,4-Trimethylbenzene	95-63-6	24	2,200	559,000
Benzene [3]	71-43-2	210	20,000	1,780,000
Ethylbenzene [3]	100-41-4	10,000	*960,000 (sol)*	180,000
Isopropylbenzene	98-82-8	850	*86,000 (sol)*	56,000
Propylbenzene	103-65-1	2,700	*240,000 (sol)*	54,100
Styrene	100-42-5	8,800	*810,000 (sol)*	290,000
Toluene [3]	108-88-3	230,000	*21,000,000 (sol)*	590,000
TPH Aliphatic EC5-EC6 [3]		1,900	*190,000 (sol)*	35,900
TPH Aliphatic >EC6-EC8 [3]		1,500	*150,000 (sol)*	5,370
TPH Aliphatic >EC8-EC10 [3]		57	*5,700 (sol)*	427
TPH Aliphatic >EC10-EC12 [3]		37	*3,600 (sol)*	34
TPH Aromatic >EC5-EC7 [2,3]		210,000	*20,000,000 (sol)*	1,780,000
TPH Aromatic >EC7-EC8 [3]		220,000	*21,000,000 (sol)*	590,000
TPH Aromatic >EC8-EC10 [3]		1,900	*190,000 (sol)*	64,600
TPH Aromatic >EC10-EC12 [3]		6,800	*660,000 (sol)*	24,500
TPH Aromatic >EC12-EC16 [3]		39,000	*3,700,000 (sol)*	5,750
meta-Xylene [3,5]	108-38-3	9,500	*940,000 (sol)*	200,000
ortho-Xylene [3,5]	95-47-6	12,000	*1,100,000 (sol)*	173,000
para-Xylene [3,5]	106-42-3	9,900	*980,000 (sol)*	200,000
Polycyclic Aromatic Hydrocarbons (PAH)				
Acenaphthene	83-32-9	*170,000 (sol)*	*15,000,000 (sol)*	4,110
Acenaphthylene	208-96-8	*220,000 (sol)*	*20,000,000 (sol)*	7,950
Fluorene	86-73-7	*210,000 (sol)*	*18,000,000 (sol)*	1,860
Naphthalene	91-20-3	220	*23,000 (sol)*	19,000
Pesticides				
Aldrin	309-00-2	*47 (sol)*	*3,700 (sol)*	20
alpha-Endosulfan	959-98-8	*7,400 (sol)*	*590,000 (sol)*	530
beta-Endosulfan	33213-65-9	*7,500 (sol)*	*600,000 (sol)*	280
Halogenated Organics				
1,1,1,2-Tetrachloroethane	79-34-5	240	22,000	1,110,000
1,1,1-Trichloroethane	71-55-6	3,000	290,000	1,300,000
1,1,2,2-Tetrachloroethane	79-35-4	1,600	150,000	2,930,000
1,1,2-Trichloroethane	79-00-5	520	49,000	4,491,000
1,1-Dichloroethane	75-34-3	2,700	260,000	3,666,000
1,1-Dichloroethene	75-35-4	160	1,6000	3,100,000
1,2,3,4-Tetrachlorobenzene	634-66-2	240	*31,000 (sol)*	7,800
1,2,3,5-Tetrachlorobenzene	634-90-2	7.0	*600*	3,500
1,2,3-Trichlorobenzene	87-61-7	35	3,100	21,000
1,2,4,5-Tetrachlorobenzene	95-94-3	8.1	*700 (sol)*	600
1,2,4-Trichlorobenzene	120-82-1	68	7,200	41,400
1,2-Dichlorobenzene	95-50-1	2,000	*220,000 (sol)*	133,000
1,2-Dichloroethane	107-06-2	8.9	850	8,680,000
1,2-Dichloropropane	78-87-5	22	2,600	2,050,000
1,3,5-Trichlorobenzene	108-70-3	7.4	660	6,000
1,3-Dichlorobenzene	541-73-1	31	2,800	103,000
1,4-Dichlorobenzene	106-46-7	5,000	*460,000 (sol)*	51,200
Bromobenzene	108-86-1	220	20,000	388,040
Bromodichloromethane	75-27-4	17	1,600	3,000,000
Bromoform (Tribromomethane)	75-25-2	3,100	400,000	3,000,000
Chlorobenzene	108-90-7	98	15,000	387,000
Chloroethane	75-00-3	10,000	1,000,000	5,742,000
Chloroethene (Vinyl Chloride)	75-01-4	0.62	63	2,760,000
Chloromethane	74-87-3	14	1,400	5,350,000
cis-1,2-Dichloroethene	156-59-2	130	13,000	7,550,000
Dichloromethane	75-09-2	3,300	370,000	20,080,000
Hexachlorobenzene	118-74-1	*16 (sol)*	*1,400 (sol)*	10
Hexachlorobutadiene	87-68-3	1.7	230	4,800
Hexachloroethane	67-72-1	8.5	740	49,900

Chemical	CAS	GAC_{gwvap}(µg/l)[1,2]		Aqueous Solubility (µg/l)
		Residential	Commercial	
Pentachlorobenzene	608-93-5	140	*12,000 (sol)*	500
Tetrachloroethene	127-18-4	34	4,600	225,000
Tetrachloromethane (Carbon Tetrachloride)	56-23-5	5.3	770	846,000
trans-1,2-Dichloroethene	156-60-5	160	16,000	5,250,000
Trichloroethene	79-01-6	5.7	530	1,370,000
Trichloromethane (Chloroform)	67-66-3	790	85,000	8,950,000
Others (organic and inorganic)				
2-Chloronaphthalene	91-58-7	160	*14,000 (sol)*	11,700
Biphenyl (Lemonene)	92-52-4	*15,000 (sol)*	*1,300,000 (sol)*	4,060
Carbon Disulphide	75-15-0	56	5,600	2,100,000
Mercury, elemental	7439-97-6	1.1	*95 (sol)*	56
Methyl tertiary butyl ether (MTBE)	1634-04-4	83,000	7,800,000	48,000,000

Notes

1. GAC in *italics* with (sol) exceed aqueous solubility.
2. GAC rounded to two significant figures.
3. The GAC for these petroleum hydrocarbon contaminants have been calculated using a sub-surface soil to indoor air correction factor of 10 in line with the physical-chemical data sources.
4. The GAC for TPH fractions do not account for genotoxic mutagenic effects. Concentrations of TPH Aromatic >EC5-EC7 should therefore also be compared with the GAC for benzene to ensure that such effects are also assessed.
5. The Health Criteria Value used for each xylene isomer was for total xylene. If site specific additivity assessments are not completed, as a conservative measure the sum of isomer concentrations should be compared to the lowest xylene GAC (as is the case for soil GAC).

Appendix F Geo-Environmental Assessment – Selection of Assessment Criteria

Selection of Soil Assessment Criteria Protective of Human Health

The results of the soil testing have been compared to the Suitable 4 Use Levels (S4UL) (Nathanail et al, 2015) and the Category 4 Screening Level (C4SL) for lead, prepared under the auspices of Defra (CL:AIRE, 2014).

The GAC for a Commercial/industrial end-use have been selected as these are considered to be the most appropriate for the protection of construction workers undertaking the development and the SWS workers who will be present at the Site during its operational phase. The GAC have been generated assuming short exposure periods over a long timescale.

The GAC have been generated using assumptions regarding soil characteristics. Where the published GAC are dependent upon Soil Organic Matter (SOM), a value of 1% has been used to provide a conservative assessment. Consideration of the default soil properties used to generate the soil GAC for protection of human health is important as these influence the fate, transport, and behaviour of contaminants.

- Soil type – the model default is set as Sandy Loam and assumes a dry and relatively porous soil. The default is considered sufficiently similar to the cover/restoration soils which are variably clayey / sandy. The waste mass is not a soil type and comparison to the GAC are provided for information.
- pH – pH influences the cation exchange capacity and the portioning behaviour of a chemical between soil and water. The default is pH 7. The cover soils at the Site have been found to have a pH of typically between 7.5 and 8.5, with only one sample of the cover soils recording a pH considerably outside of this range (5.92).

Hydrocarbon Hazard Index

In addition to the comparison of the individual hydrocarbon fraction results to their respective GAC, it is necessary to also consider the potential for harm to human health due to additive effects of the hydrocarbons.

The additive effect of the hydrocarbon fractions is considered by calculating a hazard quotient (HQ) for each fraction (hydrocarbon band) which is the result for the fraction/band divided by the fraction S4UL criterion. All HQ are added to give a Hazard Index (HI). If the HI exceeds unity (1) then this can indicate a potentially significant human health risk. The result of this calculation is included in the results review below.

In addition to the comparison of the individual hydrocarbon fraction results to their respective GAC it is necessary to also consider the potential for harm to human health due to additive effects of the hydrocarbons.

The additive effect of the hydrocarbon fractions is considered by calculating a hazard quotient (HQ) for each fraction (hydrocarbon band) which is the result for the fraction/band divided by the fraction S4UL criterion. All HQ are added to give a Hazard Index (HI). If the HI exceeds unity (1) then this can indicate a potentially significant human health risk.

Selection of Water Assessment Criteria Protective of Human Health

The Site is located over a superficial Secondary A aquifer (Raised Marine Deposits / River Terrace Deposits) and a bedrock Principal Aquifer (Lewes Nodular Chalk Formation).

Groundwater levels beneath the Site appear to be tidally influenced and the Site is located within reclaimed former marine land (i.e., saline conditions are likely to be prevalent), it is therefore considered that potable abstraction is highly unlikely to be a future consideration and on this basis an assessment of these aquifers as a potential resource in case of future abstraction and use as a drinking water resource has not been undertaken. This is consistent with the EA's view in an earlier consultation[17] where the EA stated, in regard to the chalk "***While it is notionally a principal aquifer, we recognise that given the site setting, it is unlikely to have significant resource potential***".

When assessing ground condition data and the potential to harm Controlled Waters, Stantec uses the approach presented in Groundwater Protection Policy and Practice (GP3) (EA, 2017).

Selection of Water Assessment Criteria Protective of Aquatic Eco-Systems (Controlled Waters)

The Site is located immediately west of the re-aligned Hermitage Stream. The Hermitage Stream flows southwards into Langstone Harbour, a tidal inlet of the English Channel located approximately 200 m south of the Site. Langstone Harbour is a designated SSSI, SAC, SPA, a wetland of international importance designated under the Ramsar Convention and a WFD safeguarded Groundwater Dependent Terrestrial Ecosystem (GWDTE).

The original course of the Hermitage Stream flowed through the Site, before being truncated by the construction of the bund wall and landfills, A27 and associated slip roads, and Harts Farm Way. A review of historical aerial imagery and reports suggests that the former channel may have been culverted beneath Harts Farm Way and an outlet/sluice to Langstone Harbour may have been present in the bund wall to the south of the Site. The outlet may have been sealed in the late 1970s, and there is no visual evidence of such a feature remaining today.

The landfill waste at the site has been deposited directly upon either the predominantly granular superficial Raised Marine Deposits / River Terrace Deposits, or onto the underlying Chalk bedrock. The superficial deposits directly overlie the chalk. There is therefore a direct pathway for potential contamination within the landfill to enter the underlying aquifers.

The results of the testing undertaken on the samples of groundwater and landfill leachate have therefore been compared to saltwater Environmental Quality Standards (EQS).

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[17] Email from Tom Wickens (EA) to David Jackson (DS) dated 12th January 2021

Bioavailable Environmental Quality Standards (EQS)

Bioavailable Environmental Quality Standards (EQS) have been developed for UK Specific Pollutants copper, zinc and manganese and the EU priority substances lead and nickel. An EQS is the concentration of a chemical in the environment below which there is not expected to be an adverse effect on the specific endpoint being considered, e.g., the protection of aquatic life.

The bioavailability of a metal depends on a number of physico-chemical factors which govern both metal behaviour and the interactions of the toxic forms of the metals with a biological receptor.

The EQS bioavailable corresponds to the bioavailable fraction (BioF) of dissolved metal in a sample, as determined by the physico-chemical characteristics of the water and can be calculated using a biotic ligand model (BLM) or other calculation method. To assess compliance, the bioavailable fraction of dissolved metal can be compared to the EQS bioavailable. However, bioavailable metal is not the same metric as dissolved metal as only a fraction of the dissolved metal will usually be bioavailable.

It is very difficult to measure the bioavailable concentration of a metal directly. Biotic Ligand Models (BLMs) are a predictive tool that can take account of water quality parameters such as pH, and calcium to determine the amount of bioavailable metal present. However, the complexity of the models, the runtime per sample, input data requirements and level of operator skill needed to interpret the model outputs mean that few regulatory organisations have adopted the full BLMs. The UK has developed simplified Metal Bioavailability Assessment Tool (M-BAT) for copper, zinc, nickel, and manganese.

Neither DS nor WYG have undertaken the necessary geo-environmental laboratory analyses required to generate site-specific Predicted No Effect Concentrations (PNEC) suitable for the protection of the identified receptors. On this basis, to provide a conservative assessment the results have been compared against the EQS for copper, zinc, manganese, lead and nickel without a correction for bioavailability.

Limit of Detection vs. Generic Assessment Criteria

The table below shows the potential contaminants for which the method detection limit exceeds the corresponding generic assessment criterion. Numbers in brackets denote the number of positive detections out of the 97 samples. It is noted that testing with a method detection limit lower than the environmental quality standards for the PAHs listed in the table below is typically not offered by standard commercial laboratories.

Table 1 - Comparison of Laboratory Limit of Detection against Environmental Quality Standards

Determinand	Method Detection Limit (µg/l)	Environmental Quality Standard (µg/l)
Hexavalent Chromium	5.00 (0)	0.60
Trichlorobenzene (1,2,3 & 1,2,4)	2.00 (0)	0.40
Fluoranthene	0.01 (0)	0.0063
Benzo(a)pyrene	0.01 (0)	0.00017
Benzo(g,h,i)perylene	0.01 (0)	0.0082
Hexachlorobutadiene	1.00 (0)	0.60

For all determinands analysed, but not listed in the table above, the limits of detection were below the relevant generic assessment criteria.

Where the concentration of a determinand is below the limits of detection and the limits of detection are below the relevant threshold criterion, the concentrations recorded are not considered to present a hazard to human health or controlled waters.

Where the concentration of a determinand is below the limit of detection and the limit of detection is greater than the relevant threshold criterion, ultra-low analysis or further Detailed Quantitative Risk Assessment would be required to robustly conclude that these can be eliminated as hazards.

Appendix G Geo-Environmental Laboratory Analyses (Soils) – Summary Tables

TABLE SUMMARISING SOIL RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE SOIL ASSESSMENT CRITERIA
HAVANT WRP - LP72 (COVER SOILS ONLY)

			Strata	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER
SOM 1%			Assessment Criteria	RO101	RO102	RO102	RO103	RO104	RO105	RO106	RO107	RO108	RO109	TP101	TP102	TP103	TP104	TP104	TP106	TP107	TP115	TP117	TP119	TP120	CP01	CP02A	CP05	TP01	TP03	TP03
Analyte	Units	LOD	Commercial	1.10	0.30	1.50	1.50	0.10	0.20	0.50	0.10	0.10	0.70	0.10	0.80	1.50	0.10	0.30	0.50	0.50	1.00	0.40	0.30	0.30	0.95	0.75	0.20	0.30	0.40	1.80
Stones Content	%		-																											
Arsenic*	mg/kg	1	640	12	8.9	6.2	10	9.9	12	3.8	5.6	6.6		10	2.7	16	6.3	7.1	11	14	10	9.3	7.3	7.1	5	5	6.1	9.6	5.1	7.3
Cadmium*	mg/kg	0.2	190	1.1	1.3	0.4	2.4	0.4	0.2	0.2	0.5	0.4		1.1	0.5	0.2	0.7	0.6	1.2	0.2	0.2	0.2	0.8	0.2	0.2	0.5	0.5	0.1	0.1	0.1
Chromium Trivalent	mg/kg	1	8600																											
Chromium Hexavalent*	mg/kg	1.2	33	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2		1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.3	0.3	0.3	0.3	0.3	0.3
Copper	mg/kg	1	68000	52	33	25	70	26	19	13	26	28		41	14	34	26	32	55	35	27	28	26	14	6	12	18	10	25	12
Lead*	mg/kg	1	2300	82	91	53	89	68	28	7.4	41	31		150	12	30	21	45	100	52	46	110	28	16	14	17	34	25	34	10
Mercury	mg/kg	0.3	1100	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1
Nickel	mg/kg	1	980	19	19	14	17	13	11	4.5	10	15		16	5.5	30	17	16	130	21	24	13	14	5.8	7.6	11.3	13.2	11.4	16.1	16.4
Selenium	mg/kg	1	12000																						1	1	1	1	1	2
Zinc	mg/kg	1	730000	230	79	66	140	89	46	20	78	71		110	35	77	53	74	240	73	84	57	85	23	29	60	66	43	62	60
Beryllium	mg/kg	0.5	12																						0.5	0.5	0.6	0.9	1.3	1.6
Boron	mg/kg		240000																											
Vanadium	mg/kg		9000																						25	20	30	41	42	50
Cyanide (Total)	mg/kg		-																											
Organic matter	mg/kg		-																											
Phenol, Total	mg/kg	0.2	440																0.2	0.2					0.01	0.01	0.01	0.01	0.01	0.01
Sulphate (Total) as SO4	mg/l		-																						214	326	66	26	32	193
pH	pH Units		-																						8.57	8.45	8.39	8.47	8.52	6.96
>C5 to C6 Aliphatic	mg/kg	0.001	3200	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.1	0.1	0.1	0.1	0.1	0.1
>C6 to C8 Aliphatic	mg/kg	0.001	7800	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.1	0.1	0.1	0.1	0.1	0.1
>C8 to C10 Aliphatic	mg/kg	0.001	2000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.1	0.1	0.1	0.1	0.1	0.1
>C10 to C12 Aliphatic	mg/kg	1	9700	1.1	1	1	7.2	1	10	1	1	1	1	1	1	20	1	1	8.1	27	1	1	6.1	1	0.2	0.2	0.2	0.2	0.2	0.2
>C12 to C16 Aliphatic	mg/kg	2	59000	3.8	2	2	12	6	13	2	2	2	2	2	2	8.1	2	2	9.3	15	2	2	5.5	2	4	12	4	4	4	4
>C16 to C21 Aliphatic	mg/kg	8	-	9.5	8	8	23	12	11	8	8	8	8	8	8	8	8	8	11	8	8	8	8	8	7	7	7	7	7	7
>C21 to C35 Aliphatic	mg/kg	8	-	31	8	8	110	29	37	8	8	27	8	8	15	8	8	8	130	8	8	8	8	8	7	122	7	7	7	7
>C16 to C35 Aliphatic	mg/kg	16	1600000	40.5	16	16	133	41	48	16	16	35	16	16	23	16	16	16	141	16	16	16	16	16	14	129	14	14	14	14
>C35 to C44 Aliphatic	mg/kg		1600000																						7	131	7	7	7	7
Total Aliphatic C5-C35	mg/kg	10	-	46	10	10	150	47	72	10	10	27	10	10	16	28	10	10	150	42	10	10	12	10	26	265	26	26	26	26
>C5 to C7 Aromatic	mg/kg	0.001	26000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.1	0.1	0.1	0.1	0.1	0.1
>C7 to C8 Aromatic	mg/kg	0.001	56000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.1	0.1	0.1	0.1	0.1	0.1
>C8 to C10 Aromatic	mg/kg	0.001	3500	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.1	0.1	0.1	0.1	0.1	0.1
>C10 to C12 Aromatic	mg/kg	1	16000	1.2	1	1	1	1	7.1	1	1	6.1	1	1	1	1	1	1	1	13	1	1	1	1	0.2	0.2	0.2	0.2	0.2	0.2
>C12 to C16 Aromatic	mg/kg	2	36000	2	2	2	2	25	16	2	2	19	2	2	2	2	2	2	4.4	4.1	19	2	2	2	4	20	4	4	4	4
>C16 to C21 Aromatic	mg/kg	10	28000	10	10	10	10	18	14	10	10	39	10	10	10	10	10	10	10	10	32	10	10	10	7	147	7	7	7	7
>C21 to C35 Aromatic	mg/kg	10	28000	12	10	10	10	37	33	10	10	180	10	10	10	10	10	10	63	10	52	10	10	10	21	632	67	7	7	7
>C35 to C44 Aromatic	mg/kg		28000																						39	578	79	7	7	7
Total Aromatic C5-C35	mg/kg		-																						60	1377	146	26	26	26
TPH Ali/Aro	mg/kg		-																						60	1642	146	52	52	52
EPH (C10-C40)	mg/kg		-																											
Hazard Index - Commercial	-	-	-	0.001	0.001	0.001	0.002	0.003	0.004	0.001	0.001	0.009	0.001	0.001	0.001	0.003	0.001	0.001	0.004	0.005	0.004	0.001	0.002	0.001	0.003	0.050	0.006	0.001	0.001	0.001
Hazard Index - Commercial	-	-	-	0.001	0.001	0.001	0.002	0.003	0.004	0.001	0.001	0.009	0.001	0.001	0.001	0.003	0.001	0.001	0.004	0.005	0.004	0.001	0.002	0.001	0.003	0.050	0.006	0.001	0.001	0.001
Hazard Index - Commercial	-	-	-	0.001	0.001	0.001	0.002	0.003	0.004	0.001	0.001	0.009	0.001	0.001	0.001	0.003	0.001	0.001	0.004	0.005	0.004	0.001	0.002	0.001	0.003	0.050	0.006	0.001	0.001	0.001
Benzene*	mg/kg	0.001	27	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.005	0.005	0.005	0.005	0.005
Ethylbenzene	mg/kg	0.001	5700	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.005	0.005	0.005	0.005	0.005
Toluene	mg/kg	0.001	56000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.005	0.005	0.005	0.005	0.005
Xylene	mg/kg		6600																											
M- & P-Xylene	mg/kg	0.001	-	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.005	0.005	0.005	0.005	0.005
O-Xylene	mg/kg	0.001	-	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.005	0.005	0.005	0.005	0.005
Total Xylene (M, P & O)	mg/kg	0.002	6600	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.01	0.01	0.01	0.01	0.01	0.01
MTBE	mg/kg	0.001	-	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.005	0.005	0.005	0.005	0.005
Naphthalene	mg/kg	0.05	190	0.05	0.05	0.05	0.08	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.05	0.05	0.05	0.39	0.66	0.05	0.05	0.05	0.05	0.04	0.04	0.05	0.04	0.04	0.04
Acenaphthylene	mg/kg	0.05	83000	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.03	0.03	0.14	0.03	0.03	0.03
Acenaphthene	mg/kg	0.05	84000	0.05	0.05	0.05	0.08	0.05	0.29	0.05	0.05	0.05		0.05	0.05	0.05	0.05	0.05	0.05	0.05	1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Fluorene	mg/kg	0.05	63000	0.05	0.05	0.05	0.09	0.05	0.32	0.05	0.05	0.05		0.05	0.05	0.05	0.05	0.05	0.05	0.05	1.4	0.05	0.05	0.05	0.04	0.06	0.04	0.04	0.04	0.04
Phenanthrene	mg/kg	0.05	22000	0.32	0.05	0.05	0.68	0.26	0.91	0.05	0.32	0.62		1.1	0.05	0.05	0.05	0.05	0.69	0.05	10	0.05	0.05	0.05	0.03	0.43	0.67	0.03	0.39	0.03
Anthracene	mg/kg	0.05	520000	0.05	0.05	0.05	0.15	0.05	0.05	0.05	0.05	0.05		0.3	0.05	0.05	0.05	0.05	0.18	0.05	2.1	0.05	0.05	0.05	0.04	0.27	0.3	0.04	0.15	0.04
Fluoranthene	mg/kg	0.05	23000	0.58	0.05	0.05	1.2	0.41	0.64	0.05	0.68	1.8		2.1	0.05	0.05	0.05	0.05	2.2	0.05	11	0.05	0.05	0.05	0.03	0.86	2.21	0.03	0.73	0.03
Pyrene	mg/kg	0.05	54000	0.54	0.05	0.05	1.1	0.4	0.48	0.05	0.59	1.4		1.6	0.05	0.05	0.05	0.05	2.1	0.05	9.4	0.05	0.05	0.05	0.03	0.77	1.93	0.03	0.61	0.03
Benzo(a)anthracene	mg/kg	0.05	170	0.41	0.05	0.05	0.8	0.3	0.3	0.05	0.4	1		1	0.05	0.05	0.05	0.05	1.2	0.05	4.3	0.05	0.05	0.05	0.06	0.43	1.18	0.06	0.41	0.06
Chrysene	mg/kg	0.05	350	0.4	0.05	0.05	0.54	0.23	0.2	0.05	0.38	1.1		0.92	0.05	0.05	0.05	0.05	1	0.05	3.8	0.05	0.05	0.05	0.02	0.47	1.24	0.02	0.39	0.02
Benzo(b)fluoranthene	mg/kg	0.05	44	0.5	0.05	0.05	0.86	0.33	0.05	0.05	0.36	1.4		1	0.05	0.05	0.05	0.05	1.1	0.05	4.7	0.05	0.05	0.05	0.05	0.55	1.58	0.05	0.49	0.05
Benzo(k)fluoranthene	mg/kg	0.05	1200	0.32	0.05	0.05	0.43	0.2	0.05	0.05	0.29	0.46		0.46	0.05	0.05	0.05	0.05	0.79	0.05	1.7	0.05	0.05	0.05	0.02	0.21	0.61	0.02	0.19	0.02
Benzo(a)pyrene (BaP)	mg/kg	0.05	35	0.47	0.05	0.05	0.81	0.36	0.05	0.05	0.43	1.1		0.86	0.05	0.05	0.05	0.05	1.4	0.05	4.2	0.05	0.05	0.05	0.04	0.48	1.45	0.04	0.46	0.04
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	500	0.24	0.05	0.05	0.44	0.05	0.05	0.05	0.2	0.77		0.47	0.05	0.05	0.05	0.05	0.62	0.05	2.1	0.05	0.05	0.05	0.04	0.29	0.87	0.04	0.23	0.04
Dibenzo(a,h)anthracene	mg/kg	0.05	3.5	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.61	0.05	0.05	0.05	0.04	0.06	0.16	0.04	0.07	0.04
Benzo(g,h,i)perylene	mg/kg	0.05	3900	0.31	0.05	0.05	0.42	0.05	0.05	0.05	0.24	0.66		0.48	0.05	0.05	0.05	0.05	0.72	0.05	2.8	0.05	0.05	0.05	0.04	0.3	0.91	0.04	0.26	0.04
Total PAH	mg/kg	0.8	-	4.09	0.8	0.8	7.7	2.49	3.14	0.8	3.89	10.3		10.3	0.8	0.8	0.8	0.8	12.3	0.8	59.6	0.8	0.8	0.8	0.6	5.2	13.3	0.6	4.4	0.6
Coal Tar (BaP as surrogate)	mg/kg	0.05	15	0.47	0.05	0.05	0.81	0.36	0.05	0.05	0.43	1.1		0.86	0.05	0.05	0.05	0.05	1.4	0.05	4.2	0.05	0.05	0.05						
BaP* (as surrogate for PAH)	mg/kg	0.05	77	0.47	0.05	0.05	0.81	0.36	0.05	0.05	0.43	1.1		0.86	0.05	0.05	0.05	0.05	1.4	0.05	4.2	0.05	0.05	0.05						
PCB (sum of x Aroclors)	mg/kg	0.3	-																											
1,2 Dichloroethane	mg/kg	0.001	270																											
1,1,1 Trichloroethane (TCA)	mg/kg	0.001	660																											
1,1,1,2 Tetrachloroethane	mg/kg	0.001	110																											
1,1,2,2 Tetrachloroethane	mg/kg	0.001	270																											
Tetrachloroethene (PCE)*	mg/kg	0.001	24																											
Carbon Tetrachloride	mg/kg		2.9																											
Trichloroethene (TCE)*	mg/kg	0.001	0.73																											
Trichloromethane (Chloroform)	mg/kg	0.001	99																											
Vinyl Chloride (Chloroethene)*	mg/kg	0.001	1.1																											
Asbestos (Presence of)	TEXT		-	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected		Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Detected	Not-detected
Asbestos Analysts Comments	TEXT		-																										AIB, Fibre Bundles	
Asbestos Fibre Count	%																												Am, Chry	

Assessment Criteria are the Suitable for Use Levels (S4ULs) punlished by LQM/CIEH (Copyright Land Quality Management Limited Reproduced with Permission; Publication Number S4UL3202. All Rights Reserved) unless the analyte is marked with *. Analytes identified with * the Assessment Criteria are Category 4 Screening Levels (C4SL)

This is a summary table and it is possible that not all analytical results are reproduced. Whilst we endeavour to present the data accurately errors can occur during transcribing. The laboratory certificate should be referred to as the authenticated and complete source of results

Land-use Scenarios - RwHP = Residential with Home Grown Produce, RwoHP = Residential without Home Grown Produce, POSresi = Public Open Space within residential, POSpark = Public Open Space not associated with residential

LOD = Limit of Detection. Results in italics are equal to or less than the LOD

This table should be read in conjunction with the accompanying guide on the selection of evaluation crtieria and the project specific note presenting the justification for selection.

TABLE SUMMARISING SOIL RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE SOIL ASSESSMENT CRITERIA
HAVANT WRP - LP72 (COVER SOILS ONLY)

SOM 1%			Strata	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER	COVER
			Assessment Criteria	TP04	TP07	TP10	TP09	TP02	CP03	CP04	BHW001	BHW002	BHRP01	BHRP02
Analyte	Units	LOD	Commercial	0.60	2.50	2.50	0.40	1.00	1.00	0.50	0.30	0.30	0.50	0.30
Stones Content	%		-											
Arsenic*	mg/kg	1	640	13.1	8.3	6.8	9.5	5.9	7.2	6.5	4.7	10.2	12.3	3.5
Cadmium*	mg/kg	0.2	190	0.1	2.3	0.1	0.5	0.1	3	3	*0.2*	0.4	0.3	0.5
Chromium Trivalent	mg/kg	1	8600											
Chromium Hexavalent*	mg/kg	1.2	33	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1
Copper	mg/kg	1	68000	27	34	10	21	8	41	22	10.1	21.1	17.3	9.4
Lead*	mg/kg	1	2300	26	106	19	247	11	68	36	11.4	38.7	17.2	13.9
Mercury	mg/kg	0.3	1100	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.5	0.5
Nickel	mg/kg	1	980	21.6	17.2	12.5	7.9	10.2	14.2	13.5	7.9	17.6	15.6	8.8
Selenium	mg/kg	1	12000	6	*1*	*1*	*1*	*1*	*1*	*1*	0.5	0.5	0.5	0.5
Zinc	mg/kg	1	730000	42	114	46	79	34	143	117	19.4	80.8	92	39.1
Beryllium	mg/kg	0.5	12	2	0.7	0.9	0.8	0.7	0.6	0.6				
Boron	mg/kg		240000								0.7	0.8	0.6	1.4
Vanadium	mg/kg		9000	71	33	42	0.5	35	29	27				
Cyanide (Total)	mg/kg		-								0.5	0.5	0.6	0.5
Organic matter	mg/kg		-								0.52	1.76	1.3	0.83
Phenol, Total	mg/kg	0.2	440	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.43	0.43	0.1	0.36
Sulphate (Total) as SO4	mg/l		-	164	697	331	94	169	38	1599	125	363	187	50300
pH	pH Units		-	8.34	7.87	5.92	8.54	7.71	7.84	7.74	7.5	8.3	8.3	8.6
>C5 to C6 Aliphatic	mg/kg	0.001	3200	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
>C6 to C8 Aliphatic	mg/kg	0.001	7800	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
>C8 to C10 Aliphatic	mg/kg	0.001	2000	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
>C10 to C12 Aliphatic	mg/kg	1	9700	0.2	0.2	0.2	0.2	0.2	0.2	0.2				
>C12 to C16 Aliphatic	mg/kg	2	59000	4	4	4	8	4	4	4				
>C16 to C21 Aliphatic	mg/kg	8	-	7	7	7	24	7	7	7				
>C21 to C35 Aliphatic	mg/kg	8	-	7	7	7	180	7	7	7				
>C16 to C35 Aliphatic	mg/kg	16	1600000	14	14	14	204	14	14	14				
>C35 to C44 Aliphatic	mg/kg		1600000	7	7	7	117	7	7	7				
Total Aliphatic C5-C35	mg/kg	10	-	26	26	26	329	26	26	26				
>C5 to C7 Aromatic	mg/kg	0.001	26000	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
>C7 to C8 Aromatic	mg/kg	0.001	56000	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
>C8 to C10 Aromatic	mg/kg	0.001	3500	0.1	0.1	0.1	0.1	0.1	0.1	0.1				
>C10 to C12 Aromatic	mg/kg	1	16000	0.2	0.2	0.2	0.2	0.2	0.2	0.2				
>C12 to C16 Aromatic	mg/kg	2	36000	4	4	4	15	4	4	4				
>C16 to C21 Aromatic	mg/kg	10	28000	7	7	7	284	7	7	7				
>C21 to C35 Aromatic	mg/kg	10	28000	7	7	7	1699	7	7	7				
>C35 to C44 Aromatic	mg/kg		28000	7	7	7	826	7	7	7				
Total Aromatic C5-C35	mg/kg		-	26	26	26	2824	26	26	26				
TPH Ali/Aro	mg/kg		-	52	52	52	3153	52	52	52	20.4	150	48	53.3
EPH (C10-C40)	mg/kg		-											
Hazard Index - Commercial	-	-	-	0.001	0.001	0.001	0.101	0.001	0.001	0.001				
Hazard Index - Commercial	-	-	-	0.001	0.001	0.001	0.101	0.001	0.001	0.001				
Hazard Index - Commercial	-	-	-	0.001	0.001	0.001	0.101	0.001	0.001	0.001				
Benzene*	mg/kg	0.001	27	0.005	0.005	0.005	0.005	0.005	0.005	0.005	*0.001*	0.002	*0.001*	*0.001*
Ethylbenzene	mg/kg	0.001	5700	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.002	0.002	0.002	0.002
Toluene	mg/kg	0.001	56000	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Xylene	mg/kg		6600											
M- & P-Xylene	mg/kg	0.001	-	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.004
O-Xylene	mg/kg	0.001	-	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.002	0.002	0.002	0.002
Total Xylene (M, P & O)	mg/kg	0.002	6600	0.01	0.01	0.01	0.01	0.01	0.01	0.01				
MTBE	mg/kg	0.001	-	0.005	0.005	0.005	0.005	0.005	0.005	0.005				
Naphthalene	mg/kg	0.05	190	0.04	0.04	0.04	0.73	0.04	0.04	0.04	0.08	0.09	0.09	1.42
Acenaphthylene	mg/kg	0.05	83000	0.04	0.03	0.03	3.94	0.03	0.03	0.03	0.08	0.09	0.09	1.04
Acenaphthene	mg/kg	0.05	84000	*0.05*	*0.05*	*0.05*	2.15	*0.05*	*0.05*	*0.05*	0.08	0.27	0.09	2.9
Fluorene	mg/kg	0.05	63000	0.04	0.04	0.04	1.95	0.04	0.04	0.04	0.08	0.19	0.09	2.57
Phenanthrene	mg/kg	0.05	22000	0.23	0.31	0.03	20	0.03	0.03	0.03	0.08	0.7	0.09	17.2
Anthracene	mg/kg	0.05	520000	0.11	0.11	0.04	10.62	0.04	0.04	0.04	0.08	0.26	0.09	7.7
Fluoranthene	mg/kg	0.05	23000	0.95	0.56	0.03	56.34	0.03	0.04	0.07	0.08	1.29	0.09	35.3
Pyrene	mg/kg	0.05	54000	0.81	0.45	0.03	48.65	0.03	0.03	0.06	0.08	1.16	0.09	31.6
Benzo(a)anthracene	mg/kg	0.05	170	0.57	0.33	0.06	30.8	0.06	0.06	0.06	0.08	0.74	0.09	16
Chrysene	mg/kg	0.05	350	0.54	0.31	0.02	28.34	0.02	0.02	*0.05*	0.08	0.76	0.09	12.3
Benzo(b)fluoranthene	mg/kg	0.05	44	0.71	0.42	*0.05*	39.81	*0.05*	*0.05*	*0.05*	0.08	0.85	0.09	16
Benzo(k)fluoranthene	mg/kg	0.05	1200	0.27	0.16	0.02	15.48	0.02	0.02	0.02	0.08	0.36	0.09	5.65
Benzo(a)pyrene (BaP)	mg/kg	0.05	35	0.67	0.38	0.04	36.63	0.04	0.04	*0.05*	0.08	0.87	0.09	16
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	500	0.46	0.25	0.04	23.58	0.04	0.04	0.04	0.08	0.58	0.09	9.5
Dibenzo(a,h)anthracene	mg/kg	0.05	3.5	0.07	0.04	0.04	4.72	0.04	0.04	0.04	0.08	0.14	0.09	2.04
Benzo(g,h,i)perylene	mg/kg	0.05	3900	0.39	0.21	0.04	21.67	0.04	0.04	0.04	0.08	0.51	0.09	7.8
Total PAH	mg/kg	0.8	-	5.8	3.5	0.06	245.4	0.6	0.6	0.6	1.31	8.85	1.38	185
Coal Tar (BaP as surrogate)	mg/kg	0.05	15											
BaP* (as surrogate for PAH)	mg/kg	0.05	77											
PCB (sum of x Aroclors)	mg/kg	0.3	-											
1,2 Dichloroethane	mg/kg	0.001	270											
1,1,1 Trichloroethane (TCA)	mg/kg	0.001	660											
1,1,1,2 Tetrachloroethane	mg/kg	0.001	110											
1,1,2,2 Tetrachloroethane	mg/kg	0.001	270											
Tetrachloroethene (PCE)*	mg/kg	0.001	24											
Carbon Tetrachloride	mg/kg		2.9											
Trichloroethene (TCE)*	mg/kg	0.001	0.73											
Trichloromethane (Chloroform)	mg/kg	0.001	99											
Vinyl Chloride (Chloroethene)*	mg/kg	0.001	1.1											
Asbestos (Presence of)	TEXT		-	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analysts Comments	TEXT		-							Fibre bundles				
Asbestos Fibre Count	%									Chry, <0.1%				

Assessment Criteria are the Suitable for Use Levels (S4ULs) punlished by LQM/CIEH (Copyright Land Quality Management

This is a summary table and it is possible that not all analytical results are reproduced. Whilst we endeavour to present the d

Land-use Scenarios - RwHP = Residential with Home Grown Produce, RwoHP = Residential without Home Grown Produce,

LOD = Limit of Detection. Results in italics are equal to or less than the LOD

This table should be read in conjunction with the accompanying guide on the selection of evaluation crtieria and the project sp

TABLE SUMMARISING SOIL RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE SOIL ASSESSMENT CRITERIA
HAVANT WRP - LP72 (LANDFILL WASTE ONLY)

SOM 1%

Analyte	Units	LOD	Assessment Criteria: Commercial	No. of Tests	Min	Max	No. of Exceedances: Commercial	No. of Exceedances: Commercial	No. of Exceedances: Commercial	LANDFILL RO101 2.30	LANDFILL RO101 3.00	LANDFILL RO102 2.30	LANDFILL RO102 4.00	LANDFILL RO103 3.10	LANDFILL RO104 5.00	LANDFILL RO105 2.00	LANDFILL RO105 6.00	LANDFILL RO106 2.00	LANDFILL RO106 11.00	LANDFILL RO107 3.50	LANDFILL RO108 3.20	LANDFILL RO108 4.50	LANDFILL RO109 2.40	LANDFILL TP101 2.50	LANDFILL TP102 1.70	LANDFILL TP103 1.80	LANDFILL TP104 2.00	LANDFILL TP105 3.00	LANDFILL TP106 3.00	LANDFILL TP107 1.70	LANDFILL TP108 2.00	LANDFILL TP109 3.50
Stones Content	%		-																													
Arsenic*	mg/kg	1	640	52	0.7	48					7.7	48	13	11	14	14		15		10	11		11	12			11		10	12	22	16
Cadmium*	mg/kg	0.2	190	52	0.1	35					0.6	4.2	2.2	0.6	2.6	2.5		11		0.7	0.9		12	0.8			1.7		1.3	1.2	35	16
Chromium Trivalent	mg/kg	1	8600	12	21	610					21	610		28	55									32			26			34	60	48
Chromium Hexavalent*	mg/kg	1.2	33	51	0.1	1.8					*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*		*1.2*		*1.2*	*1.2*		*1.2*	*1.2*			1.8		*1.2*	*1.2*	*1.2*	*1.2*
Copper	mg/kg	1	68000	52	6.6	3521					47	1500	190	31	310	96		440		23	77		320	75			80		58	47	1400	590
Lead*	mg/kg	1	2300	52	2.4	1400					110	160	45	67	200	270		800		54	150		480	140			170		120	99	1400	660
Mercury	mg/kg	0.3	1100	52	0.1	1.7					*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*		*0.3*		*0.3*	*0.3*		0.8	*0.3*			*0.3*		*0.3*	*0.3*	1.7	0.8
Nickel	mg/kg	1	980	52	11.2	630					14	630	110	20	240	41		50		24	23		37	26			120		240	28	100	92
Selenium	mg/kg	1	12000	28	0.5	4																										
Zinc	mg/kg	1	730000	52	31.7	5200					230	300	75	93	580	440		1500		90	200		1600	340			400		410	190	4700	2000
Beryllium	mg/kg	0.5	12	24	0.5	2.7																										
Boron	mg/kg		240000	4	0.6	4.1																										
Vanadium	mg/kg		9000	24	2.7	93																										
Cyanide (Total)	mg/kg		-	4	0.5	3.5																										
Organic matter	mg/kg		-	3	0.32	6.16																										
Phenol, Total	mg/kg	0.2	440	50	0.01	3.23				*0.2*	0.4	*0.2*		*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*			*0.2*		*0.2*			*0.2*		*0.2*	*0.2*	*0.2*	*0.2*
Sulphate (Total) as SO4	mg/l		-	26	53	4270																										
pH	pH Units		-	35	7.07	10.3																			8.3	8.2		7.6		7.9	8.6	
>C5 to C6 Aliphatic	mg/kg	0.001	3200	51	0.001	1				*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*		*0.001*	*0.001*			*0.001*		*0.001*	*0.001*	*0.001*	*0.001*
>C6 to C8 Aliphatic	mg/kg	0.001	7800	51	0.001	1				*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*		*0.001*	*0.001*			*0.001*		*0.001*	*0.001*	*0.001*	*0.001*
>C8 to C10 Aliphatic	mg/kg	0.001	2000	51	0.001	9.8				1.3	*0.001*	9.8	6.7	0.93	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*		*0.001*	*0.001*			2.4		*0.001*	*0.001*	*0.001*	*0.001*
>C10 to C12 Aliphatic	mg/kg	1	9700	51	0.2	770				2.7	28	770	86	11	*1*	6.6	5.2	*1*	*1*	*1*	3.9		*1*	6.6			3.6		12	22	*1*	3.5
>C12 to C16 Aliphatic	mg/kg	2	59000	51	2	400				9.5	81	400	120	32	36	12	17	12	30	3.8	13		14	23			35		18	12	9.4	13
>C16 to C21 Aliphatic	mg/kg	8	-	51	7	1085				23	170	680	170	78	94	33	91	32	280	30	30		24	68			94		34	*8*	24	32
>C21 to C35 Aliphatic	mg/kg	8	-	51	7	5634				270	2200	3800	2100	390	510	360	1700	140	990	540	170		100	240			520		430	40	300	280
>C16 to C35 Aliphatic	mg/kg	16	1600000	44	14	6168				293	2370	4480	2270	468	604	393	1791	172	1270	570	200		124	308			614		464	48	324	312
>C35 to C44 Aliphatic	mg/kg		1600000	24	7	999																										
Total Aliphatic C5-C35	mg/kg	10	-	51	16	7533				310	2500	5700	2400	510	640	410	1800	180	1300	570	220		140	340			650		500	81	330	320
>C5 to C7 Aromatic	mg/kg	0.001	26000	51	0.001	1				*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*		*0.001*	*0.001*			*0.001*		*0.001*	*0.001*	*0.001*	*0.001*
>C7 to C8 Aromatic	mg/kg	0.001	56000	51	0.001	1				*0.001*	0.11	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	0.004	*0.001*		*0.001*	*0.001*			*0.001*		*0.001*	*0.001*	*0.001*	*0.001*
>C8 to C10 Aromatic	mg/kg	0.001	3500	51	0.001	5.6				0.93	2.8	5.6	3.1	0.21	*0.001*	*0.001*	*0.001*	*0.001*	0.35	0.3	*0.001*		*0.001*	1.9			0.57		*0.001*	*0.001*	*0.001*	*0.001*
>C10 to C12 Aromatic	mg/kg	1	16000	51	0.12	84.8				3.1	21	45	43	2.7	*1*	5.7	9.6	11	26	*1*	1.3		*1*	14			9.5		*1*	27	*1*	11
>C12 to C16 Aromatic	mg/kg	2	36000	51	2	201				8.9	77	120	110	26	55	13	30	26	66	*2*	9.2		7.4	20			27		8.1	18	4.8	17
>C16 to C21 Aromatic	mg/kg	10	28000	51	7	862				21	220	230	220	78	110	26	120	34	340	*10*	17		29	47			62		39	18	20	56
>C21 to C35 Aromatic	mg/kg	10	28000	51	7	2805				110	890	590	1000	230	340	140	490	80	670	46	63		80	130			350		260	17	77	200
>C35 to C44 Aromatic	mg/kg		28000	24	7	581																										
Total Aromatic C5-C35	mg/kg		-	51		4056				144	1211	991	1376	337	506	185	650	151	1102	59	91		117	213			449		308	80	103	284
TPH Ali/Aro	mg/kg		-	55		11589				454	3711	6691	3776	847	1146	595	2450	331	2402	629	311		257	553			1099		808	161	433	604
EPH (C10-C40)	mg/kg		-																													
Hazard Index - Commercial	-	-	-	51	0.0	0.2				0.007	0.050	0.131	0.066	0.014	0.019	0.008	0.025	0.006	0.041	0.003	0.004		0.005	0.010			0.019		0.013	0.006	0.004	0.011
Hazard Index - Commercial	-	-	-	51	0.0	0.2				0.007	0.050	0.131	0.066	0.014	0.019	0.008	0.025	0.006	0.041	0.003	0.004		0.005	0.010			0.019		0.013	0.006	0.004	0.011
Hazard Index - Commercial	-	-	-	51	0.0	0.2				0.007	0.050	0.131	0.066	0.014	0.019	0.008	0.025	0.006	0.041	0.003	0.004		0.005	0.010			0.019		0.013	0.006	0.004	0.011
Benzene*	mg/kg	0.001	27	56	0.001	0.069				*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*			*0.001*		*0.001*	*0.001*	*0.001*	*0.001*
Ethylbenzene	mg/kg	0.001	5700	56	0.001	1.2				0.032	0.18	0.095	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	0.068	0.056	*0.001*	0.046	*0.001*	1.2			0.085		*0.001*	*0.001*	*0.001*	*0.001*
Toluene	mg/kg	0.001	56000	56	0.001	0.11				*0.001*	0.1	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	0.004	*0.001*	*0.001*	*0.001*	*0.001*			*0.001*		*0.001*	*0.001*	*0.001*	*0.001*
Xylene	mg/kg		6600																													
M- & P-Xylene	mg/kg	0.001	-	56	0.001	1.109				0.14	0.5	0.72	0.35	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	0.085	0.15	*0.001*	0.036	*0.001*	0.16			0.034		*0.001*	*0.001*	*0.001*	*0.001*
O-Xylene	mg/kg	0.001	-	56	0.001	2.5				0.046	0.16	2.5	0.076	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	0.026	0.04	*0.001*	0.021	*0.001*	0.064			0.061		*0.001*	*0.001*	*0.001*	*0.001*
Total Xylene (M, P & O)	mg/kg	0.002	6600	52	0.002	3.22				0.186	0.66	3.22	0.426	*0.002*	*0.002*	*0.002*	*0.002*	*0.002*	0.111	0.19	*0.002*	0.057	*0.002*	0.224			0.095		*0.002*	*0.002*	*0.002*	*0.002*
MTBE	mg/kg	0.001	-	52	0.001	0.05				*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*			*0.001*		*0.001*	*0.001*	*0.001*	*0.001*
Naphthalene	mg/kg	0.05	190	60	0.04	10					1.9	5.7	1.3	1.4	0.1	0.48	0.85	0.89	2.1	*0.05*	0.34	2	*0.05*	0.62	0.73	1.4	2.1	0.71	0.47	0.61	0.75	1
Acenaphthylene	mg/kg	0.05	83000	60	0.03	8.53					0.34	0.28	*0.05*	0.14	*0.05*	*0.05*	0.41	*0.05*	0.29	*0.05*	*0.05*	0.23	*0.05*	*0.05*	*0.05*	0.33	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
Acenaphthene	mg/kg	0.05	84000	60	0.05	31					6	2.6	1.7	3.1	*0.05*	0.84	8.4	0.99	10	*0.05*	*0.05*	4.6	*0.05*	0.51	0.84	4.1	2.2	0.82	*0.05*	*0.05*	0.42	1
Fluorene	mg/kg	0.05	63000	60	0.04	22					6.5	2.3	1.9	3.2	*0.05*	1.3	9.1	0.88	11	*0.05*	*0.05*	4.7	*0.05*	0.63	1.3	3.4	2.2	0.95	*0.05*	*0.05*	0.32	0.69
Phenanthrene	mg/kg	0.05	22000	60	0.03	55					32	10	10	15	0.88	7.2	46	3.4	42	0.69	0.7	19	0.43	3.3	6.7	13	5.8	5.1	0.55	0.56	1.2	1.2
Anthracene	mg/kg	0.05	520000	60	0.04	9.79					6.7	2	2.3	3.4	*0.05*	1.4	8.5	0.46	8.6	*0.05*	0.16	3.9	*0.05*	0.78	1.8	3.1	1.2	1.1	0.15	0.13	0.22	0.23
Fluoranthene	mg/kg	0.05	23000	60	0.03	40					29	8.4	8.9	17	1.1	6.2	40	3.3	29	0.91	1.2	12	0.54	3.8	6	15	4.7	6.9	1.2	0.73	1.1	1.4
Pyrene	mg/kg	0.05	54000	60	0.03	28					22	6.2	6.2	14	0.91	5.2	28	2.6	21	0.76	1.1	8.7	0.52	3.4	4.7	12	3.9	5.9	1.2	0.62	0.92	1.3
Benzo(a)anthracene	mg/kg	0.05	170	60	0.011	17					14	3.8	4.1	7.9	*0.05*	3.6	17	1.5	11	*0.05*	0.63	4.1	0.44	1.6	2.4	6.5	1.6	*0.05*	0.61	0.34	0.32	0.6
Chrysene	mg/kg	0.05	350	60	0.02	14					9.6	4.1	3.1	6.1	*0.05*	2.4	14	0.96	8	*0.05*	0.55	3	0.3	1.2	1.8	3.9	1.4	*0.05*	0.66	0.29	0.33	0.71
Benzo(b)fluoranthene	mg/kg	0.05	44	60	0.05	16					12	3.8	3.4	8.4	0.52	3	16	1.1	8.6	0.56	0.65	3	*0.05*	1.6	2.2	5.8	1.6	3.2	0.89	0.29	0.23	0.65
Benzo(k)fluoranthene	mg/kg	0.05	1200	60	0.02	8.53					7.3	1.9	1.8	3.3	0.34	1.3	4.8	0.58	4.8	0.29	0.32	1.3	*0.05*	0.63	0.83	2	0.73	2.4	0.33	0.16	0.14	0.27
Benzo(a)pyrene (BaP)	mg/kg	0.05	35	60	0.04	11					9.5	3.1	2.7	7.4	0.48	2.5	11	0.88	7.9	0.43	0.55	2.5	*0.05*	1.3	1.7	4.8	1.6	2.1	0.81	0.22	*0.05*	0.46
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	500	60	0.04	8.53					4.9	1.5	1.3	3.5	*0.05*	0.96	5	*0.05*	3.4	*0.05*	0.24	1.2	*0.05*	0.75	1	2.3	0.79	1.5	0.42	*0.05*	*0.05*	0.23
Dibenzo(a,h)anthracene	mg/kg	0.05	3.5	60	0.04	8.53	1	1	1		1.3	0.6	0.5	1.1	*0.05*	*0.05*	1.8	*0.05*	1	*0.05*	*0.05*	0.36	*0.05*	*0.05*	0.25	0.62	0.2	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
Benzo(g,h,i)perylene	mg/kg	0.05	3900	60	0.04	8.53					5.6	1.7	1.4	4.1	*0.05*	1.2	5.8	*0.05*	4.1	*0.05*	0.3	1.3	*0.05*	0.86	0.96	3	0.88	2.1	0.49	*0.05*	*0.05*	0.29
Total PAH	mg/kg	0.8	-	40	0.6	158							50.6			37.6		17.5		3.64	6.76		2.23						7.73			
Coal Tar (BaP as surrogate)	mg/kg	0.05	15	32	0.05	11					9.5	3.1	2.7	7.4	0.48	2.5	11	0.88	7.9	0.43	0.55	2.5	*0.05*	1.3	1.7	4.8	1.6	2.1	0.81	0.22	*0.05*	0.46
BaP* (as surrogate for PAH)	mg/kg	0.05	77	32	0.05	11					9.5	3.1	2.7	7.4	0.48	2.5	11	0.88	7.9	0.43	0.55	2.5	*0.05*	1.3	1.7	4.8	1.6	2.1	0.81	0.22	*0.05*	0.46
PCB (sum of x Aroclors)	mg/kg	0.3	-	7	0.3	0.3																			*0.3*	*0.3*		*0.3*		*0.3*	*0.3*	
1,2 Dichloroethane	mg/kg	0.001	270	15	0.001	0.001					*0.001*	*0.001*		*0.001*	*0.001*		*0.001*		*0.001*			*0.001*		*0.001*			*0.001*			*0.001*	*0.001*	*0.001*
1,1,1 Trichloroethane (TCA)	mg/kg	0.001	660	15	0.001	2.8					2.8	*0.001*		*0.001*	*0.001*		*0.001*		2.5			*0.001*		*0.001*			*0.001*			*0.001*	*0.001*	*0.001*
1,1,1,2 Tetrachloroethane	mg/kg	0.001	110	15	0.001	0.001					*0.001*	*0.001*		*0.001*	*0.001*		*0.001*		*0.001*			*0.001*		*0.001*			*0.001*			*0.001*	*0.001*	*0.001*
1,1,2,2 Tetrachloroethane	mg/kg	0.001	270	15	0.001	0.001					*0.001*	*0.001*		*0.001*	*0.001*		*0.001*		*0.001*			*0.001*		*0.001*			*0.001*			*0.001*	*0.001*	*0.001*
Tetrachloroethene (PCE)*	mg/kg	0.001	24	15	0.001	0.021					0.021	*0.001*		*0.001*	*0.001*		*0.001*		0.021			*0.001*		*0.001*			*0.001*			*0.001*	*0.001*	*0.001*
Carbon Tetrachloride	mg/kg		2.9																													
Trichloroethene (TCE)*	mg/kg	0.001	0.73	15	0.001	0.033					0.033	*0.001*		*0.001*	*0.001*		*0.001*		*0.001*			*0.001*		*0.001*			*0.001*			*0.001*	*0.001*	*0.001*
Trichloromethane (Chloroform)	mg/kg	0.001	99	15	0.001	0.001					*0.001*	*0.001*		*0.001*	*0.001*		*0.001*		*0.001*			*0.001*		*0.001*			*0.001*			*0.001*	*0.001*	*0.001*
Vinyl Chloride (Chloroethene)*	mg/kg	0.001	1.1	15	0.001	0.001					*0.001*	*0.001*		*0.001*	*0.001*		*0.001*		*0.001*			*0.001*		*0.001*			*0.001*			*0.001*	*0.001*	*0.001*
Asbestos (Presence of)	TEXT		-	50							Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected		Not-detected		Not-detected	Not-detected		Not-detected	Not-detected			Not-detected		Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analysts Comments	TEXT		-	14																												
Asbestos Fibre Count	%			14																												

Assessment Criteria are the Suitable for Use Levels (S4ULs) punlished by LQM/CIEH (Copyright Land Quality Management Limited Reproduced with Permission; Publication Number S4UL3202. All Rights Reserved) unless the analyte is marked with *. Analytes identified with * the Assessment Criteria are Category 4 Screening Levels (C4SL)

This is a summary table and it is possible that not all analytical results are reproduced. Whilst we endeavour to present the data accurately errors can occur during transcribing. The laboratory certificate should be referred to as the authenticated and complete source of results

Land-use Scenarios - RwHP = Residential with Home Grown Produce, RwoHP = Residential without Home Grown Produce, POSresi = Public Open Space within residential, POSpark = Public Open Space not associated with residential

LOD = Limit of Detection. Results in italics are equal to or less than the LOD

This table should be read in conjunction with the accompanying guide on the selection of evaluation crtieria and the project specific note presenting the justification for selection.

TABLE SUMMARISING SOIL RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE SOIL ASSESSMENT CRITERIA
HAVANT WRP - LP72 (LANDFILL WASTE ONLY)

			Strata	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL
SOM 1%			**Assessment Criteria**	TP110	TP111	TP112	TP113	TP114	TP115	TP116	TP118	TP119	TP120
Analyte	**Units**	**LOD**	**Commercial**	1.50	2.00	3.50	3.00	1.00	2.00	1.80	2.00	1.00	1.50
Stones Content	%		-										
Arsenic*	mg/kg	1	640	14	13	11	15	25	13	15	14		
Cadmium*	mg/kg	0.2	190	13	11	2.1	3.9	34	3	14	6.7		
Chromium Trivalent	mg/kg	1	8600			22	32	100					
Chromium Hexavalent*	mg/kg	1.2	33	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*	*1.2*		
Copper	mg/kg	1	68000	750	200	70	300	2400	98	420	300		
Lead*	mg/kg	1	2300	460	450	160	570	1100	160	730	380		
Mercury	mg/kg	0.3	1100	*0.3*	0.4	*0.3*	*0.3*	*0.3*	0.5	*0.3*	0.4		
Nickel	mg/kg	1	980	49	28	18	27	97	22	88	27		
Selenium	mg/kg	1	12000										
Zinc	mg/kg	1	730000	2200	880	330	670	5200	560	1700	710		
Beryllium	mg/kg	0.5	12										
Boron	mg/kg		240000										
Vanadium	mg/kg		9000										
Cyanide (Total)	mg/kg		-										
Organic matter	mg/kg		-										
Phenol, Total	mg/kg	0.2	440		*0.2*	*0.2*	*0.2*	*0.2*	*0.2*			*0.2*	
Sulphate (Total) as SO4	mg/l		-										
pH	pH Units		-									7.7	7.9
>C5 to C6 Aliphatic	mg/kg	0.001	3200	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*		
>C6 to C8 Aliphatic	mg/kg	0.001	7800	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*		
>C8 to C10 Aliphatic	mg/kg	0.001	2000	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	0.028		
>C10 to C12 Aliphatic	mg/kg	1	9700	1.2	*1*	3.3	1.9	1.8	2.6	14	6		
>C12 to C16 Aliphatic	mg/kg	2	59000	6.2	*2*	42	14	21	13	33	64		
>C16 to C21 Aliphatic	mg/kg	8	-	17	*8*	91	27	43	21	54	100		
>C21 to C35 Aliphatic	mg/kg	8	-	170	16	200	190	920	170	860	110		
>C16 to C35 Aliphatic	mg/kg	16	1600000	187	24	291	217	963	191	914	210		
>C35 to C44 Aliphatic	mg/kg		1600000										
Total Aliphatic C5-C35	mg/kg	10	-	190	16	330	240	990	200	960	290		
>C5 to C7 Aromatic	mg/kg	0.001	26000	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*		
>C7 to C8 Aromatic	mg/kg	0.001	56000	*0.001*	*0.001*	*0.001*	*0.001*	0.03	*0.001*	*0.001*	*0.001*		
>C8 to C10 Aromatic	mg/kg	0.001	3500	*0.001*	*0.001*	*0.001*	*0.001*	0.21	*0.001*	*0.001*	*0.001*		
>C10 to C12 Aromatic	mg/kg	1	16000	7.6	*1*	34	6.9	8.5	5.2	*1*	10		
>C12 to C16 Aromatic	mg/kg	2	36000	13	20	160	17	18	19	13	44		
>C16 to C21 Aromatic	mg/kg	10	28000	41	18	230	35	46	48	45	92		
>C21 to C35 Aromatic	mg/kg	10	28000	99	46	320	120	300	130	390	90		
>C35 to C44 Aromatic	mg/kg		28000										
Total Aromatic C5-C35	mg/kg		-	161	85	744	179	373	202	449	236		
TPH Ali/Aro	mg/kg		-	351	101	1074	419	1363	402	1409	526		
EPH (C10-C40)	mg/kg		-										
Hazard Index - Commercial	-	-	-	0.006	0.003	0.027	0.007	0.015	0.008	0.019	0.010		
Hazard Index - Commercial	-	-	-	0.006	0.003	0.027	0.007	0.015	0.008	0.019	0.010		
Hazard Index - Commercial	-	-	-	0.006	0.003	0.027	0.007	0.015	0.008	0.019	0.010		
Benzene*	mg/kg	0.001	27	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*		
Ethylbenzene	mg/kg	0.001	5700	*0.001*	*0.001*	*0.001*	*0.001*	0.016	0.009	*0.001*	*0.001*		
Toluene	mg/kg	0.001	56000	*0.001*	*0.001*	*0.001*	*0.001*	0.03	*0.001*	*0.001*	*0.001*		
Xylene	mg/kg		6600										
M- & P-Xylene	mg/kg	0.001	-	*0.001*	*0.001*	*0.001*	*0.001*	0.029	0.013	*0.001*	*0.001*		
O-Xylene	mg/kg	0.001	-	*0.001*	*0.001*	*0.001*	*0.001*	0.028	0.031	*0.001*	*0.001*		
Total Xylene (M, P & O)	mg/kg	0.002	6600	*0.002*	*0.002*	*0.002*	*0.002*	0.057	0.044	*0.002*	*0.002*		
MTBE	mg/kg	0.001	-	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*		
Naphthalene	mg/kg	0.05	190	5	0.63	10	2.6	1.3	*0.05*	*0.05*	2.2	*0.05*	1.3
Acenaphthylene	mg/kg	0.05	83000	*0.05*	*0.05*	0.44	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
Acenaphthene	mg/kg	0.05	84000	1.6	0.45	31	3.9	3.2	2	0.34	5.2	*0.05*	0.53
Fluorene	mg/kg	0.05	63000	1.3	0.32	22	4.7	2	2.3	0.45	4.9	*0.05*	0.34
Phenanthrene	mg/kg	0.05	22000	3.9	0.95	55	6.5	9.7	9.5	1.7	16	1.2	1.2
Anthracene	mg/kg	0.05	520000	0.6	0.18	8.8	1.5	1.7	2.9	0.51	2.3	0.29	0.14
Fluoranthene	mg/kg	0.05	23000	2.6	0.98	34	6.4	6.7	5.8	2.9	19	0.75	1.1
Pyrene	mg/kg	0.05	54000	2.1	0.87	25	5.3	5.1	5.3	2.9	15	0.69	0.81
Benzo(a)anthracene	mg/kg	0.05	170	0.8	0.33	8.9	2.8	2.1	5.4	1	4.8	*0.05*	0.61
Chrysene	mg/kg	0.05	350	0.67	0.28	7.8	2.2	2.2	3.8	1.4	4.1	*0.05*	0.65
Benzo(b)fluoranthene	mg/kg	0.05	44	0.57	0.31	8.8	3.1	1.9	4.9	1.3	4.3	*0.05*	0.94
Benzo(k)fluoranthene	mg/kg	0.05	1200	0.33	0.14	3.3	1.3	0.86	2.6	0.71	2.4	*0.05*	0.36
Benzo(a)pyrene (BaP)	mg/kg	0.05	35	0.5	0.25	6.9	2.7	1.7	4.8	1.1	4.2	*0.05*	0.6
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	500	0.21	*0.05*	3.6	1.5	0.93	3.8	0.59	1.1	*0.05*	0.42
Dibenzo(a,h)anthracene	mg/kg	0.05	3.5	*0.05*	*0.05*	1.2	0.46	*0.05*	1.2	*0.05*	0.38	*0.05*	0.13
Benzo(g,h,i)perylene	mg/kg	0.05	3900	0.25	*0.05*	4.7	1.6	1.1	5.5	0.77	1.2	*0.05*	0.48
Total PAH	mg/kg	0.8	-	20.4	5.69				59.6	15.7	87.5		
Coal Tar (BaP as surrogate)	mg/kg	0.05	15	0.5	0.25	6.9	2.7	1.7	4.8	1.1	4.2	*0.05*	0.6
BaP* (as surrogate for PAH)	mg/kg	0.05	77	0.5	0.25	6.9	2.7	1.7	4.8	1.1	4.2	*0.05*	0.6
PCB (sum of x Aroclors)	mg/kg	0.3	-									*0.3*	*0.3*
1,2 Dichloroethane	mg/kg	0.001	270			*0.001*	*0.001*	*0.001*					
1,1,1 Trichloroethane (TCA)	mg/kg	0.001	660			*0.001*	*0.001*	*0.001*					
1,1,1,2 Tetrachloroethane	mg/kg	0.001	110			*0.001*	*0.001*	*0.001*					
1,1,2,2 Tetrachloroethane	mg/kg	0.001	270			*0.001*	*0.001*	*0.001*					
Tetrachloroethene (PCE)*	mg/kg	0.001	24			*0.001*	*0.001*	*0.001*					
Carbon Tetrachloride	mg/kg		2.9										
Trichloroethene (TCE)*	mg/kg	0.001	0.73			*0.001*	*0.001*	*0.001*					
Trichloromethane (Chloroform)	mg/kg	0.001	99			*0.001*	*0.001*	*0.001*					
Vinyl Chloride (Chloroethene)*	mg/kg	0.001	1.1			*0.001*	*0.001*	*0.001*					
Asbestos (Presence of)	TEXT		-	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Detected	Not-detected		
Asbestos Analysts Comments	TEXT		-							Loose Fibres			
Asbestos Fibre Count	%									Am			

Strata	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL
	CP01	CP02A	CP02A	CP05	CP05	TP01	TP01	TP11	TP04	TP10	TP09	TP08	TP08	TP05	TP05	TP06	TP06
Analyte	7.00	4.50	7.00	4.20	9.50	1.90	3.40	2.50	3.30	3.30	3.80	2.30	3.20	1.00	2.40	2.00	3.10
Stones Content																	
Arsenic*	9.6	12.3	7.1	8.4	9.1	9.6	16.6	6.3	4.7	9.4	18.6	9.6	6.7	5.6	7.3	9.4	32.4
Cadmium*	0.4	9.9	1.9	0.4	1.9	12.2	1.3	6.8	0.9	0.6	0.1	29.6	12.1	0.1	6.1	28.6	9.2
Chromium Trivalent																	
Chromium Hexavalent*	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Copper	17	170	52	17	38	138	77	29	14	103	87	395	630	11	145	589	3521
Lead*	167	168	104	89	110	108	181	306	23	134	47	1033	408	30	217	1051	533
Mercury	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.1	0.1	0.6	0.9	0.5	0.1	0.1	1.5	0.4
Nickel	17.9	45.1	21.7	13.9	30.8	95.2	26.4	11.2	12.5	29.8	114.2	378	41.4	15.4	24.7	51.1	440.3
Selenium	*1*	*1*	*1*	*1*	*1*	4	*1*	*1*	*1*	*1*	*1*	3	*1*	*1*	*1*	4	3
Zinc	92	517	169	214	678	516	243	227	49	187	181	2837	2366	53	691	2835	2404
Beryllium	1	0.9	0.8	0.8	1.2	1	1.3	*0.5*	0.6	1.7	2.6	1.3	1.5	0.7	0.8	1.9	2.7
Boron																	
Vanadium	50	31	74	34	41	37	42	24	22	15	2.7	18	17	33	23	23	42
Cyanide (Total)																	
Organic matter																	
Phenol, Total	0.03	0.01	0.01	0.01	1.82	0.38	0.04	0.04	3.23	0.1	0.04	0.05	0.04	0.01	0.01	0.01	0.01
Sulphate (Total) as SO4	150	410	399	287	370	286	240	231	195	278	782	579	280	53	865	209	55
pH	8.23	7.7	7.8	7.62	7.7	7.64	8.07	7.58	7.75	7.83	7.58	7.98	7.95	8.49	7.94	8.47	8.12
>C5 to C6 Aliphatic	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	0.1	0.1	0.1	0.1
>C6 to C8 Aliphatic	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	0.1	0.1	0.1	0.1
>C8 to C10 Aliphatic	0.5	1.3	1.4	9.3	1.2	8	0.1	3	0.5	0.1	5.6	0.3	0.1	1.1	0.3	0.5	0.1
>C10 to C12 Aliphatic	0.2	13.8	29.5	9.2	4.1	161.5	0.2	39.5	118.9	0.2	65	0.2	0.2	1.5	7	0.2	0.2
>C12 to C16 Aliphatic	4	27	63	18	4	196	4	97	259	4	85	4	4	4	4	4	4
>C16 to C21 Aliphatic	7	86	126	19	34	534	7	65	1085	7	38	7	7	23	7	7	7
>C21 to C35 Aliphatic	54	568	691	399	35.1	5634	7	319	4616	87	493	69	7	106	68	168	7
>C16 to C35 Aliphatic		654	817	418	69.1	6168	14	384	5701			76	14	129			14
>C35 to C44 Aliphatic	23	158	171	117	91	999	7	89	375	11	161	45	7	80	46	37	7
Total Aliphatic C5-C35	78	854	1082	572	481	7533	26	613	6454	98	848	114	26	212	121	206	26
>C5 to C7 Aromatic	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	0.1	0.1	0.1	0.1
>C7 to C8 Aromatic	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	0.1	0.1	0.1	0.1
>C8 to C10 Aromatic	0.3	0.1	0.1	0.6	0.1	0.6	0.1	0.9	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.1
>C10 to C12 Aromatic	3.3	7.4	17.3	9.4	0.2	84.8	0.2	65.9	35.8	0.12	22.3	0.2	0.2	0.2	0.2	0.2	0.2
>C12 to C16 Aromatic	15	31	108	28	4	107	4	73	201	4	44	22	4	11	4	4	4
>C16 to C21 Aromatic	76	129	374	55	44	478	7	280	862	24	115	31	7	65	7	34	7
>C21 to C35 Aromatic	187	603	1148	332	271	2805	7	1304	2061	157	1514	160	7	292	97	169	7
>C35 to C44 Aromatic	74	362	476	117	142	581	7	221	236	64	401	100	7	253	116	92	7
Total Aromatic C5-C35	356	1133	2123	542	457	4056	26	1945	3396	245	2096	322	26	621	213	295	26
TPH Ali/Aro	434	1967	3205	1114	938	11589	52	2558	9850	343	2944	436	52	833	334	501	52
EPH (C10-C40)																	
Hazard Index - Commercial	0.013	0.044	0.081	0.026	0.018	0.175	0.001	0.078	0.141	0.009	0.086	0.011	0.001	0.023	0.009	0.011	0.001
Hazard Index - Commercial	0.013	0.044	0.081	0.026	0.018	0.175	0.001	0.078	0.141	0.009	0.086	0.011	0.001	0.023	0.009	0.011	0.001
Hazard Index - Commercial	0.013	0.044	0.081	0.026	0.018	0.175	0.001	0.078	0.141	0.009	0.086	0.011	0.001	0.023	0.009	0.011	0.001
Benzene*	0.008	0.005	0.01	0.005	0.005	0.008	0.005	0.069	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.01
Ethylbenzene	0.095	0.016	0.015	0.078	0.005	0.028	0.012	0.186	0.067	0.014	0.022	0.007	0.007	0.005	0.005	0.015	0.071
Toluene	0.027	0.005	0.005	0.005	0.005	0.006	0.005	0.025	0.005	0.005	0.005	0.009	0.014	0.005	0.013	0.014	0.032
Xylene																	
M- & P-Xylene	0.188	0.017	0.019	0.48	0.022	0.498	0.04	0.605	0.049	0.052	0.087	0.034	0.022	0.005	0.015	0.038	0.124
O-Xylene	0.046	0.168	0.049	0.116	0.015	0.112	0.014	0.186	0.018	0.011	0.077	0.038	0.019	0.005	0.007	0.018	0.065
Total Xylene (M, P & O)	0.234	0.185	0.068	0.596	0.037	0.61	0.054	0.791	0.067	0.063	0.164	0.072	0.041	0.01	0.022	0.056	0.189
MTBE	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Naphthalene	0.64	0.15	2.25	0.04	0.04	0.55	1.31	4.18	0.23	0.6	0.99	1.04	2.6	0.04	0.51	0.04	0.14
Acenaphthylene	*0.05*	0.03	0.3	0.03	0.03	0.09	0.03	0.51	0.1	0.03	0.03	*0.05*	0.04	0.03	0.2	0.03	*0.05*
Acenaphthene	0.38	1.01	15.99	*0.05*	*0.05*	0.32	3.24	1.75	0.17	*0.05*	0.5	0.25	0.2	*0.05*	1.25	*0.05*	0.22
Fluorene	0.32	1.01	15.14	0.04	0.04	0.43	2.1	2.07	0.33	0.04	0.34	0.16	0.12	0.04	0.88	0.04	0.08
Phenanthrene	1.09	4.23	52.26	0.8	0.03	2.58	2.8	6.25	2.35	0.2	0.72	0.52	0.47	0.19	1.37	0.1	0.27
Anthracene	0.24	0.86	9.79	0.04	0.04	0.49	0.64	1.95	0.82	0.04	0.12	0.13	0.09	0.06	0.86	0.04	0.08
Fluoranthene	0.95	2.08	22.02	0.09	0.03	2.64	1.39	6.68	3.74	0.37	0.46	0.62	0.41	0.25	4.47	0.1	0.37
Pyrene	0.68	1.52	14.22	0.09	0.03	2.13	0.99	5.41	3.05	0.33	0.46	0.43	0.35	0.2	3.58	0.09	0.33
Benzo(a)anthracene	0.37	0.6	4.37	0.09	0.06	1.06	0.39	3.27	2	0.19	3.2	0.26	0.15	0.15	1.56	0.1	0.19
Chrysene	0.28	0.55	3.84	0.08	0.02	1.08	0.4	3.03	1.9	0.25	0.34	0.25	0.12	0.14	1.39	0.09	0.2
Benzo(b)fluoranthene	0.27	0.59	2.69	0.12	*0.05*	1.22	0.44	3.13	2.18	0.32	0.36	0.27	0.17	0.17	1.58	0.07	0.24
Benzo(k)fluoranthene	0.11	0.23	1.04	*0.05*	0.02	0.48	0.17	1.22	0.85	0.13	0.14	0.11	0.07	0.06	0.62	0.03	0.1
Benzo(a)pyrene (BaP)	0.21	0.51	1.89	0.11	0.04	1.03	0.35	2.74	1.91	0.24	0.28	0.21	0.12	0.14	1.38	*0.05*	0.2
Indeno(1,2,3-c,d)pyrene	0.15	0.34	0.97	0.09	0.04	0.68	0.23	1.56	1.11	0.15	0.18	0.14	0.07	0.08	0.78	0.04	0.17
Dibenzo(a,h)anthracene	0.04	0.06	0.4	0.04	0.04	0.14	*0.05*	0.42	0.32	0.04	0.04	0.04	0.04	0.04	0.15	0.04	0.04
Benzo(g,h,i)perylene	0.13	0.28	0.84	0.08	0.04	0.57	0.2	1.32	0.93	0.15	0.22	0.12	0.07	0.08	0.69	0.04	0.14
Total PAH	5.9	14	147.3	0.9	0.6	15.5	14.7	45.5	22	2.4	5.4	4.6	2.7	1.5	21.3	0.6	2.8
Coal Tar (BaP as surrogate)																	
BaP* (as surrogate for PAH)																	
PCB (sum of x Aroclors)																	
1,2 Dichloroethane																	
1,1,1 Trichloroethane (TCA)																	
1,1,1,2 Tetrachloroethane																	
1,1,2,2 Tetrachloroethane																	
Tetrachloroethene (PCE)*																	
Carbon Tetrachloride																	
Trichloroethene (TCE)*																	
Trichloromethane (Chloroform)																	
Vinyl Chloride (Chloroethene)*																	
Asbestos (Presence of)	Not-detected	Detected	Detected	Detected	Detected	Not-detected	Detected	Detected	Not-detected	Detected	Not-detected	Detected	Detected	Not-detected	Not-detected	Detected	Detected
Asbestos Analysts Comments		Fibre bundles	Fibre bundles	Fibre bundles	Fibre bundles		Fibre bundles	Fibre bundles		Fibre bundles		AIB, Fibre Bund	Fibre bundles			Fibre bundles	sulation Debr
Asbestos Fibre Count		Chry, Am, <0.1	Chry, <0.1%	Chry, <0.1%	Chry, <0.1%		Am, <0.1%	Am, <0.1%		Chry, <0.1%		Am, Chry	Chry, <0.1%			Chry, <0.1%	Chry

Assessment Criteria are the Suitable for Use Levels (S4ULs) punlished by LQM/CIEH (Copyright Land Quality Management

This is a summary table and it is possible that not all analytical results are reproduced. Whilst we endeavour to present the d

Land-use Scenarios - RwHP = Residential with Home Grown Produce, RwoHP = Residential without Home Grown Produce,

LOD = Limit of Detection. Results in italics are equal to or less than the LOD

This table should be read in conjunction with the accompanying guide on the selection of evaluation crtieria and the project sp

TABLE SUMMARISING SOIL RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE SOIL ASSESSMENT CRITERIA
HAVANT WRP - LP72 (LANDFILL WASTE ONLY)

			Strata	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LANDFILL	LF	LF	LF	LF
SOM 1%			**Assessment Criteria**	TP02	CP03	CP06	CP06	CP06	CP04	CP04	BHW001	BHW002	BHRP01	BHRP02
Analyte	**Units**	**LOD**	**Commercial**	3.50	4.80	2.50	5.00	7.00	4.50	7.00	2.10	1.20	13.80	14.00
Stones Content	%		-											
Arsenic*	mg/kg	1	640	**9.3**	**6.7**	**12.2**	**9.1**	**7.7**	**8.5**	**6.6**	6.8	0.7	9.5	4.3
Cadmium*	mg/kg	0.2	190	**1.4**	**9.1**	**1.6**	**3.9**	**4.2**	**0.8**	**0.1**	1.8	0.6	*0.2*	*0.2*
Chromium Trivalent	mg/kg	1	8600											
Chromium Hexavalent*	mg/kg	1.2	33	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.9**	0.1		0.1	0.1
Copper	mg/kg	1	68000	**100**	**328**	**66**	**210**	**1637**	**142**	**110**	80	52.2	23.4	6.6
Lead*	mg/kg	1	2300	**110**	**253**	**732**	**203**	**417**	**322**	**77**	108.3	189.3	20.1	2.4
Mercury	mg/kg	0.3	1100	**0.1**	*0.3*	**0.1**	**0.2**	**0.5**	**0.1**	**0.1**	0.5	0.5	0.5	0.5
Nickel	mg/kg	1	980	**30.3**	**32.7**	**86.7**	**47.8**	**146.9**	**21.4**	**18.3**	26.2	13.6	19.8	13
Selenium	mg/kg	1	12000	*1*	**2**	*1*	*1*	*1*	*1*	*1*	0.5	0.5	0.5	0.5
Zinc	mg/kg	1	730000	**431**	**1088**	**449**	**801**	**811**	**702**	**252**	217.6	246.1	222.8	31.7
Beryllium	mg/kg	0.5	12	**0.9**	**1.1**	**1.1**	**1.3**	**1.1**	**0.7**	**0.8**				
Boron	mg/kg		240000								1.3	4.1	2	0.6
Vanadium	mg/kg		9000	**93**	**22**	**32**	**43**	**35**	**16**	**24**				
Cyanide (Total)	mg/kg		-								0.5	3.5	0.7	0.6
Organic matter	mg/kg		-								6.16		3.19	0.32
Phenol, Total	mg/kg	0.2	440	**0.01**	**0.08**	**0.01**	**0.01**	**0.01**	**1.48**	**0.02**	0.74	3	1.05	0.47
Sulphate (Total) as SO4	mg/l		-	**553**	**903**	**692**	**677**	**637**	**53**	**4133**			4270	304
pH	pH Units		-	**7.8**	**7.71**	**7.82**	**7.97**	**8.01**	**7.07**	**7.72**	7.8	8.2	10.3	7.1
>C5 to C6 Aliphatic	mg/kg	0.001	3200	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**1**	**1**				
>C6 to C8 Aliphatic	mg/kg	0.001	7800	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**1**	**1**				
>C8 to C10 Aliphatic	mg/kg	0.001	2000	**1.6**	**0.3**	**0.3**	**0.5**	**1.4**	**3.2**	**3.6**				
>C10 to C12 Aliphatic	mg/kg	1	9700	**3.1**	**0.2**	**22.4**	**0.2**	**69.2**	**42.7**	**33.6**				
>C12 to C16 Aliphatic	mg/kg	2	59000	**5**	**18**	**43**	**4**	**84**	**61**	**29**				
>C16 to C21 Aliphatic	mg/kg	8	-	**29**	**80**	**86**	**7**	**58**	**237**	**27**				
>C21 to C35 Aliphatic	mg/kg	8	-	**153**	**279**	**848**	**48**	**673**	**596**	**165**				
>C16 to C35 Aliphatic	mg/kg	16	1600000	**182**		**934**		**731**	**833**	**192**				
>C35 to C44 Aliphatic	mg/kg		1600000	**39**	**98**	**109**	**7**	**144**	**89**	**72**				
Total Aliphatic C5-C35	mg/kg	10	-	**231**	**475**	**1109**	**49**	**1030**	**1029**	**330**				
>C5 to C7 Aromatic	mg/kg	0.001	26000	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**1**	**1**				
>C7 to C8 Aromatic	mg/kg	0.001	56000	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**1**	**1**				
>C8 to C10 Aromatic	mg/kg	0.001	3500	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**1.8**	**1.4**				
>C10 to C12 Aromatic	mg/kg	1	16000	**4.9**	**6.4**	**4.8**	**0.2**	**9.8**	**16.5**	**15.9**				
>C12 to C16 Aromatic	mg/kg	2	36000	**16**	**38**	**10**	**4**	**21**	**37**	**30**				
>C16 to C21 Aromatic	mg/kg	10	28000	**89**	**257**	**159**	**7**	**58**	**182**	**92**				
>C21 to C35 Aromatic	mg/kg	10	28000	**615**	**1073**	**699**	**61**	**538**	**719**	**399**				
>C35 to C44 Aromatic	mg/kg		28000	**129**	**326**	**75**	**7**	**86**	**188**	**227**				
Total Aromatic C5-C35	mg/kg		-	**854**	**1700**	**948**	**61**	**713**	**1144**	**765**				
TPH Ali/Aro	mg/kg		-	**1085**	**2175**	**2057**	**110**	**1743**	**2173**	**1095**	**2320**	**1480**	**7660**	**210**
EPH (C10-C40)	mg/kg		-											
Hazard Index - Commercial	-	-	-	**0.032**	**0.061**	**0.038**	**0.003**	**0.035**	**0.050**	**0.034**				
Hazard Index - Commercial	-	-	-	**0.032**	**0.061**	**0.038**	**0.003**	**0.035**	**0.050**	**0.034**				
Hazard Index - Commercial	-	-	-	**0.032**	**0.061**	**0.038**	**0.003**	**0.035**	**0.050**	**0.034**				
Benzene*	mg/kg	0.001	27	**0.005**	**0.008**	**0.005**	**0.005**	**0.005**	**0.05**	**0.05**	0.002	0.002	0.01	*0.001*
Ethylbenzene	mg/kg	0.001	5700	**0.005**	**0.009**	**0.014**	**0.006**	**0.025**	**0.398**	**0.242**	0.002	0.003	0.07	0.003
Toluene	mg/kg	0.001	56000	**0.005**	**0.008**	**0.005**	**0.012**	**0.012**	**0.05**	**0.05**	0.005	0.009	0.11	0.007
Xylene	mg/kg		6600											
M- & P-Xylene	mg/kg	0.001	-	**0.075**	**0.013**	**0.014**	**0.035**	**0.093**	**1.109**	**0.858**	0.004	0.007	0.108	0.005
O-Xylene	mg/kg	0.001	-	**0.023**	**0.005**	**0.01**	**0.009**	**0.03**	**0.299**	**0.237**	0.002	0.005	0.39	0.003
Total Xylene (M, P & O)	mg/kg	0.002	6600	**0.098**	**0.018**	**0.024**	**0.044**	**0.123**	**1.408**	**1.095**				
MTBE	mg/kg	0.001	-	**0.005**	**0.005**	**0.005**	**0.005**	**0.005**	**0.05**	**0.05**				
Naphthalene	mg/kg	0.05	190	**0.26**	**1.04**	**0.06**	**0.04**	**0.08**	**4.75**	**4.35**	8.53	0.26	0.76	0.1
Acenaphthylene	mg/kg	0.05	83000	**0.04**	**0.26**	**0.03**	**0.03**	**0.06**	**0.18**	**0.09**	8.53	0.14	0.11	0.1
Acenaphthene	mg/kg	0.05	84000	**0.17**	**6.27**	**0.15**	*0.05*	**0.08**	**2.57**	**2.08**	8.53	0.14	0.77	0.1
Fluorene	mg/kg	0.05	63000	**0.17**	**4.47**	**0.06**	**0.04**	**0.04**	**1.66**	**1.77**	8.53	0.22	0.87	0.1
Phenanthrene	mg/kg	0.05	22000	**0.94**	**10.99**	**0.15**	**0.03**	**0.29**	**4.13**	**4.88**	8.99	0.74	3.09	0.1
Anthracene	mg/kg	0.05	520000	**0.31**	**2.37**	**0.04**	**0.04**	**0.1**	**1.09**	**1.07**	8.53	0.14	0.6	0.1
Fluoranthene	mg/kg	0.05	23000	**1.58**	**9.71**	**0.15**	**0.03**	**0.94**	**2.75**	**3.24**	17.2	0.72	2.39	0.1
Pyrene	mg/kg	0.05	54000	**1.25**	**6.44**	**0.17**	**0.03**	**0.77**	**2.28**	**2.81**	18	0.63	2.04	0.1
Benzo(a)anthracene	mg/kg	0.05	170	**0.45**	**2.43**	**0.011**	**0.06**	**0.53**	**1.44**	**1.75**	8.53	0.32	0.71	0.1
Chrysene	mg/kg	0.05	350	**0.45**	**2.29**	**0.17**	**0.02**	**0.46**	**1.14**	**2.08**	8.56	0.38	0.89	0.1
Benzo(b)fluoranthene	mg/kg	0.05	44	**0.4**	**2.35**	**0.12**	*0.05*	**0.54**	**1.56**	**1.71**	9.8	0.56	0.8	0.1
Benzo(k)fluoranthene	mg/kg	0.05	1200	**0.15**	**0.91**	*0.05*	**0.02**	**0.21**	**0.6**	**0.66**	8.53	0.22	0.34	0.1
Benzo(a)pyrene (BaP)	mg/kg	0.05	35	**0.34**	**1.74**	**0.1**	**0.04**	**0.43**	**1.3**	**1.62**	10	0.33	0.68	0.1
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	500	**0.2**	**1.18**	**0.1**	**0.04**	**0.28**	**0.79**	**0.73**	8.53	0.22	0.31	0.1
Dibenzo(a,h)anthracene	mg/kg	0.05	3.5	**0.04**	**0.26**	**0.04**	**0.04**	**0.07**	**0.22**	**0.24**	8.53	0.14	0.11	0.1
Benzo(g,h,i)perylene	mg/kg	0.05	3900	**0.18**	**0.99**	**0.07**	**0.04**	**0.25**	**0.72**	**0.7**	8.53	0.26	0.39	0.1
Total PAH	mg/kg	0.8	-	**6.9**	**53.7**	**1.5**	**0.6**	**5.1**	**27.2**	**29.8**	158	5.39	14.9	1.56
Coal Tar (BaP as surrogate)	mg/kg	0.05	15											
BaP* (as surrogate for PAH)	mg/kg	0.05	77											
PCB (sum of x Aroclors)	mg/kg	0.3	-											
1,2 Dichloroethane	mg/kg	0.001	270											
1,1,1 Trichloroethane (TCA)	mg/kg	0.001	660											
1,1,1,2 Tetrachloroethane	mg/kg	0.001	110											
1,1,2,2 Tetrachloroethane	mg/kg	0.001	270											
Tetrachloroethene (PCE)*	mg/kg	0.001	24											
Carbon Tetrachloride	mg/kg		2.9											
Trichloroethene (TCE)*	mg/kg	0.001	0.73											
Trichloromethane (Chloroform)	mg/kg	0.001	99											
Vinyl Chloride (Chloroethene)*	mg/kg	0.001	1.1											
Asbestos (Presence of)	TEXT		-	Not-detected	Not-detected	Detected	Not-detected	Not-detected	Detected	Not-detected	Not-detected	Not-detected		
Asbestos Analysts Comments	TEXT		-	is		Cement Debris			Fibre bundles					
Asbestos Fibre Count	%					Chry			Chry, <0.1%					

Assessment Criteria are the Suitable for Use Levels (S4ULs) punlished by LQM/CIEH (Copyright Land Quality Management

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Land-use Scenarios - RwHP = Residential with Home Grown Produce, RwoHP = Residential without Home Grown Produce,

LOD = Limit of Detection. Results in italics are equal to or less than the LOD

This table should be read in conjunction with the accompanying guide on the selection of evaluation crtieria and the project sp

TABLE SUMMARISING SOIL RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE SOIL ASSESSMENT CRITERIA
HAVANT WRP - LP72 (NATURAL SOILS ONLY)

SOM 1%			Strata / Assessment Criteria				No. of Exceedances			RTD / RMD	CHALK	CHALK	CHALK	CHALK	CHALK	CHALK	ALV	ALV
										RO102	RO103	RO105	RO109	CP01	CP02A	CP03	BHW001	BHW002
Analyte	Units	LOD	Commercial	No. of Tests	Min	Max	Commercial	Commercial	Commercial	9.00	13.50	11.00	11.00	15.00	20.00	24.00	12.40	9.60
Stones Content	%		-															
Arsenic*	mg/kg	1	640	8	0.5	14				14		4.2	4.7	1.5	0.8	0.5	2.3	2.6
Cadmium*	mg/kg	0.2	190	8	0.2	0.9				0.2		0.3	0.9	0.3	0.3	0.3	0.2	0.2
Chromium Trivalent	mg/kg	1	8600															
Chromium Hexavalent*	mg/kg	1.2	33	8	0.1	1.2				1.2		1.2	1.2	0.3	0.3	0.3	0.1	0.2
Copper	mg/kg	1	68000	8	2	23				23		15	14	2	2	3	9.6	10.2
Lead*	mg/kg	1	2300	8	2.7	884.1				12		6.6	20	5	5	6	2.7	884.1
Mercury	mg/kg	0.3	1100	8	0.1	0.5				0.3		0.3	0.3	0.1	0.1	0.1	0.5	0.5
Nickel	mg/kg	1	980	8	0.1	33				33		15	10	5.5	3.2	0.1	19.2	10.9
Selenium	mg/kg	1	12000	5	0.5	1								1	1	1	0.5	0.5
Zinc	mg/kg	1	730000	8	9	170				42		37	170	15	9	15	16	17.2
Beryllium	mg/kg	0.5	12	3	0.5	0.5								0.5	0.5	0.5		
Boron	mg/kg		240000	2	0.5	1											0.5	1
Vanadium	mg/kg		9000	3	2	5								5	2	4		
Cyanide (Total)	mg/kg		-	2	0.5	0.6											0.5	0.6
Organic matter	mg/kg		-	2	0.25	0.74											0.25	0.74
Phenol, Total	mg/kg	0.2	440	5	0.01	0.44								0.01	0.01	0.01	0.4	0.44
Sulphate (Total) as SO4	mg/l		-	5	21	259								23	44	21	116	259
pH	pH Units		-	5	8.49	10.2								8.6	8.49	8.59	9.2	10.2
>C5 to C6 Aliphatic	mg/kg	0.001	3200	4	0.001	0.1					0.001			0.1	0.1	0.1		
>C6 to C8 Aliphatic	mg/kg	0.001	7800	4	0.001	0.1					0.001			0.1	0.1	0.1		
>C8 to C10 Aliphatic	mg/kg	0.001	2000	4	0.001	0.1					0.001			0.1	0.1	0.1		
>C10 to C12 Aliphatic	mg/kg	1	9700	4	0.2	1					1			0.2	0.2	0.2		
>C12 to C16 Aliphatic	mg/kg	2	59000	4	2	4					2			4	4	4		
>C16 to C21 Aliphatic	mg/kg	8	-	4	7	8					8			7	7	7		
>C21 to C35 Aliphatic	mg/kg	8	-	4	7	25					25			7	7	7		
>C16 to C35 Aliphatic	mg/kg	16	1600000	4	14	33					33			14	14	14		
>C35 to C44 Aliphatic	mg/kg		1600000	3	7	7								7	7	7		
Total Aliphatic C5-C35	mg/kg	10	-	4	26	26					26			26	26	26		
>C5 to C7 Aromatic	mg/kg	0.001	26000	4	0.001	0.1					0.001			0.1	0.1	0.1		
>C7 to C8 Aromatic	mg/kg	0.001	56000	4	0.001	0.1					0.001			0.1	0.1	0.1		
>C8 to C10 Aromatic	mg/kg	0.001	3500	4	0.001	0.1					0.001			0.1	0.1	0.1		
>C10 to C12 Aromatic	mg/kg	1	16000	4	0.2	1					1			0.2	0.2	0.2		
>C12 to C16 Aromatic	mg/kg	2	36000	4	2	4					2			4	4	4		
>C16 to C21 Aromatic	mg/kg	10	28000	4	7	10					10			7	7	7		
>C21 to C35 Aromatic	mg/kg	10	28000	4	7	10					10			7	7	7		
>C35 to C44 Aromatic	mg/kg		28000	3	7	7								7	7	7		
Total Aromatic C5-C35	mg/kg		-	3	26	26								26	26	26		
TPH Ali/Aro	mg/kg		-	5	15.5	66.4								52	52	52	15.5	66.4
EPH (C10-C40)	mg/kg		-															
Hazard Index - Commercial	-	-	-	4	0.0	0.0					0.001			0.001	0.001	0.001		
Hazard Index - Commercial	-	-	-	4	0.0	0.0					0.001			0.001	0.001	0.001		
Hazard Index - Commercial	-	-	-	4	0.0	0.0					0.001			0.001	0.001	0.001		
Benzene*	mg/kg	0.001	27	6	0.001	0.005					0.001			0.005	0.005	0.005	0.001	0.001
Ethylbenzene	mg/kg	0.001	5700	6	0.001	0.005					0.001			0.005	0.005	0.005	0.002	0.002
Toluene	mg/kg	0.001	56000	6	0.001	0.006					0.001			0.005	0.005	0.005	0.005	0.006
Xylene	mg/kg		6600															
M- & P-Xylene	mg/kg	0.001	-	6	0.001	0.005					0.001			0.005	0.005	0.005	0.004	0.005
O-Xylene	mg/kg	0.001	-	6	0.001	0.005					0.001			0.005	0.005	0.005	0.002	0.002
Total Xylene (M, P & O)	mg/kg	0.002	6600	4	0.002	0.01					0.002			0.01	0.01	0.01		
MTBE	mg/kg	0.001	-	4	0.001	0.005					0.001			0.005	0.005	0.005		
Naphthalene	mg/kg	0.05	190	8	0.04	0.09				0.05		0.05	0.05	0.04	0.04	0.04	0.09	0.09
Acenaphthylene	mg/kg	0.05	83000	8	0.03	0.09				0.05		0.05	0.05	0.03	0.03	0.03	0.09	0.09
Acenaphthene	mg/kg	0.05	84000	8	0.05	0.09				0.05		0.05	0.05	0.05	0.05	0.05	0.09	0.09
Fluorene	mg/kg	0.05	63000	8	0.04	0.09				0.05		0.05	0.05	0.04	0.04	0.04	0.09	0.09
Phenanthrene	mg/kg	0.05	22000	8	0.03	0.09				0.05		0.05	0.05	0.03	0.03	0.03	0.09	0.09
Anthracene	mg/kg	0.05	520000	8	0.04	0.09				0.05		0.05	0.05	0.04	0.04	0.04	0.09	0.09
Fluoranthene	mg/kg	0.05	23000	8	0.03	0.09				0.05		0.05	0.05	0.03	0.03	0.03	0.09	0.09
Pyrene	mg/kg	0.05	54000	8	0.03	0.09				0.05		0.05	0.05	0.03	0.03	0.03	0.09	0.09
Benzo(a)anthracene	mg/kg	0.05	170	8	0.05	0.09				0.05		0.05	0.05	0.06	0.06	0.06	0.09	0.09
Chrysene	mg/kg	0.05	350	8	0.02	0.09				0.05		0.05	0.05	0.02	0.02	0.02	0.09	0.09
Benzo(b)fluoranthene	mg/kg	0.05	44	8	0.05	0.09				0.05		0.05	0.05	0.05	0.05	0.05	0.09	0.09
Benzo(k)fluoranthene	mg/kg	0.05	1200	8	0.02	0.09				0.05		0.05	0.05	0.02	0.02	0.02	0.09	0.09
Benzo(a)pyrene (BaP)	mg/kg	0.05	35	8	0.04	0.09				0.05		0.05	0.05	0.04	0.04	0.04	0.09	0.09
Indeno(1,2,3-c,d)pyrene	mg/kg	0.05	500	8	0.04	0.09				0.05		0.05	0.05	0.04	0.04	0.04	0.09	0.09
Dibenzo(a,h)anthracene	mg/kg	0.05	3.5	8	0.04	0.09				0.05		0.05	0.05	0.04	0.04	0.04	0.09	0.09
Benzo(g,h,i)perylene	mg/kg	0.05	3900	8	0.04	0.09				0.05		0.05	0.05	0.04	0.04	0.04	0.09	0.09
Total PAH	mg/kg	0.8	-	8	0.6	1.38				0.8		0.8	0.8	0.6	0.6	0.6	1.38	1.38
Coal Tar (BaP as surrogate)	mg/kg	0.05	15	3	0.05	0.05				0.05		0.05	0.05					
BaP* (as surrogate for PAH)	mg/kg	0.05	77	3	0.05	0.05				0.05		0.05	0.05					
PCB (sum of x Aroclors)	mg/kg	0.3	-															
1,2 Dichloroethane	mg/kg	0.001	270															
1,1,1 Trichloroethane (TCA)	mg/kg	0.001	660															
1,1,1,2 Tetrachloroethane	mg/kg	0.001	110															
1,1,2,2 Tetrachloroethane	mg/kg	0.001	270															
Tetrachloroethene (PCE)*	mg/kg	0.001	24															
Carbon Tetrachloride	mg/kg		2.9															
Trichloroethene (TCE)*	mg/kg	0.001	0.73															
Trichloromethane (Chloroform)	mg/kg	0.001	99															
Vinyl Chloride (Chloroethene)*	mg/kg	0.001	1.1															
Asbestos (Presence of)	TEXT		-	5										Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analysts Comments	TEXT		-															
Asbestos Fibre Count	%																	

Assessment Criteria are the Suitable for Use Levels (S4ULs) punlished by LQM/CIEH (Copyright Land Quality Management Limited Reproduced with Permission; Publication Number S4UL3202. All Rights Reserved) unless the analyte is marked with *. Analytes identified with * the Assessment Criteria are Category 4 Screening Levels (C4SL)

This is a summary table and it is possible that not all analytical results are reproduced. Whilst we endeavour to present the data accurately errors can occur during transcribing. The laboratory certificate should be referred to as the authenticated and complete source of results

Land-use Scenarios - RwHP = Residential with Home Grown Produce, RwoHP = Residential without Home Grown Produce, POSresi = Public Open Space within residential, POSpark = Public Open Space not associated with residential

LOD = Limit of Detection. Results in italics are equal to or less than the LOD

This table should be read in conjunction with the accompanying guide on the selection of evaluation crtieria and the project specific note presenting the justification for selection.

Appendix H Geo-Environmental Laboratory Analyses (Groundwater and Landfill Leachate) – Summary Tables

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
HAVANT WRP - LP72 (H.1 - ALL GROUNDWATER / LEACHATE SAMPLES)

England & Wales Analyte	Units	LOD	Assessment Criteria MRV	Assessment Criteria Salt Water	No. of Tests	Min	Max	No. of Exceedences MRV	No. of Exceedences Salt Water	No. of Exceedences Salt Water	CP02A @ 8.5 23/03/2021	CP02A @ 9.0 20/04/2021	CP02A @ 9.0 04/05/2021	CP02A @ 17.0 04/05/2021	CP02A @ 18.0 19/05/2021	CP03 @ 5.0 20/04/2021	CP03 @ 8.0 23/03/2021	CP03 @ 8.0 04/05/2021	CP03 @ 8.0 19/05/2021	CP05 @ 8.0 04/05/2021	CP05 @ 8.50 20/04/2021	CP05 @ 8.70 23/03/2021	CP05 @ 9.00 18/05/2021	DS101 @ 9.50 20/04/2021	DS101 @ 9.75 19/05/2021	DS101 @ 11.20 23/03/2021	DS101 @ 14.95 04/05/2021	DS102 @ 11.00 20/04/2021	DS102 @ 11.00 04/05/2021
Alkalinity as $CaCO_3$	µg/l		-	-																									
Arsenic	µg/l	0.15	-	25	76	0.28	16.2				3.72	4.15	4.46	7.39	5.54	1.71	1.46	1.8	2.18	0.91	1.1	3.33	1.57	5.06	3.21	2.92	6.54	7.4	9.26
Boron	µg/l		-	-																									
Cadmium	µg/l	0.02	0.1	0.2	76	0.02	0.06				0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chromuim (Total)	µg/l	0.2	-	-	76	1.9	16				12	11	6	6.4	9.9	10	13	6.8	10	6	6.2	15	10	5.6	9.3	12	8	4.7	8.8
Chromium Trivalent	µg/l		-	-																									
Chromium Hexavalant	µg/l	5	-	0.6	76	5	5		76	76	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Copper	µg/l	0.5	-	3.76	76	0.5	37		56	56	2.4	5.6	6.3	11	16	3	1.7	3.3	8.9	6	9	1.4	9.9	4.6	5.1	1.5	8.7	8.9	8.4
Iron	µg/l		-	1000																									
Lead	µg/l	0.2	-	1.3	76	0.2	19		3	3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.2	0.2	0.2	0.3	0.2	0.2	0.2
Mercury	µg/l	0.05	0.01	0.07	76	0.05	0.87	76	6	6	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Manganese	µg/l		-	-																									
Nickel	µg/l	0.5	-	8.6	76	3	130		55	55	16	11	13	8.4	17	3	4.1	6.1	7	6.7	4.1	29	20	23	27	15	33	6.9	19
Selenium	µg/l		-	-																									
Zinc	µg/l	0.5	-	6.8	76	0.5	540		34	34	16	6.9	10	4.8	8.7	3.9	7.1	1.2	16	27	1.8	9.4	12	3.2	2.6	2.9	5	2	2.3
Ammoniacal Nitrogen as NH_4	µg/l	15	-	-	16	27	240000						69000					22000		73000							66000		160000
Ammoniacal Nitrogen as NH_3	µg/l	15	-	21	75	15	250000		74	74	45000	46000	66000	66000	95000	26000	26000	20000	23000	69000		55000	100000	85000	86000	87000	63000	150000	150000
Chloride	µg/l	150	-	-	75	28000	2900000				160000	580000	570000	650000	810000	170000	150000	150000	170000	140000		96000	230000	480000	510000	340000	460000	2900000	2600000
Chlorine	µg/l		-	10																									
Cyanide	µg/l		-	1																									
Nitrate as NO_3	µg/l	50	-	-	75	110	77800				520	11800	3320	1450	1100	1560	780	360	110	670		520	1000	1190	370	730	780	2900	1820
Nitrite as NO_2	µg/l	5	-	-	75	5	5300				5	380	33	100	9.2	5	21	5	5	5		5	5	5	5	43	5	5	5
Phenol	µg/l	0.05	-	7.7	14	0.05	2					0.05				0.05								0.05					
Pentachlorophenol	µg/l		0.1	0.4																									
PCBs	µg/l		0.001	-																									
Sodium	µg/l		-	-																									
Sulphate	µg/l	45	-	-	76	3940	217000				30800	47300	38600	44900	39600	8090	11100	6070	3940	6390	7630	11300	4490	9950	4900	17600	6310	12800	10800
pH	pH Units		-	-	76	6.7	7.4				6.9	7	6.9	6.9	6.8	6.7	6.8	6.8	6.8	6.8	6.7	6.7	6.9	6.9	6.9	7	6.9	6.8	6.8
Dichloromethane	µg/l		-	20																									
1,2 Dichloroethane	µg/l	1	1	10	14	1	1					1				1								1					
Trichloroethene (PCE)	µg/l	1	0.1	10	14	1	1	14				1				1								1					
1,1,1 Trichloroethane	µg/l	1	0.1	-	14	1	1	14				1				1								1					
1,1,2 Trichloroethane	µg/l	1	0.1	-	14	1	1	14				1				1								1					
Trichloromethane (Chloroform)	µg/l	1	0.1	2.5	14	1	1	14				1				1								1					
1,2,3 Trichlorobenzene	µg/l	1	-	-	14	1	1					1				1								1					
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	14	1	1	14				1				1								1					
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	0.4	14	2	2		14	14		2				2								2					
Tetrachloroethene	µg/l	1	0.1	10	14	1	1	14				1				1								1					
Tetrachloromethane	µg/l	1	0.1	12	14	1	1	14				1				1								1					
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	14	1	1					1				1								1					
2-chlorophenol	µg/l	0.05	0.1	-								0.05				0.05								0.05					
4-chloro-3-methylphenol	µg/l		0.1	-																									
Hexachlorobutadiene	µg/l	1	0.005	0.6				14	14	14		1				1								1					
Vinyl Chloride (Chloroethene)	µg/l	1	-	-	14	1	1					1				1								1					
>C5 to C6 Aliphatic	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C6 to C8 Aliphatic	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aliphatic	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aliphatic	µg/l	10	-	-	76	10	63				10	10	10	10	10	10	10	10	10	10	16	10	10	13	10	10	10	12	10
>C12 to C16 Aliphatic	µg/l	10	-	-	76	10	38				10	10	10	10	10	10	10	10	10	10	24	14	10	16	10	11	10	14	10
>C16 to C21 Aliphatic	µg/l	10	-	-	76	10	43				10	10	10	10	10	10	10	10	10	10	18	11	10	10	10	10	10	10	10
>C21 to C35 Aliphatic	µg/l	10	-	-	76	10	370				10	85	10	10	10	10	10	10	10	10	370	140	10	170	10	100	10	130	10
>C35 to C44 Aliphatic	µg/l		-	-																									
Total Aliphatic C5-35	µg/l		-	-																									
>C5 to C7 Aromatic	µg/l	1	-	-	76	1	11				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C7 to C8 Aromatic	µg/l	1	-	-	76	1	6.4				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aromatic	µg/l	1	-	-	76	1	140				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aromatic	µg/l	10	-	-	76	10	1700				10	90	10	10	120	10	10	10	10	10	130	53	55	140	18	130	10	350	10
>C12 to C16 Aromatic	µg/l	10	-	-	76	10	1200				10	170	10	10	290	10	10	10	10	10	200	74	140	230	64	190	10	400	10
>C16 to C21 Aromatic	µg/l	10	-	-	76	10	440				10	100	10	10	250	10	10	10	10	10	99	34	150	130	55	120	10	200	10
>C21 to C35 Aromatic	µg/l	10	-	-	76	10	810				10	260	10	10	10	10	10	10	10	10	520	220	10	480	10	250	10	530	10
>C35 to C44 Aromatic	µg/l		-	-																									
Total Aromatic C5-C35	µg/l		-	-																									
TPH Ali/Aro	µg/l		-	-																									
Benzene	µg/l	1	1	8	76	1	10.5	7	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ethylbenzene	µg/l	1	-	-	76	1	30.5				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Toluene	µg/l	1	4	74	76	1	6.4	4			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Xylene	µg/l		3	30																									
M- & P-Xylene	µg/l	1	-	-	76	1	60.7				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
O-Xylene	µg/l	1	-	-	76	1	9				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total Xylene (M, P & O)	µg/l	2	-	30	72		2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
MTBE	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
naphthalene	µg/l	0.01	-	2	76	0.01	14.8		10	10	0.01	1	1.29	0.01	0.01	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1	0.01	14.8	0.01	0.01	0.01
acenaphthylene	µg/l	0.01	-	-	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
acenaphthene	µg/l	0.01	-	-	76	0.01	6.81				0.32	0.01	4.02	0.01	2.17	0.01	0.42	0.01	0.01	0.01	2.33	1.87	0.01	0.01	0.01	3.82	0.01	0.01	0.01
fluorene	µg/l	0.01	-	-	76	0.01	2.9				0.22	0.01	1.81	0.01	0.74	0.01	0.01	0.01	0.01	0.01	1.22	0.95	0.01	0.01	0.01	2.24	0.01	0.01	0.01
phenanthrene	µg/l	0.01	-	-	76	0.01	3.9				0.01	0.01	1.56	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.23	0.01	0.01	0.01	3.15	0.01	0.01	0.01
anthracene	µg/l	0.01	-	0.1	76	0.01	0.69		6	6	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.45	0.01	0.01	0.01
fluoranthene	µg/l	0.01	-	0.0063	76	0.01	1.3		76	76	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.71	0.01	0.01	0.01
pyrene	µg/l	0.01	-	-	76	0.01	1				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.46	0.01	0.01	0.01
benzo(a)anthracene	µg/l	0.01	-	-	76	0.01	0.36				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
chrysene	µg/l	0.01	-	-	76	0.01	0.28				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(b)fluoranthene	µg/l	0.01	-	0.017	76	0.01	0.28		1	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(k)fluoranthene	µg/l	0.01	-	0.017	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(a)pyrene	µg/l	0.01	-	0.00017	76	0.01	0.47		76	76	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(g,h,i)perylene	µg/l	0.01	-	0.00082	76	0.01	0.01		76	76	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
dibenzo(ah)anthracene	µg/l	0.01	-	-	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	-	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	-	76	0.04	0.31				0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total PAH	µg/l	0.16	-	-	76	0.16	25.6				0.54	0.16	8.68	0.16	2.91	0.16	0.42	0.16	0.16	0.16	3.55	3.05	0.16	0.16	0.16	25.6	0.16	0.16	0.16

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
HAVANT WRP - LP72 (H.1 - ALL GROUNDWATER / LEACHATE SAMPLES)

England & Wales			Assessment Criteria		No. of Tests	Min	Max	No. of Exceedences			DS102 @ 11.20	DS102 @ 11.50	DS103 @ 9.70	DS103 @ 11.00	DS103 @ 11.00	DS103 @ 11.00	RO101 @ 9.00	RO101 @ 14.30	RO101 @ 9.00	RO101 @ 15.50	RO101 @ 15.00	RO101 @ 9.50	RO101 @ 16.00	RO102 @ 9.00	RO102 @ 15.00	RO102 @ 15.00	RO102 @ 15.00	RO102 @ 15.50	RO103 @ 8.10
Analyte	Units	LOD	MRV	Salt Water				MRV	Salt Water	Salt Water	23/03/2021	19/05/2021	23/03/2021	20/04/2021	04/05/2021	19/05/2021	22/03/2021	22/03/2021	20/04/2021	20/04/2021	04/05/2021	19/05/2021	18/05/2021	22/03/2021	22/03/2021	20/04/2021	04/05/2021	18/05/2021	22/03/2021
Alkalinity as $CaCO_3$	µg/l		-	-																									
Arsenic	µg/l	0.15	-	25	76	0.28	16.2				16.2	12.7	6.12	2.77	4.68	2.17	10.3	10.5	7.5	2.8	15.1	9.12	5.75	7.05	1.09	2.32	1.84	1.35	6.66
Boron	µg/l		-	-																									
Cadmium	µg/l	0.02	0.1	0.2	76	0.02	0.06				0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.03	0.02
Chromuim (Total)	µg/l	0.2	-	-	76	1.9	16				13	13	9.9	7.6	6.4	11	12	16	8.1	4.6	5.9	9.7	6.6	16	4.6	7.6	5.2	7.2	12
Chromium Trivalent	µg/l		-	-																									
Chromium Hexavalant	µg/l	5	-	0.6	76	5	5		76	76	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Copper	µg/l	0.5	-	3.76	76	0.5	37		56	56	7	30	3.6	0.5	3.9	11	6.1	9.1	8.1	14	9.8	37	17	7.1	5.8	7.9	4.4	8.4	5.6
Iron	µg/l		-	1000																									
Lead	µg/l	0.2	-	1.3	76	0.2	19		3	3	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.7	0.2	0.4
Mercury	µg/l	0.05	0.01	0.07	76	0.05	0.87	76	6	6	0.05	0.05	0.19	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Manganese	µg/l		-	-																									
Nickel	µg/l	0.5	-	8.6	76	3	130		55	55	130	20	37	17	13	20	15	60	6.2	6.9	9.8	11	27	52	9.2	23	19	20	9.2
Selenium	µg/l		-	-																									
Zinc	µg/l	0.5	-	6.8	76	0.5	540		34	34	5.4	7.5	13	4.7	4.3	13	5.3	18	5.5	2.5	0.5	7.7	19	7.1	19	190	230	43	2.8
Ammoniacal Nitrogen as NH_4	µg/l	15	-	-	16	27	240000								120000		40000				93000				3600				49000
Ammoniacal Nitrogen as NH_3	µg/l	15	-	21	75	15	250000		74	74	170000	190000	76000	130000	110000	140000	38000	140000	39000	73000	88000	89000	81000	250000	3400	33000	14000	41000	46000
Chloride	µg/l	150	-	-	75	28000	2900000				2100000	1900000	460000	350000	330000	430000	250000	450000	320000	630000	770000	330000	1000000	560000	280000	310000	120000	200000	340000
Chlorine	µg/l		-	10																									
Cyanide	µg/l		-	1																									
Nitrate as NO_3	µg/l	50	-	-	75	110	77800				1920	1840	730	1300	990	1210	830	1040	1820	1760	2540	2100	1310	1090	10500	3320	8710	10800	670
Nitrite as NO_2	µg/l	5	-	-	75	5	5300				66	5	50	5	5	5	5	5	5	5	5	5	5	5	70	1800	410	5300	5
Phenol	µg/l	0.05	-	7.7	14	0.05	2				0.05						0.05	0.05								0.05			0.05
Pentachlorophenol	µg/l		0.1	0.4																									
PCBs	µg/l		0.001	-																									
Sodium	µg/l		-	-																									
Sulphate	µg/l	45	-	-	76	3940	217000				23800	5980	12200	16400	15700	10100	24700	23200	28200	49700	58700	4550	110000	15300	67500	48100	38000	30200	127000
pH	pH Units		-	-	76	6.7	7.4				7.1	6.8	7.1	6.9	6.9	6.8	6.8	6.9	6.9	6.9	6.8	6.8	6.8	6.8	7	6.8	6.9	7	6.7
Dichloromethane	µg/l		-	20																									
1,2 Dichloroethane	µg/l	1	1	10	14	1	1				1						1	1								1			1
Trichloroethene (PCE)	µg/l	1	0.1	10	14	1	1	14			1						1	1								1			1
1,1,1 Trichloroethane	µg/l	1	0.1	-	14	1	1	14			1						1	1								1			1
1,1,2 Trichloroethane	µg/l	1	0.1	-	14	1	1	14			1						1	1								1			1
Trichloromethane (Chloroform)	µg/l	1	0.1	2.5	14	1	1	14			1						1	1								1			1
1,2,3 Trichlorobenzene	µg/l	1	-	-	14	1	1				1						1	1								1			1
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	14	1	1	14			1						1	1								1			1
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	0.4	14	2	2		14	14	2						2	2								2			2
Tetrachloroethene	µg/l	1	0.1	10	14	1	1	14			1						1	1								1			1
Tetrachloromethane	µg/l	1	0.1	12	14	1	1	14			1						1	1								1			1
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	14	1	1				1						1	1								1			1
2-chlorophenol	µg/l	0.05	0.1	-							0.05						0.05	0.05								0.05			0.05
4-chloro-3-methylphenol	µg/l		0.1	-																									
Hexachlorobutadiene	µg/l	1	0.005	0.6				14	14	14	1						1	1								1			1
Vinyl Chloride (Chloroethene)	µg/l	1	-	-	14	1	1				1						1	1								1			1
>C5 to C6 Aliphatic	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C6 to C8 Aliphatic	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aliphatic	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aliphatic	µg/l	10	-	-	76	10	63				10	10	10	42	10	10	10	10	34	63	10	10	10	16	10	10	10	10	14
>C12 to C16 Aliphatic	µg/l	10	-	-	76	10	38				20	10	10	18	10	10	11	17	21	21	10	10	10	25	10	10	10	10	22
>C16 to C21 Aliphatic	µg/l	10	-	-	76	10	43				32	10	12	10	10	10	13	13	10	12	10	10	10	25	10	10	10	10	43
>C21 to C35 Aliphatic	µg/l	10	-	-	76	10	370				150	10	95	190	10	10	160	130	10	160	10	10	10	240	10	92	10	10	200
>C35 to C44 Aliphatic	µg/l		-	-																									
Total Aliphatic C5-35	µg/l		-	-																									
>C5 to C7 Aromatic	µg/l	1	-	-	76	1	11				1	1	1	1	1	1	9.1	5.9	7.1	1	1	11	1	4	1	1	1	1	3.9
>C7 to C8 Aromatic	µg/l	1	-	-	76	1	6.4				1	1	1	1	1	1	6.4	6.4	4.4	1	1	4.4	1	1	1	1	1	1	2
>C8 to C10 Aromatic	µg/l	1	-	-	76	1	140				1	1	1	1	1	1	33	5.8	4.8	1	1	16	1	9.2	1	1	1	1	110
>C10 to C12 Aromatic	µg/l	10	-	-	76	10	1700				230	91	65	160	10	78	350	250	640	1700	10	620	64	350	10	80	10	10	490
>C12 to C16 Aromatic	µg/l	10	-	-	76	10	1200				270	220	88	150	10	200	250	380	400	530	10	1200	180	430	10	140	10	10	260
>C16 to C21 Aromatic	µg/l	10	-	-	76	10	440				130	150	51	67	10	170	120	150	110	220	10	440	120	200	10	78	10	10	170
>C21 to C35 Aromatic	µg/l	10	-	-	76	10	810				280	10	200	320	10	10	270	300	10	600	10	10	10	430	10	10	10	10	410
>C35 to C44 Aromatic	µg/l		-	-																									
Total Aromatic C5-C35	µg/l		-	-																									
TPH Ali/Aro	µg/l		-	-																									
Benzene	µg/l	1	1	8	76	1	10.5	7	2	2	1	1	1	1	1	1	9.1	5.9	7.1	1	1	10.5	1	1	1	1	1	1	3.9
Ethylbenzene	µg/l	1	-	-	76	1	30.5				1	1	1	1	1	1	4.2	1	1	1	1	2.5	1	1	1	1	1	1	24.6
Toluene	µg/l	1	4	74	76	1	6.4	4			1	1	1	1	1	1	6.4	6.4	4.4	1	1	4.4	1	1	1	1	1	1	2
Xylene	µg/l		3	30																									
M- & P-Xylene	µg/l	1	-	-	76	1	60.7				1	1	1	1	1	1	7.5	1.9	1	1	1	4.4	1	1	1	1	1	1	47.5
O-Xylene	µg/l	1	-	-	76	1	9				1	1	1	1	1	1	1.8	1	1	1	1	1	1	1	1	1	1	1	6.6
Total Xylene (M, P & O)	µg/l	2	-	30	72		2				2	2	2	2	2	2		1	2	2	2	1	2	2	2	2	2	2	
MTBE	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
naphthalene	µg/l	0.01	-	2	76	0.01	14.8		10	10	0.93	0.01	0.65	2.22	0.01	0.01	9.7	0.74	10.2	0.42	0.78	5.11	0.01	2.68	0.01	1	0.01	0.01	1.3
acenaphthylene	µg/l	0.01	-	-	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
acenaphthene	µg/l	0.01	-	-	76	0.01	6.81				0.72	2.22	0.85	5.08	0.01	6.81	3.2	1.4	1.81	0.97	3.63	1.2	6.45	1.32	0.01	0.01	0.01	0.01	0.4
fluorene	µg/l	0.01	-	-	76	0.01	2.9				0.44	1.1	0.56	2.15	0.01	1.74	1.9	0.4	0.93	0.38	1.52	0.61	2.88	0.76	0.01	0.01	0.01	0.01	0.25
phenanthrene	µg/l	0.01	-	-	76	0.01	3.9				0.53	1	0.77	2.28	0.01	0.01	1.9	0.01	0.47	0.01	0.35	0.73	0.55	0.62	0.01	0.01	0.01	0.01	0.67
anthracene	µg/l	0.01	-	0.1	76	0.01	0.69		6	6	0.01	0.01	0.01	0.23	0.01	0.01	0.21	0.01	0.01	0.01	0.01	0.01	0.01	0.23	0.01	0.01	0.01	0.01	0.01
fluoranthene	µg/l	0.01	-	0.0063	76	0.01	1.3		76	76	0.01	0.01	0.01	0.33	0.01	0.01	0.36	0.01	0.01	0.01	0.01	0.01	0.01	0.32	0.01	0.01	0.01	0.01	0.75
pyrene	µg/l	0.01	-	-	76	0.01	1				0.01	0.01	0.01	0.25	0.01	0.01	0.28	0.01	0.01	0.01	0.01	0.01	0.01	0.23	0.01	0.01	0.01	0.01	0.69
benzo(a)anthracene	µg/l	0.01	-	-	76	0.01	0.36				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
chrysene	µg/l	0.01	-	-	76	0.01	0.28				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(b)fluoranthene	µg/l	0.01	-	0.017	76	0.01	0.28		1	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(k)fluoranthene	µg/l	0.01	-	0.017	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(a)pyrene	µg/l	0.01	-	0.00017	76	0.01	0.47		76	76	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(g,h,i)perylene	µg/l	0.01	-	0.00082	76	0.01	0.01		76	76	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
dibenzo(ah)anthracene	µg/l	0.01	-	-	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	-	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	-	76	0.04	0.31				0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total PAH	µg/l	0.16	-	-	76	0.16	25.6				2.62	4.32	2.83	12.5	0.16	8.55	17.5	2.49	13.4	1.77	6.28	7.65	9.88	6.16	0.16	0.16	0.16	0.16	4.07

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
HAVANT WRP - LP72 (H.1 - ALL GROUNDWATER / LEACHATE SAMPLES)

England & Wales			Assessment Criteria		No. of Tests	Min	Max	No. of Exceedences			RO103 @ 15.90	RO103 @ 8.50	RO103 @ 16.00	RO103 @ 15.00	RO103 @ 8.80	RO103 @ 16.00	RO104 @ 15.20	RO104 @ 9.00	RO104 @ 16.50	RO104 @ 16.00	RO104 @ 9.75	RO104 @ 16.00	RO105 @ 9.23	RO105 @ 14.90	RO105 @10.00	RO105 @ 14.50	RO105 @ 15.00	RO105 @10.00	RO105 @ 15.50
Analyte	Units	LOD	MRV	Salt Water				MRV	Salt Water	Salt Water	22/03/2021	20/04/2021	20/04/2021	04/05/2021	19/05/2021	19/05/2021	23/03/2021	20/04/2021	20/04/2021	04/05/2021	19/05/2021	19/05/2021	23/03/2021	23/03/2021	20/04/2021	20/04/2021	04/05/2021	19/05/2021	19/05/2021
Alkalinity as $CaCO_3$	µg/l		-	-																									
Arsenic	µg/l	0.15	-	25	76	0.28	16.2				2.7	6.41	5.52	2.6	10.5	1.29	1.52	5.88	1.71	0.66	12	0.28	1.06	0.65	1.57	5.13	7.74	0.49	6.05
Boron	µg/l		-	-																									
Cadmium	µg/l	0.02	0.1	0.2	76	0.02	0.06				0.02	0.02	0.02	0.02	0.03	0.02	0.06	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.02	0.02
Chromuim (Total)	µg/l	0.2	-	-	76	1.9	16				2.7	10	2.4	2.1	8.2	2.9	3.1	7.6	10	1.9	11	2.4	14	6.6	11	9.6	5.8	9	6.5
Chromium Trivalent	µg/l		-	-																									
Chromium Hexavalant	µg/l	5	-	0.6	76	5	5		76	76	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Copper	µg/l	0.5	-	3.76	76	0.5	37		56	56	1.6	8.3	12	1.1	18	5.7	2.3	13	11	0.6	23	2.7	1.6	3.4	8.5	9.4	1.7	8.5	2.8
Iron	µg/l		-	1000																									
Lead	µg/l	0.2	-	1.3	76	0.2	19		3	3	2.2	0.5	0.2	0.2	0.2	0.2	19	0.3	0.2	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Mercury	µg/l	0.05	0.01	0.07	76	0.05	0.87	76	6	6	0.08	0.05	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Manganese	µg/l		-	-																									
Nickel	µg/l	0.5	-	8.6	76	3	130		55	55	5.9	11	5.1	5.3	13	5.1	5	9.1	8.7	3.9	25	3.8	7.8	34	7.6	19	10	10	14
Selenium	µg/l		-	-																									
Zinc	µg/l	0.5	-	6.8	76	0.5	540		34	34	23	3.3	3.1	4.7	38	8.6	34	4.8	4.4	5.5	13	7.5	5.4	41	4.5	3.4	1.7	26	5.5
Ammoniacal Nitrogen as NH_4	µg/l	15	-	-	16	27	240000							27			150						83000				27000		
Ammoniacal Nitrogen as NH_3	µg/l	15	-	21	75	15	250000		74	74	15	110000	120	26	120000	100	140	180000	44	120	190000	85	78000	28000	65000	44000	26000	74000	25000
Chloride	µg/l	150	-	-	75	28000	2900000				170000	840000	140000	71000	750000	63000	110000	420000	32000	28000	410000	28000	170000	91000	200000	160000	100000	150000	86000
Chlorine	µg/l		-	10																									
Cyanide	µg/l		-	1																									
Nitrate as NO_3	µg/l	50	-	-	75	110	77800				620	1250	310	2390	53600	77800	8400	1040	3010	21300	1520	23200	520	10700	830	1400	360	1310	680
Nitrite as NO_2	µg/l	5	-	-	75	5	5300				5	5	5	290	5	400	110	5	230	120	5	60	16	4500	5	5	5	5	5
Phenol	µg/l	0.05	-	7.7	14	0.05	2				0.05							2							0.05				
Pentachlorophenol	µg/l		0.1	0.4																									
PCBs	µg/l		0.001	-																									
Sodium	µg/l		-	-																									
Sulphate	µg/l	45	-	-	76	3940	217000				42200	6570	27800	13000	6490	9130	73900	6420	27200	25500	5830	22200	17800	39300	10900	4760	15200	5750	13600
pH	pH Units		-	-	76	6.7	7.4				7.2	6.8	7.3	7.3	6.9	7.4	7.4	7	7.3	7.2	6.9	7.4	6.8	7	6.9	6.9	7	7	7
Dichloromethane	µg/l		-	20																									
1,2 Dichloroethane	µg/l	1	1	10	14	1	1				1							1							1				
Trichloroethene (PCE)	µg/l	1	0.1	10	14	1	1	14			1							1							1				
1,1,1 Trichloroethane	µg/l	1	0.1	-	14	1	1	14			1							1							1				
1,1,2 Trichloroethane	µg/l	1	0.1	-	14	1	1	14			1							1							1				
Trichloromethane (Chloroform)	µg/l	1	0.1	2.5	14	1	1	14			1							1							1				
1,2,3 Trichlorobenzene	µg/l	1	-	-	14	1	1				1							1							1				
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	14	1	1	14			1							1							1				
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	0.4	14	2	2		14	14	2							2							2				
Tetrachloroethene	µg/l	1	0.1	10	14	1	1	14			1							1							1				
Tetrachloromethane	µg/l	1	0.1	12	14	1	1	14			1							1							1				
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	14	1	1				1							1							1				
2-chlorophenol	µg/l	0.05	0.1	-							0.05							0.05							0.05				
4-chloro-3-methylphenol	µg/l		0.1	-																									
Hexachlorobutadiene	µg/l	1	0.005	0.6				14	14	14	1							1							1				
Vinyl Chloride (Chloroethene)	µg/l	1	-	-	14	1	1				1							1							1				
>C5 to C6 Aliphatic	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C6 to C8 Aliphatic	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aliphatic	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aliphatic	µg/l	10	-	-	76	10	63				10	12	10	10	10	10	13	19	10	10	10	10	10	10	10	10	10	10	10
>C12 to C16 Aliphatic	µg/l	10	-	-	76	10	38				10	17	10	10	10	10	21	18	10	10	10	10	18	10	11	10	10	10	10
>C16 to C21 Aliphatic	µg/l	10	-	-	76	10	43				10	10	10	10	10	10	26	13	10	10	10	10	16	10	10	10	10	10	10
>C21 to C35 Aliphatic	µg/l	10	-	-	76	10	370				10	100	10	10	10	10	160	220	10	10	10	10	150	10	100	10	10	10	10
>C35 to C44 Aliphatic	µg/l		-	-																									
Total Aliphatic C5-35	µg/l		-	-																									
>C5 to C7 Aromatic	µg/l	1	-	-	76	1	11				1	4.5	1	1	5.6	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C7 to C8 Aromatic	µg/l	1	-	-	76	1	6.4				1	1.8	1	1	2.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aromatic	µg/l	1	-	-	76	1	140				1	70	1	1	140	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aromatic	µg/l	10	-	-	76	10	1700				10	480	10	10	270	10	55	320	10	10	72	10	95	10	120	10	10	24	10
>C12 to C16 Aromatic	µg/l	10	-	-	76	10	1200				10	330	10	10	290	10	110	380	10	10	150	10	130	10	170	10	10	64	10
>C16 to C21 Aromatic	µg/l	10	-	-	76	10	440				10	200	10	10	230	10	99	240	10	10	140	10	73	10	110	10	10	73	10
>C21 to C35 Aromatic	µg/l	10	-	-	76	10	810				10	570	10	10	10	10	480	660	10	10	10	10	260	10	440	10	10	10	10
>C35 to C44 Aromatic	µg/l		-	-																									
Total Aromatic C5-C35	µg/l		-	-																									
TPH Ali/Aro	µg/l		-	-																									
Benzene	µg/l	1	1	8	76	1	10.5	7	2	2	1	4.5	1	1	5.6	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ethylbenzene	µg/l	1	-	-	76	1	30.5				1	17.8	1	1	30.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Toluene	µg/l	1	4	74	76	1	6.4	4			1	1.8	1	1	2.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Xylene	µg/l		3	30																									
M- & P-Xylene	µg/l	1	-	-	76	1	60.7				1	29.7	1	1	60.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1
O-Xylene	µg/l	1	-	-	76	1	9				1	5.3	1	1	9	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total Xylene (M, P & O)	µg/l	2	-	30	72		2				2		2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2
MTBE	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
naphthalene	µg/l	0.01	-	2	76	0.01	14.8		10	10	1	0.99	0.01	0.01	4.26	0.01	0.01	0.43	0.01	0.01	0.01	0.01	0.01	0.01	1	0.01	0.01	0.01	0.01
acenaphthylene	µg/l	0.01	-	-	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
acenaphthene	µg/l	0.01	-	-	76	0.01	6.81				0.01	0.01	0.01	0.01	0.85	0.01	0.01	0.67	0.01	0.01	0.01	0.01	1.16	0.38	0.01	0.01	0.83	1.58	0.01
fluorene	µg/l	0.01	-	-	76	0.01	2.9				0.01	0.01	0.01	0.01	0.34	0.01	0.01	0.47	0.01	0.01	0.01	0.01	0.56	0.2	0.01	0.01	0.52	0.76	0.01
phenanthrene	µg/l	0.01	-	-	76	0.01	3.9				0.01	0.01	0.01	0.01	0.44	0.01	0.01	0.37	0.01	0.01	0.01	0.01	0.33	0.01	0.01	0.01	0.51	0.88	0.01
anthracene	µg/l	0.01	-	0.1	76	0.01	0.69		6	6	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
fluoranthene	µg/l	0.01	-	0.0063	76	0.01	1.3		76	76	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
pyrene	µg/l	0.01	-	-	76	0.01	1				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(a)anthracene	µg/l	0.01	-	-	76	0.01	0.36				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
chrysene	µg/l	0.01	-	-	76	0.01	0.28				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(b)fluoranthene	µg/l	0.01	-	0.017	76	0.01	0.28		1	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(k)fluoranthene	µg/l	0.01	-	0.017	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(a)pyrene	µg/l	0.01	-	0.00017	76	0.01	0.47		76	76	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(g,h,i)perylene	µg/l	0.01	-	0.00082	76	0.01	0.01		76	76	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
dibenzo(ah)anthracene	µg/l	0.01	-	-	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	-	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	-	76	0.04	0.31				0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total PAH	µg/l	0.16	-	-	76	0.16	25.6				0.16	0.99	0.16	0.16	5.89	0.16	0.16	1.94	0.16	0.16	0.16	0.16	2.05	0.58	0.16	0.16	1.86	3.22	0.16

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
HAVANT WRP - LP72 (H.1 - ALL GROUNDWATER / LEACHATE SAMPLES)

England & Wales			Assessment Criteria		No. of Tests	Min	Max	No. of Exceedences			RO106 @ 12.30	RO106 @ 16.60	RO106 @ 12.50	RO106 @ 16.00	RO106 @ 17.00	RO106 @ 17.00	RO106 @ 18.00	RO107 @ 14.80	RO107 @ 15.00	RO107 @ 15.00	RO107 @ 15.00	RO108 @13.10	RO108 @ 13.00	RO108 @ 14.00	RO108 @13.25	RO109 @ 14.00	RO109 @ 14.50	RO109 @ 14.50	RO109 @ 14.50
Analyte	Units	LOD	MRV	Salt Water				MRV	Salt Water	Salt Water	23/03/2021	23/03/2021	20/04/2021	20/04/2021	04/05/2021	19/05/2021	19/05/2021	23/03/2021	20/04/2021	05/05/2021	18/05/2021	23/03/2021	20/04/2021	04/05/2021	18/05/2021	04/05/2021	23/03/2021	20/04/2021	19/05/2021
Alkalinity as $CaCO_3$	µg/l		-	-																									
Arsenic	µg/l	0.15	-	25	76	0.28	16.2				3.24	4.41	1.44	5.53	13.3	10.8	2.78	9.24	8.71	8.73	4.45	2.69	4.03	2.48	1.32	0.73	2.83	1.17	0.55
Boron	µg/l		-	-																									
Cadmium	µg/l	0.02	0.1	0.2	76	0.02	0.06				0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chromuim (Total)	µg/l	0.2	-	-	76	1.9	16				14	5.5	5	5	4.3	5.8	14	3.5	4.1	3.3	4.1	6.9	6.9	4	3.6	3.1	5.6	4.2	3.5
Chromium Trivalent	µg/l		-	-																									
Chromium Hexavalant	µg/l	5	-	0.6	76	5	5		76	76	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Copper	µg/l	0.5	-	3.76	76	0.5	37		56	56	2.7	3.2	13	4.3	2.7	5.4	11	9.7	16	15	15	7	6.1	6.4	4.4	5.4	4.4	5.1	4.3
Iron	µg/l		-	1000																									
Lead	µg/l	0.2	-	1.3	76	0.2	19		3	3	0.2	2.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Mercury	µg/l	0.05	0.01	0.07	76	0.05	0.87	76	6	6	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.56	0.83	0.87	0.58	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Manganese	µg/l		-	-																									
Nickel	µg/l	0.5	-	8.6	76	3	130		55	55	10	20	3.8	40	35	28	12	20	24	19	15	20	24	13	8.3	12	29	14	10
Selenium	µg/l		-	-																									
Zinc	µg/l	0.5	-	6.8	76	0.5	540		34	34	6.5	540	0.5	6.1	0.5	5.4	35	4.4	8.8	5	5.5	9.2	6.1	3.4	2.5	7	9.1	4.9	5
Ammoniacal Nitrogen as NH_4	µg/l	15	-	-	16	27	240000				240000															15000			
Ammoniacal Nitrogen as NH_3	µg/l	15	-	21	75	15	250000		74	74	220000	17000	180000	23000	13000	12000	230000	230	120	40	110	47000	43000	17000	3500	14000	25000	19000	10000
Chloride	µg/l	150	-	-	75	28000	2900000				510000	420000	500000	540000	480000	490000	630000	1300000	2300000	1200000	930000	410000	370000	330000	270000	87000	150000	120000	83000
Chlorine	µg/l		-	10																									
Cyanide	µg/l		-	1																									
Nitrate as NO_3	µg/l	50	-	-	75	110	77800				990	930	1450	880	420	790	1370	7730	10600	11000	8510	1820	1040	13600	22900	31000	11700	25700	32400
Nitrite as NO_2	µg/l	5	-	-	75	5	5300				5	28	5	5	5	5	5	190	5	8	25	330	44	330	770	630	510	380	1100
Phenol	µg/l	0.05	-	7.7	14	0.05	2				0.05								0.05								0.05		
Pentachlorophenol	µg/l		0.1	0.4																									
PCBs	µg/l		0.001	-																									
Sodium	µg/l		-	-																									
Sulphate	µg/l	45	-	-	76	3940	217000				9270	97500	9740	48500	37900	22800	6700	208000	217000	165000	184000	63100	51400	54100	50300	19900	20500	20600	18000
pH	pH Units		-	-	76	6.7	7.4				6.9	7.2	6.9	7.1	7	7	7	7.2	7.3	7.2	7.3	7	7	7.1	7.2	7.1	7	7	7.1
Dichloromethane	µg/l		-	20																									
1,2 Dichloroethane	µg/l	1	1	10	14	1	1				1								1								1		
Trichloroethene (PCE)	µg/l	1	0.1	10	14	1	1	14			1								1								1		
1,1,1 Trichloroethane	µg/l	1	0.1	-	14	1	1	14			1								1								1		
1,1,2 Trichloroethane	µg/l	1	0.1	-	14	1	1	14			1								1								1		
Trichloromethane (Chloroform)	µg/l	1	0.1	2.5	14	1	1	14			1								1								1		
1,2,3 Trichlorobenzene	µg/l	1	-	-	14	1	1				1								1								1		
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	14	1	1	14			1								1								1		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	0.4	14	2	2		14	14	2								2								2		
Tetrachloroethene	µg/l	1	0.1	10	14	1	1	14			1								1								1		
Tetrachloromethane	µg/l	1	0.1	12	14	1	1	14			1								1								1		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	14	1	1				1								1								1		
2-chlorophenol	µg/l	0.05	0.1	-							0.05								0.05								0.05		
4-chloro-3-methylphenol	µg/l		0.1	-																									
Hexachlorobutadiene	µg/l	1	0.005	0.6				14	14	14	1								1								1		
Vinyl Chloride (Chloroethene)	µg/l	1	-	-	14	1	1				1								1								1		
>C5 to C6 Aliphatic	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C6 to C8 Aliphatic	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aliphatic	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aliphatic	µg/l	10	-	-	76	10	63				19	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
>C12 to C16 Aliphatic	µg/l	10	-	-	76	10	38				38	10	13	13	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
>C16 to C21 Aliphatic	µg/l	10	-	-	76	10	43				31	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
>C21 to C35 Aliphatic	µg/l	10	-	-	76	10	370				340	10	10	110	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
>C35 to C44 Aliphatic	µg/l		-	-																									
Total Aliphatic C5-35	µg/l		-	-																									
>C5 to C7 Aromatic	µg/l	1	-	-	76	1	11				1.9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C7 to C8 Aromatic	µg/l	1	-	-	76	1	6.4				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aromatic	µg/l	1	-	-	76	1	140				1.2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aromatic	µg/l	10	-	-	76	10	1700				370	10	160	160	10	14	120	10	10	10	10	10	10	10	10	10	10	10	10
>C12 to C16 Aromatic	µg/l	10	-	-	76	10	1200				530	10	250	250	10	130	270	10	10	10	10	10	10	10	10	10	10	10	10
>C16 to C21 Aromatic	µg/l	10	-	-	76	10	440				320	10	150	150	10	44	270	10	10	10	10	10	10	10	10	10	10	10	10
>C21 to C35 Aromatic	µg/l	10	-	-	76	10	810				810	10	10	450	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
>C35 to C44 Aromatic	µg/l		-	-																									
Total Aromatic C5-C35	µg/l		-	-																									
TPH Ali/Aro	µg/l		-	-																									
Benzene	µg/l	1	1	8	76	1	10.5	7	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ethylbenzene	µg/l	1	-	-	76	1	30.5				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Toluene	µg/l	1	4	74	76	1	6.4	4			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Xylene	µg/l		3	30																									
M- & P-Xylene	µg/l	1	-	-	76	1	60.7				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
O-Xylene	µg/l	1	-	-	76	1	9				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total Xylene (M, P & O)	µg/l	2	-	30	72		2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
MTBE	µg/l	1	-	-	76	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
naphthalene	µg/l	0.01	-	2	76	0.01	14.8		10	10	5.9	2.02	3.96	0.01	0.01	0.01	1.48	0.01	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1	0.01	0.01
acenaphthylene	µg/l	0.01	-	-	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
acenaphthene	µg/l	0.01	-	-	76	0.01	6.81				5.1	0.73	3.92	0.01	0.01	0.01	4.85	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
fluorene	µg/l	0.01	-	-	76	0.01	2.9				2.9	0.44	2.2	0.01	0.01	0.01	1.46	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
phenanthrene	µg/l	0.01	-	-	76	0.01	3.9				3.9	0.66	2.22	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
anthracene	µg/l	0.01	-	0.1	76	0.01	0.69		6	6	0.69	0.01	0.29	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
fluoranthene	µg/l	0.01	-	0.0063	76	0.01	1.3		76	76	1.3	0.29	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
pyrene	µg/l	0.01	-	-	76	0.01	1				1	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(a)anthracene	µg/l	0.01	-	-	76	0.01	0.36				0.36	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
chrysene	µg/l	0.01	-	-	76	0.01	0.28				0.28	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(b)fluoranthene	µg/l	0.01	-	0.017	76	0.01	0.28		1	1	0.28	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(k)fluoranthene	µg/l	0.01	-	0.017	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(a)pyrene	µg/l	0.01	-	0.00017	76	0.01	0.47		76	76	0.47	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(g,h,i)perylene	µg/l	0.01	-	0.00082	76	0.01	0.01		76	76	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
dibenzo(ah)anthracene	µg/l	0.01	-	-	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	-	76	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	-	76	0.04	0.31				0.31	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total PAH	µg/l	0.16	-	-	76	0.16	25.6				22.3	4.38	12.6	0.16	0.16	0.16	7.79	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16

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TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
HAVANT WRP - LP72 (H.1 - ALL GROUNDWATER / LEACHATE SAMPLES)

England & Wales			Assessment Criteria		No. of Tests	Min	Max	No. of Exceedences		
Analyte	Units	LOD	MRV	Salt Water				MRV	Salt Water	Salt Water
Alkalinity as $CaCO_3$	µg/l		-	-						
Arsenic	µg/l	0.15	-	25	76	0.28	16.2			
Boron	µg/l		-	-						
Cadmium	µg/l	0.02	0.1	0.2	76	0.02	0.06			
Chromuim (Total)	µg/l	0.2	-	-	76	1.9	16			
Chromium Trivalent	µg/l		-	-						
Chromium Hexavalant	µg/l	5	-	0.6	76	5	5		**76**	**76**
Copper	µg/l	0.5	-	3.76	76	0.5	37		**56**	**56**
Iron	µg/l		-	1000						
Lead	µg/l	0.2	-	1.3	76	0.2	19		**3**	**3**
Mercury	µg/l	0.05	0.01	0.07	76	0.05	0.87	**76**	**6**	**6**
Manganese	µg/l		-	-						
Nickel	µg/l	0.5	-	8.6	76	3	130		**55**	**55**
Selenium	µg/l		-	-						
Zinc	µg/l	0.5	-	6.8	76	0.5	540		**34**	**34**
Ammoniacal Nitrogen as NH_4	µg/l	15	-	-	16	27	240000			
Ammoniacal Nitrogen as NH_3	µg/l	15	-	21	75	15	250000		**74**	**74**
Chloride	µg/l	150	-	-	75	28000	2900000			
Chlorine	µg/l		-	10						
Cyanide	µg/l		-	1						
Nitrate as NO_3	µg/l	50	-	-	75	110	77800			
Nitrite as NO_2	µg/l	5	-	-	75	5	5300			
Phenol	µg/l	0.05	-	7.7	14	0.05	2			
Pentachlorophenol	µg/l		0.1	0.4						
PCBs	µg/l		0.001	-						
Sodium	µg/l		-	-						
Sulphate	µg/l	45	-	-	76	3940	217000			
pH	pH Units		-	-	76	6.7	7.4			
Dichloromethane	µg/l		-	20						
1,2 Dichloroethane	µg/l	1	1	10	14	1	1			
Trichloroethene (PCE)	µg/l	1	0.1	10	14	1	1	**14**		
1,1,1 Trichloroethane	µg/l	1	0.1	-	14	1	1	**14**		
1,1,2 Trichloroethane	µg/l	1	0.1	-	14	1	1	**14**		
Trichloromethane (Chloroform)	µg/l	1	0.1	2.5	14	1	1	**14**		
1,2,3 Trichlorobenzene	µg/l	1	-	-	14	1	1			
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	14	1	1	**14**		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	0.4	14	2	2		**14**	**14**
Tetrachloroethene	µg/l	1	0.1	10	14	1	1	**14**		
Tetrachloromethane	µg/l	1	0.1	12	14	1	1	**14**		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	14	1	1			
2-chlorophenol	µg/l	0.05	0.1	-						
4-chloro-3-methylphenol	µg/l		0.1	-						
Hexachlorobutadiene	µg/l	1	0.005	0.6				**14**	**14**	**14**
Vinyl Chloride (Chloroethene)	µg/l	1	-	-	14	1	1			
>C5 to C6 Aliphatic	µg/l	1	-	-	76	1	1			
>C6 to C8 Aliphatic	µg/l	1	-	-	76	1	1			
>C8 to C10 Aliphatic	µg/l	1	-	-	76	1	1			
>C10 to C12 Aliphatic	µg/l	10	-	-	76	10	63			
>C12 to C16 Aliphatic	µg/l	10	-	-	76	10	38			
>C16 to C21 Aliphatic	µg/l	10	-	-	76	10	43			
>C21 to C35 Aliphatic	µg/l	10	-	-	76	10	370			
>C35 to C44 Aliphatic	µg/l		-	-						
Total Aliphatic C5-35	µg/l		-	-						
>C5 to C7 Aromatic	µg/l	1	-	-	76	1	11			
>C7 to C8 Aromatic	µg/l	1	-	-	76	1	6.4			
>C8 to C10 Aromatic	µg/l	1	-	-	76	1	140			
>C10 to C12 Aromatic	µg/l	10	-	-	76	10	1700			
>C12 to C16 Aromatic	µg/l	10	-	-	76	10	1200			
>C16 to C21 Aromatic	µg/l	10	-	-	76	10	440			
>C21 to C35 Aromatic	µg/l	10	-	-	76	10	810			
>C35 to C44 Aromatic	µg/l		-	-						
Total Aromatic C5-C35	µg/l		-	-						
TPH Ali/Aro	µg/l		-	-						
Benzene	µg/l	1	1	8	76	1	10.5	**7**	**2**	**2**
Ethylbenzene	µg/l	1	-	-	76	1	30.5			
Toluene	µg/l	1	4	74	76	1	6.4	**4**		
Xylene	µg/l		3	30						
M- & P-Xylene	µg/l	1	-	-	76	1	60.7			
O-Xylene	µg/l	1	-	-	76	1	9			
Total Xylene (M, P & O)	µg/l	2	-	30	72		2			
MTBE	µg/l	1	-	-	76	1	1			
naphthalene	µg/l	0.01	-	2	76	0.01	14.8		**10**	**10**
acenaphthylene	µg/l	0.01	-	-	76	0.01	0.01			
acenaphthene	µg/l	0.01	-	-	76	0.01	6.81			
fluorene	µg/l	0.01	-	-	76	0.01	2.9			
phenanthrene	µg/l	0.01	-	-	76	0.01	3.9			
anthracene	µg/l	0.01	-	0.1	76	0.01	0.69		**6**	**6**
fluoranthene	µg/l	0.01	-	0.0063	76	0.01	1.3		**76**	**76**
pyrene	µg/l	0.01	-	-	76	0.01	1			
benzo(a)anthracene	µg/l	0.01	-	-	76	0.01	0.36			
chrysene	µg/l	0.01	-	-	76	0.01	0.28			
benzo(b)fluoranthene	µg/l	0.01	-	0.017	76	0.01	0.28		**1**	**1**
benzo(k)fluoranthene	µg/l	0.01	-	0.017	76	0.01	0.01			
benzo(a)pyrene	µg/l	0.01	-	0.00017	76	0.01	0.47		**76**	**76**
benzo(g,h,i)perylene	µg/l	0.01	-	0.00082	76	0.01	0.01		**76**	**76**
dibenzo(ah)anthracene	µg/l	0.01	-	-	76	0.01	0.01			
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	-	76	0.01	0.01			
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	-	76	0.04	0.31			
Total PAH	µg/l	0.16	-	-	76	0.16	25.6			

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TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
HAVANT WRP - LP72 (G.2 -SUPERFICIAL DEPOSITS ONLY)

England & Wales			Assessment Criteria		No. of Tests	Min	Max	No. of Exceedences			DS101 @ 9.50	DS101 @ 9.75	DS101 @ 11.20	DS101 @ 14.95	DS102 @ 11.00	DS102 @ 11.00	DS102 @ 11.20	DS102 @ 11.50	DS103 @ 9.70	DS103 @ 11.00	DS103 @ 11.00	DS103 @ 11.00
Analyte	Units	LOD	MRV	Salt Water				MRV	Salt Water	Salt Water	20/04/2021	19/05/2021	23/03/2021	04/05/2021	20/04/2021	04/05/2021	23/03/2021	19/05/2021	23/03/2021	20/04/2021	04/05/2021	19/05/2021
Alkalinity as $CaCO_3$	µg/l		-	-																		
Arsenic	µg/l	0.15	-	25	12	2.17	16.2				5.06	3.21	2.92	6.54	7.4	9.26	16.2	12.7	6.12	2.77	4.68	2.17
Boron	µg/l		-	-																		
Cadmium	µg/l	0.02	0.1	0.2	12	0.02	0.03				0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02
Chromuim (Total)	µg/l	0.2	-	-	12	4.7	13				5.6	9.3	12	8	4.7	8.8	13	13	9.9	7.6	6.4	11
Chromium Trivalent	µg/l		-	-																		
Chromium Hexavalant	µg/l	5	-	0.6	12	5	5		12	12	5	5	5	5	5	5	5	5	5	5	5	5
Copper	µg/l	0.5	-	3.76	12	0.5	30		9	9	4.6	5.1	1.5	8.7	8.9	8.4	7	30	3.6	0.5	3.9	11
Iron	µg/l		-	1000																		
Lead	µg/l	0.2	-	1.3	12	0.2	0.3				0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2
Mercury	µg/l	0.05	0.01	0.07	12	0.05	0.19	12	1	1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.19	0.05	0.05	0.05
Manganese	µg/l		-	-																		
Nickel	µg/l	0.5	-	8.6	12	6.9	130		11	11	23	27	15	33	6.9	19	130	20	37	17	13	20
Selenium	µg/l		-	-																		
Zinc	µg/l	0.5	-	6.8	12	2	13		3	3	3.2	2.6	2.9	5	2	2.3	5.4	7.5	13	4.7	4.3	13
Ammoniacal Nitrogen as NH_4	µg/l	15	-	-	3	66000	160000							66000		160000					120000	
Ammoniacal Nitrogen as NH_3	µg/l	15	-	21	12	63000	190000		12	12	85000	86000	87000	63000	150000	150000	170000	190000	76000	130000	110000	140000
Chloride	µg/l	150	-	-	12	330000	2900000				480000	510000	340000	460000	2900000	2600000	2100000	1900000	460000	350000	330000	430000
Chlorine	µg/l		-	10																		
Cyanide	µg/l		-	1																		
Nitrate as NO_3	µg/l	50	-	-	12	370	2900				1190	370	730	780	2900	1820	1920	1840	730	1300	990	1210
Nitrite as NO_2	µg/l	5	-	-	12	5	66				5	5	43	5	5	5	66	5	50	5	5	5
Phenol	µg/l	0.05	-	7.7	2	0.05	0.05				0.05						0.05					
Pentachlorophenol	µg/l		0.1	0.4																		
PCBs	µg/l		0.001	-																		
Sodium	µg/l		-	-																		
Sulphate	µg/l	45	-	-	12	4900	23800				9950	4900	17600	6310	12800	10800	23800	5980	12200	16400	15700	10100
pH	pH Units		-	-	12	6.8	7.1				6.9	6.9	7	6.9	6.8	6.8	7.1	6.8	7.1	6.9	6.9	6.8
Dichloromethane	µg/l		-	20																		
1,2 Dichloroethane	µg/l	1	1	10	2	1	1				1						1					
Trichloroethene (PCE)	µg/l	1	0.1	10	2	1	1	2			1						1					
1,1,1 Trichloroethane	µg/l	1	0.1	-	2	1	1	2			1						1					
1,1,2 Trichloroethane	µg/l	1	0.1	-	2	1	1	2			1						1					
Trichloromethane (Chloroform)	µg/l	1	0.1	2.5	2	1	1	2			1						1					
1,2,3 Trichlorobenzene	µg/l	1	-	-	2	1	1				1						1					
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	2	1	1	2			1						1					
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	0.4	2	2	2		2	2	2						2					
Tetrachloroethene	µg/l	1	0.1	10	2	1	1	2			1						1					
Tetrachloromethane	µg/l	1	0.1	12	2	1	1	2			1						1					
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	2	1	1				1						1					
2-chlorophenol	µg/l	0.05	0.1	-							0.05						0.05					
4-chloro-3-methylphenol	µg/l		0.1	-																		
Hexachlorobutadiene	µg/l	1	0.005	0.6				2	2	2	1						1					
Vinyl Chloride (Chloroethene)	µg/l	1	-	-	2	1	1				1						1					
>C5 to C6 Aliphatic	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
>C6 to C8 Aliphatic	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aliphatic	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aliphatic	µg/l	10	-	-	12	10	42				13	10	10	10	12	10	10	10	10	42	10	10
>C12 to C16 Aliphatic	µg/l	10	-	-	12	10	20				16	10	11	10	14	10	20	10	10	18	10	10
>C16 to C21 Aliphatic	µg/l	10	-	-	12	10	32				10	10	10	10	10	10	32	10	12	10	10	10
>C21 to C35 Aliphatic	µg/l	10	-	-	12	10	190				170	10	100	10	130	10	150	10	95	190	10	10
>C35 to C44 Aliphatic	µg/l		-	-																		
Total Aliphatic C5-35	µg/l	43	-	-	12	43	263				212	43	134	43	169	43	215	43	130	263	43	43
>C5 to C7 Aromatic	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
>C7 to C8 Aromatic	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aromatic	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aromatic	µg/l	10	-	-	12	10	350				140	18	130	10	350	10	230	91	65	160	10	78
>C12 to C16 Aromatic	µg/l	10	-	-	12	10	400				230	64	190	10	400	10	270	220	88	150	10	200
>C16 to C21 Aromatic	µg/l	10	-	-	12	10	200				130	55	120	10	200	10	130	150	51	67	10	170
>C21 to C35 Aromatic	µg/l	10	-	-	12	10	530				480	10	250	10	530	10	280	10	200	320	10	10
>C35 to C44 Aromatic	µg/l		-	-																		
Total Aromatic C5-C35	µg/l	43	-	-	12	43	1483				983	150	693	43	1483	43	913	474	407	700	43	461
TPH Ali/Aro	µg/l	86	-	-	12	86	1652				1195	193	827	86	1652	86	1128	517	537	963	86	504
Benzene	µg/l	1	1	8	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
Ethylbenzene	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
Toluene	µg/l	1	4	74	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
Xylene	µg/l		3	30																		
M- & P-Xylene	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
O-Xylene	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
Total Xylene (M, P & O)	µg/l	2	-	30	12	2	2				2	2	2	2	2	2	2	2	2	2	2	2
MTBE	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
naphthalene	µg/l	0.01	-	2	12	0.01	14.8		2	2	1	0.01	14.8	0.01	0.01	0.01	0.93	0.01	0.65	2.22	0.01	0.01
acenaphthylene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
acenaphthene	µg/l	0.01	-	-	12	0.01	6.81				0.01	0.01	3.82	0.01	0.01	0.01	0.72	2.22	0.85	5.08	0.01	6.81
fluorene	µg/l	0.01	-	-	12	0.01	2.24				0.01	0.01	2.24	0.01	0.01	0.01	0.44	1.1	0.56	2.15	0.01	1.74
phenanthrene	µg/l	0.01	-	-	12	0.01	3.15				0.01	0.01	3.15	0.01	0.01	0.01	0.53	1	0.77	2.28	0.01	0.01
anthracene	µg/l	0.01	-	0.1	12	0.01	0.45		2	2	0.01	0.01	0.45	0.01	0.01	0.01	0.01	0.01	0.01	0.23	0.01	0.01
fluoranthene	µg/l	0.01	-	0.0063	12	0.01	0.71		12	12	0.01	0.01	0.71	0.01	0.01	0.01	0.01	0.01	0.01	0.33	0.01	0.01
pyrene	µg/l	0.01	-	-	12	0.01	0.46				0.01	0.01	0.46	0.01	0.01	0.01	0.01	0.01	0.01	0.25	0.01	0.01
benzo(a)anthracene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
chrysene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(b)fluoranthene	µg/l	0.01	-	0.017	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(k)fluoranthene	µg/l	0.01	-	0.017	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(a)pyrene	µg/l	0.01	-	0.00017	12	0.01	0.01		12	12	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(g,h,i)perylene	µg/l	0.01	-	0.00082	12	0.01	0.01		12	12	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
dibenzo(ah)anthracene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	-	12	0.04	0.04				0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total PAH	µg/l	0.16	-	-	12	0.16	25.6				0.16	0.16	25.6	0.16	0.16	0.16	2.62	4.32	2.83	12.5	0.16	8.55

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TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
HAVANT WRP - LP72 (G.3 - CHALK ONLY)

England & Wales			Assessment Criteria		No. of Tests	Min	Max	No. of Exceedences			CP02A @ 17.0	CP02A @ 18.0	RO101 @ 14.30	RO101 @ 15.50	RO101 @ 15.00	RO101 @ 16.00	RO102 @ 15.00	RO102 @ 15.00	RO102 @ 15.00	RO102 @ 15.50	RO103 @ 15.90	RO103 @ 16.00	RO103 @ 15.00	RO103 @ 16.00	RO104 @ 15.20	RO104 @ 16.50	RO104 @ 16.00	RO104 @ 16.00	RO105 @ 14.90
Analyte	Units	LOD	MRV	Salt Water				MRV	Salt Water	Salt Water	04/05/2021	19/05/2021	22/03/2021	20/04/2021	04/05/2021	18/05/2021	22/03/2021	20/04/2021	04/05/2021	18/05/2021	22/03/2021	20/04/2021	04/05/2021	19/05/2021	23/03/2021	20/04/2021	04/05/2021	19/05/2021	23/03/2021
Alkalinity as $CaCO_3$	µg/l		-	-																									
Arsenic	µg/l	0.15	-	25	38	0.28	15.1				7.39	5.54	10.5	2.8	15.1	5.75	1.09	2.32	1.84	1.35	2.7	5.52	2.6	1.29	1.52	1.71	0.66	0.28	0.65
Boron	µg/l		-	-																									
Cadmium	µg/l	0.02	0.1	0.2	38	0.02	0.06				0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.03	0.02	0.02	0.02	0.02	0.06	0.02	0.02	0.02	0.04
Chromuim (Total)	µg/l	0.2	-	-	38	1.9	16				6.4	9.9	16	4.6	5.9	6.6	4.6	7.6	5.2	7.2	2.7	2.4	2.1	2.9	3.1	10	1.9	2.4	6.6
Chromium Trivalent	µg/l		-	-																									
Chromium Hexavalant	µg/l	5	-	0.6	38	5	5		38	38	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Copper	µg/l	0.5	-	3.76	38	0.6	17		28	28	11	16	9.1	14	9.8	17	5.8	7.9	4.4	8.4	1.6	12	1.1	5.7	2.3	11	0.6	2.7	3.4
Iron	µg/l		-	1000																									
Lead	µg/l	0.2	-	1.3	38	0.2	19		3	3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.7	0.2	2.2	0.2	0.2	0.2	19	0.2	0.4	0.2	0.2
Mercury	µg/l	0.05	0.01	0.07	38	0.05	0.87	38	5	5	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.08	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.05
Manganese	µg/l		-	-																									
Nickel	µg/l	0.5	-	8.6	38	3.8	60		28	28	8.4	17	60	6.9	9.8	27	9.2	23	19	20	5.9	5.1	5.3	5.1	5	8.7	3.9	3.8	34
Selenium	µg/l		-	-																									
Zinc	µg/l	0.5	-	6.8	38	0.5	540		17	17	4.8	8.7	18	2.5	0.5	19	19	190	230	43	23	3.1	4.7	8.6	34	4.4	5.5	7.5	41
Ammoniacal Nitrogen as NH_4	µg/l	15	-	-	6	27	93000								93000		3600						27		150				
Ammoniacal Nitrogen as NH_3	µg/l	15	-	21	38	15	140000		37	37	66000	95000	140000	73000	88000	81000	3400	33000	14000	41000	15	120	26	100	140	44	120	85	28000
Chloride	µg/l	150	-	-	38	28000	2300000				650000	810000	450000	630000	770000	1000000	280000	310000	120000	200000	170000	140000	71000	63000	110000	32000	28000	28000	91000
Chlorine	µg/l		-	10																									
Cyanide	µg/l		-	1																									
Nitrate as NO_3	µg/l	50	-	-	38	310	77800				1450	1100	1040	1760	2540	1310	10500	3320	8710	10800	620	310	2390	77800	8400	3010	21300	23200	10700
Nitrite as NO_2	µg/l	5	-	-	38	5	5300				100	9.2	5	5	5	5	70	1800	410	5300	5	5	290	400	110	230	120	60	4500
Phenol	µg/l	0.05	-	7.7	5	0.05	0.05						0.05					0.05			0.05								
Pentachlorophenol	µg/l		0.1	0.4																									
PCBs	µg/l		0.001	-																									
Sodium	µg/l		-	-																									
Sulphate	µg/l	45	-	-	38	4760	217000				44900	39600	23200	49700	58700	110000	67500	48100	38000	30200	42200	27800	13000	9130	73900	27200	25500	22200	39300
pH	pH Units		-	-	38	6.8	7.4				6.9	6.8	6.9	6.9	6.8	6.8	7	6.8	6.9	7	7.2	7.3	7.3	7.4	7.4	7.3	7.2	7.4	7
Dichloromethane	µg/l		-	20																									
1,2 Dichloroethane	µg/l	1	1	10	5	1	1						1					1			1								
Trichloroethene (PCE)	µg/l	1	0.1	10	5	1	1	5					1					1			1								
1,1,1 Trichloroethane	µg/l	1	0.1	-	5	1	1	5					1					1			1								
1,1,2 Trichloroethane	µg/l	1	0.1	-	5	1	1	5					1					1			1								
Trichloromethane (Chloroform)	µg/l	1	0.1	2.5	5	1	1	5					1					1			1								
1,2,3 Trichlorobenzene	µg/l	1	-	-	5	1	1						1					1			1								
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	5	1	1	5					1					1			1								
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	0.4	5	2	2		5	5			2					2			2								
Tetrachloroethene	µg/l	1	0.1	10	5	1	1	5					1					1			1								
Tetrachloromethane	µg/l	1	0.1	12	5	1	1	5					1					1			1								
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	5	1	1						1					1			1								
2-chlorophenol	µg/l	0.05	0.1	-									0.05					0.05			0.05								
4-chloro-3-methylphenol	µg/l		0.1	-																									
Hexachlorobutadiene	µg/l	1	0.005	0.6				5	5	5			1					1			1								
Vinyl Chloride (Chloroethene)	µg/l	1	-	-	5	1	1						1					1			1								
>C5 to C6 Aliphatic	µg/l	1	-	-	38	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C6 to C8 Aliphatic	µg/l	1	-	-	38	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aliphatic	µg/l	1	-	-	38	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aliphatic	µg/l	10	-	-	38	10	63				10	10	10	63	10	10	10	10	10	10	10	10	10	10	13	10	10	10	10
>C12 to C16 Aliphatic	µg/l	10	-	-	38	10	21				10	10	17	21	10	10	10	10	10	10	10	10	10	10	21	10	10	10	10
>C16 to C21 Aliphatic	µg/l	10	-	-	38	10	26				10	10	13	12	10	10	10	10	10	10	10	10	10	10	26	10	10	10	10
>C21 to C35 Aliphatic	µg/l	10	-	-	38	10	160				10	10	130	160	10	10	10	92	10	10	10	10	10	10	160	10	10	10	10
>C35 to C44 Aliphatic	µg/l		-	-																									
Total Aliphatic C5-35	µg/l	43	-	-	38	43	259				43	43	173	259	43	43	43	125	43	43	43	43	43	43	223	43	43	43	43
>C5 to C7 Aromatic	µg/l	1	-	-	38	1	5.9				1	1	5.9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C7 to C8 Aromatic	µg/l	1	-	-	38	1	6.4				1	1	6.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aromatic	µg/l	1	-	-	38	1	5.8				1	1	5.8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aromatic	µg/l	10	-	-	38	10	1700				10	120	250	1700	10	64	10	80	10	10	10	10	10	10	55	10	10	10	10
>C12 to C16 Aromatic	µg/l	10	-	-	38	10	530				10	290	380	530	10	180	10	140	10	10	10	10	10	10	110	10	10	10	10
>C16 to C21 Aromatic	µg/l	10	-	-	38	10	250				10	250	150	220	10	120	10	78	10	10	10	10	10	10	99	10	10	10	10
>C21 to C35 Aromatic	µg/l	10	-	-	38	10	600				10	10	300	600	10	10	10	10	10	10	10	10	10	10	480	10	10	10	10
>C35 to C44 Aromatic	µg/l		-	-																									
Total Aromatic C5-C35	µg/l	43	-	-	38	43	3053				43	673	1098.1	3053	43	377	43	311	43	43	43	43	43	43	747	43	43	43	43
TPH Ali/Aro	µg/l	86	-	-	38	86	3312				86	716	1271.1	3312	86	420	86	436	86	86	86	86	86	86	970	86	86	86	86
Benzene	µg/l	1	1	8	38	1	5.9	1			1	1	5.9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ethylbenzene	µg/l	1	-	-	38	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Toluene	µg/l	1	4	74	38	1	6.4	1			1	1	6.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Xylene	µg/l		3	30																									
M- & P-Xylene	µg/l	1	-	-	38	1	1.9				1	1	1.9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
O-Xylene	µg/l	1	-	-	38	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total Xylene (M, P & O)	µg/l	2	-	30	38	1	2				2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
MTBE	µg/l	1	-	-	38	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
naphthalene	µg/l	0.01	-	2	38	0.01	2.02		1	1	0.01	0.01	0.74	0.42	0.78	0.01	0.01	1	0.01	0.01	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
acenaphthylene	µg/l	0.01	-	-	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
acenaphthene	µg/l	0.01	-	-	38	0.01	6.45				0.01	2.17	1.4	0.97	3.63	6.45	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.38
fluorene	µg/l	0.01	-	-	38	0.01	2.88				0.01	0.74	0.4	0.38	1.52	2.88	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.2
phenanthrene	µg/l	0.01	-	-	38	0.01	0.66				0.01	0.01	0.01	0.01	0.35	0.55	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
anthracene	µg/l	0.01	-	0.1	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
fluoranthene	µg/l	0.01	-	0.0063	38	0.01	0.29		38	38	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
pyrene	µg/l	0.01	-	-	38	0.01	0.24				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(a)anthracene	µg/l	0.01	-	-	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
chrysene	µg/l	0.01	-	-	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(b)fluoranthene	µg/l	0.01	-	0.017	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(k)fluoranthene	µg/l	0.01	-	0.017	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(a)pyrene	µg/l	0.01	-	0.00017	38	0.01	0.01		38	38	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(g,h,i)perylene	µg/l	0.01	-	0.00082	38	0.01	0.01		38	38	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
dibenzo(ah)anthracene	µg/l	0.01	-	-	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	-	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	-	38	0.04	0.04				0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total PAH	µg/l	0.16	-	-	38	0.16	9.88				0.16	2.91	2.49	1.77	6.28	9.88	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.58

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
HAVANT WRP - LP72 (G.3 - CHALK ONLY)

England & Wales			Assessment Criteria		No. of Tests	Min	Max	No. of Exceedences			RO105 @ 14.50	RO105 @ 15.00	RO105 @ 15.50	RO106 @ 16.60	RO106 @ 16.00	RO106 @ 17.00	RO106 @ 17.00	RO107 @ 14.80	RO107 @ 15.00	RO107 @ 15.00	RO107 @ 15.00	RO108 @13.10	RO108 @ 13.00	RO108 @ 14.00	RO108 @13.25	RO109 @ 14.00	RO109 @ 14.50	RO109 @ 14.50	RO109 @ 14.50
Analyte	Units	LOD	MRV	Salt Water				MRV	Salt Water	Salt Water	20/04/2021	04/05/2021	19/05/2021	23/03/2021	20/04/2021	04/05/2021	19/05/2021	23/03/2021	20/04/2021	05/05/2021	18/05/2021	23/03/2021	20/04/2021	04/05/2021	18/05/2021	04/05/2021	23/03/2021	20/04/2021	19/05/2021
Alkalinity as $CaCO_3$	µg/l		-	-																									
Arsenic	µg/l	0.15	-	25	38	0.28	15.1				5.13	7.74	6.05	4.41	5.53	13.3	10.8	9.24	8.71	8.73	4.45	2.69	4.03	2.48	1.32	0.73	2.83	1.17	0.55
Boron	µg/l		-	-																									
Cadmium	µg/l	0.02	0.1	0.2	38	0.02	0.06				0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chromuim (Total)	µg/l	0.2	-	-	38	1.9	16				9.6	5.8	6.5	5.5	5	4.3	5.8	3.5	4.1	3.3	4.1	6.9	6.9	4	3.6	3.1	5.6	4.2	3.5
Chromium Trivalent	µg/l		-	-																									
Chromium Hexavalant	µg/l	5	-	0.6	38	5	5		38	38	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Copper	µg/l	0.5	-	3.76	38	0.6	17		28	28	9.4	1.7	2.8	3.2	4.3	2.7	5.4	9.7	16	15	15	7	6.1	6.4	4.4	5.4	4.4	5.1	4.3
Iron	µg/l		-	1000																									
Lead	µg/l	0.2	-	1.3	38	0.2	19		3	3	0.2	0.2	0.2	2.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Mercury	µg/l	0.05	0.01	0.07	38	0.05	0.87	38	5	5	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.56	0.83	0.87	0.58	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Manganese	µg/l		-	-																									
Nickel	µg/l	0.5	-	8.6	38	3.8	60		28	28	19	10	14	20	40	35	28	20	24	19	15	20	24	13	8.3	12	29	14	10
Selenium	µg/l		-	-																									
Zinc	µg/l	0.5	-	6.8	38	0.5	540		17	17	3.4	1.7	5.5	540	6.1	0.5	5.4	4.4	8.8	5	5.5	9.2	6.1	3.4	2.5	7	9.1	4.9	5
Ammoniacal Nitrogen as NH_4	µg/l	15	-	-	6	27	93000					27000														15000			
Ammoniacal Nitrogen as NH_3	µg/l	15	-	21	38	15	140000		37	37	44000	26000	25000	17000	23000	13000	12000	230	120	40	110	47000	43000	17000	3500	14000	25000	19000	10000
Chloride	µg/l	150	-	-	38	28000	2300000				160000	100000	86000	420000	540000	480000	490000	1300000	2300000	1200000	930000	410000	370000	330000	270000	87000	150000	120000	83000
Chlorine	µg/l		-	10																									
Cyanide	µg/l		-	1																									
Nitrate as NO_3	µg/l	50	-	-	38	310	77800				1400	360	680	930	880	420	790	7730	10600	11000	8510	1820	1040	13600	22900	31000	11700	25700	32400
Nitrite as NO_2	µg/l	5	-	-	38	5	5300				5	5	5	28	5	5	5	190	5	8	25	330	44	330	770	630	510	380	1100
Phenol	µg/l	0.05	-	7.7	5	0.05	0.05												0.05								0.05		
Pentachlorophenol	µg/l		0.1	0.4																									
PCBs	µg/l		0.001	-																									
Sodium	µg/l		-	-																									
Sulphate	µg/l	45	-	-	38	4760	217000				4760	15200	13600	97500	48500	37900	22800	208000	217000	165000	184000	63100	51400	54100	50300	19900	20500	20600	18000
pH	pH Units		-	-	38	6.8	7.4				6.9	7	7	7.2	7.1	7	7	7.2	7.3	7.2	7.3	7	7	7.1	7.2	7.1	7	7	7.1
Dichloromethane	µg/l		-	20																									
1,2 Dichloroethane	µg/l	1	1	10	5	1	1												1								1		
Trichloroethene (PCE)	µg/l	1	0.1	10	5	1	1	5											1								1		
1,1,1 Trichloroethane	µg/l	1	0.1	-	5	1	1	5											1								1		
1,1,2 Trichloroethane	µg/l	1	0.1	-	5	1	1	5											1								1		
Trichloromethane (Chloroform)	µg/l	1	0.1	2.5	5	1	1	5											1								1		
1,2,3 Trichlorobenzene	µg/l	1	-	-	5	1	1												1								1		
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	5	1	1	5											1								1		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	0.4	5	2	2		5	5									2								2		
Tetrachloroethene	µg/l	1	0.1	10	5	1	1	5											1								1		
Tetrachloromethane	µg/l	1	0.1	12	5	1	1	5											1								1		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	5	1	1												1								1		
2-chlorophenol	µg/l	0.05	0.1	-															0.05								0.05		
4-chloro-3-methylphenol	µg/l		0.1	-																									
Hexachlorobutadiene	µg/l	1	0.005	0.6				5	5	5									1								1		
Vinyl Chloride (Chloroethene)	µg/l	1	-	-	5	1	1												1								1		
>C5 to C6 Aliphatic	µg/l	1	-	-	38	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C6 to C8 Aliphatic	µg/l	1	-	-	38	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aliphatic	µg/l	1	-	-	38	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aliphatic	µg/l	10	-	-	38	10	63				10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
>C12 to C16 Aliphatic	µg/l	10	-	-	38	10	21				10	10	10	10	13	10	10	10	10	10	10	10	10	10	10	10	10	10	10
>C16 to C21 Aliphatic	µg/l	10	-	-	38	10	26				10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
>C21 to C35 Aliphatic	µg/l	10	-	-	38	10	160				10	10	10	10	110	10	10	10	10	10	10	10	10	10	10	10	10	10	10
>C35 to C44 Aliphatic	µg/l		-	-																									
Total Aliphatic C5-35	µg/l	43	-	-	38	43	259				43	43	43	43	146	43	43	43	43	43	43	43	43	43	43	43	43	43	43
>C5 to C7 Aromatic	µg/l	1	-	-	38	1	5.9				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C7 to C8 Aromatic	µg/l	1	-	-	38	1	6.4				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aromatic	µg/l	1	-	-	38	1	5.8				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aromatic	µg/l	10	-	-	38	10	1700				10	10	10	10	160	10	14	10	10	10	10	10	10	10	10	10	10	10	10
>C12 to C16 Aromatic	µg/l	10	-	-	38	10	530				10	10	10	10	250	10	130	10	10	10	10	10	10	10	10	10	10	10	10
>C16 to C21 Aromatic	µg/l	10	-	-	38	10	250				10	10	10	10	150	10	44	10	10	10	10	10	10	10	10	10	10	10	10
>C21 to C35 Aromatic	µg/l	10	-	-	38	10	600				10	10	10	10	450	10	10	10	10	10	10	10	10	10	10	10	10	10	10
>C35 to C44 Aromatic	µg/l		-	-																									
Total Aromatic C5-C35	µg/l	43	-	-	38	43	3053				43	43	43	43	1013	43	201	43	43	43	43	43	43	43	43	43	43	43	43
TPH Ali/Aro	µg/l	86	-	-	38	86	3312				86	86	86	86	1159	86	244	86	86	86	86	86	86	86	86	86	86	86	86
Benzene	µg/l	1	1	8	38	1	5.9	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ethylbenzene	µg/l	1	-	-	38	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Toluene	µg/l	1	4	74	38	1	6.4	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Xylene	µg/l		3	30																									
M- & P-Xylene	µg/l	1	-	-	38	1	1.9				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
O-Xylene	µg/l	1	-	-	38	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total Xylene (M, P & O)	µg/l	2	-	30	38	1	2				2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
MTBE	µg/l	1	-	-	38	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
naphthalene	µg/l	0.01	-	2	38	0.01	2.02		1	1	0.01	0.01	0.01	2.02	0.01	0.01	0.01	0.01	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1	0.01	0.01
acenaphthylene	µg/l	0.01	-	-	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
acenaphthene	µg/l	0.01	-	-	38	0.01	6.45				0.01	0.83	0.01	0.73	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
fluorene	µg/l	0.01	-	-	38	0.01	2.88				0.01	0.52	0.01	0.44	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
phenanthrene	µg/l	0.01	-	-	38	0.01	0.66				0.01	0.51	0.01	0.66	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
anthracene	µg/l	0.01	-	0.1	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
fluoranthene	µg/l	0.01	-	0.0063	38	0.01	0.29		38	38	0.01	0.01	0.01	0.29	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
pyrene	µg/l	0.01	-	-	38	0.01	0.24				0.01	0.01	0.01	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(a)anthracene	µg/l	0.01	-	-	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
chrysene	µg/l	0.01	-	-	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(b)fluoranthene	µg/l	0.01	-	0.017	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(k)fluoranthene	µg/l	0.01	-	0.017	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(a)pyrene	µg/l	0.01	-	0.00017	38	0.01	0.01		38	38	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(g,h,i)perylene	µg/l	0.01	-	0.00082	38	0.01	0.01		38	38	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
dibenzo(ah)anthracene	µg/l	0.01	-	-	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	-	38	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	-	38	0.04	0.04				0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total PAH	µg/l	0.16	-	-	38	0.16	9.88				0.16	1.86	0.16	4.38	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16

TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
HAVANT WRP - LP72 (G.3 - CHALK ONLY)

England & Wales			Assessment Criteria		No. of Tests	Min	Max	No. of Exceedences		
Analyte	Units	LOD	MRV	Salt Water				MRV	Salt Water	Salt Water
Alkalinity as $CaCO_3$	µg/l		-	-						
Arsenic	µg/l	0.15	-	25	38	0.28	15.1			
Boron	µg/l		-	-						
Cadmium	µg/l	0.02	0.1	0.2	38	0.02	0.06			
Chromuim (Total)	µg/l	0.2	-	-	38	1.9	16			
Chromium Trivalent	µg/l		-	-						
Chromium Hexavalant	µg/l	5	-	0.6	38	5	5		**38**	**38**
Copper	µg/l	0.5	-	3.76	38	0.6	17		**28**	**28**
Iron	µg/l		-	1000						
Lead	µg/l	0.2	-	1.3	38	0.2	19		**3**	**3**
Mercury	µg/l	0.05	0.01	0.07	38	0.05	0.87	**38**	**5**	**5**
Manganese	µg/l		-	-						
Nickel	µg/l	0.5	-	8.6	38	3.8	60		**28**	**28**
Selenium	µg/l		-	-						
Zinc	µg/l	0.5	-	6.8	38	0.5	540		**17**	**17**
Ammoniacal Nitrogen as NH_4	µg/l	15	-	-	6	27	93000			
Ammoniacal Nitrogen as NH_3	µg/l	15	-	21	38	15	140000		**37**	**37**
Chloride	µg/l	150	-	-	38	28000	2300000			
Chlorine	µg/l		-	10						
Cyanide	µg/l		-	1						
Nitrate as NO_3	µg/l	50	-	-	38	310	77800			
Nitrite as NO_2	µg/l	5	-	-	38	5	5300			
Phenol	µg/l	0.05	-	7.7	5	0.05	0.05			
Pentachlorophenol	µg/l		0.1	0.4						
PCBs	µg/l		0.001	-						
Sodium	µg/l		-	-						
Sulphate	µg/l	45	-	-	38	4760	217000			
pH	pH Units		-	-	38	6.8	7.4			
Dichloromethane	µg/l		-	20						
1,2 Dichloroethane	µg/l	1	1	10	5	1	1			
Trichloroethene (PCE)	µg/l	1	0.1	10	5	1	1	**5**		
1,1,1 Trichloroethane	µg/l	1	0.1	-	5	1	1	**5**		
1,1,2 Trichloroethane	µg/l	1	0.1	-	5	1	1	**5**		
Trichloromethane (Chloroform)	µg/l	1	0.1	2.5	5	1	1	**5**		
1,2,3 Trichlorobenzene	µg/l	1	-	-	5	1	1			
1,2,4 Trichlorobenzene	µg/l	1	0.01	-	5	1	1	**5**		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	0.4	5	2	2		**5**	**5**
Tetrachloroethene	µg/l	1	0.1	10	5	1	1	**5**		
Tetrachloromethane	µg/l	1	0.1	12	5	1	1	**5**		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-	5	1	1			
2-chlorophenol	µg/l	0.05	0.1	-						
4-chloro-3-methylphenol	µg/l		0.1	-						
Hexachlorobutadiene	µg/l	1	0.005	0.6				**5**	**5**	**5**
Vinyl Chloride (Chloroethene)	µg/l	1	-	-	5	1	1			
>C5 to C6 Aliphatic	µg/l	1	-	-	38	1	1			
>C6 to C8 Aliphatic	µg/l	1	-	-	38	1	1			
>C8 to C10 Aliphatic	µg/l	1	-	-	38	1	1			
>C10 to C12 Aliphatic	µg/l	10	-	-	38	10	63			
>C12 to C16 Aliphatic	µg/l	10	-	-	38	10	21			
>C16 to C21 Aliphatic	µg/l	10	-	-	38	10	26			
>C21 to C35 Aliphatic	µg/l	10	-	-	38	10	160			
>C35 to C44 Aliphatic	µg/l		-	-						
Total Aliphatic C5-35	µg/l	43	-	-	38	43	259			
>C5 to C7 Aromatic	µg/l	1	-	-	38	1	5.9			
>C7 to C8 Aromatic	µg/l	1	-	-	38	1	6.4			
>C8 to C10 Aromatic	µg/l	1	-	-	38	1	5.8			
>C10 to C12 Aromatic	µg/l	10	-	-	38	10	1700			
>C12 to C16 Aromatic	µg/l	10	-	-	38	10	530			
>C16 to C21 Aromatic	µg/l	10	-	-	38	10	250			
>C21 to C35 Aromatic	µg/l	10	-	-	38	10	600			
>C35 to C44 Aromatic	µg/l		-	-						
Total Aromatic C5-C35	µg/l	43	-	-	38	43	3053			
TPH Ali/Aro	µg/l	86	-	-	38	86	3312			
Benzene	µg/l	1	1	8	38	1	5.9	**1**		
Ethylbenzene	µg/l	1	-	-	38	1	1			
Toluene	µg/l	1	4	74	38	1	6.4	**1**		
Xylene	µg/l		3	30						
M- & P-Xylene	µg/l	1	-	-	38	1	1.9			
O-Xylene	µg/l	1	-	-	38	1	1			
Total Xylene (M, P & O)	µg/l	2	-	30	38	1	2			
MTBE	µg/l	1	-	-	38	1	1			
naphthalene	µg/l	0.01	-	2	38	0.01	2.02		**1**	**1**
acenaphthylene	µg/l	0.01	-	-	38	0.01	0.01			
acenaphthene	µg/l	0.01	-	-	38	0.01	6.45			
fluorene	µg/l	0.01	-	-	38	0.01	2.88			
phenanthrene	µg/l	0.01	-	-	38	0.01	0.66			
anthracene	µg/l	0.01	-	0.1	38	0.01	0.01			
fluoranthene	µg/l	0.01	-	0.0063	38	0.01	0.29		**38**	**38**
pyrene	µg/l	0.01	-	-	38	0.01	0.24			
benzo(a)anthracene	µg/l	0.01	-	-	38	0.01	0.01			
chrysene	µg/l	0.01	-	-	38	0.01	0.01			
benzo(b)fluoranthene	µg/l	0.01	-	0.017	38	0.01	0.01			
benzo(k)fluoranthene	µg/l	0.01	-	0.017	38	0.01	0.01			
benzo(a)pyrene	µg/l	0.01	-	0.00017	38	0.01	0.01		**38**	**38**
benzo(g,h,i)perylene	µg/l	0.01	-	0.00082	38	0.01	0.01		**38**	**38**
dibenzo(ah)anthracene	µg/l	0.01	-	-	38	0.01	0.01			
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	-	38	0.01	0.01			
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	-	38	0.04	0.04			
Total PAH	µg/l	0.16	-	-	38	0.16	9.88			

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TABLE SUMMARISING WATER RESULTS AND HIGHLIGHTING EXCEEDANCES ABOVE WATER ASSESSMENT CRITERIA
HAVANT WRP - LP72 (G.4 - SURFACE WATER ONLY)

England & Wales			Assessment Criteria		No. of Tests	Min	Max	No. of Exceedences			DOWNSTREAM HIGH TIDE	DOWNSTREAM HIGH TIDE	DOWNSTREAM LOW TIDE	DOWNSTREAM LOW TIDE	MIDSTREAM HIGH TIDE	MIDSTREAM HIGH TIDE	MIDSTREAM LOW TIDE	MIDSTREAM LOW TIDE	UPSTREAM HIGH TIDE	UPSTREAM HIGH TIDE	UPSTREAM LOW TIDE	UPSTREAM LOW TIDE
Analyte	Units	LOD	MRV	Salt Water				MRV	Salt Water	Salt Water	20/04/2021	04/05/2021	20/04/2021	04/05/2021	20/04/2021	04/05/2021	20/04/2021	04/05/2021	20/04/2021	04/05/2021	20/04/2021	04/05/2021
Alkalinity as $CaCO_3$	µg/l		-	-																		
Arsenic	µg/l	0.15	-	25	12	0.84	9.69				9.69	2.2	1.54	2.28	7.83	1.04	0.84	1.44	3.87	5.35	0.99	1.49
Boron	µg/l		-	-																		
Cadmium	µg/l	0.02	0.1	0.2	12	0.02	0.02				0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chromuim (Total)	µg/l	0.2	-	-	12	1.7	3.4				2.9	2	2.3	1.7	2.4	3.4	2.2	1.8	2.9	2.3	2.3	1.9
Chromium Trivalent	µg/l		-	-																		
Chromium Hexavalant	µg/l	5	-	0.6	12	5	5		12	12	5	5	5	5	5	5	5	5	5	5	5	5
Copper	µg/l	0.5	-	3.76	12	2.5	11		10	10	8.3	9.4	9.3	5	11	2.5	2.5	5.1	5.8	6.8	5	6.4
Iron	µg/l		-	1000																		
Lead	µg/l	0.2	-	1.3	12	0.2	0.2				0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Mercury	µg/l	0.05	0.01	0.07	12	0.05	0.05	12			0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Manganese	µg/l		-	-																		
Nickel	µg/l	0.5	-	8.6	12	2.1	6.7				2.5	2.3	2.1	2.4	2.6	6.7	2.5	2.3	2.4	2.9	2.2	2.3
Selenium	µg/l		-	-																		
Zinc	µg/l	0.5	-	6.8	12	0.9	31		1	1	1.5	2	1.5	3.3	1.7	1.2	31	4.8	2.7	2.9	0.9	1.8
Ammoniacal Nitrogen as NH_4	µg/l	15	-	-																		
Ammoniacal Nitrogen as NH_3	µg/l	15	-	21	12	15	130		7	7	17	18	92	87	15	31	130	100	24	48	15	15
Chloride	µg/l	150	-	-	12	68000	11000000				970000	120000	170000	290000	1000000	11000000	78000	130000	680000	740000	68000	120000
Chlorine	µg/l		-	10																		
Cyanide	µg/l		-	1																		
Nitrate as NO_3	µg/l	50	-	-	12	27300	36200				31800	33700	35900	31000	34500	27300	35500	32100	34400	28200	36200	31600
Nitrite as NO_2	µg/l	5	-	-	12	5	74				5	19	20	74	5	19	10	50	5	35	6.9	48
Phenol	µg/l	0.05	-	7.7																		
Pentachlorophenol	µg/l		0.1	0.4																		
PCBs	µg/l		0.001	-																		
Sodium	µg/l		-	-																		
Sulphate	µg/l	45	-	-	12	24800	1830000				164000	31000	38100	47400	157000	1830000	25400	33000	128000	94200	24800	32200
pH	pH Units		-	-	12	7.4	7.9				7.5	7.7	7.8	7.9	7.5	7.7	7.7	7.9	7.4	7.7	7.7	7.8
Dichloromethane	µg/l		-	20																		
1,2 Dichloroethane	µg/l	1	1	10																		
Trichloroethene (PCE)	µg/l	1	0.1	10																		
1,1,1 Trichloroethane	µg/l	1	0.1	-																		
1,1,2 Trichloroethane	µg/l	1	0.1	-																		
Trichloromethane (Chloroform)	µg/l	1	0.1	2.5																		
1,2,3 Trichlorobenzene	µg/l	1	-	-																		
1,2,4 Trichlorobenzene	µg/l	1	0.01	-																		
Trichlorobenzene (1,2,3 & 1,2,4)	µg/l	2	-	0.4																		
Tetrachloroethene	µg/l	1	0.1	10																		
Tetrachloromethane	µg/l	1	0.1	12																		
1,1,1,2 Tetrachloroethane	µg/l	1	-	-																		
2-chlorophenol	µg/l	0.05	0.1	-																		
4-chloro-3-methylphenol	µg/l		0.1	-																		
Hexachlorobutadiene	µg/l	1	0.005	0.6																		
Vinyl Chloride (Chloroethene)	µg/l	1	-	-																		
>C5 to C6 Aliphatic	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
>C6 to C8 Aliphatic	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aliphatic	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aliphatic	µg/l	10	-	-	12	10	10				10	10	10	10	10	10	10	10	10	10	10	10
>C12 to C16 Aliphatic	µg/l	10	-	-	12	10	10				10	10	10	10	10	10	10	10	10	10	10	10
>C16 to C21 Aliphatic	µg/l	10	-	-	12	10	10				10	10	10	10	10	10	10	10	10	10	10	10
>C21 to C35 Aliphatic	µg/l	10	-	-	12	10	10				10	10	10	10	10	10	10	10	10	10	10	10
>C35 to C44 Aliphatic	µg/l		-	-																		
Total Aliphatic C5-35	µg/l		-	-																		
>C5 to C7 Aromatic	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
>C7 to C8 Aromatic	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
>C8 to C10 Aromatic	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
>C10 to C12 Aromatic	µg/l	10	-	-	12	10	10				10	10	10	10	10	10	10	10	10	10	10	10
>C12 to C16 Aromatic	µg/l	10	-	-	12	10	10				10	10	10	10	10	10	10	10	10	10	10	10
>C16 to C21 Aromatic	µg/l	10	-	-	12	10	10				10	10	10	10	10	10	10	10	10	10	10	10
>C21 to C35 Aromatic	µg/l	10	-	-	12	10	10				10	10	10	10	10	10	10	10	10	10	10	10
>C35 to C44 Aromatic	µg/l		-	-																		
Total Aromatic C5-C35	µg/l		-	-																		
TPH Ali/Aro	µg/l		-	-																		
Benzene	µg/l	1	1	8	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
Ethylbenzene	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
Toluene	µg/l	1	4	74	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
Xylene	µg/l		3	30																		
M- & P-Xylene	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
O-Xylene	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
Total Xylene (M, P & O)	µg/l	2	-	30	12	2	2				2	2	2	2	2	2	2	2	2	2	2	2
MTBE	µg/l	1	-	-	12	1	1				1	1	1	1	1	1	1	1	1	1	1	1
naphthalene	µg/l	0.01	-	2	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
acenaphthylene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
acenaphthene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
fluorene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
phenanthrene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
anthracene	µg/l	0.01	-	0.1	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
fluoranthene	µg/l	0.01	-	0.0063	12	0.01	0.01		12	12	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
pyrene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(a)anthracene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
chrysene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(b)fluoranthene	µg/l	0.01	-	0.017	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(k)fluoranthene	µg/l	0.01	-	0.017	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(a)pyrene	µg/l	0.01	-	0.00017	12	0.01	0.01		12	12	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
benzo(g,h,i)perylene	µg/l	0.01	-	0.00082	12	0.01	0.01		12	12	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
dibenzo(ah)anthracene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
indeno(1,2,3-c,d)pyrene	µg/l	0.01	-	-	12	0.01	0.01				0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sum (benzo b, k, ghi & indeno123cd)	µg/l	0.04	-	-	12	0.04	0.04				0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Total PAH	µg/l	0.16	-	-	12	0.16	0.16				0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16