East Tip, Haulbowline Island, Cork

Detailed Quantitative Risk Assessment
(Including Generic Assessment)

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DETAILED QUANTITATIVE RISK ASSESSMENT PEER REVIEW

In February 2012 SKM Enviros (SKME) were appointed by Cork County Council from their Multi-Disciplinary Environmental Advisory Services in relation to the waste licensing and land remediation/reclamation project at Haulbowline Island, Co Cork. Under the scope of services relating to this framework agreement is the requirement to undertake peer review of a number of technical reports and studies carried out by other consultancy providers appointed by Cork CC under a parallel framework agreement.

In May 2012 Cork CC requested that SKME provide on-going technical peer review related services to assist in the delivery of a Detailed Quantitative Risk Assessment (DQRA) and supporting investigations at the East Tip in order to progress towards assessment of potential remedial options to support remediation and reclamation of the site.

WYG Environmental Planning and Transport Ltd (WYG EPT Ltd) have undertaken detailed site investigations and a quantitative risk assessment of the East Tip, details of which are contained within the attached report.

SKM Enviros have undertaken an independent technical review of the investigations and subsequent report, which has included a review of the overall approach adopted and a review of work and methodologies employed against current relevant national and international best practice and guidance. Having completed our review we are in agreement with the methodologies applied, the report findings, and the conclusions and recommendations contained therein. It should be noted that in completing our review, factual information presented within the report such as geological data, testing and analysis data compiled by WYG EPT Ltd. has been taken at face value by SKM Enviros as being factually correct.

For and on behalf of SKM Enviros

Mike McDonald

Project Manager

18th October 2013

Non-Technical Summary

In February 2012 WYG Environment Planning Transport Ltd. were appointed by Cork County Council from their Framework Agreement with Multiple Operators for Multi-disciplinary Environmental Consultancy in relation to Waste Licensing and Remediation/Reclamation Projects in County Cork to complete detailed site investigations and a quantitative risk assessment of the East Tip at Haulbowline Island, County Cork.

A quantitative risk assessment determines whether or not contamination is present on a site. Where present it quantifies the level encountered and compares it against various human health and environmental assessment criteria thus determining the risk to the respective receptors. Once the risk has been identified and quantified the mitigation measures required to minimise that risk are outlined. With respect to the East Tip the quantitative risk assessment performs an additional function in that it also informs the planning, waste licence and foreshore licence applications necessary to progress the reclamation and regularisation of the East Tip required in order for the Irish State to comply with the European Court of Justice Ruling in case C494/01. Cork County Council, on behalf of the Irish State, has assumed the role of project manager for the various consent processes.

The initial phase of this project consisted of a comprehensive desk study involving a detailed review of a significant body of existing monitoring data and other environmental information pertaining to the East Tip. On foot of this review further targeted and comprehensive investigations have been successfully completed undertaken including:

- Sampling and testing of all known waste types contained within the body of the tip;
- Detailed investigation and sampling of groundwater horizons in various geological strata which exist beneath the East Tip;
- Sampling and testing of waters in Cork Harbour surrounding the tip for evidence of contamination;
- Sampling and testing of sediments adjacent to the tip shoreline for evidence of contamination.

All of the above work has been undertaken with reference to relevant guidance documents and recognised Irish and International norms.

Completion of the above studies has greatly increased the level of understanding of the hydrological and geo-chemical regime within, and surrounding, the East Tip and has allowed the development of a Conceptual Site Model. This model identifies potential existing pathways (or linkages) between contamination present in the East Tip and human and environmental receptors such as users of and visitors to the site and ecological receptors in Cork Harbour. Using the Conceptual Site Model as a basis, a site specific detailed Quantitative Risk Assessment (dQRA) has been undertaken in order to quantify these risks. The dQRA has established that in its present condition the East Tip poses a risk to both site visitors and ecological receptors.

Under a risk based approach some form of remedial works are required in order to address the risks which have been identified. In this instance such mitigation measures function by breaking or controlling the pathway between the East Tip and the human and environmental receptors identified. The mitigation measures specified entail the use of a capping layer across the surface of the site, to prevent future contact with materials contained within the East Tip, combined with a perimeter engineered structure, to limit the migration of contaminants into the harbour waters. The perimeter engineered structure would also provide a dual role in preventing future erosion from the base of the East Tip.

Executive Summary

Instruction and outline	WYG were appointed by Cork County Council, on 27th January 2012, for the provision of multi-disciplinary environmental consultancy services for the site investigation and Detailed Quantitative Risk Assessment (DQRA) of the East Tip, on Haulbowline Island in Cork Harbour. This project relates to geo-environmental services required under Phase IV of the project programme, consultant contract requirements of the Council's regularisation programme for the East Tip which involves the completion of intrusive site investigations and a Detailed Quantitative Risk Assessment (DQRA).
Aims	The overall aim of the works completed at the East Tip was to undertake an assessment of the significance of the risks to human health and the environment receptors, in order to assist in identifying risks which may require mitigation as part of the licensing process. As specified by tender documentation, this report presents a Generic and Detailed Quantitative Risk Assessment (GQRA & DQRA) which integrates relevant data obtained from the recent 2012 site investigations with existing (previous) site investigation data.
Site Investigation Scope	An intrusive investigation was completed between the 24th April and the 12th June 2012 by Priority Geotechnical Ltd (PGL) to address data gaps identified by WYG in a gap analysis developed from review of previous work. The site investigation works included completion of 21 No. cable percussive boreholes to a maximum depth of 35m below ground level (bgl); 2 No. trial trenches; 3 No. rotary boreholes; 3 No. open hole rotary boreholes; chemical, NRA leachability and geotechnical testing of solid and water samples; landfill gas monitoring; groundwater monitoring; and in-situ permeability testing.
Generic Quantitative Risk Assessment	The laboratory analysis results were assessed against relevant GACs. In regard to human health, these were compared to commercial land use GACs to consider the current use of the site and also to park land use GACs to consider the current Naval football pitch and also a potential future recreational use. Whilst, arsenic, cadmium, lead, nickel, vanadium, zinc and benzo(a)pyrene had measured concentrations which exceeded the GACs for either one or both uses, statistical analysis of the data found that only arsenic and lead contamination in the waste across the East Tip are present at levels posing significant risk to human health for future site users. Significant risks to the health of users of the current Navy Football pitch were not identified. Leachable concentrations, in excess of water quality standards (WQS), of chromium, chromium VI[1], copper and to a lesser extent zinc, lead and mercury were identified from solid samples of the waste material. Groundwater samples collected from wells screened in the various horizons of waste, alluvium, sands and gravels and limestone, were found to have measured concentrations of some of the contaminants of concern in excess of their relevant WQSs. The most significant concentrations were observed in water collected from wells screened in the waste material in regard to chromium, chromium VI, copper, zinc, lead, manganese, nickel, mercury and PAH compounds. Measured concentrations of arsenic, cadmium, chromium, copper, manganese and mercury were also in excess of the WQSs in alluvium, arsenic, cadmium, chromium, copper, manganese and mercury in sands and gravels and cadmium, chromium, copper, mercury, nickel, zinc and manganese in limestone. Although significantly lower metal concentrations were measured in the Limestone which typically only marginally exceeded WQSs providing evidence of limited contaminant downward migration. Sampling and analysis of Cork Harbour marine waters did not measure concentrations in excess of WQSs showing that they are not currently being impacted. Ground gas monitoring has shown that the alluvium is generating significant concentrations methane whereby the gassing regime of the horizon has been assigned a maximum classification of characteristic situation 5 according to best practice guidance such that further monitoring and risk assessment would be required for any buildings to be constructed on site.

[1] Refer to glossary for further information on chromium and chromium VI

Hydrogeology and Hydrology Environment	Haulbowline Island is set in the centre of the main estuarine channel of Cork Harbour. The central part of the island is a large artificial harbour and dock area. The East Tip accounts for around one quarter of the land mass of Haulbowline Island (circa 9Ha.) extending radially, eastward into the sea from the central harbour with an irregular shoreline. Monitoring of groundwater within the waste material has shown that approximately 65% of the waste is below mean sea level and is therefore in direct hydraulic continuity with the tidal cycle. This is supported by in situ groundwater data level monitoring which has shown tidal signals for groundwater within the waste and also the underlying alluvium, sands and gravels and limestone. There is therefore no "perched" water table or aquifer which would behave a similar way to that observed for land based systems, instead the groundwater underlying the site is predominantly controlled by the tide. There is no definitive groundwater gradient or groundwater flow direction. Permeability testing has shown the waste to be permeable and heterogeneous. Lower permeabilities were observed for the underlying alluvium which is consequently inhibiting downward contaminant migration.
DQRA – Tier 4	A bespoke Detailed Quantitative Risk Assessment model has been completed to establish a conservative estimate of the mass of dissolved phase contaminant flux potentially leaving the waste material as part of the local tidal regime and its impact on Cork Harbour marine waters taking into account the potential for dilution. The modelling showed no theoretical impacts to the waters of Cork Harbour from the majority of the potential constituents of concern identified through the generic assessment process. However, the model predicted that chromium VI and manganese concentrations in the harbour waters to a distance of 50m from the shoreline could be impacted, but these impacts quickly diminish to negligible concentrations at distances beyond 100m of the shoreline. It should be noted that sampling and laboratory analysis of Cork Harbour waters for the above contaminants has not identified an actual impact. Modelling was undertaken using a conservative permeability of 10^{-3} m/s which is an average of in-situ permeability testing and permeabilities derived from laboratory analysis of cored material. Sensitivity analysis undertaken as part of the modelling indicates that decreasing the lateral permeability by just one order of magnitude would be sufficient to reduce the theoretical impact of dissolved phase contaminant discharge into the harbour to negligible levels.
Recommendations	Remediation is considered necessary for arsenic, lead and asbestos in waste material with respect to human health and for chromium VI and manganese concentrations in respect to the Cork Harbour waters. A possible remedial approach is through the provision of a low permeability cover system which will break the pathway associated with risks to human health and minimise infiltration of surface water into the waste and underlying waters in combination with an engineered perimeter system with a maximum permeability of 10^{-5}m/s to reduce contaminant flux leaving the waste into the Cork Harbour waters and secondly to prevent erosion of the waste material into the sea.

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1 Introduction

1.1 Instruction

WYG Environment, Transport and Planning (WYG EPT) were appointed by Cork County Council (CCC) on 27th January 2012, to provide multi-disciplinary environmental consultancy services for the site investigation and Detailed Quantitative Risk Assessment (DQRA) of the East Tip, on Haulbowline Island in Cork Harbour, (Figure 1 and Figure 2). This project relates to geo-environmental services required under Phase IV of the Council's regularisation programme of the waste in the East Tip (http://www.corkcoco.ie/haulbowline) which involved the completion of intrusive site investigations and a Detailed Quantitative Risk Assessment (DQRA).

1.2 Legal Context and Assessment Framework

The European Court of Justice ruling in case C494/01 requires that the East Tip is regularised in accordance with the Waste Framework Directive (WFD) (licensing requirements) and in particular an application will be made to the Environmental Protection Agency (EPA) for a waste licence.

The Environmental Risk Assessment for the East Tip, including site investigations and monitoring, completion of DQRA and design of an appropriate outline remediation plan, are required to support this process. The work, as presented in this report, has been completed in accordance with best practice guidance documents including "Framework Approach for the Management of Contaminated Land and Groundwater at EPA Licensed Facilities" (EPA, 2012); the "Code of Practice: Environmental Risk Assessment for Unregulated Disposal Sites" (EPA, 2007) and the "Model Procedures for the Management of Land Contamination – Contaminated Land Report" (EA, 2004). This latter piece of guidance is specifically relevant to land contamination in the United Kingdom (UK), however it is relevant as the EPA's framework has been broadly based on it.

The framework approach identifies three stages as outlined below:

Stage 1 – Site Investigation and Assessment including

- Preliminary Site Assessment
- Detailed Site Investigation
- Quantitative Risk Assessment

Stage 2 – Corrective Action Feasibility and Design

- Outline Corrective Action Strategy (Objectives)
- Feasibility study and outline design
- Detailed design
- Final Strategy and implementation plan

Stage 3 – Corrective Action Implementation and Aftercare

- Enabling works
- Corrective Action Implementation and Verification
- Aftercare

This assessment presented in this report presents the results of a detailed site investigation and quantitative risk assessment in accordance with Stage 1 above.

The risk assessment process is underpinned by the establishment and continual refinement of a Conceptual Site Model (CSM). A CSM describes the potential sources of contamination at a site, the contaminant migration pathways it may follow and the receptors that could be or are being impacted. When all three are present i.e. source, pathway and receptor, then a potential pollutant linkage is considered to be present, requiring characterisation and assessment in order to determine whether remedial works are needed to adequately address any potentially unacceptable risks.

1.3 Limitations of the Report

Attention is drawn to the report conditions, included in Appendix A.

1.4 Aims and Objectives

The overall aim of the work completed at the East Tip and this report is to present the results of an assessment of the significance of the risks to human and environmental receptors, in order to assist in identifying risks which may require mitigation as part of the waste licensing process. As specified by tender documentation, it provides a Generic and Detailed Quantitative Risk Assessment (GQRA & DQRA) which integrates relevant data obtained from the recent 2012 site investigations with existing (previous) site investigation data.

The scope of work included:

- Providing an integrated profile of the chemical and physical nature of made ground, alluvium, gravel and bedrock by defined area;
- Providing a detailed interpretation of testing results from current and previous investigations in respect to sources, pathways and receptors;
- Providing an assessment of waste in terms of the DQRA;
- Determining/assessing the nature and extent of biodegradable materials present in the waste which were initially identified in previous investigations;
- Determining the nature of the vertical and horizontal groundwater flows through the identified strata underlying the site to support contaminant fate transport modelling and risk assessment, hydrogeological assessment, drainage design and civil structures design for the remedial design solution;
- Providing a DQRA using best practice modelling techniques in respect to contaminant transport and human health;
- Providing a final detailed CSM;
- Providing an outline assessment options for managing risks identified; and

- Providing an outline generic design for remedial option selected as most appropriate (note detailed design will not be part of this task).

It should be noted that the term "waste" utilised within this report refers to non-natural materials which have been deposited in the East Tip above alluvium or natural sediments. Any use of the term "soil" within this report refers to natural materials, soils or sediments, including alluvium, sands, silts, clays and gravel.

The purpose of this report is to inform a waste licence application for the East Tip. The scope of this report includes:

- Development of an initial Conceptual Site Model;
- Review and inclusion of relevant site investigation and monitoring data up to and including the site investigation works completed in 2012;
- Assessment of contaminants of concern to assess their significance through comparison of chemical analysis results (solid, leachability and water analysis) with relevant standards and thresholds;
- Development of a revised conceptual site model;
- Completion of a DQRA to test the significance of contaminants of concern present and develop a site specific assessment;
- Presentation of an updated conceptual site model; and,
- Presentation of an outline or generic proposed remedial risk management approach.

1.5 Initial Conceptual Site Model

WYG in collaboration with Cork County Council (CCC) undertook a review of all previous works undertaken on the site in order to develop an initial CSM and identify gaps for which further data was required (CCC, 2012a). The initial CSM developed from this review is presented in Table 1, Table 2 and Figure 3.

Table 1 - Initial Conceptual Site Model – Water

	Source		Pathway		Receptor
S1	Shallow and deep metal contamination associated with waste material including surface stockpiles. Arsenic, chromium, copper, zinc, lead, nickel, cadmium, water soluble boron, vanadium, Also PCBs, TPH and PAHs	P1	Leaching from unsaturated zone	R1	Shallow groundwater in slag material
		P2	Leaching within tidal zone through wetting and drying	R1	Shallow groundwater in slag material
		P3	Lateral and vertical groundwater migration	R2, R3, R4	Cork Harbour waters (R2), alluvium & sands and gravels (R3), limestone (R4)
		P4	Uptake by flora and fauna	R5	Flora and fauna in Cork Harbour particularly on foreshore
S2	Groundwater Contamination associated with waste material, arsenic, chromium, copper, zinc, minor lead, nickel, cadmium	P3	Lateral and vertical groundwater migration	R2, R3, R4	Cork Harbour waters (R2), alluvium & sands and gravels (R3), limestone (R4)
		P4	Uptake by flora and fauna	R5	Flora and fauna in Cork Harbour particularly on foreshore
S3	unauthorised refuse waste (flytipping) – ammoniacal nitrogen and other potential contaminants	P1	Leaching from unsaturated zone	R1	Shallow groundwater in slag material
		P2	Leaching within tidal zone through wetting and drying	R1	Shallow groundwater in slag material
		P3	Lateral and vertical groundwater migration	R2, R3, R4	Cork Harbour waters (R2), alluvium & sands and gravels (R3), limestone (R4)
S4	Groundwater - unauthorised refuse waste (flytipping) – ammoniacal nitrogen	P3	Lateral and vertical groundwater migration	R2, R3, R4	Cork Harbour waters (R2), alluvium & sands and gravels (R3), limestone (R4)
S5	Waste material - Hydrocarbons e.g. due to the known presence of sludge	P1	Leaching from unsaturated zone	R1	Shallow groundwater in slag material
		P2	Leaching within tidal zone through wetting and drying	R1	Shallow groundwater in slag material
		P3	Lateral and vertical groundwater migration	R2, R3, R4	Cork Harbour waters (R2), alluvium & sands and gravels (R3), limestone (R4)
S6	Groundwater – hydrocarbons in groundwater due to known presence of sludge, TPHs and PAHs	P3	Lateral and vertical groundwater migration	R2, R3, R4	Cork Harbour waters (R2), alluvium & sands and gravels (R3), limestone (R4)

Table 2 - Initial Conceptual Site Model – Human Health

	Source		Pathway		Receptor
S1	Shallow metal contamination associated with slag material including surface stock piles	P5	Direct dermal contact Ingestion dust and soil Inhalation of dust	R5	Current & future site users Users of the Football Pitch Construction workers
S2	Groundwater Contamination associated with waste material, arsenic, chromium, copper, zinc, minor lead, nickel, cadmium, aluminium, manganese	P5	Direct dermal contact Ingestion	R5	Construction workers (unlikely unless excavating below water table)
S3	Ground Gas – methane and carbon dioxide possibly due to natural organic sediments and or possibly waste	P6	Lateral and vertical migration	R5	Current and future site users Adjacent buildings and users (Naval Base)
S5	Waste material - Hydrocarbons e.g. due to the known presence of sludge - speciated TPH, PAHs	P5	Direct dermal contact Ingestion dust and soil Inhalation of dust	R5	Future site users construction workers (unlikely unless excavating in area)
S6	Groundwater – Waste material - Hydrocarbons e.g. due to the known presence of sludge - TPHs and PAHs	P5	Direct dermal contact Ingestion	R5	Construction workers (unlikely unless excavating in area)

1.6 Report Content

This report sets forth the findings of this study in the following chapters:

Chapter 2 Site Investigation 2012 including assessment methodology and results presentation

Chapter 3 Generic Quantitative Risk Assessment (GQRA) for human health and waters

Chapter 4 Updated Conceptual Model (Post GQRA)

Chapter 5 Hydrogeological and Hydrology Setting

Chapter 6 Waters (DQRA Tier 4)

Chapter 7 Recommendations for Remediation Arising from Risk Assessment

Chapter 8 Conclusions

2 Site Investigation 2012

A site investigation and associated monitoring works was completed between April 2012 to August 2012 to address data gaps identified in the gap analysis report, provide valid data to test the pollutant linkages listed in Tables 1 and 2, and to further develop the CSM shown in Figure 3. Table 3 provides specific detail with regard to site investigation and monitoring actions that were completed to address each of the identified gaps.

The intrusive site investigation drilling works were carried out between the 24th April and the 12th June 2012 by Priority Geotechnical Ltd (PGL). Hydrogeological testing, groundwater monitoring and ground gas monitoring was completed during the intrusive site investigation. Following completion of the intrusive investigation, monitoring works continued until August 2012. All site investigation works were supervised on a full time basis by suitably qualified WYG consultants and a suitably qualified hydrogeologist undertook the hydrogeological testing and groundwater monitoring. A factual report titled "Haulbowline East Tip – Exploratory Ground Investigation Factual Report No. p12030, Priority Geotechnical, July 2012" presents details on the site investigation, fieldwork records and geotechnical/geoenvironmental data (PGL, 2012). It is not the intention to reproduce this data within this report. Consequently PGL's report should be read in conjunction with this report and is included on a CD at the end of the appendices.

In summary the site investigation and monitoring works included:

- 21 No. cable percussive boreholes to max depth of 35m. The locations were initially progressed with trial pits to depth of approximately 5mbgl;
- 2 No. trial trenches;
- 3 No. rotary boreholes;
- 2 No. open hole rotary boreholes;
- Chemical, National Rivers Authority (NRA) leachability testing[2] and geotechnical testing of solid samples;
- Chemical and geochemical testing of water samples;
- Landfill gas monitoring;
- Groundwater monitoring
- Surface water and seepage sampling; and
- In-situ permeability testing.

Site investigation locations are shown on Figure 4 along with site investigation locations from two previous investigations in 2005 (WYG, 2005) and 2008 (WYG, 2008) which have been utilised within the risk assessment contained in this report.

[2] NRA Leachability test is a laboratory test completed on solid material during which leachate is generated and analysed for contaminants of concern. It is used to assess the potential for contaminants to leach from solid to liquid phase to impact groundwater and surface water.

CLR Report number 04 – Sampling Strategies for Contaminated Land (DOETR, 1994) provides a calculation which can be used to calculate the number of investigation or sampling points required to ensure identified of a hotspot area with 95% confidence depending on site area and hotspot size. This has been completed to determine whether a sufficient number of investigation points have been completed. The calculation or equation is provided below.

$$N = {kA}/{a}$$

Where:
N = number of sampling points
A = total site area (approx 330m x 250m)
a = hotspot area (m^2)

This equation has been used to provide information on the sampling density which has been completed at the East Tip, where input data:

N = 45 sampling points (investigation locations)
A = approximately 82,500m^2 (site area)
K = 1.5 considered to be a conservative value as recommended by the guidance

The predicted hotspot area 2,860 m^2 equates to 3% of the total East Tip site area. This is considered to be sufficiently small and demonstrates the efficiency of the site investigations completed at the East Tip.

2.1 Potential Contaminants of Concern – Industry Profile

The UK's department of the Environment Industry Profile for steelworks (DOE, 1995) provides information on the processes, material and wastes associated with steelworks. It identifies that steel is an alloy of iron produced by refining iron to remove excess carbon and other elements and that some aluminium, nickel and chromium may be deliberately added. Solid material produced in the process includes slag, arising, scrap, dust and slurries and refractory material. Steel making slags are normally poured into contained areas and allowed to solidify.

The profile identified the following contaminants of concern in relation to steelworks sites:

- Metals and metalloids - Iron, arsenic, chromium, lead, manganese, molybdenum, nickel and zinc. Additionally aluminium, tin and vanadium associated with rolling and finishing processes;
- Inorganic compounds - fluoride, sulphates and phosphates;
- Acid/alkalis associated with rolling and finishing;
- Asbestos; and
- Organic compounds - fuels and oils and PCBs.

As a result of the above and considering the completed gap analysis results as summarised in Table 3, the following extensive list of contaminants were tested for as part of the site investigation, sampling and monitoring works completed:

Solid waste and natural sediments;

- Metals including aluminium, arsenic, cadmium, calcium, chromium (total), hexavalent chromium (or chromium VI), lead, mercury, selenium, boron (water-soluble), copper, nickel, zinc, antimony, barium, beryllium, magnesium, manganese and vanadium;
- Organic Compounds including phenols total and speciated, mineral oil, speciated total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene, xylene (BTEX) and methyl tertiary butly ether (MTBE), total polyaromatic hydrocarbons (PAHs), suite of volatile organic compounds (VOCs) and suite of semi- volatile organic compounds (SVOCs);
- Inorganics including cyanide total, cyanide complex, cyanide free, thiocyanate, sulphide, sulphate - total, acid, soluble, sulphate - water soluble, 2 : 1 extract, sulphur free, pH value and asbestos.
- Dioxins and Furans; and
- Polychlorinated biphenyls (PCBs).

Groundwater, surface water and leachate from leachability tests;

- Metals including aluminium, arsenic, cadmium, calcium, chromium (total), hexavalent chromium (or chromium VI), lead, mercury, selenium, boron (water-soluble), copper, nickel, zinc, antimony, barium, beryllium, magnesium, manganese, vanadium, iron, sodium, potassium
- Organic Compounds including phenols total and speciated, mineral oil, speciated total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene, xylene (BTEX) and methyl tertiary butly ether (MTBE), total polyaromatic hydrocarbons (PAHs), suite of volatile organic compounds (VOCs) and suite of semi- volatile organic compounds (SVOCs);
- Nitrogen compounds including ammoniacal nitrogen and nitrate nitrogen.
- Inorganics including cyanide total, cyanide complex, cyanide free, thiocyanate, sulphide, sulphate - total, acid, soluble, sulphate - water soluble, 2 : 1 extract, sulphur free, pH value and asbestos;
- Dioxins and Furans;
- Polychlorinated biphenyls (PCBs); and
- Water quality indicators chemical oxygen demand (COD), biochemical oxygen demand (BOD) and electrical conductivity.

Table 3 – Identified Data Gaps and Site Investigation Scope

Item	Identified Gap	Site Investigation Requirement	Site Investigation/Monitoring Works Completed 2012
1	Unknown laboratory accreditation in respect of earlier sampling in 1995 and 1998 and therefore uncertainties associated with results.	Chemical and physical analysis for all media to be completed by a suitably accredited laboratory.	Analysis completed by: Alcontrol UKAS accredited (Solid chemical analysis) Alcontrol UKAS accredited (NRA leachate) Alcontrol UKAS accredited (Groundwater and surface water) Professional Soils Laboratory UKAS accredited (Physical (geotechnical) analysis)
2	Limited sampling for chemical analysis and leachability testing of different steelworks waste types, such as sludge and flue dust for source identification and characterisation purposes.	Further sampling and analysis of the different waste types will be completed; Sampling to be completed using best practice techniques by suitably qualified and appropriately trained personnel to ensure representative samples are taken and their integrity protected; Accurate logging of ground conditions with particular reference to different waste streams; Leachability testing on the different waste types.	Sampling and laboratory analysis of different waste types were undertaken. Results of these are presented in Appendices D-H and described in Appendix P. These waste types included construction and demolition waste, flue dust, sludge, millscale and general unprocessed slag. Crib sheets used by contractor to ensure different waste types correctly identified and logged. Total of 65 No. solid waste samples for chemical analysis. 49 No. analysed for samples comprising of slag material of various proportions, out of these only 23 No. were of samples comprising 100% slag, remainder included slag mixed with other waste types e.g., refractory waste, millscale, sludge. 13 No. samples contained varying quantities of refractory waste varying from slag with occasional refractory bricks to slag with 50% refractory waste; 7 No. samples contained millscale with varying quantities, out of these 2 No. contained 100% millscale, remainder also included varying amounts of slag, flue dust, and construction and demolition type waste; 4 No. samples contained sludge out of these 2 No. comprised of 100% sludge not mixed with other waste and rest mixed with slag and construction and demolition type waste; 1 No. sample contained flue dust; 10 No. samples contained construction & demolition waste of quantities varying from occasional occurrences to 50%.
3	Refuse type waste (flytipping) suspected to be present but not identified through previous site investigations.	Investigation will target locations suspected of being infilled with domestic type waste, particularly the area to the north of the football pitch around BH116 and BH120.	Two trial trenches, each ~12m long completed in area to the north of football pitch (TP01 and TP02). New boreholes, each with a starter trial pit, also drilled in general area BH304, BH301, BH301A, BH302 and BH303.

Item	Identified Gap	Site Investigation Requirement	Site Investigation/Monitoring Works Completed 2012
4	Invalid collection of data for use within a DQRA due to use of composite sampling which is formed by mixing a number of samples from different locations to form one sample.	Composite sampling will not be used during the site investigation.	Composite sampling was not utilised during the current investigation. Only discrete sampling undertaken during 2012 investigation.
5	Insufficient density of sampling locations and sampling density required to support a DQRA in regard to variability of waste e.g. domestic waste and sludge pits, natural soil and groundwater characterisation.	Sampling density will be increased to an approximate 50m grid, in line with that required for a main investigation in accordance with BSI 10175, 2011. This will allow for better identification, characterisation and delineation of potential contamination sources with acceptable levels of residual uncertainty, essential for completion of the DQRA.	Sampling density increased to one sample location per 45m grid square, based on 48 sample locations from current and previous investigations.
6	Previous site investigation data unable to provide relative quantities of different waste types present.	Accurate logging of wastes will be undertaken by suitably qualified and trained personnel.	Logging of boreholes undertaken noting different waste types, i.e. slag (processed and unprocessed), flue dust, refractory bricks, demolition type waste, inclusions of steel. Crib sheets used for this purpose. Percentages provided in most instances. All parties were present for a workshop prior to commencement of the works on describing slag and its properties. Crib sheets were provided to all site investigation personnel to help in the correct identification of different waste types.
7	Receptor land use not previously targeted namely the football pitch.	Investigation will be targeted to include the Naval Base Football Pitch, (three sampling locations proposed). In respect to the users of the football pitch, the critical contaminant pathways are direct contact pathways in respect of contamination in the surface layer. As a result, samples selected for analysis will be targeted to near surface soils to determine more accurately risks to the health of the users of the football pitch, i.e. samples of the waste material from surface and top 0.5m.	BH304, BH305 and BH308 completed on football pitch with samples taken at 1m intervals starting at 0.3mbgl. Samples of topsoil were taken from all three locations at 0.3mbgl were analysed to more accurately assess health risks to the users of the football pitch from near surface waste material.
8	Insufficient chemical data available on underlying natural soils and hydrogeological aquifer units, alluvium, gravels and limestone. Only one borehole installed into limestone and none into underlying gravels which is not sufficient for chemical, physical and hydrogeological characterisation.	Site investigation will target underlying natural strata including the alluvium from which samples will be taken at different depths to obtain a profile of contaminant concentrations and provide an understanding of attenuation mechanisms which are occurring. In total, 8 No. boreholes to be installed into alluvium, 3 No. into gravels and 3 No. into limestone for chemical, physical and	In total, 8 No. boreholes were installed discretely into alluvium, 3 No. into gravels and 3 No. into limestone for chemical, physical and hydrogeological considerations. 1 No. borehole was also installed into encountered clay.

Item	Identified Gap	Site Investigation Requirement	Site Investigation/Monitoring Works Completed 2012
		hydrogeological considerations.	
9	Laboratory detection limits not sufficiently low enough to allow comparison with water quality standards.	The laboratory testing will utilise suitable laboratory detection limits to allow for comparison with appropriate assessment quality standards wherever possible.	Alcontrol Laboratories undertook the analysis using suitable detection limits that allowed for comparison to the appropriate assessment quality standards. This is with the exception of mercury and chromium VI water analysis where LODs (0.15µg/l and 30µg/l respectively) less than water quality standards were not achieved due to the brackish quality of the water being sampled. Subsequently, further groundwater and surface water sampling and laboratory analysis was undertaken to provide further data with LODs closer to or below appropriate assessment quality standards.
10	Monitoring wells not installed into discrete horizons or aquifer units to provide data representative of horizon and installation not appropriate for site specific hydrogeological parameter testing.	Installation of monitoring wells will be discrete, i.e. only installed into one horizon e.g. either targeted to alluvium or waste material but not both. Will allow characterisation and determination of the gassing regime of each potential source, collection of representative groundwater samples, and site specific hydrogeological testing to be undertaken.	All monitoring wells were installed into discrete horizons or aquifer units as per item 8 above.
11	Chemical and physical data not available to determine current status of site, for example whether high zinc encountered in groundwater at BH119 and BH127 during sampling in 2005 is currently present.	Site investigation will include sampling groundwater from all existing site investigation locations to determine current contamination status for DQRA purposes and allow trends to be determined by comparison with previous site investigation data.	All existing and new groundwater monitoring wells were sampled at both high tide and low tide. In total 70 groundwater samples were taken across the site, excluding duplicate/trip samples.
12	Data lacking in regard to groundwater quality associated with contractor excavation[3] and sludge pit.	Contractor excavation will be targeted during site investigation to further characterise including groundwater hydrocarbon analysis with the aim of assessing if the groundwater continues to not be impacted from sludge in this area as identified previously.	BH306B, C & D drilled and installed immediately adjacent to contractor excavation. BH316, BH305, BH125R also drilled and installed in close proximity to the contractor excavation. Groundwater samples from all of these locations were analysed for hydrocarbon contamination.
13	Data unreliable with regard to arsenic concentrations in marine waters due to potential ionic interference during analysis.	Appropriate laboratory analysis to be undertaken for marine waters to ensure representative analysis and avoidance of ionic interference.	Laboratory analysis screened samples for salinity in order to ensure appropriate analysis taken into account to minimise ionic interference.
14	Length and number of gas monitoring rounds conducted, less than guidance recommended values.	Further ground gas monitoring will be completed on boreholes on a weekly basis over a period of two months to allow for completion of a more	5 No. monitoring rounds completed from end July 2012 to end August 2012 with monitoring of existing boreholes completed during site investigation works.

[3] "Contractor excavation" refers to unauthorised excavations which took place on the East Tip in 2007-2008 in an area known to contain sludge.

Item	Identified Gap	Site Investigation Requirement	Site Investigation/Monitoring Works Completed 2012
		robust ground gas characterisation and risk assessment.	
15	Data lacking on physical properties of wastes especially for slags, including their in situ permeabilities.	Additional chemical and physical data will be collect from waste material, alluvium, gravels and Limestone including PSDs and U100s as appropriate, bulk density and FOC/SOM, accurate borehole/trial pit logging as input requirements to any DQRA model. Permeability data to be obtained for waste material.	In order to determine the physical properties of the wastes on site the following geotechnical testing was completed on waste: 27 No. PSDs 14 No. Moisture Content & 1 No. Atterberg Tests 14 No. Bulk Density tests 15 No. FOC results. Permeability data has also been developed (see Item 17)
16	Data lacking on leaching potential for contaminants from waste to water.	In addition to item 2 above, further leachate analysis will be undertaken through use of less aggressive leaching tests, to replicate site conditions. For example column tests such as the upward percolation test, will have flow varied during the test to simulate the wetting and drying process which occurs with tidal fluctuations which could be influencing leaching mechanisms.	One column test (standard upward flow percolation test) was completed. A further column test was being completed at the time of writing this report, modified from upward flow percolation test to include wetting and drying of the sample to replicate tidal wetting and drying and utilising sea water as the leachate eluant.
17	Data gap in regard to fully understanding hydrogeological connections between waste, alluvium, underlying gravels and limestone, excavations and Cork Harbour.	Detailed hydrogeological monitoring, using data loggers in wells will be installed into different discrete strata to provide a better understanding of permeability, hydraulic gradients, and hydrogeological connections between the different hydrogeological units under varying tidal conditions. Tidal monitoring of Cork Harbour should be completed to understand the hydrogeological connection between groundwater in the East Tip and Harbour water; Monitoring and sampling of all groundwater locations, surface waters, foreshore seeps and harbour waters will be undertaken at the same time to allow comparisons to be made between different contaminant concentrations between the different aquifer units. This will enable assessments to be made on migration and behaviour of contaminants, attenuation/dilution factors and also connectivity between the different units.	PGL sub-contracted hydrogeological consultants to oversee all hydrogeological monitoring works. Dataloggers were used to provide a detailed understanding of the hydrogeological conditions and connectivity's within and between the different strata, and also harbour waters. Data loggers installed for a minimum of two weeks in most borehole locations to provide a robust understanding of tidal fluctuations. Rising head and falling head permeability testing was completed in all strata and at various tidal conditions to provide a detailed understanding of the hydrogeological characteristics of the site. 18 No. falling head and 38 No. rising head permeability tests were completed.

To summarise, it is considered that the site investigation completed at the East Tip has addressed the data gaps as identified during the gap analysis review. This has resulted in the completion of a robust site investigation, significantly increasing the understanding of the current contaminative status of waste within the East Tip and underlying groundwater, hydrogeological regime and connectivities. It has resulted in providing a greater understanding with increased certainty on the potential significance of risks to identified sensitive receptors including human health and Cork Harbour.

2.2 Methodology Assessment Criteria

For a risk of harm to human health or the environment to occur as a result of ground contamination, all of the following elements must be present:

- A source, i.e. a substance that is capable of causing pollution or harm;
- A receptor (or target), i.e. something which could be adversely affected by the contaminant; and
- A pathway, i.e. a route by which the contaminant can reach the receptor.

If one of these elements is missing there can be no risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

In order to assess the human health and environmental risks posed by potential contaminants within the waste material and underlying groundwater an initial screen of the laboratory results was undertaken using Generic Assessment Criteria (GACs). GACs are generic screening values used for comparison purposes to assess the risk associated with contaminant concentrations found on site and are derived using non-site-specific information. Where contaminant concentrations fall below relevant GACs, they are not considered to be capable of causing a risk to the receptor being considered and as a result do not warrant further consideration.

2.2.1 Human Health – Chemical Analysis of Solid Samples

In order to assess the solid laboratory analyses results, both for waste material and natural sediments, WYG have utilised GACs which comply with current Irish Framework Guidance (EPA, 2012) to assess potential risks to human health receptors. Following discussion with CCC, WYG have used appropriate commercially available GACs for the generic human health risk assessment which are regularly used in Ireland and the UK. GACs are contaminant specific and have been derived for various land use types including commercial / industrial, low density and high density housing and park / playgrounds and allotments. Those that are relevant to assessing contamination within the East Tip include for:

- Park land use Atrisk GACs are commercially available GACs and are considered appropriate for screening soils based upon the possible future recreational use of the East Tip. The CSM for this land use and derivation of GACs assumes that the site in question has large grassed areas that are used for a range of recreational activities including picnicing, sunbathing and casual sports uses e.g. a football 'kick around'. There is also often a small children's play area, which may have tarmac or other hard cover. Parks are also assumed to have areas such as flower beds and paddling pools or duck ponds. However, pathways relating to contact with surface water are not included within the GACs. These GACs are considered to be more appropriate in the context of the potential future site end use than other commercially available GACs such as those that have been calculated by the CIEH and LQM

(CIEH, 2009) which only provide GACs relevant to residential, allotments and commercial land uses. It is considered the use of residential GACs would provide an overly conservative assessment and they assume that a child is the critical receptor who would be exposed 365 days per year.

- Commercial and industrial land use GACs, have been recently derived in the UK by the Chartered Institute of Environmental Health and the Land Quality Management Team at the University of Nottingham. These were developed through collaboration of a number of UK contaminated land specialist practitioners and published jointly by CLAIRE and CIEH, (CIEH, 2009). These screening criteria can be considered to be appropriate in assessing risks to the health of current users of the site. They assume that buildings are present, normally for office use on site and that indoor pathways are therefore applicable. Outdoor contact pathways are restricted to lunchtimes or break times. There is currently a building on site which, on occasion, is utilised as an office. It should be noted that these GACs are typically less than the above park land use GACs and therefore generally the use of park land use GACs provides for a more conservative assessment.

A full list of the GACs is provided in Appendix B. Solid sampling laboratory analysis results compared to relevant GACs are presented in Appendices C - I for the waste body as a whole, for the different waste types' present and natural sediments.

Statistical Methodology

In May 2008, "*Guidance on comparing soil contamination data with a critical concentration*" was jointly published by the Chartered Institute of Environmental Health (CIEH) and Contaminated Land Applications in the Real Environment (CL:AIRE) (CIEH, CLAIRE, 2008). This document provides guidance on statistical techniques and methods for data assessment purposes, specifically comparing a critical concentration with an unbiased sample data set of soil contaminant results. Refer to Appendix J for further detail.

In order to present the results in a standardised format and prevent calculation errors, the selected contaminant data sets are analysed within a specialist spreadsheet package, the ESI Contaminated Land Statistics Calculator (ESI, 2008).

2.2.2 Methods for Water Assessment

The analytical data from solid leachability tests, groundwater and surface water samples has been assessed by direct comparison with water quality standards (WQS) as presented in Table 4. Where a specific Irish Surface Water Standard is not available, then other standards such as drinking water standards (Irish standards if available) were utilised or environmental quality standards (EQS) from the UK. These are mainly national statutory standards sourced from, in order of preference, European Communities Environmental Objectives (Surface Waters) Regulations 2009 (Annual Average) for surface waters other than inland waters e.g. coastal and transitional waters; European Communities Environmental Objectives (Surface Waters) Regulations 2009 (Annual Average) for inland surface waters; and other international water quality standards namely UK Environmental Quality Standards (EQS) and UK Drinking Water Standards (DWS). These are used as screening standards in the first instance to determine which of the potential contaminants of concern (PCOC) should be further assessed for significance of the risk posed.

In order to assess PCOCs, compliance point standards are required which should be appropriate for the receptor being considered. For the East Tip site, the Cork Harbour waters are considered to be the primary receptor. As a result the preferred quality standards adopted are those as in Table 4 and are EQS values for "other surface waters".

The initial conceptual model developed during the gap analysis has identified that the underlying limestone aquifer is not considered to be a sensitive receptor. It is brackish or saline is therefore considered to be of a poor water quality and would not be used for public or private drinking water supplies. This has been confirmed by this investigation as outlined in Section 3.2.5. As a result it has not been included as a sensitive receptor for risk assessment purposes.

2.2.3 NRA Leachability Tests on the Solid Matrix

The National Rivers Authority (NRA) leachability tests were assessed for the solid matrix (waste and natural sediments) by comparing to the WQSs in Table 4.

NRA leachability test results and water analysis summary screening sheets are presented in Appendix K and Appendix L respectively. These sheets summarise the laboratory analysis results and compare them to a contaminant specific GAC (appropriate water quality standard), with concentrations in excess of GACs highlighted.

Table 4 - Water Quality Standards from European Communities Environmental Objectives (Surface Waters) Regulations 2009 (Annual Average)(DoEHLG, 2009)

Contaminant	Water Quality Standard (WQS) (µg/l)
Arsenic	20
Chromium III	4.6 (inland water – no other surface water)
Chromium VI	0.6
Copper	5
Zinc	40
Lead	7.2
Nickel	20
Phenol	8
Mercury	0.05
Cadmium	0.2
Total Ammonia (mg/l N/l)(good status)	60
Ammoniacal Nitrogen (by calculation from ammonia)	50
Benzene	8
Xylene	10
Toluene	10
Anthracene	0.1
Benzo(a)pyrene	0.05
Benzo(b & k)fluoranthene (sum)	0.03
Benzo(g,h,i)perylene & indeno (1,23-cd)pyrene (sum)	0.02
Fluoranthene	0.1
Naphthalene	1.2

Other standards:
Aluminium – Drinking Water Standard – 0.2mg/l Water Soluble Boron – UK Marine Water EQS - 7mg/l Manganese – UK freshwater EQS – 0.03mg/l

2.2.4 Asbestos Tests on the Solid Matrix

In total 229 No. samples were analysed either by Alcontrol or IOM Consultating to identify asbestos fibres and identified that 131 No. tested for asbestos mainly comprising of loose chysotile fibres. However quantification analysis has shown this to be in very low quantities typically in the 0.003%-0.006% range and typically the lower risk chrysotile has been identified. Further examination has identified that the asbestos fibres had not been subjected to a heat treatment and as a result are not considered to originate from the slag or raw scrap metal that was used by the steelworks. More detailed results are presented in Appendix M.

2.2.5 Ground Gas

Ground gas monitoring results have been assessed using methodologies from CIRIA Document, C665 (CIRIA, 2007). This provides guidance on the collection of relevant and valid data to allow the gassing regime to be adequately characterised and assessed. Appendix N contains a more detailed assessment methodology and the results of the assessment are in Appendix O.

2.3 Chemical Analysis Results - Solid Waste Quality

In undertaking this assessment, to consider solid waste quality, data for samples collected from investigations in 2005, 2008 and 2012 were compared to the GACs as presented in Table 5 and included in Appendices D-J. Waste samples include those obtained from slag (both processed and unprocessed, slag waste with inclusions of timber, concrete, metal, demolition waste, plastic, domestic waste, refractory waste, flue dust and sludge). Further detailed consideration is given to the waste material and in particular different waste types in respect of contamination in Appendix P.

Table 5 - Summary Analysis Results from Solid Samples in 2012 where Concentrations of Contaminants of Concern exceed GACs

Contaminant	No. of Samples	Maximum Conc. (mg/kg)	No. of Samples below Detection Limit	Park Land Use Human Health GAC			Commercial Land Use GAC		
				GAC (mg/kg)	No. of Samples Exceeding GAC	Location and Depth (mbgl)	GAC (mg/kg)	No. of Samples Exceeding GAC	Location and Depth (mbgl)
Arsenic	138	126	16	41.4	29	BH301A (0.6-1), BH306a (5), BH312A (3.6-3.8), BH312B (1), BH312B (2.5), BH312B (5), BH312C (1), BH312C (2.3), BH312C (3.5), BH314 (2.2), BH314 (3.2), BH314 (5.3), BH315 (6), BH316 (0.2-0.5), OP10 (0.8), OP10 (2), OP14 (1.1-1.6), BH125 (2.5), TP123 (1.6), TP125 (0.3), TP125a (0-2), TP126 (3-4.2), TP127 (0-0.5), TP131 (1.8), TP132 (2.5-3.5), TP132 (4.2), DIS101 (0), DIS102 (0), DIS104 (0).	640	0	None
Cadmium	138	553	30	83.6	2	BH312B (1), OP10 (2).	230	1	OP10 (2)
Lead	138	41700	0	477	34	BH301A (0.2-0.3), BH301A (4), BH302 (2), BH302 (5), BH303 (1), BH304 (2), BH304 (4.2), BH306a (9), BH308 (0.7-0.9), BH310A (1), BH312A (0.5-0.6), BH312A (2-2.1), BH312A (3.6-3.8), BH312B (1), BH312B (2.5), BH312B (5), BH312C (3.5), BH313 (2), BH314 (2.2), BH314 (5.3), BH315 (1), BH316 (0.2-0.5), OP10 (0.8), OP10 (2) BH125 (2.5), TP121 (0-0.4), TP123 (0-0.5), TP123 (1.6), TP125 (0.3), TP125 (3.3), TP126 (0-1), TP127 (0-0.5), TP128 (0-0.5), DIS103 (0).	4,640	3	BH312B (1), BH312C (3.5), OP10 (2)
Nickel	138	2860	0	922	1	BH314 (2.2)	1,800	1	BH314 (2.2)
Vanadium	138	581	0	422	12	BH304 (4.2), BH306a (2), BH306B (6.5), BH307 (0.6), BH309 (5.5-6), BH310A (3), BH310A (9), BH310B (5), BH310B (8), BH313 (5), BH315 (1), OP10 (1.1)	3,160	0	None

Contaminant	No. of Samples	Maximum Conc. (mg/kg)	No. of Samples below Detection Limit	Park Land Use Human Health GAC			Commercial Land Use GAC		
				GAC (mg/kg)	No. of Samples Exceeding GAC	Location and Depth (mbgl)	GAC (mg/kg)	No. of Samples Exceeding GAC	Location and Depth (mbgl)
Zinc	138	189000	0	54800	1	OP10 (2)	665,000	0	None
Benzo(a) pyrene	62	2.88	51	1.2	1	BH119 (7.2)	14	0	None

Heavy Metals

Chemical laboratory analysis of samples obtained from waste measured arsenic, cadmium, lead, nickel, vanadium, zinc and benzo(a)pyrene concentrations in excess of respective GACs for a park land use and cadmium, lead and nickel concentrations exceeded the respective commercial GAC (Appendix C).

Samples analysed for arsenic exceeded the park land use GAC in 29 No. out of 138 No. samples, with a maximum concentration of 126mg/kg measured at BH125 at 2.5mbgl. Concentrations did not exceed the commercial land use GAC.

Measured cadmium concentrations exceeded the park land use GACs in 2 No. samples analysed, BH312 at 1mbgl which mainly comprised millscale and OP10 at 2mbgl, described in the site investigation logs as "flue dust". The later measured the maximum concentration of 553mg/kg compared to the park land use GAC of 83.6mbgl. This concentration also exceeded the commercial land use GAC of 230mg/kg.

Lead concentrations exceeded the park land use GAC in 34 No. out 138 No. samples analysed, with a maximum concentration of 41,700mg/kg measured in a sample obtained from OP10 at 2mbgl described in the site investigation logs as flue dust. However, this concentration is not typical of the other concentrations which exceeded the GAC, with the next highest concentration of lead measured as 5,770mg/kg. 3 No. lead concentrations also exceeded the commercial land use GAC of 4,640mg/kg at BH312B (1mbgl), BH312C (3.5mbgl) and OP10 (2mbgl).

One sample from BH314 at 2.2mbgl from slag material with pockets of black material and metal wire exceeded the nickel park land use GAC of 922mg/kg with a concentration of 2,860mg/kg. This concentration also exceeded the commercial land use GAC of 1,800mg/kg.

Vanadium concentrations exceeded the park land use GAC of 422mg/kg in 12 No. out of 138 No. samples analysed with a maximum concentration of 581mg/kg measured at BH309 at 5.5-6.0mbgl comprising of slag material. These concentrations did not exceed the commercial land use GAC.

Only one zinc concentration exceeded the GAC of 54,800mg/kg with a concentration of 189,000mg/kg measured in a sample described as "flue dust" encountered at OP10 at 2mbgl.

A number of samples obtained from the area of BH312 (A, B & C) have multiple metal contaminant concentrations in excess of the park land use GACs. This is potentially a hotspot area. Measured lead concentrations exceeded the park land use GAC in samples collected from several depths at BH312A, BH312B and from one depth at BH312C. The highest concentrations were measured at BH312B 1mbgl, which was comprised of millscale with some scrap metal, refractory waste and a minute amount of refuse waste. Arsenic was also elevated in 7 No. samples collected from this location and cadmium in 1 No. sample. Samples obtained from BH314 located to the south of BH312 also measured multiple metal concentrations, arsenic, lead and nickel, in excess of the park land use GAC.

Where contaminant concentrations in near surface materials (i.e. =/<1mbgl) exceed GACs, they have been considered further, through statistical analysis, to consider risks to human health as detailed in Section 3.1. The locations of samples from the top 1m with concentrations that exceed park land use and commercial land use GACs are shown on Figure 5. Where contaminant concentrations exceed GACs at depths of greater than 1m they are not considered to be capable of causing significant risks to human health through direct contact pathways and are not considered further unless they are considered to be volatile.

It should be noted that the total concentration of chromium and hexavalent chromium measured in samples from all 3 investigations was found to be less than the GACs for both park and commercial land uses.

<u>Organic Compounds</u>

The soil samples were analysed for a number of organic parameters which included total phenols, speciated total petroleum hydrocarbons, VOCs, dioxins, furans and PCBs. The generic assessment identified only one exceedance of the Park Land use GAC for a single parameter, benzo(a)pyrene (BaP). The measured concentration of BaP was 2.88mg/kg from a sample collected at a depth of 7.2mbgl. Waste from this depth is not considered capable of causing risks to the potential future park users of the East Tip, as they cannot come into direct contact with this material and BaP is not sufficiently volatile to cause a risk through inhalation of vapours.

<u>Dioxins, Furans and Polychlorinated Byphenols</u>

Dioxins and furans were measured at concentrations above laboratory detection limits in all 11 No. samples analysed. For the majority of the samples, the measured concentrations were close to or within an order of magnitude of the laboratory detection limits.

Total PCB concentrations were less than laboratory detection limits in 29 No. out of 53 No. samples analysed with a maximum concentration of 1,544µg/kg observed at TP125 at 0.3mbgl. The Environment Agency in the UK has set a soil guideline value (SGV) of 8µg/kg for PCBs in residential and allotment soils and 240µg/kg in soils on commercial sites. The UK criteria are considered conservatively protective compared to the Dutch Intervention Value of 1000 µg/kg. Regardless, the concentration of PCBs measured from this location exceeds the published screening criteria

2.3.1 Waste Type Quality

The site investigation found that the East Tip is comprised of waste which was deposited on shallow harbour sediments and built up to form a land mass. The waste is generally composed of several different waste types which originated from the steel works and are identified as:

- Slag Waste;
- Refractory Waste;
- Millscale Waste;
- Sludge;
- Flue Dust; and
- Demolition and Construction Waste.

Descriptions of the observed different waste types can be found in the factual site investigation report (PGL, 2012). At the time of the investigation, the wastes were found to be highly heterogeneous in their composition and were mixed with each other to the degree that it was difficult to obtain samples comprising solely of a particularly waste type. None the less, where possible samples of each of the different wastes were collected and analysed for the contaminants of concern in order to determine the waste quality and leachate potential using the NRA leaching test. The results of the waste quality testing were used in evaluating remedial options.

This has been completed by comparing the laboratory analysis results with GACs. Descriptions of contaminant concentrations for the different waste types encountered at the East Tip is included in Appendix P, with analysis results sorted according to waste type, i.e. slag, refractory, flue dust, millscale and sludge included in Appendix D to H. In summary:

- Slag waste - the majority of metal and organic contaminants measured in the slag material have concentrations which do not exceed relevant park land use or commercial land use GACs. Slag wastes exceeded the GACs for arsenic, lead and vanadium for a park land use with between 5% and 32% of the 22 No. slag samples tested. This included 1 No. arsenic concentration, 3 No. lead and 7 No. vanadium. Vanadium concentrations only marginally exceeded the park land use GAC. Concentrations for these contaminants did not exceed relevant commercial land use GACs;

- Refractory Waste - Generally where refractory waste was observed, it was mixed with varying quantities of slag material and other waste types. Refractory wastes exceeded the GACs for arsenic, lead and vanadium for a park land use with between and 8-54% of the 13 No. Refractory Waste samples tested having elevated concentrations of these metals. A sample obtained from BH311 at 0.5-at 0.6mbgl contained the greatest proportion of refractory waste comprising of slag with 50% refractory brick and did not contain contaminant concentrations in excess of either the park or commercial land use GAC.

- Millscale – Rarely encountered during the investigation, resulting in only 2 No. of the samples analysed in 2012 being comprised of 100% millscale (BH312B at 2.5mbgl and OP14 1.1-1.6mbgl) with another 5 samples comprising various percentages of millscale mixed with slag and demolition material. Arsenic and lead were measured at concentrations in excess of the park land use GACs in 71% (5 No. out 7 No. samples) of samples analysed and one sample had a measured cadmium concentration in excess of the commercial GAC.

- Sludge – Rarely encountered during the investigation and as a result only 4 No. samples of sludge material were analysed as part of the 2012 investigation. Concentrations of arsenic in 2 out of 3 No. samples, lead in all 3 No. samples and nickel in 1 No. sample were measured above the park land use GACs.

- Flue Dust – observed at only one location during the investigation OP10 at 2mbgl and analysis results of a sample from this location identified metal concentrations of cadmium and lead in excess of both the park and commercial land use GACs and zinc and arsenic concentrations in excess of the park land use GACs.

- Construction and Demolition Waste – From the site investigation logs, low volumes of demolition waste were encountered, typically observed as occasional construction and demolition type waste mixed with slag. Concentrations of arsenic, lead and vanadium exceeded the park land use GAC in approximately 50% of the 9 No. samples analysed. Analysis for other heavy metals did not measure concentrations in excess of relevant GACs. One lead concentration exceeded the commercial GAC, however this sample comprised of mainly slag material with only 5% demolition waste. Construction and Demolition waste is also present in stockpiles on the surface of the East Tip.

2.4 Geological Strata Assessment

Table 6 summarises analysis results for solid samples taken from geological strata underlying waste material in the East Tip. This table includes a summary of the results from both the 2005 investigation (WYG, 2005) and the current 2012 investigation. The results have been compared to the park and commercial land use GACs as presented in Appendix I.

Table 6 - Summary Analysis Results from Solid Samples in 2005 and 2012 – Geological Strata

Contaminant	Number of Samples	Maximum Conc. (mg/kg)n	Parks Land Use Human Health GAC (mg/kg)	Number of Samples Exceeding	Location and Depth (mbgl)
Arsenic	34	92.4	41.4	1	BH304 (16.5-17)

From Table 6, with the exception of one sample from slightly gravelly clay at BH304 16.5-17mbgl, contaminant concentrations in natural sediments underlying the waste material did not exceed park or commercial land use GACs. In natural clay at BH304 at 16.5-17mbgl, measured arsenic exceeded the parkland use GAC, 41.4mg/kg, with a concentration of 92.4mg/kg. The base of the waste material at this location was 6.2mbgl. Due to the depth at which this was encountered this is not considered to be capable of causing harm to human health as end users of the site can not come into direct contact with this elevated concentration and the direct contact pathways through which users could be exposed to risks are not considered to be present. It is therefore not of concern and does not warrant further consideration within the human health risk assessment process.

Table 7 further summarises laboratory analysis results of samples obtained from the underlying natural soils with the aim of assessing whether contamination has migrated vertically downwards through overlying waste material and vertically downwards through natural soils. Decreasing concentrations with increasing depth provides evidence that downward contaminant migration is limited.

Table 7 - Summary Analysis Results from Natural Soil Samples from 2005 (WYG, 2005) and 2012 Investigation

Contaminant	Waste			Geological Strata		
	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Average Concentration (mg/kg)	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Average Concentration (mg/kg)
Arsenic	3.5	126	31	<1 (LOD)	92.4	9.5
Total Chromium	23	6480	2081	<4.5 (LOD)	1593	84
Chromium VI	<0.6 (LOD)	14.7	1.6	<0.3 (LOD)	<3 (LOD)	NC
Copper	<1 (LOD)	4020	780	<1 (LOD)	210	27
Zinc	95	189000	4435	15.6	789	142
Lead	21	41700	900	7.75	184	35
Nickel	8.1	2860	228	2.6	209	29
Cadmium	<0.2 (LOD)	553	12	<0.1 (LOD)	1.4	0.4
Water soluble boron	<1 (LOD)	17.3	100	1.4	10.4	5.8
Vanadium	3.1	581	219	2.69	238	33
pH	6.5	12.7	8.38	6.5	10	7.8

Notes: NC=not calculated as all concentrations were less than LODs.
Averages utilise LODs as numerical values to calculate presented averages.

The concentrations of arsenic measured in natural soils ranged from less than laboratory detection limits to 92.4mg/kg (BH304 16.5-17mbgl), with an average of 9.5mg/kg (Table 7). These data are considerably less than the maximum and average concentrations for the overlying waste with respective maximum and average concentrations of 126mg/kg and 31mg/kg.

The concentrations of total chromium in natural soils ranged from less than laboratory detection limits to a maximum of 1593mg/kg (BH131 15mbgl) with an average of 84mg/kg. Typically the measured concentrations were less than 100mg/kg for most samples analysed. These data were lower than those observed for the overlying waste material with a maximum concentration of 6480mg/kg and average of 2081mg/kg.

Similar differences between measured concentrations in the waste and natural soils was observed for other contaminant concentrations as in Table 7, including chromium VI where concentrations in natural soils were less than laboratory detection limits in all samples analysed, however in the waste material the maximum observed concentration was 14.7mg/kg with an average of 1.6mg/kg. Copper, zinc, lead, nickel, cadmium, water soluble boron, vanadium and pH all had measured maximum concentrations and average concentrations compared to that of the waste material.

Figures 6, 7, and 8 present the results for chromium, arsenic and zinc metals plotted against depth to assessment downward contaminant migration.

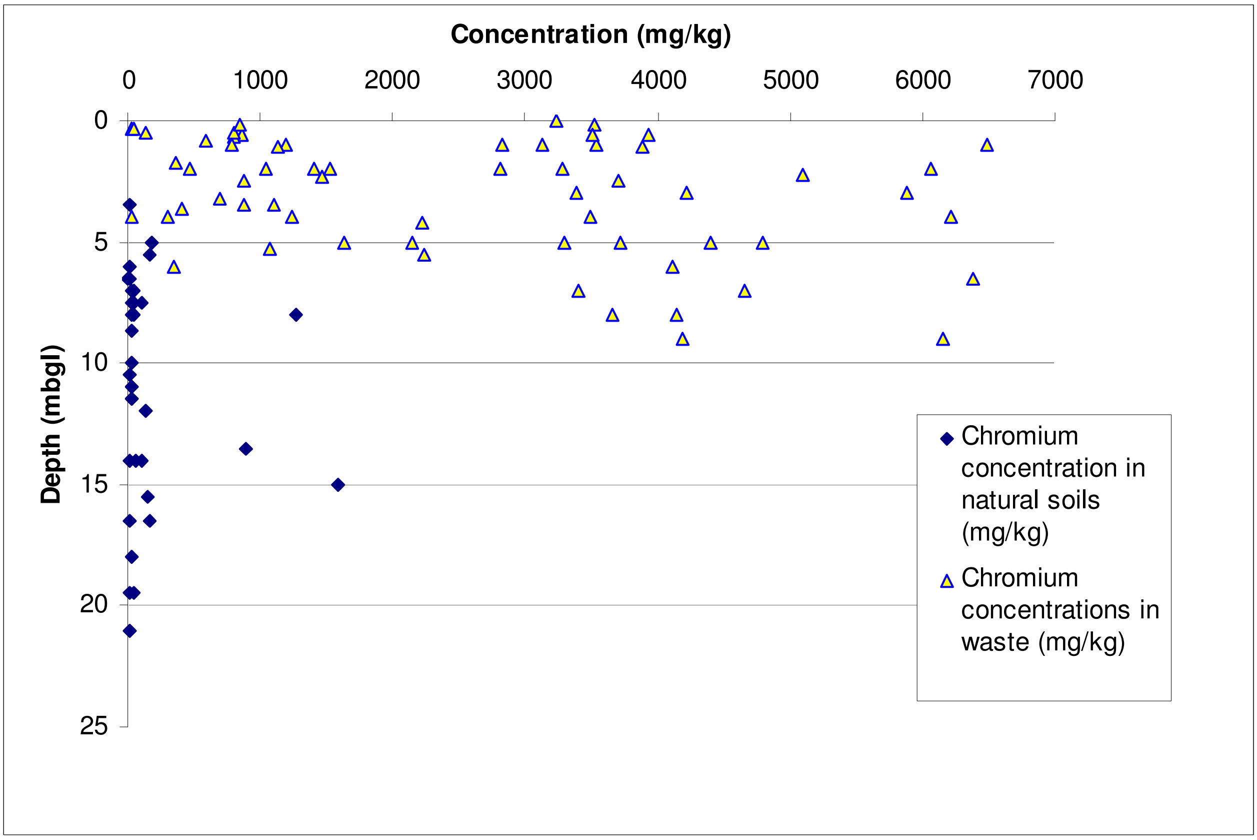


Figure 6 - Chromium Concentrations Vs Depth

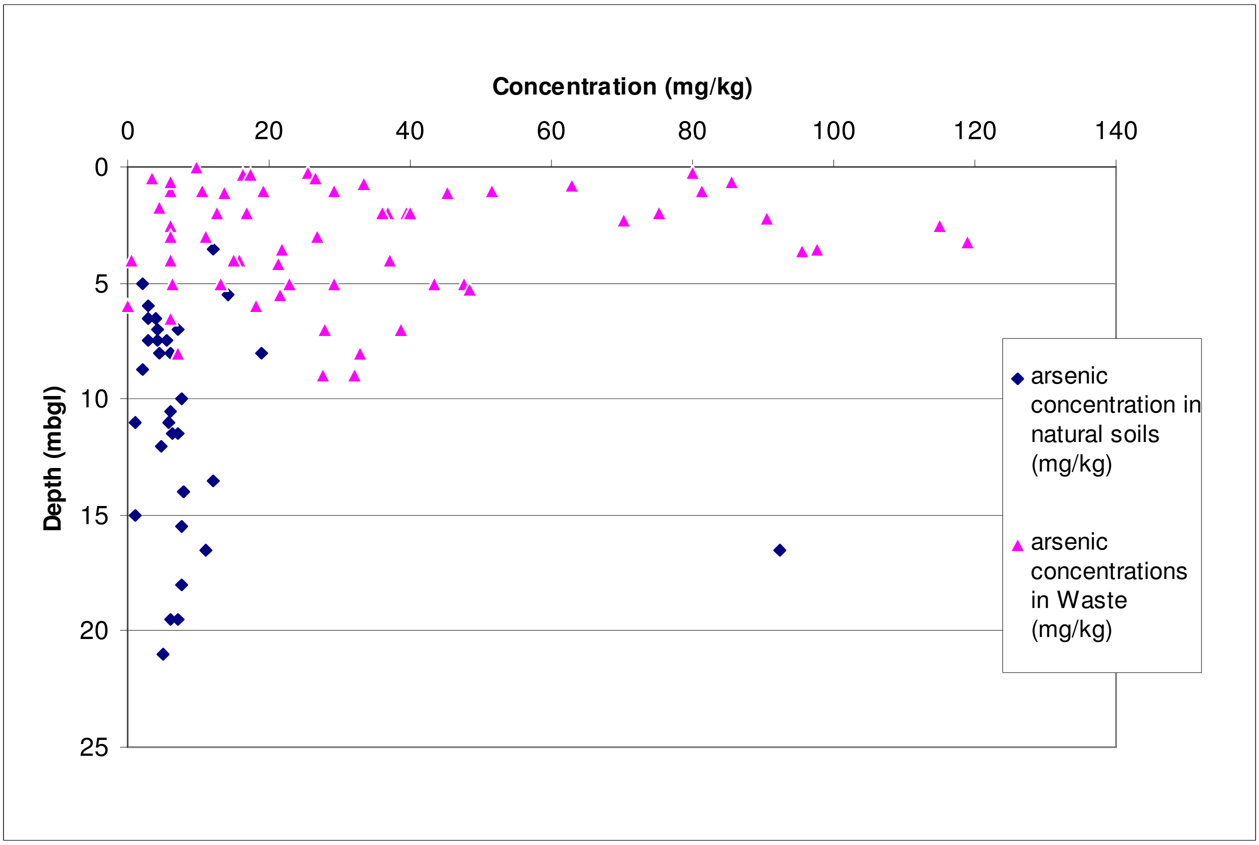


Figure 7 - Arsenic Concentrations Vs Depth

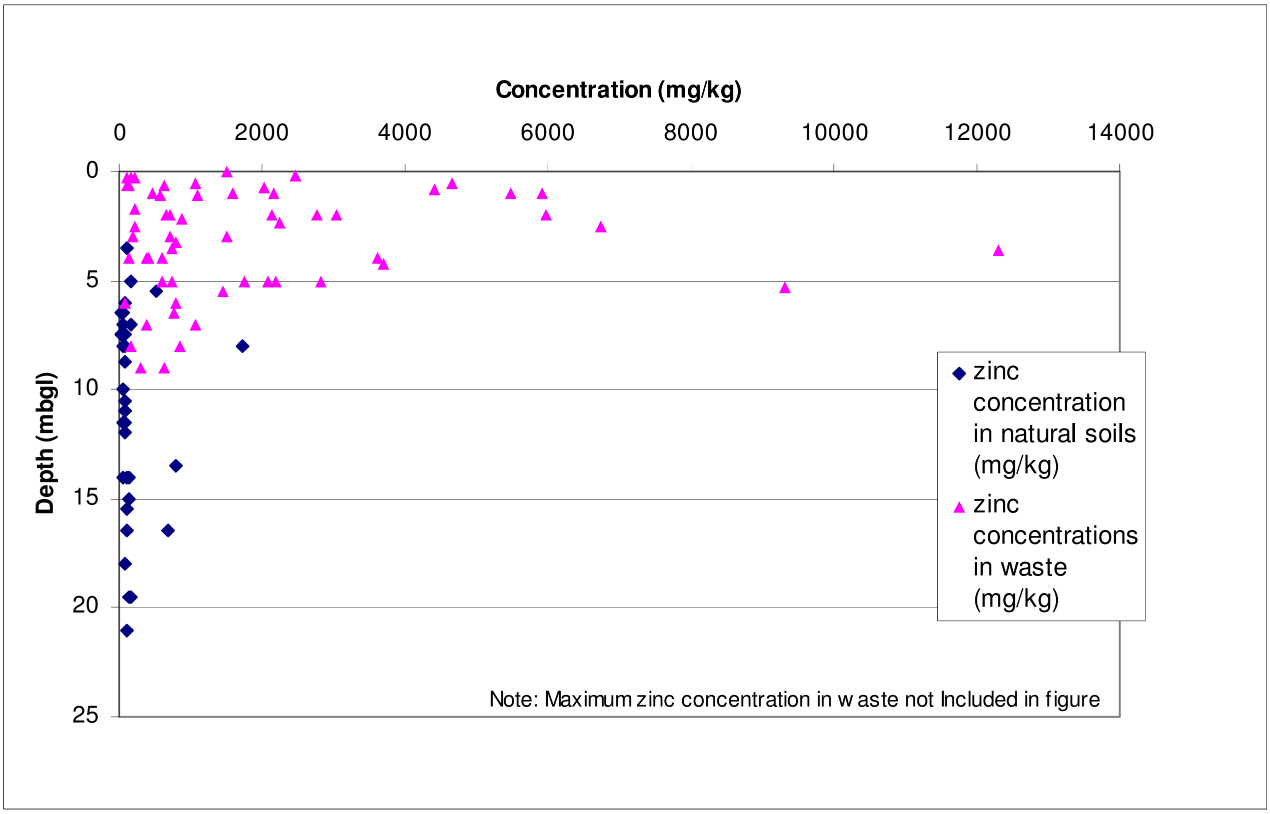


Figure 8: Zinc Concentrations Vs Depth

As illustrated in figures 6, 7 and 8 significantly higher concentrations of chromium, arsenic and zinc were measured in waste samples. The plots show that relatively elevated levels of the metals are measured to depths of 10mbgl which is the approximate thickness of the waste. Below 10m the concentrations of the metals decrease with concentrations of arsenic and zinc approaching levels which might be considered as 'Normal' background values, i.e. 9.1-12 mg/kg arsenic and 60-80mg/kg zinc (Fay and Zhang, 2013).

2.5 Solid Leachability Analysis Results – Waste

Leachability testing was undertaken using NRA leachability tests in order to determine the potential for contaminants to leach from the waste to groundwater in the unsaturated zone and pose a risk to ground and surface waters. It should be noted that the use of NRA leachability tests provides a conservative assessment due to its procedure of grinding down the sample. This increases the sample's specific surface which will be in contact with pore water thus increasing the potential for contaminants to leach.

The NRA contaminant leachability data were compared to respective Water Quality Standards (WQS) for each of the potential contaminants of concern and the results for those COCs which exceed applicable WQS are presented in Table 8. The leachability test results for all samples tested as compared to relevant WQSs are presented in Appendix K.

The leachable concentrations of metals including arsenic, boron, manganese and nickel were measured at concentrations below the relevant WQSs and are therefore not of concern in respect to their potential to leach from solid to liquid phase.

Table 8 - Summary Waste Leachability Test Analysis Results 2012

Contaminant	Water Quality Standard (WQS) (µg/l)	Total No. of Samples	Range (µg/l)	No. Samples Exceeding WQS	WQS Exceedance Locations and Depth (mbgl)
Aluminium	200	21	<2.9-6840	11	BH302 (9), BH303 (3), BH305 (4-4.5), BH310A, (1), BH311 (0.5-0.6), BH312C (2.6), BH312C (4.5), BH316 (0.2-0.5), OP10 (0.8), OP10 (2), OP14 (1.7)
Cadmium	0.2	21	<0.1-0.26	1	OP10 (2)
Chromium	4.6	21	<0.22-429	10	BH303 (0.2), BH303 (3), BH310A (1), BH311 (0.5-0.6), BH312C (2.6), OP10 (0.8), OP10 (2), OP10 (1.1), OP14 (1.1-1.6), OP14 (1.7)
Chromium VI	0.6	21	<30-457	7	BH303 (3), BH306A (7), BH310A (1), BH311 (0.5-0.6), BH312C (2.6), OP10 (0.8), OP14 (1.7)
Copper	5	21	<0.85-20	6	BH303 (0.2), BH311 (0.5-0.6), BH312C (2.6), OP10 (0.8), OP14 (1.1-1.6), OP2 (1.7)
Zinc	40	21	0.41-124	1	OP10 (2)
Lead	7.2	21	<0.02-255	2	BH311 (0.5-0.6), OP10 (2)
Mercury	0.05	21	<0.01-0.16	1	OP10 (2)
Anthracene	0.1	21	<0.015-0.43	4	BH302 (9), BH306A (7), BH309 (6.5-7), BH311 (0.5-0.6)
Fluoranthene	0.1	21	<0.017-0.56	10	BH302 (9), BH304 (5.5-6), BH305 (4-4.5), BH306A (7), BH309 (6.5-7), BH311 (0.5-0.6), BH312A (4-4.1), BH312C (4.5), OP10 (2), OP14 (1.7)
pH	<4.5, >9	21	7-12	16	BH302 (9), BH303 (0.2), BH303 (3), BH304 (5.5-6), BH305 (4-4.5), BH309 (6.5-7), BH310A (1), BH310B (5.4), BH311 (0.5-0.6), BH312C (2.6), BH316 (0.2-0.5), OP10 (0.8), OP10 (2), OP10 (1.1), OP14 (1.1-1.6), OP14 (1.7)

The leachability of metals as dissolved cations is a pH controlled process. The leachate testing found that nearly 76% of the samples tested had leachate pH in excess of the upper pH limit of 9. This is important in considering leaching of metals as shown in Figure 9. Chromium, lead and zinc are amphoteric metals, which means that these metals may be mobilised in both acidic and alkali waters. For chromium, mobility is least at a pH of approximately 7.5 becoming increasingly mobile as the pH increases above 8. Lead and zinc are more stable at pH of approximately 10 but are readily mobilised at pHs above and below this value.

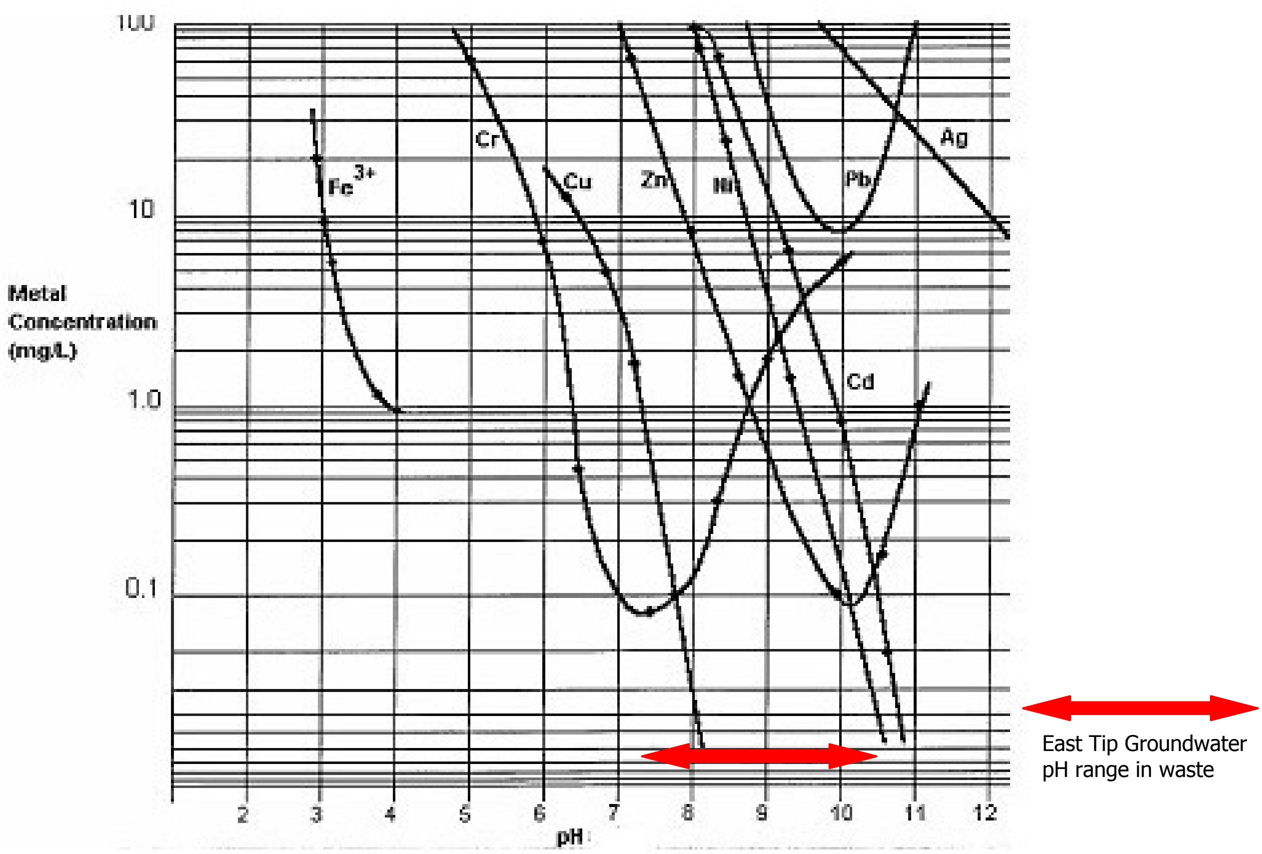


Figure 9 Metal Solubility as a function of pH (adopted from Stumm and Morgan , 1981).

Leachable concentrations of aluminium, cadmium, chromium, chromium VI, copper, zinc, lead, mercury, anthracene and fluoranthene exceeded the relevant WQS. The greatest number of exceedances was observed in respect of aluminium which exceeded the applicable WQS of 200µg/l, with 52% of the samples tested having leachable aluminium concentrations ranging from 280µg/l to 6840µg/l.

Leachable concentrations of chromium ranged from less than laboratory detection limits (<0.22µg/l) to 429µg/l. Leachable concentrations of chromium VI, were measured above laboratory detection limits and the applicable WQS of 0.6µg/l in 7 No. samples out of 21 No. tested, with measured concentrations ranging from 34µg/l to 457µg/l.

Leachable copper concentrations were found to exceed the applicable WQS of 5µg/l in 6 No. samples out of 21 No. samples analysed, with exceeding concentrations ranging from 5.02µg/l to 20µg/l.

Lead, cadmium, zinc and mercury were generally fixed within the solid matrix and only one sample, which consisted of flue dust had concentrations for these metals which exceeded the respective WQSs. The results of these leaching tests are in good agreement with the predicted mobility as a function of pH. At pH greater than 6, aluminium may be present as solid aluminium hydroxide but is distributed in water as Al^{+3} and several hydroxide complexes. Chromium was found to be leachable from samples with elevated pH while the leachability of the other metals was comparatively reduced.

Leachable concentrations of PAH compounds in excess of applicable WQSs were also measured for anthracene and fluoranthene. The concentrations are considered to be minor as they are within one order of magnitude in excess of the relevant WQS, 0.1µg/l. This includes the maximum anthracene concentration of 0.4µg/l measured in a sample obtained from BH306A 7mbgl comprising of slag and maximum fluoranthene concentration of 0.56µg/l from OP20 2mbgl comprising of flue dust.

NRA leachability testing was also completed during a previous investigation in 2005 by WYG (WYG, 2005). Table 9 summarises leachability analysis results that exceed relevant WQSs for samples obtained exclusively from waste material in the East Tip in 2005. The leachability test results as compared to WQSs are included in Appendix K.

Fifteen samples collected in 2005 by WYG were analysed according to the NRA leachate procedure, the results of the analysis of the leachates is presented in Table 9.

Chromium and chromium VI leachable concentrations exceeded the respective WQS's of 4.6µg/l and 0.6µg/l in 15 No. and 12 No. respective samples out of 15 No. analysed. Chromium concentrations that exceeded the WQS ranged from 6µg/l to 204µg/l with the maximum concentration measured in a sample obtained from TP129 at 0-0.6mbgl. Chromium VI concentrations ranged from less than detection limits (30µg/l) to 220µg/l with the maximum concentration observed in the same sample obtained from TP129 at 0-0.6mbgl. Typically where elevated chromium concentrations were measured elevated chromium VI concentrations were also measured above WQSs.

Copper exceeded the WQS in 67% of the samples leached with concentrations ranging from less than laboratory detection limits to 266µg/.

Leachable concentrations of lead ranged from less than laboratory detection limits (<1µg/l) to 31µg/l. In total, 5 No. out of 15 No. samples analysed exceeded the relevant WQS 7.2µg/l.

Of the leached samples, 2 No. had measureable leachate concentrations of zinc and mercury which exceeded respective WQSs of 40µg/l and 0.05µg/l, with maximum respective concentrations of 53µg/l and 0.12µg/l.

The leachability test results for pH measured elevated pH above the WQS of pH 9 in 3 No. samples out of 15 No. analysed with a maximum pH of 11.96.

Table 9 - Summary Waste Leachability Test Analysis Results from 2005

Contaminant	Water Quality Standard (WQS) (µg/l)	Total No. of Samples	Range (µg/l)	No. Samples Exceeding WQS	Exceedance Locations & Depths (mbgl)
Chromium	4.6	15	6-204	15	TP121 (0-0.4), TP121 (1.5), TP123 (0-0.5), TP123 (1.6), TP125 (0-0.5), TP125 (3.3), TP125 (0-2), TP129 (0-0.6), TP129 (1.9), TP129 (3), TP129 (3.5), TP129 (0-2), TP130 (0-0.5), TP130 (1.6), TP130 (2.6).
Chromium VI	0.6	15	<30-220	12*	TP121 (0-0.4), TP121 (1.5), TP123 (0-0.5), TP123 (1.6), TP125 (0-0.5), TP129 (0-0.6), TP129 (1.9), TP129 (3), TP129 (0-2) TP130 (0-0.5), TP130 (1.6), TP130 (2.6).
Copper	5	15	<4-266	10	TP121 (0-0.4), TP121 (1.5), TP123 (0-0.5), TP123 (1.6), TP125 (0-0.5), TP125 (3.3), TP125 (0-2), TP129 (1.9), TP130 (0-0.5), TP130 (2.6).
Zinc	40	15	0.05-57	2	TP125 (0-0.05), TP129 (3.5).
Lead	7.2	15	<1-31	6	TP121 (0-0.4), TP121 (1.5), TP125 (0-0.05), TP125 (3.3), TP130 (1.6), TP130 (2.6).
Mercury	0.05	15	<0.05-0.12	2	TP121 (0-0.4), TP121 (1.5)
pH	<4.5->9	15	7.47-11.96	3	TP129 (1.9), TP130 (1.6) TP130 (2.6)
Anthracene	0.1	15	0.01-0.468	2	TP121 (1.5), TP123 (0-0.5)
Benzo(a)pyrene	0.05	15	0.01-0.091	1	TP121 (1.5)
Benzo(b) Fluoranthene	0.03	15	0.01-0.08	1	TP121 (1.5)
Benzo(g,h,i) Perylene	0.02	15	0.01-0.056	1	TP121 (1.5)
Benzo(k) Fluoranthene	0.03	15	0.01-0.054	1	TP121 (1.5)
Fluoranthene	0.1	15	0.01-2.71	5	TP121 (1.5), TP123 (0-0.5), TP123 (1.6), TP125 (3.3), TP130 (0-0.5)
Indeno(1,2,3) Pyrene	0.02	15	0.01-0.03	1	TP121 (1.5)
Naphthalene	1.2	15	0.01-11.94	1	TP123 (0-0.5)

Note: * other concentrations less than LODs (30µg/l) were not counted as exceedances.Leachable concentrations in excess of applicable WQSs were also observed for PAH compounds particularly in a sample obtained from

TP121 at 1.5mbgl where leachable concentrations of anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, fluoranthene and indeno(1,2,3)pyrene marginally exceeded applicable WQS with concentrations typically not greater than an order of magnitude above the WQS. Leachable concentrations of anthracene and fluoranthene were also marginally above relevant WQSs, 0.1µg/l, in samples obtained from TP123 (0-0.5mbgl and 1.6mbgl) with an anthracene concentrations of 0.2µg/l and fluoranthene concentrations of 0.18µg/l and 0.13µg/l. 1 No. leachable naphthalene concentration was also measured in excess of the WQS, 1.2µg/l at TP123 0-0.5mbgl with a concentration of 11.9µg/l. 1 No. sample obtained from TP130 at 0-0.5mbgl, measured a leachable fluoranthene concentration, 0.15µg/l, marginally in excess of the WQS 0.1µg/l.

Consideration has been given to the potential contaminant leachability test results for each of the different waste types as contained in Appendix P.

2.6 Solid Leachability Analysis Results – Natural Strata

Table 10 summarises contaminant concentrations which exceed applicable WQSs for laboratory leachability tests conducted from samples obtained from natural soils during the 2012 investigation (Appendix K). This analysis can provide an indication on the potential for contamination to leach from the solid phase to dissolved phase in groundwater.

Table 10 – Summary Leachability Analysis Results 2012 – Natural Soils

Contaminant	Water Quality Standard (WQS) (µg/l)	Total No. of Samples	Range (µg/l)	No. Samples Exceeding WQS	Locations with Concentrations Exceeding WQS		
					Location	Depth (mbgl)	Exceeding Conc. (µg/l)
Zinc	40	6	0.41-205	1	BH301A	9	205

From the 6 No. samples analysed for leachable contaminant concentrations, only one concentration of zinc exceeded the applicable WQS of 40µg/l with a concentration of 205µg/l. All other concentrations of leachable contaminants were less than relevant WQSs.

2.7 Chemical Analysis Results - Water Quality

Groundwater samples were obtained from a total of 35 No. monitoring boreholes including:

- 13 No. screened solely within the waste horizon of the East Tip,
- 8 No. from the 2005 investigation screened into the waste and underlying alluvial sediments,
- 7 No. screened into alluvial strata,
- 3 No. screened into sands and gravels, and
- 4 No. screened into limestone.

During June – July 2012, two groundwater samples were collected from each borehole, one at high tide and one at low tide. Table 11 summarises locations where contaminant concentrations were measured in excess of applicable WQSs. The laboratory analysis results compared to relevant WQSs are presented in Appendix L.

Of the parameters that exceeded the WQS in 70 No. samples collected during June – July 2012 from groundwater, pH, chromium, manganese and mercury had the highest number of exceedances with 22 No., 40 No., 37 No. and 35 No. samples respectively with concentrations that exceeded applicable WQSs. The greatest number of exceedances were measured in groundwater samples obtained from the waste as outlined further in Section 3.2 when compared to groundwater samples analysed from the underlying alluvium, sands and gravels and limestone. pH ranged from 7.4 to 10.4, measured chromium from less than laboratory detection limits (<1.5µg/l) to 123µg/l, manganese from less than laboratory detection limits (<0.3µg/l) to 13300µg/l and mercury from less than laboratory detection limits (<0.15µg/l) to 2.61µg/l.

Measured arsenic, cadmium and copper concentrations exceeded relevant WQSs in groundwater sampled from 5 No., 7 No., and 8 No. boreholes respectively, with respective concentrations ranging from less than laboratory detection limits to maximum concentrations of 33.3µg/l, 12µg/l and 146µg/l. Measured chromium VI, zinc, lead, nickel, speciated PAHs including benzo(a)pyrene, benzo(b)-fluoranthene, benzo(k)-fluoranthene, benzo(g,h,i) perylene, fluoranthene, Indeno(1,2,3-cd)pyrene and ammoniacal nitrogen concentrations exceeded relevant WQS in one to three groundwater samples analysed with concentrations ranging from less than laboratory detection limits to respective maximum concentrations of 117µg/l, 76µg/l, 7.8µg/l, 41.4µg/l, 0.86µg/l, 0.39µg/l, 0.65µg/l, 0.48µg/l, 0.4µg/l and 0.49µg/l.

Table 11 - Summary Groundwater Concentrations June – July 2012

Contaminant	WQS (µg/l)	Total No. of Samples	Range (µg/l)	No. samples exceeding WQS
pH	<4.5->9	70	7.4-10.4	22
Ammoniacal Nitrogen	50000	6	<200-53100	1
Arsenic	20	16	<0.5-33.3	5*
Cadmium	0.2	8	<0.15-12	7
Chromium	4.6	70	<1.5-123	40
Chromium VI	0.6	70	<30- 117	*1* **
Copper	5	70	<1-146	8
Zinc	40	70	<2.1-76	2
Lead	7.2	70	<0.2-7.79	1
Manganese	30	70	<0.3-13300	37
Nickel	20	70	<1-41.4	3
Mercury	0.05	70	<0.15-2.61	*35****
Benzo(a)pyrene	0.05	70	<0.01-0.86	2
Benzo(b)-fluoranthene	0.03	16	<0.01-0.39	1
Benzo(k)-fluoranthene	0.03	70	<0.01-0.65	2
Benzo(g,h,i) perylene	0.03	16	<0.01-0.48	2
Fluoranthene	0.1	70	<0.01-0.4	3
Indeno(1,2,3-cd)pyrene	0.02	16	<0.01-0.49	1

Note 1 – does not include duplicate samples

* non saline method utilised, therefore may not be strictly representative of arsenic concentrations in groundwater

** The LOD for chromium VI exceeds the WQS. Only samples with a concentration of chromium VI exceeding the LOD are included here. The issue of LOD has been addressed through further sampling and analysis completed in November 2012 (see Section 3.2)

*** The LOD for mercury exceeds the WQS. Only samples with a concentration of mercury exceeding the LOD are included here. The issue of LOD has been addressed through further sampling and analysis completed in November 2012 (see Section 3.2)

To assess the brackish quality of groundwater, salinity analysis was completed on groundwater, surface water and harbour water samples. The harbour water samples and therefore seawater measured salinity concentrations ranging from 1.33mg/l to 5.2mg/l with an average of 3.1mg/l. In groundwater samples collected from limestone, salinity ranged from less than laboratory detection limits of 0.3mg/l at BH306c to

2.11mg/l at BH310C, shows that the groundwater in limestone is brackish. Salinity concentrations were less than laboratory detection limits in all 6 No. samples obtained from sands and gravels and in groundwater sampled from 5 No. out of 7 No. sampled alluvium boreholes. Groundwater concentrations of salinity ranged from 0.6mg/l – 1.55mg/l at the other two sampled alluvium boreholes Salinity concentrations in waste ranged from less than detection limits at BH315 only to 2.2mg/l with an average of 1.2mg/l. In conclusion this provides evidence that groundwater within the waste is also brackish.

2.7.1 Assessment of Dissolved Vs Leachable

As noted in the preceding sections elevated concentrations of chromium, chromium VI, copper, zinc, lead, manganese, nickel and mercury were measured above WQSs, at a number of locations within groundwater in the East Tip. In the case of chromium this includes for groundwater samples obtained from BH128, BH130, BH303, BH305, BH306B, BH307, BH310A, BH311 (high tide only), BH312A, BH314 (low tide only), BH315. Leachability testing has also identified leachable concentrations of chromium above WQSs for a number of these locations including BH303 (0.2mbgl and 3mbgl), BH310A (1mbgl), BH311 (0.5-0.6mbgl), BH312C (2.6mbgl and 4.5mbgl) which is in the same area as BH312A. This suggests that the groundwater chromium concentrations are due to chromium leaching from solid phase to dissolved phase.

Similar evidence is also present for the other metals. The chromium VI maximum groundwater concentration measured in BH310A was also where the maximum leachable chromium VI concentration was observed in a sample obtained from BH310A (1mbgl). Leachable concentrations of copper above the WQS were measured at OP14 which is in close proximity to BH305 where elevated concentrations of copper were measured above the WQS in groundwater sampled from waste. Leachable copper concentrations were also measured at BH312C which is in the area of BH312A where elevated concentrations of copper were measured in groundwater.

Leachable concentrations of aluminium above the WQS were measured at a number of locations, however concentrations of aluminium have not been measured in excess of the WQS in groundwater sampled and therefore evidence is not available to show that aluminium has impacted groundwater. Nickel, lead and zinc were rarely measured above the respective WQS, which is supported by the fact that leachable concentrations of these metals were also rarely measured above relevant WQS.

Mercury concentrations in groundwater collected from wells screened within the waste have been measured in excess of the WQS at a number of locations. Significantly elevated concentrations have not been identified in solid waste samples analysed for mercury nor in leachability tests, with the exception of one elevated concentration, 0.16µg/l, observed in a sample from OP10 at 2mbgl comprising of flue dust. As a result a waste source of mercury is not considered to be present. It appears from review of the analytical data that the method for analysis of mercury used by the laboratory was not the cold vapour atomic fluorescence (CV-AF) method, which is the recommended method for mercury analysis. Further sampling and analysis has been completed which shows lower mercury concentrations as measured by CV-AF (See Section 3.2)

Manganese concentrations in groundwater sampled from the waste have also been measured in excess of the WQS in the northwest of the site at BH301A and BH302 (4No. samples out of 30No). However leachable concentrations of manganese from waste samples analysed across the site did not measure concentrations in excess of the WQS. Although, the maximum manganese solid waste analysis concentration was measured in the sample obtained from OP10 in this general area, the leachable concentration of this sample measured the manganese concentration as being less than the laboratory detection limit and therefore also less than the relevant WQS.

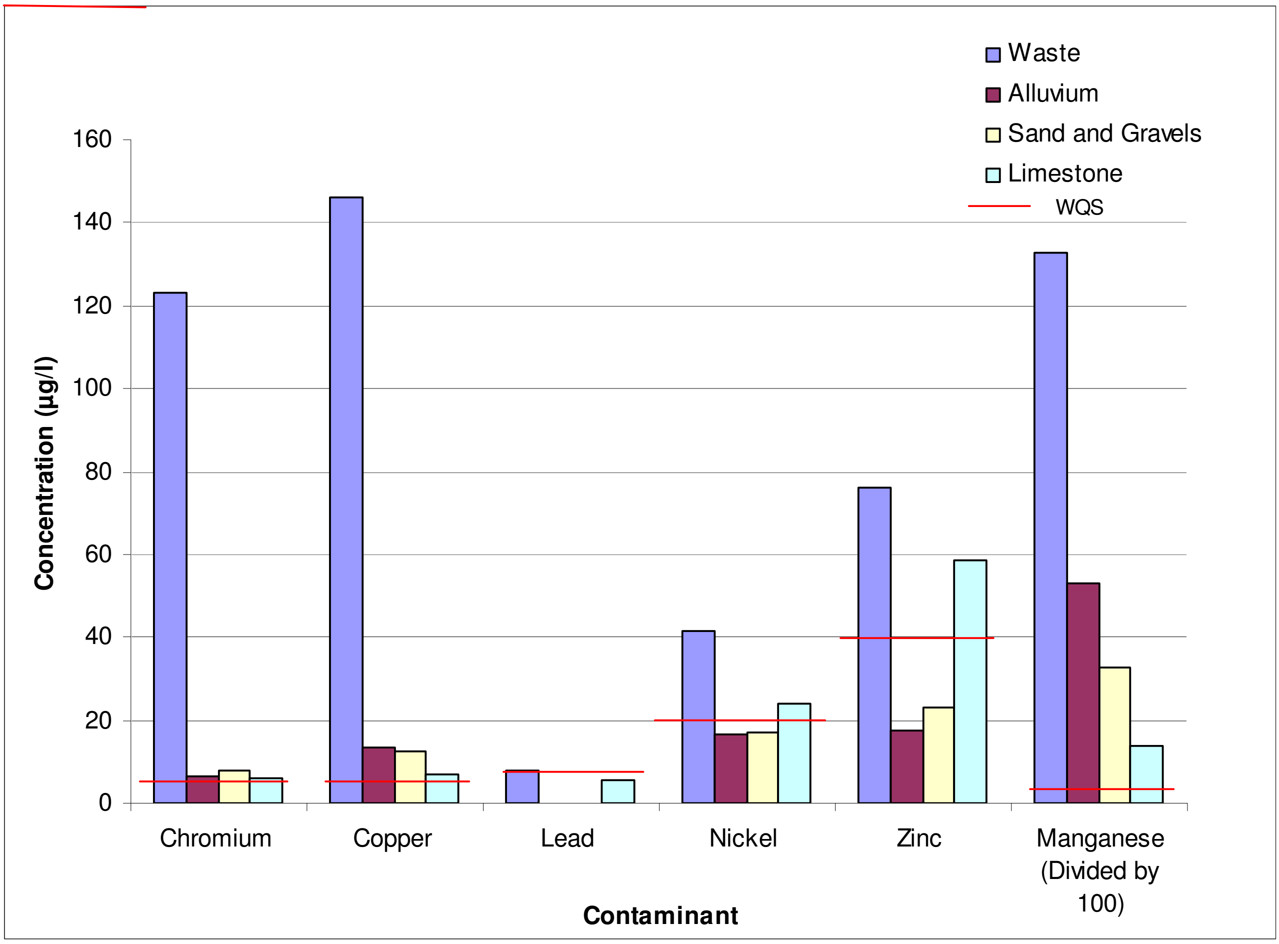
2.7.2 Vertical Profile of Groundwater Contaminants

The groundwater data were assessed to determine the vertical profile of the contaminants within the underlying water in order to determine if contamination of the water extended at depth into the underlying limestone unit. The results of this analysis found that the metal concentrations generally decrease with depth and between the different aquifer units. Plots of this analysis are shown in Figure 10.

The maximum chromium concentration in groundwater sampled from the waste material was 123µg/l, in alluvium the maximum concentration measured was 6.28µg/l, in sands and gravels 7.67µg/l and 6µg/l in groundwater sampled from limestone considered to only be slightly elevated.

Similar trends are present for other heavy metals including copper, zinc, lead, nickel and manganese concentrations which were measured in excess of the relevant WQSs in groundwater sampled from waste. Zinc, lead and nickel concentrations were not measured in excess of the WQS in groundwater samples obtained from the underlying alluvium, sands and gravels, and limestone. Copper was elevated above the WQS in one to two samples obtained from alluvium, sands and gravels and limestone, however concentrations ranged from less than detection limits to 13µg/l which is significantly less than those measured in waste which ranged from less than laboratory detection limits to 146µg/l.

Similarly for organic PAH compounds in waste, low concentrations typically marginally in excess of WQSs were observed at a few locations, however concentrations in excess of WQSs were not observed in groundwater sampled from the underlying alluvium, sands and gravels and limestone.



Note: for presentation purposes maximum manganese concentrations shown above have been divided by 100.

Figure 10 – Maximum Measured Groundwater Contaminant Concentrations Trends associated with manganese appear to be slightly different from those observed for the other metals as noted above. Concentrations of manganese decrease with depth. In the waste material the measured maximum concentration 13,300µg/l was observed in the northwest of the East Tip at BH301 during low tide. Respective maximum concentrations of 2,970µg/l, 5,220µg/l, 3,260µg/l and 1,370µg/l were measured in boreholes installed into both waste and alluvium, exclusive alluvium boreholes, sand and gravel boreholes and limestone. From this, concentrations appear to decrease with increasing depth. However it is worth noting that manganese concentrations measured in waste in excess of the WQS are localised to the northwest corner of the East Tip, BH301A and BH302. Concentrations were not in excess of the WQS at other waste boreholes. However the elevated concentrations appear to be more widespread in alluvium and the sands and gravels with all sampled locations measuring concentrations in excess of the WQS and in the Limestone three of the four sampled locations measured concentrations in excess of the WQS. Whilst a source of groundwater manganese is considered to be present in overlying waste material, it should be noted that the elevated manganese concentrations in groundwater in the alluvium and sands and gravels may be due to natural conditions. Manganese is known to be naturally elevated in aquifers in coastal areas (EPA, 2008). Manganese

concentrations were monitored by Cork County Council in 1992 in groundwater abstracted from the Dinantian Mudstone and Sandstone aquifer in Nohoval which is 2km from the coast and 14km to the southwest of Haulbowline. This aquifer extends to the immediate north and south of Haulbowline. At this time manganese concentrations varied from 0.5-2.6mg/l which is within the range measured in the limestone and sands and gravels in this investigation.

2.7.3 2012 Groundwater Data Comparison with 2005 and 2008 Analysis Results

Boreholes which were previously sampled and analysed as part of the investigations in 2005 (i.e. BH116 through to BH130) were resampled in 2008 and 2012. Table 12 provides a summary of groundwater analysis results for 2005, 2008 and 2012 for groundwater samples from these boreholes that previous exceeded WQS, as identified in the gap analysis pDQRA report. The aim was to consider trends with respect to contaminant concentrations over time. The table also presents summary concentrations only in respect of boreholes where groundwater contaminant concentrations previously exceeded relevant WQSs.

Table 12 – Groundwater Analysis Results 2005, 2008 and June – July 2012

Contaminant	WQS (µg/l)	2005 Conc. Range (µg/l)	2008 Conc. Range (µg/l)	June – July 2012 Conc. Range (µg/l)
Arsenic	20	31-56	19-120	<0.5-9.48*
Copper	5	3-20	3-10**	<1-7.08
Zinc	40	20-13,500	39-119	<2.1-58.6
Lead	7.2	2-3	10	<0.2
Nickel	20	4-41	13-60	<0.1-39.1
Cadmium	0.2	<0.4-15.8	<0.4-6.2	<0.15-12
Aluminium	200 (DWS)	Not analysed	359-1460	All less than WQS
Manganese	30	Not analysed	680-4983	198-2970
pH	<4.5 >9	7.2-9.2	8.06-9.4	7.09-9.25

* excludes results for non saline method
** 2 No. LODs were <50µg/l which are not included in above table

Previously arsenic concentrations were measured above WQSs in number of samples with a maximum concentration of 56µg/l in 2005 and 120µg/l in 2008. Analysis completed during 2012 has not identified concentrations of arsenic in excess of the WQS with measured concentrations typically less than 10µg/l. This is with the exception of 3 No. samples analysed from BH117 and BH125. These were analysed using a non saline analytical method which did not prevent the potential for ionic interference. As a result these elevated concentrations are not considered to be representative and have not been included in Table 12. The 2005 and 2008 arsenic analysis results were also obtained using a non saline method (inductively coupled plasma-mass spectrometry (ICP-MS)) which provides an explanation as to why the range of concentrations appears to be higher than that measured in 2012. Given this, arsenic in respect to risks to ground and surface waters is not considered to be of concern, as all other concentrations are less than the WQS.

Similar results have also been observed for copper, lead and cadmium concentrations. Copper concentrations previously ranged from 3-20µg/l in 2005 and 3-10µg/l in 2008. In 2012 typically concentrations were less than laboratory detection limits, <1µg/l with a maximum concentration of 7.1µg/l. The 2005 and 2008 zinc analysis results were also obtained using a non saline method (ICP-MS) which provides an explanation as to why the range of concentrations appears to be higher than that measured in 2012. Cadmium concentrations in 2005 ranged from <0.4-15.8µg/l, in 2008 from <0.4-6.3µg/l and in 2012 concentrations were typically less than laboratory detection limits (<0.15µg/l). This is with the exception of BH122 which measured a maximum concentration of 12µg/l in 2012, in 2008 6.2µg/l was measured and in 2005 a maximum of 15.8µg/l was measured.

Zinc concentrations measured during sampling and analysis in 2012 are typically less than those measured during sampling in 2005 and 2008. A maximum zinc concentration of 13,500µg/l was measured during 2005 at BH119. During 2012 the concentration was less than laboratory detection limits (<2.1µg/l). Other concentrations measured during 2005 and 2008 typically ranged from 20 - 324 µg/l where as in 2012 the maximum concentration of 58.6µg/l was measured.

Significant concentration decreases have not been observed in respect to manganese and pH concentrations. In 2008 manganese concentrations ranged from 680µg/l to 4,983µg/l and in 2012 concentrations from the same boreholes concentrations ranged from 198-2,970µg/l. In 2005 pH concentrations ranged from 7.2-9.2pH, 2008 from 8.06-9.4pH and in 2012 7.09-9.25pH.

In summary, the results overall appear to show an overall decrease in contaminant concentrations particularly in regard to arsenic and zinc.

3 Generic Quantitative Risk Assessment (GQRA)

3.1 Human Health GQRA

The results of the laboratory chemical analysis of the samples collected from waste horizons within the East Tip were assessed against GACs for Park and Commercial Land Uses in order to determine if the East Tip could be deemed as 'fit for use' under either of these scenarios with the site in its present form. As outlined in Section 2.1.1, in regards to human health and GACs, where contamination is present with concentrations that exceed GAC at depths greater than 1m, the probability of human exposure via the direct contact pathways is significantly reduced, leaving inhalation of volatile compounds as the dominant pathway with regard to human health risks. Typically, volatile compounds only significantly affect the indoor inhalation pathway. Therefore, for the purposes of considering human health and statistical analysis, data from the top 1.0m has been used for assessment of risks to human health via the direct contact pathway. However additionally to consider the waste in its entirety statistical analysis has also been completed to include waste data for all depths as this provides a larger more statistically robust dataset for the heterogeneous waste mass e.g. in case of disturbance during construction works.

The results of the comparison of the measured concentrations of the Potential Contaminants of Concern (Table 5) has identified the following metals or metalloids which exceed relevant Human Health GACs for near surface waste (<1mbgl).

They will be considered as Contaminants of Concern and are assessed in this section for significance:

- Arsenic;
- Cadmium;
- Lead; and
- Vanadium.

3.1.1 Statistical Analysis – Entire East Tip (Waste Samples Only)

The method of statistical analysis for each contaminant which exceeded GAC was completed in accordance with best practice guidance as outlined in Section 2.1. Summary statistical analysis sheets of the results are presented in Appendix Q. The key questions and assumptions for this specific site analysis are bullet pointed below:

- Evaluated under the planning and licensing system scenario;
- The overall aim is to answer the question: "Is there sufficient evidence that the true mean concentration of the contaminant (μ) is less than the critical concentration (Cc)?";
- Where non-detects were present in the data, half the non-detect value was used to process the statistical results;
- The site was considered as one zone in its entirety and additionally a zoned area comprising of the Navy Football pitch. This was considered reasonable, taking into account the presence of waste material across the East Tip with potential associated contaminants and a current recreational use present on site; and
- The datasets analysed generally displayed a non-normal distribution and therefore significant was tested using the Chebychev statistical test, unless otherwise noted. Normality was tested using the Shapiro-Wilk normality test and outliers tested using Grubbs test.

The concentration data set distribution was assessed using the following hypothesis. Where:

$H0 = \mu \geq Cc$

H0 = the null hypothesis, μ=True mean concentration of contaminant and Cc=critical concentration (Cc in this case is the same as the GAC)

And:

$H1 = \mu < Cc$

H1= the alternative hypothesis, μ=True mean concentration of contaminant and Cc=critical concentration (Cc in this case is the same as the TSV for commercial/industrial land use)

The tests were undertaken at the 95% confidence level (The statistical chance the decision is wrong would be less than 5%).

If H0 is rejected then there is sufficient statistical evidence, at the 95% confidence level, that the area under consideration has a true mean contaminant concentration which is lower than the critical value (relevant GAC). All contaminants statistically analysed are summarised in Table 13 which summarises the results of the completed statistical tests for contaminants which exceeds park land use GACs in the top 1m depth of waste, including arsenic, cadmium, lead and vanadium.

Table 13 – Statistical Analysis Results for Solid Samples from top 1m – Park Land Use (Using Combined 2005 and 2012 Data)

Contaminant	No. of samples exceeding GAC	Total No. of samples	Park Land Use GAC (mg/kg)	UCL 95th percentile (mg/kg)	95th percentile value exceeds GAC	Outliers	Assessment
Arsenic	8	34	41.4	45	**Yes**	No	**Site wide impact**
Cadmium	1	34	83.6	26	No	No	No impact
Lead	16	34	477	1571	**Yes**	No	**Site wide impact**
Vanadium	1	34	422	333	No	No	No impact

Table 13 shows that potential significant risks to human health with reference to a park land use have not been identified for concentrations of cadmium and vanadium as the calculated upper confidence level (UCL) 95^{th} percentile mean value does not exceed the critical concentration (park land use GACs). There is sufficient evidence that the likely true mean concentration of the contaminant (μ) is less than the critical concentration (Cc). The outlier test was completed to identify potential hotspot areas of higher contaminant concentrations. The test did not identify any outliers within the sample population.

The UCL 95^{th} percentile mean value for arsenic and lead, 45mg/kg and 1571mg/kg respectively, did exceed the park land use GACs of 41.4mg/kg and 477mg/kg respectively. However the arsenic UCL concentration is considered to be only marginally in excess of the GAC. However due to this exceedance and 95% evidence level achieved there is not sufficient evidence to suggest that the true mean is less than critical concentrations (park land use GAC), site wide impacts have been identified and lead and arsenic concentrations are considered to be capable of causing risks to the health of future park end users of existing or current facility through direct contact pathways. Further consideration of these contaminants is therefore required.

The Chebychev outlier test, appropriate for a non normally distributed dataset, was also completed on arsenic and lead concentrations and did not identify any outliers. The test has therefore not identified potential hotspot areas of higher contaminant concentrations.

Potential significant risks to human health with reference to a commercial land use have not been identified for lead concentrations as the calculated UCL 95^{th} percentile mean concentration does not exceed the critical concentration (commercial land use GACs). There is sufficient evidence that the likely true mean concentration of the contaminant (μ) is less than the critical concentration (Cc). Significant risks to commercial site users due to the presence of lead has not been identified as shown in Table 14.

Table 14 – Statistical Analysis Results from Solid Samples from top 1m in 2005 and 2012 – Commercial Land Use

Contaminant	No. of samples exceeding GAC	Total No. of samples	Commercial Land Use GAC (mg/kg)	UCL 95th percentile (mg/kg)	95th percentile value exceeds GAC	Outliers	Assessment
Lead	1	34	4640	1571	No	No	No impact

Note: Arsenic, cadmium and vanadium did not exceed commercial GACs for waste samples for the top 1m and are therefore not included in above table.

In accordance with guidance (CIEH, 2008), the Chebychev test, considered to be applicable to a non-normally distributed dataset, was completed to test for potential outliers which could be hotspot areas of higher contaminant concentrations. The test did not identify any outliers within the sample population.

Table 15 shows similar results for the entire waste dataset when compared to statistical analysis of samples for the top 1m of waste as summarised in Table 13. Potential significant risks to human health with reference to a park land use have not been identified for concentrations of cadmium, vanadium, nickel, zinc and benzo(a)pyrene as the calculated upper confidence level (UCL) 95th percentile mean concentration values do not exceed the critical concentration (park land use GACs). There is sufficient evidence that the likely true mean concentration of the contaminant (μ) is less than the critical concentration (Cc). The outlier test was completed to identify potential hotspot areas of higher contaminant concentrations. The test did not identify any outliers within the sample population for these contaminants.

Table 15 – Statistical Analysis Results for all Solid Waste Samples – Park Land Use (Using Combined 2005 and 2012 Data)

Contaminant	No. of samples exceeding GAC	Total No. of samples	Park Land Use GAC (mg/kg)	UCL 95th percentile (mg/kg)	95th percentile value exceeds GAC	Outliers	Assessment
Arsenic	29	108	41.4	43.2	**Yes**	No	**Site wide impact**
Cadmium	2	108	83.6	33.6	No	No	No impact
Lead	34	108	477	908	**Yes**	Yes	**Site wide impact & outlier at OP10 @ 2mbgl**
Vanadium	12	108	422	288	No	No	No impact
Nickel	1	108	922	365	No	No	No impact
Zinc	1	108	54,800	5042	No	No	No impact
Benzo(a) pyrene	1	62	1.2	0.5	No	No	No impact

The UCL 95th percentile mean value for arsenic and lead, 43mg/kg and 908mg/kg respectively, did exceed the park land use GACs of 41.4mg/kg and 477mg/kg respectively. However arsenic concentrations are considered to be only marginally in excess of the GAC. None the less, this means that there is not sufficient evidence to suggest that the true mean is less than critical concentrations (park land use GAC), site wide impacts have been identified with lead and arsenic concentrations are considered to be capable of causing risks to the health of future park end users through direct contact pathways. Further consideration of these contaminants is therefore required.

The Chebychev outlier test, appropriate for a non normally distributed dataset, was also completed on arsenic and lead concentrations and did not identify any outliers with respect to arsenic. However the maximum lead concentration of 41,700mg/kg as measured at OP10 at 2mbgl has been identified as an outlier and is therefore potentially a hotspot area. This is not unexpected as the sample from this location comprised of flue dust.

Table 16 shows that potential significant risks to human health with reference to a commercial land use have not been identified for cadmium, lead and nickel concentrations as the calculated UCL 95th percentile mean value does not exceed the critical concentration (commercial land use GACs). There is sufficient evidence that the likely true mean concentration of the contaminants (μ) is less than the critical concentrations (Cc). Significant risks to commercial site users due to the presence of cadmium, lead and nickel concentrations has not been identified.

Table 16 – Statistical Analysis Results all Solid Waste Samples 2005 and 2012 – Commercial Land Use

Contaminant	No. of samples exceeding GAC	Total No. of samples	Commercial Land Use GAC (mg/kg)	UCL 95th percentile (mg/kg)	95th percentile value exceeds GAC	Outliers	Assessment
Cadmium	1	108	230	33.6	No	No	No impact
Lead	3	108	4640	908	No	Yes	**outlier at OP10 @ 2mbgl**
Nickel	1	108	1800	365	No	No	No impact

Note: Arsenic, vanadium, zinc and benzo(a)pyrene did not exceed commercial GACs for waste samples and are therefore not included in above table.

In accordance with guidance (CIEH, 2008), the Chebychev test, considered to be applicable to a non-normally distributed dataset, was completed to test for potential outliers which could be hotspot areas of higher contaminant concentrations. As noted above with reference to Table 15, the maximum lead concentration of 41,700mg/kg as measured at OP10 at 2mbgl has been identified as an outlier. This concentrations is in excess of the commercial GAC, however as it was measured at a depth of greater than 1m it cannot cause risks to current commercial users.

3.1.2 Navy Football Pitch and Statistical Analysis

Table 17 summarises analysis results for solid samples taken from the Navy Football pitch. The results have been compared to the park land use GACs as presented in Appendix R. During the 2012 investigation, three boreholes were drilled within the Football pitch. The results presented below also include laboratory analysis results of surface and subsurface samples, generally at depths of approximately 5cm below the ground surface completed by RPS in 2008 (RPS, 2008). The laboratory analysis completed included for heavy metals, hydrocarbons (TPH and PAHs), VOCs and some inorganics.

The football pitch has been considered separately in this section due to its current recreational use and also as the site investigation logs show that the surface comprises of top soil which is not present on the rest of the East Tip.

Table 17 – Current Navy Football Pitch Summary Laboratory Analysis Results from Solid Samples which Exceed Park Land Use GACs (2008 and 2012 data)

Contaminant	Number of Samples	Maximum Conc. (mg/kg)	Park Land Use Human Health GAC (mg/kg)	Number of Samples Exceeding	Location and Depth (mbgl)
Lead	25	1090	477	3	BH304 (2), BH304 (4.2), BH308 (0.7-0.9)
Vanadium	25	498	422	1	BH304 (4.2)

Note: dataset includes sample analysis results from RPS investigation in 2008

<u>Heavy metals</u>

With the exception of lead and vanadium, concentrations of heavy metals, arsenic, barium, beryllium, boron, cadmium, chromium, chromium VI, copper, mercury, nickel, selenium and zinc did not exceed the applicable park land use GACs and are not considered to be capable of causing significant risks to the health of those that use the football pitch.

The analysis results for lead, found that 3 No. out of 25 No. samples analysed measured concentrations in excess of the GAC with a maximum concentration of 1090mg/kg measured at BH304 (2mbgl). A second exceedance was also observed at BH304 at 4.2mbgl. Direct contact by the users of the football pitch is not possible for these lead concentrations at depth (>1mbgl) and as a result they are not capable of causing significant risks to human health. This is also the case for the maximum concentration of vanadium 498mg/kg which marginally exceeds the park land use GAC of 422mg/kg. Further consideration has been given to lead concentrations by conducting statistical analysis on the measured concentrations in the top 1m of material to further consider potential risks to the health of the users of the football pitch as in Table 18.

Table 18 – Statistical Analysis Results from Football Pitch Solid Samples from top 1m in 2008 and 2012

Contaminant	Number of samples exceeding GAC	Total No. of samples	Park Land Use GAC (mg/kg)	UCL 95th percentile (mg/kg)	95th percentile value exceeds GAC	Outliers	Assessment
Lead	12	22	477	223	No	Yes	**Outlier at BH304 0.7-0.9mbgl**

Note: dataset includes sample analysis results from RPS investigation in 2008

Table 18 shows that, with reference to the football pitch, the calculated UCL 95^{th} percentile mean value does not exceed the critical concentration (park land use GACs). There is sufficient evidence that the likely true mean concentration of the contaminant (μ) is less than the critical concentration (Cc). As a result, statistically concentrations of lead within the top 1m of material in the football pitch are unlikely to cause significant risks to human health. The UCL 95^{th} percentile (223mg/kg) is less than the UCL 95^{th} percentile calculated for the top 1m of the entire East Tip (1571mg/kg). This is considered to be due to the presence topsoil forming the surface of the football pitch, the sample analysis results of which are included in the above dataset and contain lower contaminant concentrations.

In accordance with guidance (CIEH, 2008), the Chebychev test, considered to be applicable to a non-normally distributed dataset, was completed to test for potential outliers which could be hotspot areas of higher contaminant concentrations. The test did identify one outlier within the sample population at BH304 0.7-0.9mbgl with a concentration of 542mg/kg, this marginally exceeds the park land use GAC of 477mg/kg. This concentration is at a depth where direct contact by the football pitch users is not possible. This is demonstrated by the fact that the sample taken from topsoil at 0.3mbgl at this location, measured a lead concentration of 67mg/kg, less than the GAC. The lead exceedance is not near surface and cannot cause significant risks to the health of users of the football pitch. The outputs of the statistical tests are included in Appendix S.

3.2 Generic Waters Assessment

Elevated contaminant concentrations in groundwater can be the result of contaminants being released from solid waste material through leaching mechanisms. It can also arise as a direct result of liquid contaminant release through waste liquid disposal such as that which may have occurred during sludge disposal.

As part of the site investigation contract and as noted in Section 2.7 groundwater samples were obtained from a total of 35 No. monitoring boreholes including boreholes screened solely within the waste horizon, 2005 investigation boreholes screened into the waste and underlying alluvial sediments, boreholes screened solely into the alluvium strata, boreholes screened into sands and gravels, and boreholes screened into limestone at depth. During June – July 2012, two groundwater samples were collected from each borehole, one at high tide and one at low tide.

However, there were some issues in regard to the analysis method and achieved limit of detection for mercury analysis and chromium VI analysis. Consequently, further sampling and analysis of ground and surface waters was undertaken in November 2012 by a suitably qualified engineer from WYG with the aim of addressing identified uncertainties. As per the June – July 2012 sampling and analysis, all sampled wells were purged by removing at least three well volumes prior to sampling. Collected samples were filtered and preserved on site prior to dispatch to an UKAS accredited laboratory. The accredited laboratory was selected based on their metal analysis method and achievable detection limits for mercury for and chromium VI. The preferred analysis method for metals was inductively coupled plasma optical emission spectrometry (ICP-OES) which suffers less from ionic interference that the previous analysis method ICP-MS. Mercury analysis was completed using the cold vapour atomic fluorescence spectroscopy (CV-AF) which does not suffer from ionic interference. In addition a selection of samples were sent to a specialist mercury analysis laboratory PS Analytical with analysis also completed using CV-AF.

Sections 3.2.1 – 3.4 described the analysis results with respect to locations where contaminant concentrations were measured in excess of applicable WQSs. The laboratory analysis results compared to relevant WQSs are presented in Appendix L. Laboratory certificates for the November 2012 sampling are included in Appendix T.

3.2.1 Groundwater Analysis for Boreholes Screened into Waste

During June to early July 2012, groundwater samples were obtained from 13 No. monitoring boreholes screened within the waste horizon of the East Tip. These boreholes were BH128, BH130, BH301A, BH302, BH303, BH305, BH306B, BH307, BH310A, BH311, BH312A, BH314 and BH315. Table 19 summarises contaminant concentrations that were in excess of applicable WQSs. The laboratory analysis results compared to relevant WQSs are presented in Appendix L.

Of the parameters that exceeded the WQS from the waste material, pH, chromium and mercury had the highest number of exceedances with 20 No., 22 No. and 16 No. samples respectively. pH ranged from 7.45 to 10.4, with the maximum pH concentration measured in groundwater sampled from BH312A at high tide.

Table 19 - Summary Groundwater Concentrations for Boreholes Screened into Waste (June-July 2012)

Contaminant	WQS (µg/l)	Total No. of Samples	Range (µg/l)	No. samples exceeding WQS	Boreholes that exceed WQS standard
pH	<4.5->9	26	7.45-10.4	20	BH128, BH130, BH303, BH305, BH306B, BH307, BH310A, BH311 (high tide only), BH312A, BH314 (low tide only), BH315
Chromium	4.6	26	2.9-123	22	BH128, BH130, BH301A, BH303, BH306B, BH307, BH310A, BH311, BH312A, BH314, BH315
Chromium VI*	0.6	26	<30- 117	1	BH310A (low tide only)
Copper	5	26	<1-146	4	BH305 (high tide only), BH312A, BH314 (low tide only)
Zinc	40	26	<2.1-76	1	BH314 (high tide only)
Lead	7.2	26	<0.2-7.79	1	BH312A (high tide only)
Manganese	30	26	<0.3-13300	4	BH301A, BH302
Nickel	20	26	<1-41.4	1	BH312A (high tide only)
Mercury**	0.05	26	<0.15-1.15	16	BH128, BH130, BH303, BH305, BH307, BH311, BH314, BH315
Benzo(a)pyrene	0.05	26	<0.01-0.08	1	BH312A (low tide only)
Benzo(k)-fluoranthene	0.03	26	<0.01-0.06	1	BH312A (low tide only)
Fluoranthene	0.1	26	<0.01-0.29	1	BH312A (low tide only)

Note 1 – table does not include results of duplicate samples

* The LOD for chromium VI (30µg/l) exceeds the WQS. Only samples with a concentration of chromium VI exceeding the LOD are included here.

** The LOD for mercury (0.15 µg/l) exceeds the WQS. Only samples with a concentration of mercury exceeding the LOD are included here.

Chromium concentrations measured during low and high tides are shown in contaminant distribution plots in Appendix U. It should be noted that the concentration distribution plots are provided for illustrative purposes only and should not be used to infer the presence of plumes with behavioural characteristics that would be present in a land based aquifer system. The groundwater underlying the East Tip is tidal and behaves differently when compared to a land based aquifer system. Please refer to Section 5 for further detail. In total

22 No. samples out of 26 No. analysed measured chromium in excess of the WQS 4.6µg/l. The maximum chromium concentration, 123µg/l was measured at low tide in groundwater sampled from BH312A in the east of the site. Chromium VI was also elevated above the WQS in this sample with a concentration of 117µg/l. The maximum high tide chromium concentration, 28µg/l, was also observed at this location. The lowest concentrations were observed in boreholes in the centre and north of the site, BH302 and BH305, both during high tide and low tide, with concentrations measured less than the WQS. With the exception of BH312A, chromium VI concentrations were less than laboratory detection limits at all other locations samples. However it should be noted that the analytical laboratory undertaking the analysis was unable to meet a detection limit of less than or close to the WQS with a detection limit of 30 µg/l.

The measured copper and manganese concentrations in groundwater from wells screened within waste, exceeded the WQS in 4No. samples. Copper concentrations ranged from less than laboratory detection limits (1µg/l) to 146µg/l measured in groundwater sampled from BH312A during high tide as shown in copper indicative contaminant distribution plots in Appendix U. The maximum concentration measured during low tide was at BH314 with a concentration of 6.8µg/l. BH312A measured a similar concentration of 6.6µg/l. Manganese concentrations exceeded the WQS of 30µg/l, in 4 No. samples collected from two locations, BH301A and BH302 in the north of the site, during both low and high tides. A maximum manganese concentration of 13,300µg/l, was measured at BH301A during low tide. At high tide the manganese concentration in BH301A, 5,750µg/l, was less than half that of low tide. In BH302 the high and low tide concentrations of manganese were 709µg/l and 727µg/l respectively. The samples obtained from the surrounding boreholes typically measured concentrations at less than laboratory detection limits and therefore less than the WQS. Manganese is considered to be restricted to groundwater from these two locations and does not extend across the entire East Tip. Other contaminants which exceeded applicable WQS's included a single sample taken from BH314 at high tide which had a zinc concentration of 76µg/l and exceeded the WQS of 40µg/l; elevated nickel was measured in water collected from BH312A with a concentration of 141µg/l compared to the WQS 20µg/l. Appendix U contains indicative contaminant concentration distribution plots for these metals.

It is worth noting that measured concentrations of chromium, copper, lead and nickel also exceeded relevant WQS's in groundwater sampled from BH312A.

Mercury concentrations exceeded the WQS in 16 No. out of 30 No. samples analysed with a maximum concentration of 1.15µg/l compared to the WQS of 0.05µg/l. However it should be noted that the analytical laboratory undertaking the analysis of Hg was unable to meet a detection limit of less than the WQS and that the detection limit was 0.15µg/l.

Additional groundwater sampling was completed to reduce uncertainties with respect to the above in November 2012, with groundwater samples collected from 13 No. monitoring boreholes screened within the waste horizon of the East Tip. These boreholes were BH128, BH130, BH301A, BH302, BH303, BH305, BH306B, BH307, BH310A, BH311, BH312A, BH314 and BH315. Generally groundwater samples were collected from each borehole at low tide, with high tide samples also collected from BH310A, BH312A and BH314. Table 20 summarises contaminant concentrations that were in excess of applicable WQSs. The laboratory analysis results compared to relevant WQSs are presented in Appendix L.

Of the parameters that exceeded the WQS from the waste material, chromium had the highest number of exceedances with 6 No. out of 16 No. analysed with concentrations that exceeded applicable WQSs with a maximum concentration of 18.3µg/l measured in a sample collected from BH312A during high tide. Typically chromium VI concentrations were measured as less than the laboratory detection limits (2µg/l) with the exception of 3 No. samples obtained from BH310A during high and low tide and BH311 with respective concentrations of 33µg/l, 20µg/l and 4µg/l. Previously during sampling and analysis in June 2012, elevated chromium VI concentrations were measured at BH310A during high tide with a concentration of 117µg/l as a result these exceeding concentrations are not unexpected.

Table 20 - Summary Groundwater Concentrations for Boreholes Screened into Waste (Nov 2012)

Contaminant	WQS (µg/l)	Total No. of Samples	Range (µg/l)	No. samples exceeding WQS	Boreholes that exceed WQS standard
Chromium	4.6	16	<0.2-18.3	6	BH130, BH306B, BH310A (high and low tide), BH311, BH315
Chromium VI*	0.6	16	<2- 33	3	BH310A (low and high tide only)
Copper	5	16	<3-21	2	BH312A (low and high tide)
Zinc	40	16	1.8-45.4	1	BH314 (high tide only)
Manganese	30	16	<0.3-1784	3	BH301A, BH302, BH305
Mercury**	0.05	22	<0.003-0.23	3	BH312A (high and low tide) and BH314

Note 1 – table does not include results of duplicate samples
* The LOD for chromium VI exceeds the WQS (2µg/l). Only samples with a concentration of chromium VI exceeding the LOD are included here.

The measured copper concentrations in groundwater from wells screened within waste, exceeded the WQS in 2 No. samples. Copper concentrations ranged from less than laboratory detection limits (3µg/l) to 21µg/l measured in groundwater sampled from BH312A during low tide. Previous sampling in June 2012 also measured the maximum copper concentration of 146µg/l at this location although measured in the high tide sample.

Manganese and mercury concentrations were measured in excess of the relevant WQS in 3 No. samples with respective maximum concentrations of 1784µg/l and 0.23µg/l measured at respective locations BH301A and BH314. BH301A was where the previous maximum manganese concentration of 13,300µg/l was measured and BH314 was where the maximum mercury concentration of 1.15µg/l was measured in June-July 2012. These concentrations appear to be lower than those measured during sampling in June – July 2012 and a lower number of samples also measured concentrations in excess of relevant GACs. This is considered to be due to the analysis method. Previously ICP-MS was the analysis method utilised whereas the most recent analysis method was cold vapour atomic fluorescence spectroscopy (CVAF) which has minimised the ionic interference cause by the brackish groundwater quality. Similar results appear to be present in regard to manganese concentrations in groundwater in the waste with lower concentrations observed.

1 No. out of 16 No. samples analysed measured a zinc groundwater concentration 45.4µg/l marginally exceeded the WQS 40µg/l in a sample obtained from BH314 during high tide. This is a slightly lower than the previous June-July 2012 analysis results when 76µg/l zinc was measured in the groundwater sampled from this location. This was also the only concentration measured in excess of the WQS.

3.2.2 Groundwater Analysis for Boreholes Screened into Alluvium

Seven boreholes were installed exclusively into the alluvial strata across the site. These included BH304, BH306D BH308, BH309, BH310B, BH312B and BH316. Table 21 summarises contaminants in groundwater sampled in June – July 2012 from alluvium, with measured concentrations in excess of applicable WQSs. Laboratory analysis results compared to WQS are presented in Appendix L and groundwater concentration distribution plots are presented in Appendix V.

Table 21 - Summary Groundwater Concentrations for Boreholes screened into Alluvium (June – July 2012)

Contaminant	WQS (µg/l)	Total No. of Samples	Range (µg/l)	No. samples exceeding WQS	Borehole exceedance of standard
pH	<4.5->9	14	7.4-9.1	1	BH312B (low tide only)
Arsenic	20	14	<0.5-33.3	2	BH310B
Chromium	4.6	14	2.9-6.28	8	BH304, BH310B, BH312B, BH316
Copper	5	14	<1-13	2	BH308
Manganese	30	14	67-5220	14	BH304, BH306D, BH308, BH309, BH310B, BH312B, BH316
Mercury	0.05	14	<0.15-0.6	7*	BH304 (low tide only), BH308, BH309, BH312B

Note 1 – does not include duplicate samples

* The LOD (0.15µg/l) for mercury exceeds the WQS. Only samples with a concentration of mercury exceeding the LOD are included here.

Manganese concentrations exceeded the WQS of 30µg/l in all samples collected with concentrations ranging from between 66.5µg/l in BH312B at low tide and 5,320µg/l in BH304 (high tide).

Chromium concentrations marginally exceeded the WQS of 4.6µg/l in 8 No. samples with a maximum concentration of 6.28µg/l observed in the groundwater sample obtained from BH310B at high tide.

Mercury concentrations exceeded the WQS of 0.05µg/l in 7 No. samples with a maximum concentration of 0.6µg/l in BH308 at low tide.

Elevated concentrations of arsenic of 33.3µg/l and 32.2µg/l exceeded the WQS of 20µg/l in BH310B (high and low tides) respectively.

Elevated concentrations of copper of 13.2µg/l and 10.9µg/l exceeded the WQS of 5µg/l in BH308 (high and low tides) respectively.

pH was marginally elevated above the WQS in BH312B at low tide.

Table 22 summarises contaminants in groundwater sampled in November 2012 from alluvium, with measured concentrations in excess of applicable WQSs. Laboratory analysis results compared to WQS are presented in Appendix L and groundwater concentration distribution plots are presented in Appendix V.

Table 22 - Summary Groundwater Concentrations for Boreholes Screened into Alluvium (November 2012)

Contaminant	WQS (µg/l)	Total No. of Samples	Range (µg/l)	No. samples exceeding WQS	Borehole exceedance of standard
Arsenic	20	9	<0.9-31.1	1	BH310B
Cadmium	0.2	9	<0.03-0.36	1	BH310B
Manganese	30	9	75.9-4908	9	BH304 (high and low tide), BH306D, BH308, BH309, BH310B, BH312B, BH316 (low and high tide)

Note 1 – does not include duplicate samples

Manganese concentrations exceeded the WQS of 30µg/l in all samples collected with similar concentrations to those measured in June – July 2012 sampling. Concentrations ranged from between 75.9µg/l in BH312B at low tide and 4908µg/l in BH304 (high tide). It should also be noted that the same locations also provided the minimum and maximum concentrations in June – July 2012.

Arsenic and cadmium concentrations were in excess of their respective WQS in one groundwater sample collected from BH310B. Previously cadmium concentrations did not exceed the WQS for samples collected from the alluvium. However both the high tide and low tide arsenic groundwater samples from BH310B sample measured concentrations in excess of the WQS with a maximum of 33.3µg/l. This is similar to the maximum arsenic concentration of 31.1 µg/l measured during June-July 2012.

Unlike previous analysis results, chromium, copper and mercury concentrations measured in groundwater samples obtained from alluvium did not contain concentrations in excess of applicable WQSs. Again this is considered to be attributable to the analysis methods employed which have achieved lower detection limits whilst minimising the potential for ionic interference.

3.2.3 Groundwater Analysis for Boreholes Screened into Sands and Gravels

Three boreholes were installed to monitor groundwater quality within a sand and gravel horizon encountered below the alluvium. These were BH313, BH117R and BH125R. Table 23 summarises contaminant concentrations that exceeded relevant WQSs from samples obtained in June – July 2012. Laboratory analysis results compared to WQS are presented in Appendix L.

Table 23 - Summary Groundwater Concentrations for Boreholes Screened into Sands and Gravels (June – July 2012)

Contaminant	WQS (µg/l)	Total No. of Samples	Range (µg/l)	No. samples exceeding WQS	Borehole exceedance of standard
Ammoniacal Nitrogen	50000	6	<200-53,100	1	BH313 (high tide only)
Chromium	4.6	6	2.65-7.67	4	BH313, BH125R
Copper	5	6	<1-12.5	1	BH125R
Manganese	30	6	207-3,260	6	BH313, BH117R, BH125R
Mercury*	0.05	6	<0.-0.226	2	BH117R

* The LOD for mercury (0.15µg/l) exceeds the WQS. Only samples with a concentration of mercury exceeding the LOD are included here.

Typically most contaminant concentrations were not measured in excess of relevant WQSs, with the exception of ammoniacal nitrogen, chromium, copper, manganese and mercury.

Manganese concentrations exceeded the WQS of 30µg/l in all 6 No. samples analysed with concentrations of between 207µg/l in BH125R at low tide and 3,260µg/l in BH313 at low tide. Chromium concentrations exceeded the WQS of 4.6µg/l in 4 No. samples with concentrations ranging between 5.23µg/l and 7.67µg/l and in BH125R at low tide and high tide respectively.

Laboratory analysis of water samples collected from BH117 measured elevated levels of mercury in both high and low tide samples in excess of the WQS. Other measured concentrations were less than laboratory detection limits.

One concentration of ammoniacal nitrogen in BH313 at high tide was measured as 53,100µg/l which was just above the WQS of 50,000µg/l but within the margin of analytical error for this parameter. This is an isolated occurrence with all other groundwater samples as obtained from waste, alluvium, sands and gravels and limestone not exceeding the WQS. It is therefore not of concern.

Table 24 summarises contaminant concentrations that exceeded relevant WQSs from samples obtained in November 2012. Laboratory analysis results compared to WQS are presented in Appendix L.

Table 24 - Summary Groundwater Concentrations for Boreholes Screened into Sands and Gravels (November 2012)

Contaminant	WQS (µg/l)	Total No. of Samples	Range (µg/l)	No. samples exceeding WQS	Borehole exceedance of standard
Arsenic	20	3	3.4-25	1	BH313
Cadmium	0.2	3	<0.03-0.65	2	BH313, BH117R
Manganese	30	3	76.2-2126	3	BH313, BH117R, BH125R

Typically most metal contaminant concentrations were not measured in excess of relevant WQSs, with the exception of arsenic, cadmium and manganese.

Manganese concentrations exceeded the WQS of 30µg/l in all 3 No. samples analysed with concentrations of between 75.6µg/l in BH125R at low tide and 2126µg/l in BH313 at low tide the same locations as per the June – July sampling.

2 No. out of the 3 No. samples analysed measured cadmium concentrations in excess the WQS 0.2µg/l with a maximum concentration of 0.65µgll measured in a sample from BH313 and 1 No. arsenic concentration 25µg/l was measured in excess of the WQS 20µg/l also in the groundwater sample from BH313. Previously in June – July 2012, concentrations of arsenic and cadmium were not measured in excess of the WQS.

It should be noted that chromium, copper and mercury concentrations did not exceed their respective WQSs whereas previously excedences had been measured for sampling in June – July 2012.

3.2.4 Groundwater Analysis for Boreholes Screened into Limestone

Four boreholes were installed into bedrock across the site: BH122, BH306C, BH310C and BH312C. Table 25 summarises the parameters where exceedances of the WQS have occurred as measured in samples obtained during June – July 2012. Laboratory analysis results compared to WQS are presented in Appendix L.

The measured concentrations of copper, mercury, nickel and zinc in waters collected from 2 locations at low tide were above their respective WQS. BH122 (high tide sample only) measured concentrations of copper, mercury and zinc that marginally exceeded their respective WQSs and BH310C (low tide sample) measured a marginally elevated concentration of nickel, 24.1µg/l that exceeded its WQS value, 20µg/l.

Table 25 - Summary Groundwater Concentrations for Boreholes Screened into Limestone (June – July 2012)

Contaminant	WQS (µg/l)	Total No. of Samples	Range (µg/l)	No. samples exceeding WQS	Borehole exceedance of standard
Cadmium	0.2	8	<0.15-12	7	BH122, BH306C, BH310C (low tide only), BH312C
Chromium	4.6	8	<1.5-6	3	BH306C (high tide only), BH312C
Copper	5	8	<1-7.08	1	BH122 (high tide only)
Mercury*	0.05	8	<0.15-0.918	1	BH122 (high tide only)
Nickel	20	8	2.24-24.1	1	BH310C (low tide only)
Zinc	40	8	<2.1-58.6	1	BH122 (high tide only)
Manganese	30	8	1.89-1370	6	BH306C, BH310C, BH312C

Note 1 – does not include duplicate sample
* The LOD for mercury (0.15µg/l) exceeds the WQS. Only samples with concentrations of mercury exceeding the LOD are included here.

7 No. of the 8 No. well water samples analysed had concentrations of cadmium that exceeded the WQS of 0.2µg/l with exceeding concentrations ranging from 0.636µg/l (BH306C at low tide) to 12µg/l (BH122 at high tide). Cadmium concentrations were not measured in excess of WQSs in groundwater sampled from the overlying sands and gravels, alluvium and waste material. It is thus considered unlikely that the source of the elevated cadmium in groundwater in limestone is the overlying waste. Elevated cadmium concentrations were previously identified in the limestone groundwater samples collected from the area of the former steel works (WYG, 2010). During a 2010 investigation groundwater samples were collected from 5 No. boreholes installed into the limestone. A maximum concentration of 1.1µg/l of cadmium was measured in the sample collected from BH206 which is located to the west of the docks (WYG, 2010). Shallow groundwater sampled from the steelworks site also has not identified significant groundwater cadmium concentrations that could be resulting in elevated concentrations in limestone underlying the East Tip. Consequently, there is no indication that cadmium has percolated downwards from the waste material or laterally from the former Steelworks.

In regard to metals in limestone, particularly cadmium and zinc, it is possible that the measured concentrations are due to mineralisation within the Waulsortian Limestone (Wilkinson et al, 2005), however there is not enough data to draw conclusions on this.

Chromium concentrations marginally in excess by less than an order of magnitude of the WQS of 4.6µg/l were measured in groundwater from BH306C (high tide only) and BH312C (high and low tides) with concentrations of 6µg/l, 5.62µg/l and 5.91µg/l respectively.

Table 26 summarises the parameters where exceedances of the WQS have occurred as measured in samples obtained during November 2012. Laboratory analysis results compared to WQS are presented in Appendix L.

Table 26 - Summary Groundwater Concentrations for Boreholes Screened into Limestone (November 2012)

Contaminant	WQS (µg/l)	Total No. of Samples	Range (µg/l)	No. samples exceeding WQS	Borehole exceedance of standard
Cadmium	0.2	4	0.37-1.78	4	BH122, BH306C, BH310C, BH312C
Manganese	30	4	7-790.5	2	BH306C, BH310C
Zinc	40	4	16.7-95	1	BH310C
Mercury	0.05	4	<0.01-0.07	1	BH306C

Note 1 – does not include duplicate sample

All groundwater samples analysed measured concentrations of cadmium that exceeded the WQS of 0.2µg/l with exceeding concentrations ranging from 0.37µg/l (BH306C at low tide) to 1.8µg/l (BH122 at low tide). Similar concentrations were also observed at the same locations sampled in June – July 2012. Cadmium concentrations were not measured in excess of WQSs in groundwater sampled from the overlying waste material, however concentrations in excess of the WQS have been measured in samples obtained from overlying sands and gravels and also from the overlying alluvium at BH310B. It is still considered unlikely that the source of the elevated cadmium in groundwater in limestone is the overlying waste.

2 No. out 4 No. samples analysed measured manganese concentrations in excess of the WQS. Concentrations ranged from 7µg/l at BH122 to 790.5µg/l at BH310c. these are similar concentrations to those observed during the June – July 2012.

1 No. zinc and mercury concentration was measured in excess of relevant WQSs at BH310C and BH306C respectively with concentrations of 95µg/l and 0.07µg/l. Previously at BH310C in June – July 2012 zinc and mercury were measured at less than the detection limit of 2.1µg/l and 0.15µg/l respectively.

Chromium and chromium VI concentrations were not measured in excess of WQSs.

3.3 Surface Water, Foreshore Seepages and Excavations

Surface water sampling was undertaken as shown in Figure 11 during June-July 2012. This includes surface water samples taken from the contractor excavations (SW01 and SW02) and seepages (SP01, SP02 and SP03) as summarised in Table 27. Seepages are where groundwater exits the waste onto the foreshore of the East Tip and into the Cork Harbour during low tides. Laboratory analysis results compared to WQS are presented in Appendix L.

Table 27 - Summary Surface Water Samples, Excavations and Foreshore Seepages (June-July 2012)

Contaminant	WQS (µg/l)	Total No. of Samples	Range (µg/l)	No. samples exceeding WQS	Location of exceedance of standard
Chromium	4.6	5	<0.022-12.1	3	SW01, SW02, SP03
Copper	5	5	<1-6.75	1	SW01
Mercury	0.05	5	<0.15-0.4	4	SW01, SW02, SP01, SP02
Benzo(k) Fluoranthene	0.03	5	<0.01-0.04	1	SP01

Note 1 – does not include duplicate sample
*The LOD for mercury (0.15µg/l) exceeds the WQS. Only samples with concentrations of mercury exceeding the LOD are included here.

Both samples from the contractor excavation (marked SW01 and SW02 Figure 11) measured chromium and mercury that exceeded their respective WQS values. Measured chromium concentrations in water sampled from SW01 and SW02 of 12.1µg/l and 7.74µg/l marginally exceeded the WQS of 4.6µg/l. Mercury concentrations at SW01 and SW02 were 0.4µg/l and 0.29µg/l respectively which exceeded the WQS of 0.05µg/l. Copper measured an elevated concentration of 0.4µg/l in SW01 which exceeded the WQS of 0.05µg/l. it should be noted that the surface water samples SW01 and SW02 were from an area known to have sludge waste deposited.

Analysis of the seepage water samples found that contaminant concentrations exceeded relevant WQSs for chromium and mercury. One chromium concentration of 9µg/l exceeded the WQS of 4.6µg/l at SP03. Hexavalent chromium was not observed above laboratory detection limits in water collected at any of the three sampled locations. Mercury concentrations were in excess of the WQS 0.05µg/l, in 2 No. sampled locations SP01 and SP02 with respective concentrations of 0.3µg/l and 0.2µg/l. All other heavy metals analysed in the water samples collected were measured as less than respective WQS's. Benzo(k)fluoranthene was measured at an elevated concentration of 0.04µg/l in SP01 which marginally exceeded the WQS of 0.03µg/l.

Samples were also collected from the seepages during low tide during the sampling in November 2012. The analysis results did not identify concentrations in excess of WQS. In particular chromium VI concentrations were less than the laboratory detection limit of 2µg/l. Laboratory analysis results compared to WQS are presented in Appendix L.

3.4 Marine Waters

Samples of seawater were collected from 6 No, locations from around Cork Harbour during low tide in June 2012 and again in November 2012 and analysed for the PCOC. Laboratory analysis results compared to WQS are presented in Appendix L. The sample locations are presented on Figure 12. The samples were taken during low tide with, one sample from up river of the East Tip (HW01), three from close proximity to the East Tip (HW02, HW03 and HW04) (approximately 1-50m from the low tide water mark on the foreshore) and two are from the outer harbour (HW05, HW06) down river of the East Tip.

For all samples tested, none of the PCOC concentrations exceeded relevant WQS.

4 Updated Conceptual Model (Post Generic)

4.1 Human Health

On the basis of comparison of solid analysis results with appropriate GACs and consideration of water analysis results, a number of pollutant linkages have been identified in regard to the East Tip, which are summarised in Table 28 and Table 29 and shown on Figure 13. It should be noted that these are presented for the site in its current condition without remediation.

4.1.1 Sources

Park Land Use

Whilst a number of metals in the waste material were measured at concentrations that exceeded park land use GACs, including arsenic, cadmium, lead, nickel, vanadium and zinc, only arsenic and lead are considered to be present at concentrations which pose a potential site wide risk to the health of users of a future park. Statistical analysis of arsenic and lead concentrations has shown that it is likely that mean concentrations of these contaminants in the surface material (up to and including 1mbgl) and for the waste material in its entirety exceed park land use GACs.

In regard to chromium and chromium VI, measured concentrations in all samples analysed did not exceed the relevant park land use GAC and as a result potential significant risks to the health of potential future park users due to chromium have not been identified.

Commercial Land Use

Cadmium, lead and nickel concentrations exceeded the applicable commercial land use GACs in 1 No. to 3 No. samples, however only lead was encountered in near surface material. The statistical analysis results identified that mean cadmium, lead and nickel concentrations across the site for near surface materials (up to and including 1mbgl) and for the entire waste material is unlikely to exceed the commercial GAC and lead is therefore unlikely to cause significant risks to commercial site users.

However a lead outlier or potential hotspot area comprising of higher lead concentrations has been identified in the area of OP10 at a depth of 2mbgl. The concentration exceeds the commercial land use GAC, however it is not capable of causing risks to human health as it is non volatile and at a depth of greater than 1mbgl, where exposure occurs through the predominant inhalation of vapours pathway. It is worth noting that analysis results of samples from overlying waste at 1.1mbgl and 0.8mbgl have not measured lead concentrations in excess of the commercial GAC.

Football Pitch

Laboratory analysis results for the football pitch were considered in isolation to consider the current recreational use and potential risks to health. Lead and vanadium concentrations were in excess of the park end use GACs at a few locations, however only lead was observed in near surface soils. Following statistical analysis, mean lead concentrations, across the pitch, have not been identified in excess of the park land use GAC. However one outlier was identified within the dataset. BH304 at 0.7-0.9mbgl measured a concentration of 542mg/kg which exceeded the park land use GAC. At this location the overlying sample taken from 0.3mbgl did not measure a concentration in excess of the park land use GAC and as a result a direct contact pathway to the elevated lead concentration is not considered to be present and significant health risks to the users of the football pitch have not been identified.

Potential Contamination Hotspots

With the exception of OP10 at 2mbgl, statistical analysis (Appendix Q) has not identified outliers in the datasets. However, there are a number of other locations where solid analysis results appear to be elevated by comparison to the rest of the data. This includes for BH312 (A, B & C) where a number of samples measured multiple metal contaminant concentrations, typically lead, arsenic and cadmium, in excess of the park land use GAC. The most significant concentrations (minimum of 95% confidence level) were measured in millscale and also in samples containing scrap metal, refractory waste, black demolition waste and steel barrels with tar inside. To the south of this location, samples obtained from BH314, also measured multiple metal concentrations, arsenic, lead and nickel, in excess of the park land use GACs.

It should also be noted that the identified lead outlier at OP10 is considered to be associated with the presence of flue dust at OP10. Further evidence is provided by the fact that in this sample multiple metal concentrations were measured in excess of both the park land use and commercial land use GACs, particularly cadmium, lead and zinc which were maximum concentrations observed across all solid samples analysed during the 2012.

Groundwater

Concentrations of contaminants in groundwater, particularly in the waste and particularly for heavy metals have been measured in excess of WQSs. Risks to human health from metals in groundwater will only occur in two circumstances, if the users of the site can come into direct contact with groundwater or where the groundwater is used for a potable supply. Users of the football pitch and also a future park land use will not be able to come into contact with groundwater at the site due to groundwater levels being below ground level. Typically groundwater is only exposed in the contractor excavations which are currently fenced off preventing access. The brackish quality of groundwater also means that it is unlikely that it would be used for a potable supply. Metal concentrations in groundwater are therefore not of concern with respect to human health.

None of the contaminants of concern in groundwater were measured at concentrations which would pose a risk to human health through vapour inhalation pathways. Low concentrations of organic contaminants, speciated TPH and speciated PAHs have been encountered in groundwater sampled from the waste material. Typically concentrations were observed for heavier TPH fractions greater than C12 which are non volatile and will not volatise in high enough concentrations to cause risks to human health through inhalation of hydrocarbon vapours. This is also the case for PAH compounds. C8-C10 TPH fractions were measured at BH312A, with concentrations ranging from 12-22µg/l, whilst this fraction is considered to be volatile the concentrations are sufficiently low to not cause a significant health risk through inhalation of vapours. Therefore the DQRA has not assessed risk to human health through a groundwater pathway.

Ground Gas

The ground gas assessment in Appendix O has identified that the waste material is typically not generating significant concentrations of ground gas. This is considered to be due to the absence of significant putrescible material. However boreholes installed into the underlying alluvium have shown elevated concentrations of methane to be present which have resulted in a maximum CIRIA characteristic situation 5 being assigned to one of the locations BH316. BH126 has been classified as characteristic situation 4, and BH116 and BH306D have been classified as characteristic situation 2. The source of the elevated ground gas is considered to be the underlying natural organic alluvium as opposed to the waste. Further monitoring and assessment and or protection gas protection measures will be required for any buildings to be constructed on site.

Asbestos

Approximately 50% of samples screened were identified as containing very low quantities of asbestos fibres, typically 0.003%-0.006% comprising mainly of the lower risk chrysotile. Further examination identified that the asbestos fibres had not been subjected to a heat treatment and as a result are not considered to originate from the slag or raw scrap metal that was used by the steelworks. It is considered that the most likely source is construction and demolition type waste deposited both at depth and present at the surface. More detailed results are presented in Appendix M. Asbestos is considered to have the potential to cause risks to the health of current and future site users through inhalation pathways.

Table 28 – Updated Conceptual Site Model – Human Health Under Current Site Conditions

Source	Pathway	Receptor
Shallow arsenic and lead contamination associated with waste material including surface stock piles across the site	Direct dermal contact Ingestion dust and soil Inhalation of dust	Future park land users
Asbestos in waste material	Inhalation of fibres	Current commercial users, future park users and construction workers
Hotspots of contamination, BH312m BH314, OP10 Millscale, sludge and flue dust	Direct dermal contact Ingestion dust and soil Inhalation of dust	Future park land users
Groundwater Contamination associated with waste material, arsenic, chromium, copper, zinc, minor lead, nickel, cadmium, aluminium, manganese	Direct dermal contact Ingestion	Construction workers (unlikely unless excavating below water table)
Ground Gas – methane	Lateral and vertical migration	Current and future site users

4.2 Water and Ecology

On the basis of comparison of solid, leachability and water analysis results with appropriate GACs, a number of pollutant linkages have been identified in ground water from the East Tip, which are summarised in Table 29.

4.2.1 Sources

Leachable concentrations of chromium, chromium VI, copper and to a lesser extent zinc, lead, mercury, pH and PAHs have been observed above applicable WQSs. Elevated concentrations of these contaminants have also been identified in groundwater sampled from the waste material and therefore pollutant linkages are considered to be present with respect to leaching to groundwater.

Concentrations of chromium, chromium VI, copper, zinc, lead, manganese, nickel, mercury and PAH compounds have been measured in excess of WQSs in groundwater in waste and will be considered further in respect of their potential to pollute Cork Harbour waters.

Concentrations of arsenic, cadmium, chromium, copper, manganese and mercury above WQSs have been measured in groundwater sampled from the alluvium; arsenic, cadmium chromium, copper, manganese and mercury in sands and gravels and cadmium, chromium, copper, manganese, mercury, nickel and zinc in groundwater sampled from the limestone. Decreasing concentrations have been observed with increasing depth whereby in the sands and gravels and limestone aquifer units concentrations are considered to only marginally exceed WQS and therefore evidence suggests only limited downward migration is occurring.

Table 29 - Updated Conceptual Site Model –Water and Ecology

Source	Pathway	Receptor
Leachable chromium, chromium VI, copper, lead, limited cadmium, zinc and PAHs. Waste types – slag, sludge, refractory, millscale, flue dust, construction and demolition materials	Leaching from unsaturated zone	Shallow groundwater in slag material
	Leaching within tidal zone through wetting and drying	Shallow groundwater in slag material
	Lateral and vertical groundwater migration, preferentially through waste	Cork Harbour waters
	Uptake by flora and fauna	Flora and fauna in Cork Harbour particularly on foreshore
	Erosion and leaching	Cork harbour waters and flora and fauna in Cork Harbour particularly on foreshore
Groundwater contamination associated with waste material, arsenic, chromium, chromium VI, copper, zinc, lead, manganese, nickel and mercury	Lateral and vertical groundwater migration, preferentially through waste	Cork Harbour waters
	Uptake by flora and fauna	Flora and fauna in Cork Harbour particularly on foreshore

4.2.2 Pathways

Based on review of existing site investigation data and information contained in previous reports, the following pathways have been identified with respect to water receptors:

- Leaching of mobile compounds through rainwater infiltration in the unsaturated zone, i.e. leaching of materials from slag material, other steelworks waste, sludge pits, domestic type waste to underlying groundwater in waste material;
- Leaching of compounds within tidally influenced waste material and saturated waste materials from tidal flows i.e. leaching of materials from slag material, other steelworks waste, sludge pits, domestic type waste to underlying groundwater in waste material;
- Contaminant migration in groundwater including through tidal groundwater flow appearing as seepage onto foreshore (during low tide);
- Preferential pathways through areas of higher permeable waste; and
- Vertical migration into alluvium, underlying sands and gravels and into limestone bedrock.

A number of seepages are present exiting the waste on the foreshore. Contaminant concentrations observed in seepages typically did not exceed relevant WQSs with the exception of a concentration of chromium measured in the seepage from SP03 which marginally exceeded the WQS. Further to this, sampling of the harbour waters has not identified contaminant concentrations in excess of relevant WQSs for all measured contaminants showing that the actual pollutant linkages are not present and the Harbour Waters are not being significantly impacts by elevated contaminant concentrations in groundwater underlying the East Tip.

Attenuation mechanisms such as sorption are likely to be present and combined with lower permeable alluvium are considered to be preventing significant downward contaminant migration as outlined in Section 2.6 with lower contaminant concentrations measured in the underlying alluvium, sands and gravels and limestone when compared to groundwater sampled and analysed from the waste material. Analysis results of solid samples also show decreasing concentrations with depth.

Elevated chromium, copper, manganese and mercury concentrations above relevant WQSs have been measured in sands and gravels and cadmium, chromium, copper, mercury, nickel, zinc and manganese in limestone. Typically these were marginally in excess of the WQSs. These aquifers are not valuable resources in regard to their potential for abstractions as they of a poor quality due to their brackish quality. Consequently the primary receptor is considered to be the Cork Harbour in regard to potential contaminant migration. It is considered unlikely that the elevated concentrations would migrate in sufficient concentrations to cause WQSs to be exceeded in Cork Harbours due to the pathway length that is present and the attenuation mechanisms that would occur.

4.2.3 Receptors

The primary receptor in regard to water and the East Tip is considered to be the Cork Harbour due to the actual hydraulic connection between the waste material and marine waters in Cork Harbour. In considering this as the primary receptor it is also considered to be protective of ecology, flora and fauna in the Cork Harbour.

5 Hydrogeological and Hydrology Setting

The gap analysis undertaken identified that future risk assessments would benefit from a better understanding regarding the groundwater regime beneath the site, particularly with respect to the influence of the tidal cycle on the previous water level data. As a result, the investigation works which followed involved the deployment of in-situ data loggers in monitoring wells across the site screened within each of the main strata types.

The following section draws together the available factual data from previous reports and the 2012 investigation and outlines a hydro-geological Conceptual Site Model (CSM) describing the relationship between the land and the surrounding water bodies. This CSM has been used as the technical basis for further assessment of groundwater source-pathway-receptor linkages.

5.1 Site waste/geological conditions

The ground conditions at the site can be simplified into the following key component parts and are summarised in Table 30.

- **Waste**: Encountered at all 2012 investigation locations to a maximum depth of 11mbgl (BH306D). Some boreholes (BH306A, BH306B, BH310A, BH311, BH314, BH315) were terminated in the waste indicating that it may be present to a greater depth locally across the site. Topographically, waste was encountered between +12mAOD (in large stockpiles) and to depths up to -9mAOD, based on a combination of records from borehole logs and estimates made by previous geophysical surveys (Apex, 2012). An estimated average thickness of waste is in the approximate order of 9.7m, generally greater in the centre and along the eastern boundary of the site (7 to 11m) and thinnest along the western boundary (2 to 5m). The waste was variable in composition but was predominantly described as grey/black 'unprocessed slag'. The slag is commonly described as gravel and cobble sized with varying amounts of refractory bricks. Occasionally other waste types were observed, described as millscale, sandy clay, topsoil, shells with metal debris, sandy gravel and black sludge/sand, timber, construction waste, metal, plastics, steel and iron. These are described in further detail in Appendix P.

- **Alluvium**: directly underlies the waste and is comprised of clay and/or silt. It was found to be between 6m and 15m thick, to a maximum depth of 24.38mbgl (BH306C)(silt) and 27.43mbgl (clay). A geophysical survey has indicated that this is between 3 and >13m thick (Apex 2012).

- **Fluvio-glacial deposits**: Comprised of sand and gravel underlying the alluvium, varied in thickness from 2m to greater than 20m (approx) to a maximum depth of 36.58mbgl (BH310C), generally described as slightly sandy and occasionally slightly clayey gravel with cobbles throughout.

- **Limestone Bedrock**: the top of which was encountered at depths of between 24mbgl and 37mbgl. A geophysical survey (Apex, 2012) indicated that the top of this is between 19.2mbgl and 39mbgl.

Table 30– Summary of Ground Conditions Encountered During 2012 Site Investigation

Stratum Title	Strata Description	Thickness Range (m)
Waste	Comprised predominantly slag (granular) and to a lesser extent refractory, millscale, sludge and construction and demolition type waste	3-11
Alluvium	Sands, silts and silty clay with clay lense and occasional gravel lenses	6.18-15m
Sands and Gravels	Silty clay, silt, peaty clay, gravelly sand, gravel and sand	1.9 – 19.5*
Bedrock Limestone	Limestone and weathered limestone, top of encountered at 23.8-43.1mbgl	Base not proven

* maximum thickness at BH117R, however base wasn't proven

5.1.1 Geological Cross Sections

A series of geological cross sections have been developed for the site utilising the 2012 site investigation data and also boreholes logs from the 2005 investigation (WYG, 2005). These are presented in Appendix W, and can be summarised as follows;

<u>North to South Cross Section</u>

Cross Section A-A' cut the site in an east to west direction along the centre of the site from BH302 in the north, through BH303, BH116A, BH305, BH309 and BH312C. The waste depth varies in this cross section from approximately 11m thick at BH302 in the north, decreasing to approximately 7m at BH116, located centrally in the north and approximately 7m thickness in the south at BH312C. Underlying the waste is approximately 11m thickness of alluvial silt from approximately -4mAOD to approximately -15mAOD, underlain by between 4m and 8m (approx) thickness of gravels, underlain by limestone the top of which was recorded at between -20mAOD and -23mAOD.

<u>East to West Cross Sections</u>

Cross Sections B-B' and C-C' intersects the site in an east to west direction with B-B' in the north of the site and C-C' in the south of the site. Both cross sections show shallower depths of waste in the western most part of the site at BH304 and BH308, with depths of waste typically increasing towards the eastern part of the site. Underlying the waste material is alluvial silts, varying from approximately 6m thick to approximately 15m thick, with the greater depths observed in the centre of the site. A continuous thin layer of clay is shown in the cross section B-B', however this is not present in the southern cross section C-C'. Gravels are shown to underlie alluvium and clays at thicknesses ranging from 7m to 15m extending to a maximum of -36mAOD. This is underlain by limestone at an approximate depth of approximately -30mAOD.

5.2 Hydrology

Haulbowline Island is set in the main estuarine channel servicing a large natural harbour to the southeast of the City of Cork. The central part of the island is large artificial harbour and dock area. The East Tip accounts for around one quarter of the land mass of Haulbowline Island extending radial, eastward into the sea from the central harbour with an irregular shoreline.

5.2.1 Tidal regime

The correlation of topographic levels, typically reported in metres above ordnance datum (mAOD), to bathymetric levels of the sea bed, typically referenced against local Chart Datums, require a correction to enable direct comparison of land and sea. Understanding this relationship is a fundamental aspect of the hydro-geological conceptual site model.

Topographic (land) levels in this region of Ireland are based on the ‘Malin Head Datum’ which is the standard Ordnance Datum and all topographic surveying (and borehole height referencing) is benchmarked against this datum and quoted as mAOD. It is important to note that 0.00mAOD does not equate to local Mean Sea Level, for reasons which will be discussed below.

Bathymetric surveys of the sea bed surrounding Haulbowline Island indicated that within the area immediately surrounding the site (at least 100m from the foreshore), the bathymetric levels are recorded as circa -0.5m ‘Chart Datum’. In this instance, the local Chart Datum is based on the ‘Admiralty Tide Charts’ which are in-turn based on the lowest astronomical tide (i.e. Spring Low Water), also known as the ‘Poolbeg Datum’. The Poolbeg Datum is 2.7m below the Malin Head Datum (i.e.-2.7mOD). In addition, there is a further local correction factor for the Cobh area which must be applied to the Chart (Poolbeg) Datum of +0.13m to correlate between land and sea.

In summary, a correction factor of -2.57m needs to be applied to sea level data referenced against local Chart Datum to allow direct reconciliation against land levels referenced against Ordnance Datum.

For example, bathymetric readings of -0.5m in the water surrounding the site are not indicative of half a metre of water depth at low tide but are instead indicative of over 3m of water depth (-0.5m -2.57m = 3.07m).

Table 31 presents the key data statistics of the tidal regime and calculated mean high and low water levels.

Table 31 – Tidal Regime

Tidal Stages	Admiralty Chart Datum (Cobh)	Metres Above Ordnance Datum (mAOD)
Mean High Water Spring (MHWS)	4.1	1.53
Mean High Water Neap (MHWN)	3.2	0.63
Mean Low Water Neap (MLWN)	1.3	-1.27
Mean Low Water Spring (MHWS)	0.4	-2.17
Calculated average High Water Level	-	1.08
Calculated average mid tide	-	-0.32
Calculated average Low Water Level	-	-1.72
Calculated average Tidal range	-	2.8

* -2.57m correction factor applied from Chart Datum to Ordnance Datum

5.3 Relationship of East Tip Groundwater and Tidal Regime

Mean local sea level is approximately -0.32mAOD. Mean High Water Mark is 1.08mAOD with a Spring High Water Level of 1.53mAOD. Given that Waste Slag materials are known to be present to depths up to -9.0mOD, but perhaps more typically at depths circa -6mOD, it follows that the majority of the overall mass of waste material on the site (60-65%) is below mean sea level and therefore potentially in direct hydraulic continuity with the tidal cycle. A cross section showing the above is presented in Appendix X.

The relationship of land to sea level will be discussed in more detail in the following section within the context of groundwater monitoring data recently acquired from the site.

5.4 Groundwater level data

In situ groundwater data level loggers were strategically deployed in monitoring installations across the site to determine the variability in groundwater levels over time. Full factual records are presented in the site investigation Factual Report (PGL, 2012) together with data plots and the key data statistics are summarised in Table 32 for each of the key strata types.

All of the data collected during the monitoring period (July – August 2012) was within the tidal range (i.e. between MHWS 1.53mAOD and MLWS -2.17mOD) and the average sea level is close to zero mAOD. Moreover, a consistent twice-daily 'tidal' pressure signal was recorded within all strata types (including saturated waste material) monitored beneath the site.

Rainfall data for the monitoring period was also procured and overlaid on the in-situ data logger plots and show that the effects of precipitation on hydraulic head levels were absent or negligible by comparison to the tidally driven fluctuations. (Figure 14). Figure 14 shows the neap tide on the 28th May, followed by a spring tide around the 5th June.

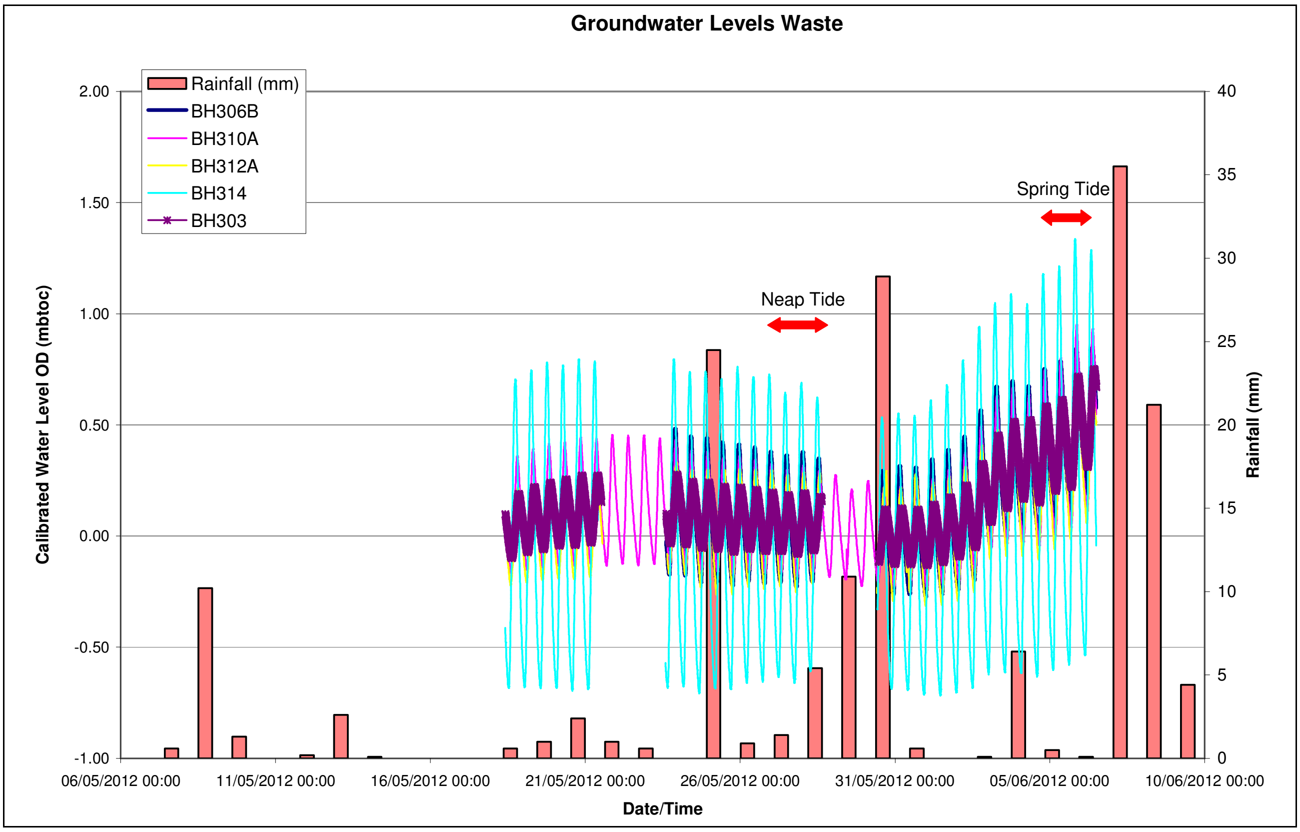


Figure 14 – Groundwater Levels in Waste Boreholes

Table 32 – Groundwater Level Data Summary

Strata	Borehole	Max (mAOD)	Min (mAOD)	Ave (mAOD)
Waste	BH303	0.75	-0.13	0.14
	BH310A	0.95	-0.23	0.12
	BH312A	0.59	-0.31	0.08
	BH314	1.34	-0.72	0.01
Alluvium (Silt/ Clay)	BH304	0.41	0.07	0.18
	BH308	1.15	-0.72	0.16
	BH309	0.45	0.01	0.16
	BH316	0.51	0.01	0.22
	BH306D	0.70	-0.43	-0.01
	BH312B	1.03	-1.38	-0.05
Sand and Gravel (Fluvio-glacial deposits)	BH117R	**1.43**	-1.35	0.00
	BH125R	1.25	-1.16	-0.04
	BH313	1.31	-1.34	-0.04
Bedrock (Limestone)	BH306C	1.49	**-1.83**	-0.41
	BH310C	1.18	-1.47	-0.07
	BH312C	1.38	-1.45	-0.07
Selected Value		**1.43**	**-1.83**	**-0.02**

Note 1: Levels referenced against topographic benchmark (mAOD) and not corrected for local mean sea level, which is -0.3 to -0.4m below Ordnance Datum in this area. Note 2: Maximums, minimums and therefore averages weren't necessarily recorded over same time periods.

Collectively these observations indicate that there is no 'perched' groundwater table on the site (as previously thought), or a 'water table' in the traditional sense of land based assessments. Instead, the data demonstrates that there is a saturated mass of waste material which is in a perpetual state hydraulic interaction with the surrounding tidal waters of the estuary (i.e. direct hydraulic continuity with the sea). On this basis, any apparent hydraulic gradient observed across the site is considered to be a short-lived function of the tidal regime and will be reversed and balanced within a normal 6-12 hour tidal cycle. The net effect, as evidenced by the overall average head level of -0.02mOD in Table 31, is a flat hydraulic gradient approximating to mean local sea level and no definitive (or continuous) direction of groundwater flow can be inferred.

It is important to note that a tidal signal, as evidenced by twice-daily variations in hydraulic head level in monitoring wells, is clear evidence of hydraulic connection to the sea.

Again, the hydraulic head fluctuations observed in saturated natural strata below the normal tidal range are considered to be a pressure signal related to tidal loading rather than as direct evidence of the flow of water either vertically or laterally within these units. This is represented in a cross section with tidal graphs presented in Appendix Y.

Additional to the above, Figures 15 to 17 below provide hydrographs for groundwater in the waste, alluvium and limestone for 3 sets of 3 No. boreholes clustered together (BH306, BH310 and BH312). The data was collected using data loggers installed into each of these boreholes from 21st January 2012 until 4th February 2012 and confirmed by a series of manual spot measurements of groundwater level. The sea water level has also been plotted on the graphs from published tidal charts for the nearby Cobh. All boreholes show a tidal signal with it being most pronounced in the limestone boreholes. It is clear that there is no persistent downward head. During a rising tide the limestone does appears to have an upward head, however this appears to be confined by the low permeability alluvium. If it was unconfined similar high tide levels would have been recorded in the waste material.

Based on the similarity in water levels with the harbour waters the limestone appears to have the greatest hydraulic connection with the Cork Harbour waters showing the greatest tidal variation which is closest to that observed in the sea. This is considered to be due to the presence of outcropping limestone in the vicinity of Haulbowline island.

The hydrographs also show a lag between the high tide water levels in the alluvium and waste when compared with the limestone and seawater. The alluvium's hydraulic conductivity as outlined in Section 5.5.2 is an order of magnitude lower than that of the limestone, which may account for the dampening of the tidal signal and lag of about ¼ of the tidal cycle.

The lag and less pronounced tidal signal in the waste may also be indicative of a lower bulk hydraulic conductivity within this material. It is considered possible that the reduced conductivity of the waste is preventing it being influenced by the full tidal range such that the full influence of the high tide is not reached in this horizon before the tide falls again. Similarly the water level in the waste does not drain to the minimum low tidal level as it is essentially contained within a confining low permeable alluvium basin (Cross Section BB Appendix W).

In Figure 16, the hydrograph shows a very similar tidal signal and response for groundwater in both the alluvium and limestone. However this response is different from that observed for the groundwater in the waste, indicating a hydraulic separation between the waste and the underlying horizons. The installation for BH310B extends into the base of the alluvium to within 2m of the top of the fluvio-glacial sands and gravels at -18.47mAOD and the drilling returns below 21 mAOD were slurry like in consistency – all other alluvial returns from that borehole were massive. Also the top of the sands and gravels appears to vary significantly in this area. BH310C drilled within 5m of BH310B encountered the top of the gravels at -11.56mAOD, i.e. 7m higher that at BH310B. It is therefore possible that the base of the alluvium at this location is hydraulically connected to the sands and gravels and will exhibit a similar response to that observed for limestone.

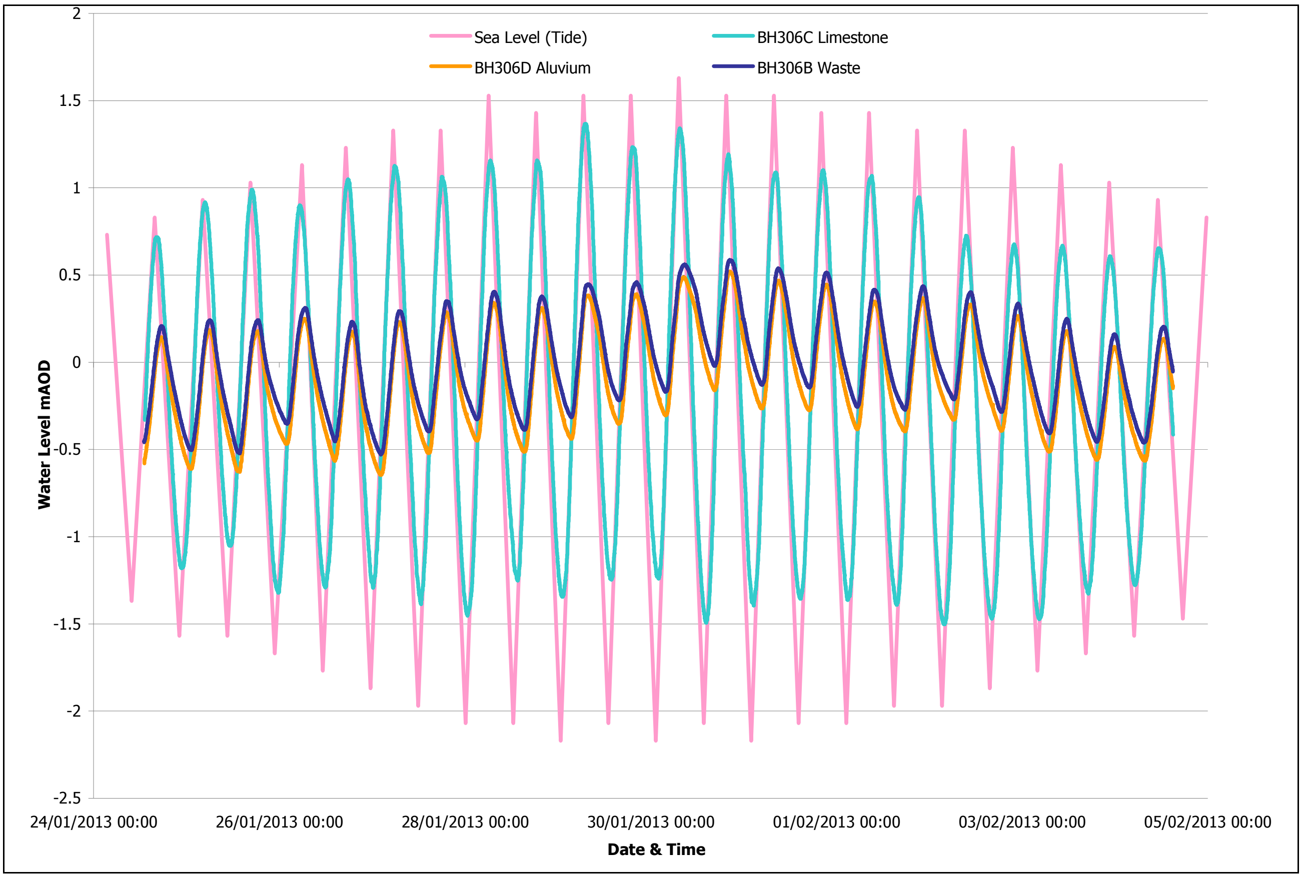


Figure 15: Hydrograph Showing Groundwater Levels Monitored at BH306B, BH306C and BH306D

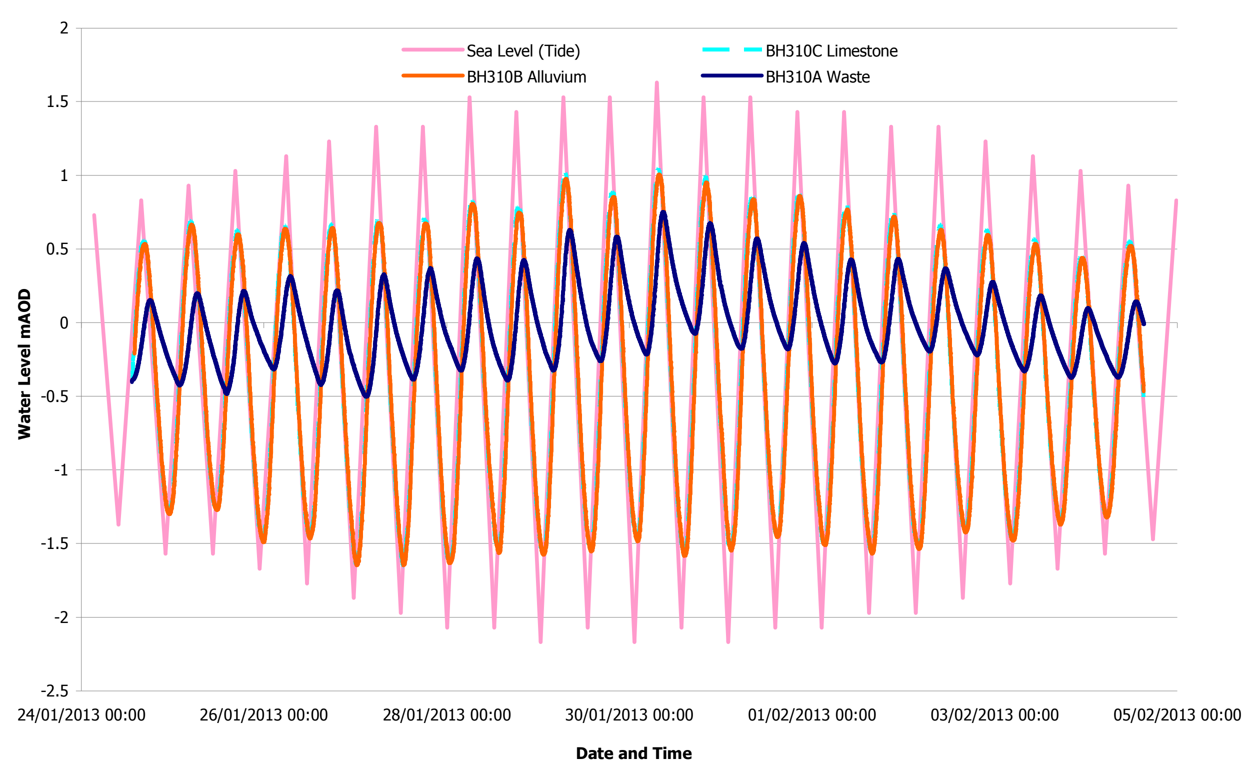


Figure 16: Hydrograph Showing Groundwater Levels Monitored at BH310A, BH310B, and BH310C

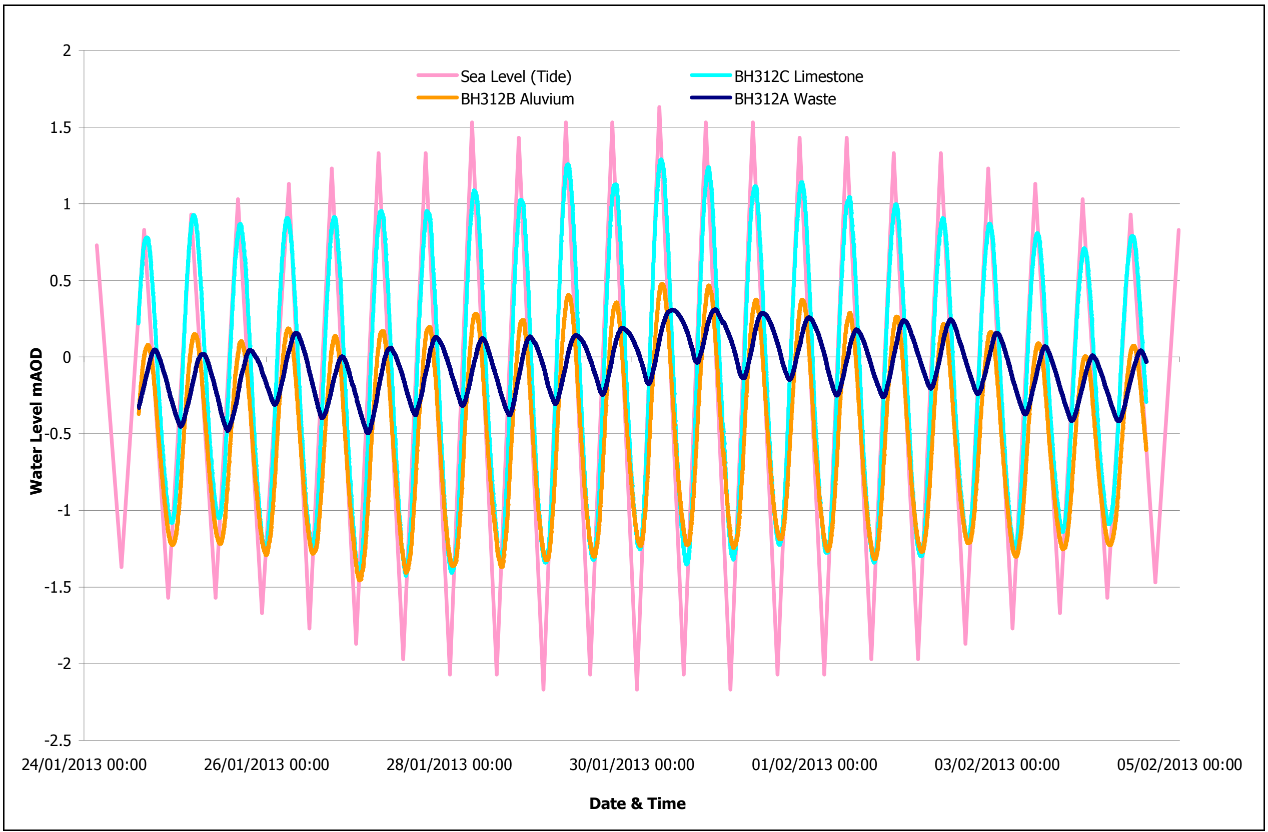


Figure 17: Hydrograph Showing Groundwater Levels Monitored at BH312A, BH312B, and BH312C

5.5 Hydraulic Conductivity (Waste, Alluvium, Gravels & Limestone)

Hydraulic conductivity is a key parameter in undertaking a DQRA, while published values for different geology types are available, site specific data is always preferred. Consequently a large number, 40 No. in situ hydraulic conductivity tests have been completed to provide robust data for assessment purposes. This includes in situ rising and falling head tests were conducted in boreholes both during drilling and subsequently within groundwater monitoring boreholes. In addition, the hydraulic conductivity for certain strata units (waste material) was assessed using analytical correlations based on Particle Size Distribution (PSD) data from laboratory testing.

It is important to note that; because the main strata types on this site are in direct hydraulic continuity with the tidal cycle (as discussed above), the results of empirical in situ testing (i.e. rising and falling head test) can be significantly influenced (both positively and negatively) by the local tidal regime. Consequently, the results of such testing should be considered as indicative.

By contrast, the estimates of hydraulic conductivity by analytical methods using correlations based on PSD results are not affected by the local tidal regime and, providing the collected sample were representative of the unit. However, material used in undertaking PSD testing may have conservative bias introduced by fracturing of material caused by the drilling methods employed. Thus an average of in situ and PSD derived hydraulic conductivity data will be used in the subsequent risk assessment modelling.

Full factual records of the results of in situ hydraulic conductivity testing are presented in the factual site investigation report (PGL, 2012), together with full workings and the equations used for analytical correlations based on PSD test results.

5.5.1 Waste

Table 33 presents a summary of the results of hydraulic conductivity estimates by the various methods outlined above and presents the minimum, maximum and average based on all results.

Table 33 – Summary Hydraulic Conductivity Estimates - Waste

Testing Method	Borehole	Hydraulic Conductivity (m/sec)	Hydraulic conductivity (m/day)
Rising Head	BH120	2.10E-07	1.81E-02
	BH128	1.50E-04	1.29E+01
	BH130	8.81E-04	7.61E+01
	BH305	1.20E-03	1.04E+02
	BH307	2.90E-04	2.51E+01
	BH315	1.20E-03	1.04E+02
Falling Head	BH302	2.55E-05	2.20E+00
	BH306A	5.76E-07	4.98E-02
	BH307	7.42E-03	6.41E+02
	BH309 (Test 2)	8.80E-07	7.60E-02
	BH311	1.91E-06	1.65E-01
	BH313 (Graph Segment A)	3.22E-04	2.78E+01
	BH313 (Graph Segment B)	1.68E-05	1.45E+00
	BH315	3.98E-07	3.44E-02
PSD correlations	BH301A	7.13E-05	6.16E+00
	BH302	2.98E-02	2.57E+03
	BH303	1.24E-03	1.07E+02
	BH304	9.99E-05	8.63E+00
	BH306A	9.55E-04	8.25E+01
	BH309	2.82E-04	2.44E+01
	BH310A	3.13E-03	2.71E+02
	BH301A	4.35E-04	3.76E+01
	BH315	3.69E-03	3.19E+02
	Maximum	2.98E-02	2572
	Average	2.13E-03	184
	Minimum	2.10E-07	0.0181

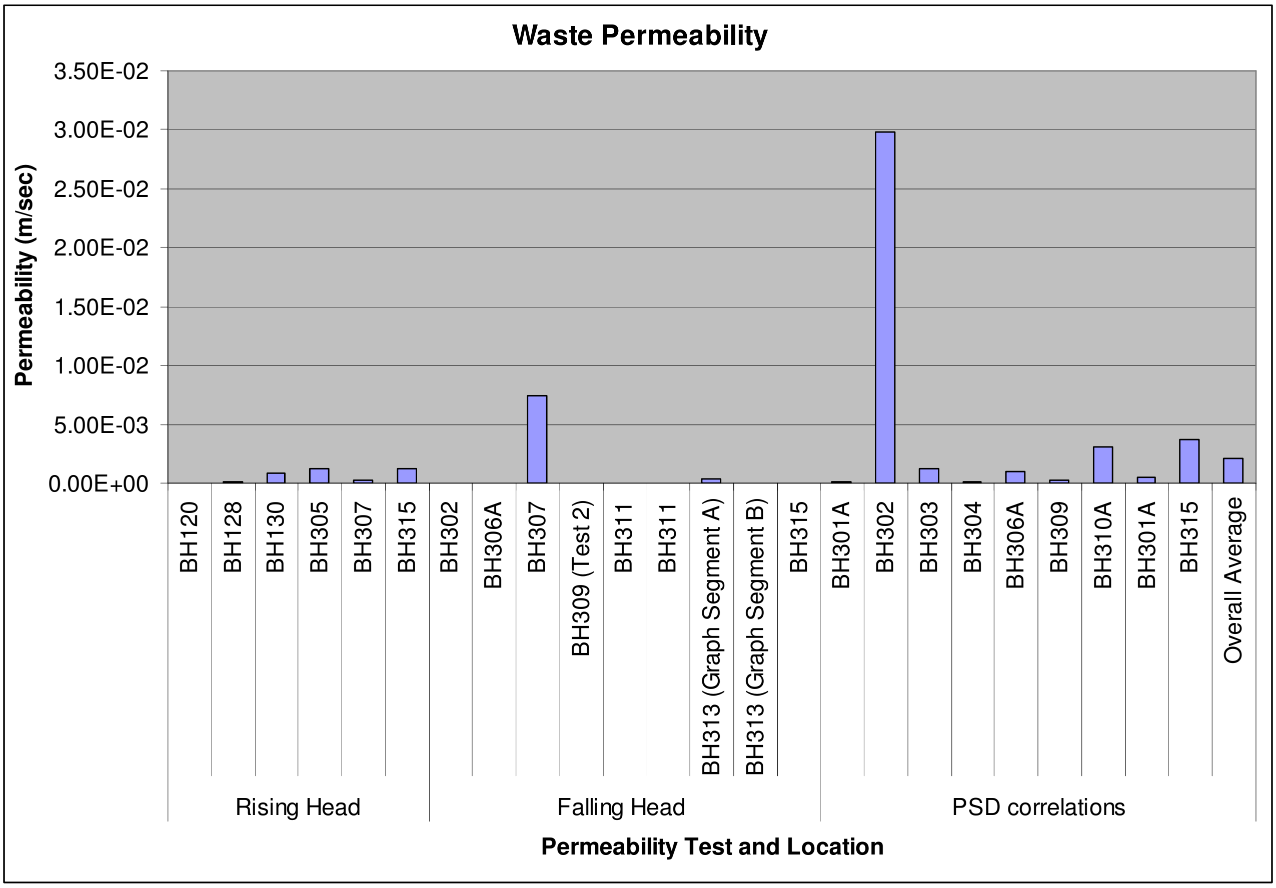


Figure 18 – Waste Hydraulic Conductivities

As can be seen from the above, the calculated average hydraulic conductivity of 2.13E-03m/sec is considered to be representative of a generally granular material with some fines, ie within the literature range for well sorted sands or glacial outwash to well sorted gravels (Fetter, 2001) and also literatures values for steel slag of 4.5×10^{-4}m/sec (Ziemkiewicz and Skousen, 1998). This value is considered to be conservative based on comparison with a median value of 2.9×10^{-4}m/sec and also based on the hydrograph presented in Figures 15 which shows that groundwater movement in the waste is similar to that observed in the alluvium which is of a lower permeability as in Section 5.5.2.

The broad range of hydraulic conductivity's exhibited by the waste is in-keeping with the heterogeneity of the material recorded from site observations and from engineering borehole logs.

It should also be noted that a variety of hydraulic conductivity test methods have been utilised in the calculation of an average value. PSD correlations have been utilised in addition to in-situ tests as they are not influenced by tidal fluctuations that will have been present during the in-situ tests. However PSDs collected during the drilling works which may have broken up the sample increasing the granular fractions and therefore providing a higher hydraulic conductivity value. This is considered to be appropriate for inclusion and provides a more conservative hydraulic conductivity value.

5.5.2 Alluvium (Clay/Silt)

Table 34 presents a summary of the results of hydraulic conductivity estimates for alluvium by the various methods outlined above and presents the minimum, maximum and average based on all results. Average permeabilities of alluvium are significantly less, by three orders of magnitude, than that observed for the overlying waste material. They are considered to be appropriate when compared to a literature value range for silt, sandy silts, clayey sands and till with a range of 10^{-8}-10^{-6} m/sec and silty sands, fine sands with a range of 10^{-7} – 10^{-5} (Fetter 2001).

Table 34 – Summary Hydraulic Conductivity Estimates - Alluvium

Testing Method	Borehole	Hydraulic Conductivity (m/sec)	Hydraulic conductivity (m/day)
Rising Head	BH301A[4]	8.9E-7	8E-2
	BH302	2.3E-7	4E-2
	BH304	2.4E-7	2E-2
	BH306D	2.8E-8	3E-3
	BH308[1]	*4E-7*	*3E-2*
	BH309[2]	*6.4E-5*	*5.57*
	BH310B	2.1E-6	0.19
	BH312[3]	*2.8E-5*	*2.46*
	BH316	1.5E-6	0.13
Falling Head	BH301silt	6.8E-6	0.59
	BH303 silt	7.8E-7	0.07
	BH304[4]	3.7E-6	0.32
	BH305 silt	2.5E-6	0.22
	BH307 Silt	1.4E-7	0.01
	BH310B	2.1E-6	0.18
	Maximum	1.5E-6	0.59
	Average	1.8E-6	0.15
	Minimum	2.8E-8	0.003

Note 1 - BH308 high tide - unreliable data due to logger moving during the test. Therefore only high tide average presented in table.

Note 2 - BH309 bentonite interface only 0.3m from slag to silt higher hydraulic conductivity results considered to be due to potential leakage

Note 3 - Casing lost in the borehole at the screen installation depth during drilling may have affected the installation. Result not utilised in overall average.

Note 4 – [4] borehole screened into clay rich strata

5.5.3 Fluvio-Glacial Deposits (Sand and Gravel)

Table 35 presents a summary of the results of hydraulic conductivity estimates for sands and gravel by the various methods outlined above and presents the minimum, maximum and average based on all results. The calculated average is considered to be a representative value for sands and gravels. Literature values include a range of 10^{-7} – 10^{-5} m/sec with respect to silty sands and fine sands, well-sorted sands and glacial outwash range from 10^{-5} - 10^{-3} m/sec (Fetter 2001).

Table 35 – Summary Hydraulic Conductivity Estimates – Sand and Gravel

Testing Method	Borehole	Hydraulic Conductivity (m/sec)	Hydraulic conductivity (m/day)
Rising Head	BH313	9.3E-6	0.81
	BH117R	6.6E-5	5.72
	BH125R	1.2E-4	9.98
Falling Head	BH308 sands and gravels	8.9E-7	0.08
	BH310B sands and gravels	4.7E-7	0.04
	BH312B	8E-5	6.92
	Maximum	1.2E-4	9.98
	Average	4.6E-5	3.9
	Minimum	4.7E-7	0.04

5.5.4 Bedrock (Limestone)

Table 36 presents a summary of the results of hydraulic conductivity estimates for the limestone bedrock by the various methods outlined above and presents the minimum, maximum and average based on all results. Literature value for Waulsortian Limestone found a range of 0.1-20m/day (Tedd et all, 2011)

Table 36 – Summary Hydraulic Conductivity Estimates - Bedrock

Testing Method	Borehole	Hydraulic Conductivity (m/sec)	Hydraulic Conductivity (m/day)
Rising Head	BH122B	7.8E-6	0.68
	BH306C	2.2E-6	0.17
	BH310C	6.3E-5	5.44
	BH312C	3.2E-5	2.73
	Maximum	6.3E-5	5.44
	Average	2.63E-05	2.26E+00
	Minimum	2.2E-6	0.17

5.6 Updated Hydrogeological Conceptual Model

On the basis of comparison of solid, leachability and water analysis results with appropriate GACs, a number of pollutant linkages have been identified in groundwater from the East Tip, summarised in Table 28, Section 4.

The waste material is considered to be heterogeneous as is shown by the engineering logs and the range of hydraulic conductivity estimates, from a maximum of 2.98E-02m/sec to a minimum of 2.10E-07m/sec (see Section 5.5). The waste has been shown to be in direct connectivity with the Cork Harbour waters as presented in Section 5.3 with 60-65% of the overall mass of the waste material on site below mean sea level. There is no 'perched' groundwater table on the site, or a 'groundwater table' in the traditional sense of land based assessments. Instead, the saturated mass of waste material is in a perpetual state hydraulic interaction with the surrounding tidal waters of the estuary (i.e. direct hydraulic continuity with the sea).

However, there is an important distinction between fluctuations in head measurements at the periphery of the site (which are in the order of 2-2.5m) and those head measurements within the interior of the site (which are in the order of 0.5m). In simple terms, there is insufficient time between high and low tide (approximately 6 hours) for most of the water within the saturated mass of waste in interior and near the centre of the site to flow to the periphery (conservatively assuming an average hydraulic conductivity of 2.13E-03m/sec or 184m/day) before the transient and tidally created hydraulic gradient in one direction is reversed with the incoming tide (i.e. equal and opposite hydraulic gradients in both directions over each tidal cycle). The more pronounced tidally influenced fluctuations in hydraulic head near the periphery of the site (i.e. circa 2-2.5m – see Tidal Conceptual Site Model in Appendix Y) suggest that a component of flow may be occurring, albeit only for a few hours either side of each high tide and limited with decreasing distance from the shoreline.

Lower contaminant concentrations have been measured in groundwater sampled from depth in natural strata compared to shallow groundwater sampled from waste (Section 2.6). It is considered that the lower permeable alluvium horizon as identified in Section 5.5 is inhibiting downward migration together with attenuation mechanisms provided by the alluvium. In addition, notwithstanding the tidally induced pressure signal observed in data-loggers, there is no persistent pressure head which could drive advective vertical flow. Consequently, the predominant groundwater migration pathway is laterally through the waste at the periphery of the site and into the Cork Harbour and will be the primary focus of the groundwater DQRA presented in Section 6.

6 Water DQRA

6.1 Rationale and Methodology for Assessment

For the avoidance of doubt, the assessment presented herein is considered to be an appropriate response to the particular situation presented by this site and has been undertaken for clear technical reasons. The assessment is intended to present a conservative and yet realistic baseline of theoretical environmental impact, specifically from dissolved phase contaminants within the saturated parts of the site into the surrounding waters of Cork Harbour. In turn the outputs of this modelling are intended to allow informed decisions about the appropriate course of remedial action to be made and outline remedial design solutions to be tested and validated.

6.2 Technical Basis for Groundwater Assessment

As discussed in previous sections of this report, there are various technical reasons which necessitate the adoption of a bespoke Groundwater DQRA on this site, and these are summarised below within the context of the tiered assessment process.

6.2.1 Generic Quantitative Risk Assessment (Leachate and Groundwater Screening)

This process compares site chemical data against the relevant water quality standards which are intended to be conservatively protective of sensitive aquatic ecosystems and/or human health. This process precedes the DQRA and is intended to identify the contaminants of concern (COCs) in both solid phase derived leachate and in local groundwater beneath the site (solid waste samples are considered separately in this document with respect to human health risk assessment). Given the immediate proximity of the receptor (i.e. estuarine waters of Cork Harbour), the identification of various COCs prompted the requirement for further and more refined assessment to the wider environment (i.e. Groundwater DQRA).

6.2.2 Tier 1 DQRA (Soil to Leachate)

This process utilises the UK's Environment Agency's (EA) Remedial Targets Methodology (RTM) software to model the leaching potential of soils using established Soil:Water partition co-efficient's (kd) for the various COCs identified through screening and initial assessment. The need to model this step using computer software (RTM) is to a greater or lesser extent made redundant by empirical (actual and measured) results of leachability testing, but the outputs can be used to calibrate the laboratory test results if necessary. The results of this step, together with the results of various laboratory testing, confirmed that certain COCs were potentially leachable from the waste material on the East Tip at concentrations above the relevant WQS.

6.2.3 Tier 2 DQRA (Soil Derived Leachate to Groundwater)

This stage of assessment again utilises the EA's RTM model to create a 2 dimensional analytical model describing the relationship between soil derived leachate and its potential impact on the underlying groundwater. The model requires a number of key site specific input parameters which include hydraulic gradient and also a background concentration of contaminant in pore water (i.e. groundwater). Critically, the hydrological Conceptual Site Model, together with analysis of data-logger results (Appendix Y) has shown that there is no persistent hydraulic gradient in the groundwater beneath the site, only the twice daily ebb and flow of the tide which averages to mean sea level (i.e. a flat gradient). This means that for modelling purposes either an arbitrary and theoretical gradient must be adopted to drive flow or more conservatively a flow estimate can be made by adopting a change in water level based on 50% of the tidal fluctuation.

Additionally, in a number of instances the concentration of certain COC's in the groundwater are already in excess of WQSs. In these circumstances, should such concentrations be included as background concentrations within the model, the software model (RTM) would not be able to run the algorithms within the model to dilute leachate into groundwater because the logic breaks down. In other words, the Tier 2 RTM model seeks to dilute the leaching concentrations into the available groundwater to achieve the WQSs, which it can not do if that groundwater already contains a greater concentration.

6.2.4 Tier 3 Groundwater Assessment (Groundwater to Groundwater)

This type of assessment again uses the RTM software to model the fate and transport (attenuation, degradation and sorption characteristics) of the identified concentrations of COCs in groundwater during passage along a flow path toward the receptor (or an identified compliance point). However, as established previously, the CSM shows that groundwater beneath the site is in direct hydraulic continuity with the tidal waters of the harbour and hence is already technically within the receptor. It follows that there is no pathway which can be reliably or realistically modelled using the Tier 3 methodology and this in-turn demonstrates the technical requirement to adopt a bespoke approach in this case.

6.2.5 Tier 4 - Contaminant Flux and Dilution (Mass Transport) Model

Cognisant of the fact that a substantial proportion of the waste material beneath the site is in direct hydraulic continuity with the estuarine waters of Cork Harbour, the remaining questions are:

- How much contaminant is being generated and discharged into Cork Harbour? and
- Is the contribution of contaminants 'significant' and how far does this impact extend?

This approach requires a bespoke analytical model which seeks to improve the understanding of the likely scale of theoretical impact represented by the site by considering the effects of dilution of contaminants in the estuarine waters of Cork Harbour. A Tier 4 CSM is presented in Appendix Z. The model will be discussed in greater detail below and within the calculation sheets presented in Appendix AA.

6.3 Introduction to Tier 4 Assessment

The assessment of risks to surface water presented previously within this report are conservative and have indicated that the site poses a theoretical risk to the wider environment in terms of dissolved phase contaminants discharging into the Cork Harbour at concentrations above relevant Water Quality Standards. However, this assessment does not assess the scale or extent of impact, since this requires a broader consideration of the relationship of land to sea and also the local tidal regime.

The Tier 4 modelling exercise presented within the following sections of this report seeks to establish a conservative estimate of the mass of dissolved phase contaminant flux potentially leaving the site, and to understand this mass within the context of the daily flux of water passing the site as part of the local tidal regime.

6.4 Methodology Overview

There are two key component parts to the Tier 4 Mass Transport model. The first is a flux model which quantifies the volume of water flux from the site. The second is a dilution model based on the calculation and application of dilution factors which may be applied to representative concentrations of identified contaminants in the groundwater being discharged into the receptor, in this instance, the tidal waters of Cork Harbour.

Whilst based on as much site specific data and input parameters as possible, the model relies on a number of reasonable assumptions and is necessarily a conservative simplification of a complex and dynamic environment. In order to maintain the integrity of the model and to ensure its technical defensibility, a balance needs to be maintained between realism and conservatism. The key input parameters are tested through sensitivity analysis to ensure that those selected as the basis of the model are appropriately conservative.

6.5 CSM and Basis for Modelling

An idealised 'schematic' representation of the Conceptual Site Model is presented in Appendix Z and shows an overview of the main theoretical inputs and outputs of the site system (Referenced 1-4). As shown, approximately two thirds (65%) of the mass of waste deposited on the site is beneath sea level and therefore saturated, leaving the remaining third (35%) in the unsaturated zone.

Of the saturated mass of waste (i.e. 65% of the total), approximately half is within the 'normal tidal range' (i.e. between 1.08mOD and -1.72mOD), which equates to 2.8m between low and high tide (discounting spring and neap tides). On first principles, it is reasonable to conclude that the substantial majority of flow through the saturated parts of the site will occur within this zone affected by the 'normal' tidal range.

It is acknowledged that there is a deeper section of saturated waste and natural strata which is below mean low tide level, wherein an element of mixing of water may occur but the actual flow of groundwater within this zone, either laterally or vertically, will be negligible by comparison to that which occurs within the overlying tidally affected zone.

On this basis, and for the purposes of modelling, only the flow associated with the waste saturated zone within the tidal range are directly assessed. The contribution from precipitation/infiltration is also considered as part of this system and will be discussed further below.

The following sections describe the methodology underpinning the Flux model and in-turn the Dilution model.

6.6 Flux modelling

The flux model (presented in Appendix AA) has two component parts. The first is an estimate of the discharge through site from each tidal cycle and is based primarily on Darcy's Law which is considered to adequately describe discharge (herein flow) given the inter-granular flow associated with the waste deposits. The second component is a calculation of total flux from the site on a daily basis, assuming two tidal cycles each day as well as the average daily contribution from precipitation/infiltration. Each will be discussed in turn below.

6.6.1 Flow

The key components of 'flow' described by Darcy's Law are as by the following equation:

- Q= KIA

Where 'Q' is Flow (m^3/day)'K' is Hydraulic conductivity (m/day); 'I' is hydraulic gradient, expressed by hydraulic head over distance of travel (h/l); 'A' is the cross sectional area through which flow occurs.

The key input parameters used for this calculation are presented within the model spreadsheet in Appendix AA and discussed in further detail below.

6.6.2 Conservatism within the Flow Model

Hydraulic conductivity (K)

The risk assessment process is undertaken using site specific data and minimising the use of any literature values with respect to the physical properties of the waste and underlying geology. Because of the heterogeneities within both the waste and the underlying geology, multiple measurements or tests were undertaken to obtain the physical properties. For some properties, such as hydraulic conductivity within the waste, there is a large range in property value. Waste samples which were collected through a destructive drilling technique because of the hardness of the material, were sent to the laboratory for particle size analysis and this data was also used to calculate a hydraulic conductivity. This laboratory derived hydraulic conductivity is greater than the in-situ measured conductivities.

The hydraulic conductivity of waste material is the most important and sensitive parameter concerning estimates of flow on this site. As shown in Table 34 in Section 5.5.1, the range of estimated hydraulic conductivity's exhibited by this material through various analytical and/or empirical testing methods is large with the highest estimates at 2.98E-02m/sec and the lowest at 2.10E-07m/sec.

From this data and field observations, it is clear the material is highly heterogeneous and anisotropic and therefore groundwater flow through this medium is likely to be complex and impractical to model in any detail. On this basis, it is considered appropriate to adopt a conservative estimate of hydraulic conductivity for modelling purposes which is broadly representative of the mass of waste as a whole.

An 'average' value for K has been adopted as 2.13E-03m/sec which is considered appropriately conservative. Further justification for adoption of this value is provided within the sensitivity analysis in Section 6.6.4.

Consideration has also been given to the potential for migration to and through the navy harbour to the west. Only basic information is known about the construction of the harbour dock wall or revetment and therefore its potential hydraulic conductivity. It is known that the base of the revetment comprises a geotextile/geogrid to prevent washout of fines. This is overlain by the under-layer comprising granular material. The outer/armour layer is made up of larger grouted or cemented quarry-stone. Toe protection is typically in the form of a buried toe apron to prevent scour. An in-situ reinforced concrete capping slab is provided at the crest of the revetment. It is therefore assumed that this would not have a greater hydraulic permeability than that which has been utilised to represent waste material, i.e. 2.13E-03m/sec which is in the range of literature values for well sorted sands or glacial outwash to well sorted gravels (Fetter, 2001).

Contaminant Concentrations

Consideration was given to whether it was more appropriate to use a median value as opposed to a mean value which is then applied across the entire unit and a representative value for assessment purposes. In some instances a mean value can be skewed by the presence of a very high or low value when compared to the rest of the data, in this case the use of a median value is often considered to be more representative. For example in regard to manganese concentrations in groundwater in the waste, the average value which has been utilised in this assessment is 535µg/l and the median value is <0.3 µg/l (i.e. LOD). Most concentrations measured in groundwater in the waste were less than the laboratory detection limit and less than WQSs and as a result the average concentration is considered to have been skewed by one large manganese concentration of 13,300µg/l. However averages have been used in preference to median values in this value as the offer a further conservative level to the assessment.

Discharge

It should be noted that the model assumes instantaneous contaminant discharge to the harbour which thus considers maximum impact and minimum attenuation. Given the hydrographs presented in Figures 15, 16 and 17 this represents the worst case scenario and is thus considered to be highly conservative.

Hydraulic gradient (I)

It is important to note that; based on the available data, there is no evidence to suggest that a steady hydraulic gradient exists beneath the site. There is a clear tidal hydraulic head observed in all saturated strata beneath the site (including waste) but the peaks created by high tides are balanced by the troughs of low tide creating effectively a flat gradient around mean sea level (as would be expected in a purely tidal system).

Darcy's Law cannot function without a component of hydraulic gradient (I) to drive flow and therefore an arbitrary or artificial value for 'I' must be adopted and this introduces an inherent element of conservatism into the model. In this instance, a 'h' (hydraulic head) value equating to half of the total tidal range (1.4m) acting over half the width of the site ('L' equating to 154m) has been adopted giving a dimensionless value 0.009 for 'I'.

Notwithstanding the lack of any measurable hydraulic gradient, the observations of relatively large changes in head (circa 2-2.5m) in monitoring wells closer to the periphery of the site (see Tidal CSM – Appendix Y), coupled with the relatively high hydraulic conductivity of the waste, it is reasonable to conclude that an element of flow does indeed occur around the edges of the site as a result of the tidal cycle. On this basis, the conservative estimates of 'I' are considered to be valid and yet suitably conservative.

<u>Cross sectional area (A)</u>

The cross sectional area is based on the shoreline perimeter of the site at low tide multiplied by the full tidal range (i.e. 2.8m) and for modelling purposes is considered to be fixed and reasonable given the naval harbour to the west of the site will represent an effective low flow barrier in this direction. Additionally the naval harbour will offer additional dilution when compared to the foreshore area of the East Tip due to greater water depths and therefore greater dilution potential. On this basis, flow is assumed to occur in a radial pattern through the shoreline perimeter of the site and will provide a more conservative assessment. The foreshore, i.e. up to the low water tide mark, has been included within the site area which will allow for waste extending beyond that which is currently visible.

6.6.3 Flux

Taking the outputs of the flow calculations above (Section 6.6.1), together with a highly conservative estimate of contribution from precipitation and subsequent infiltration (assumed to be 100% with no loss to evapo-transpiration), a further calculation of the total daily flux from the site can be made. The total daily flux for the site was thus calculated as 4341 m^3/d. Full details of the calculation outputs are presented within the flux model in Appendix AA. In essence this assumes a continuous discharge from the site and does not take into account the twice daily rising tide which retards the flux. It is thus considered suitably conservative.

6.6.4 Flux Model Sensitivity Analysis

Sensitivity analysis on the key parameters is presented in Appendix AA and discussed in outline below. The outputs of this exercise have also been used to validate the input parameters selected for the model.

Context

A comparison of estimated tidally driven flow compared to specific yield of the saturated soil mass (ie groundwater volume within the waste) within normal tidal range was undertaken to provide some context to the estimates of flow using Darcy's Law. This assessment provided an upper limit to what could be expected to theoretically drain from the site assuming the maximum hydraulic conductivity (k) and an arbitrary hydraulic gradient. The outputs of this calculation equated to approximately 40% of the total specific yield.

In essence, and because of the twice daily tidal cycle, this would necessitate over 80% of all available water within the waste moving in and out of the site every day, equating to over 55,000m^3. This value is clearly implausible in reality, because the transient hydraulic gradient is only acting for a few hours either side of high tide and is highly subdued within the interior of the site (see Tidal CSM in Appendix Y). Consequently there is insufficient time and gradient to cause advective Darcian flow for the substantial majority of the water resident within the saturated waste mass.

Darcy's Law Calculations

A sensitivity analysis was undertaken on hydraulic gradient (i) in Darcy's Law flow calculations assuming full 2.8m normal tidal range rather than adopted value of 1.4m (equating to 50% of the tidal range). It should be noted that the adopted value is already highly conservative but the results are presented for transparency. The outputs were approximately double that predicted using the adopted value of 1.4m.

Sensitivity analysis was also undertaken by varying the value for Hydraulic conductivity (k) in Darcy's Law calculations. The analysis was performed assuming the following values for k in Table 37:

Table 37 – Hydraulic conductivity Values used in Sensitivity Analysis

K(0)	2.98E-02	m/second	
	2572	m/day	Highest
K(1)	**2.13E-03**	**m/second**	
	184	**m/day**	**Adopted**
K(2)	2.13E-04	m/second	
	18	m/day	
K(3)	2.13E-05	m/second	
	2	m/day	
K(4)	2.13E-06	m/second	
	0.18	m/day	
K(5)	2.10E-07	m/second	
	0.02	m/day	Lowest

The outputs of this analysis suggest that at hydraulic conductivity's below 2.13 E-05, the contribution of flux from rainfall outweighs the contribution from tidally driven flow. In other words, the movement of water is too slow for any significant flow to occur during low tide.

6.7 Dilution Model

The dilution model describes a process whereby the daily mixing of a given volume of water (defined by the flux model) containing a given concentration of a particular contaminant (based on representative groundwater chemistry results) is diluted by varying volumes of water in the receptor representing increasing distances away from the site within the wider harbour. The model is inherently conservative as it assumes that the water body into which dilution occurs is a static entity, whereas the reality of the situation is that the local system is in a perpetual state of tidally induced flux. This model is also conservative as it does not allow for a dilution factor which is offered by the navy harbour to the west. Only dilution to the north, east and south is included.

The dilution model is presented in Appendix AA together with associated sensitivity analysis on key input parameters. The following sections outline the key component parts of the model.

6.7.1 Groundwater Chemistry (COCs)

Table 38 presents a summary of the key COCs and associated data statistics identified within groundwater within the saturated waste (slag) material.

Table 38 – Contaminants of Concern (COCs)

Determinant	WQS (µg/l)	Total No. of Samples	Average (µg/l)	Minimum (µg/l)	Maximum (µg/l)	No. samples exceeding WQS
Chromium VI	0.6	40	**22**	<2	117	5*
Chromium	4.6	43	**11**	<0.2	123	28
Copper	5	43	**12**	<1	146	6
Zinc	40	43	**9**	1.8	76	2
Lead	7.2	43	**2.4**	<0.2	7.79	1
Manganese	30	43	**535**	<0.3	13300	7
Nickel	20	43	**6.4**	<0.2	41.4	1
Mercury	0.05	49	**0.2**	<0.0005	1.15	19
Benzo(a)pyrene	0.05	26	**0.024**	<0.01	0.08	1
Benzo(k)-fluoranthene	0.03	26	**0.018**	<0.01	0.06	1
Fluoranthene	0.1	26	**0.04**	<0.01	0.29	1

Note LOD values have been used in the calculation of averages where concentrations were measured as less than the LOD.

* Has not counted samples with concentrations which are less the LOD

As can be seen from the above, the groundwater contains various constituents which are marginally and/or locally in excess of the relevant Water Quality Standard. For example, the average concentrations of Arsenic in groundwater are below the WQS but a small number of samples are only marginally above. For other constituents, including manganese and chromium (VI) the average concentration in ground water is elevated by comparison to the corresponding WQS. On this basis, the 'average' concentration of these COCs in groundwater has been conservatively assumed to be representative of the whole for modelling purposes.

The 'maximum' values have been included within the above table for completeness and transparency but also for sensitivity analysis purposes.

6.7.2 Modelling of the receptor

Cork harbour is a very large natural harbour with a correspondingly large coastline and complex tidally influenced flow regime. It is of course impractical and inappropriate to seek to use the entire water volume within Cork Harbour to model the effects of dilution. Consequently, for modelling purposes, a series of arbitrary radial 'zones' have been adopted with increasing distance / radii from the site. These are summarised as follows:

- Zone 1: 0- 10m (volume of water for dilution $3x10^4m^3$)
- Zone 2: 0- 15m (volume of water for dilution $4x10^4m^3$)
- Zone 3: 0- 25m (volume of water for dilution $7x10^4m^3$)
- Zone 4: 0- 50m (volume of water for dilution $1x10^5m^3$)
- Zone 5: 0- 100m (volume of water for dilution $3x10^5m^3$)

The site area has been assumed to be a semi-circle which allows simple calculations of area covered by each zone. Based on Bathymetry surveys of the near shore waters an average depth water of 3m has been conservatively assumed between the shoreline perimeter and 250m. Beyond this distance, and because of the known presence of shipping lanes, a water depth of 4m has been assumed and factored into the calculations. On this basis, the volume of water present in each of the zones (1-5) can be calculated, and converted into litres to enable direct comparison with the chemical testing results which are referenced in ug/l.

6.7.3 Dilution calculations

The estimated daily flux (outputs from the flux model) divided by the total volume in zones 1-5 (doubled to account for two tidal cycles per day) provides a 'dilution factor' which is in-turn applied to the representative concentrations of each of the COCs identified in groundwater beneath the site. Table 39 summarises the outputs.

Table 39 – Dilution Calculation Outputs

	WQS (µg/l)	Predicted Concentrations (µg/l)				
		Zone 1 (Shoreline perimeter to 10m)	Zone 2 (Shoreline perimeter to 15m)	Zone 3 (Shoreline perimeter to 25m)	Zone 4 (Shoreline perimeter to 50m)	Zone 5 (Shoreline perimeter to 100m)
Dilution Factor		8.E-02	5.E-02	3.E-02	2.E-02	8.E-03
Chromium VI	0.6	**1.81**	**1.19**	**0.70**	0.34	0.18
Chromium	4.6	0.90	0.60	0.35	0.17	0.09
Copper	5	0.98	0.65	0.38	0.18	0.10
Zinc	40	0.74	0.49	0.29	0.14	0.08
Lead	7.2	0.20	0.13	0.08	0.04	0.02
Manganese	30	**43.90**	29.02	17.11	8.20	4.48
Nickel	20	0.53	0.35	0.20	0.10	0.05
Mercury	0.05	0.02	0.01	0.01	0.00	0.00
Benzo(a)pyrene	0.05	0.00	0.00	0.00	0.00	0.00
Benzo(k)-fluoranthene	0.03	0.00	0.00	0.00	0.00	0.00
Fluoranthene	0.1	0.00	0.00	0.00	0.00	0.00

* Values highlighted in red show where concentration exceeds WQS

6.7.4 Sensitivity analysis

Sensitivity analysis on the key parameters of the dilution model is presented in Appendix AA and discussed in outline below. The outputs of this exercise have also been used to validate the input parameters selected for the model.

Sensitivity analysis was undertaken assuming the 'maximum' (rather than average) recorded concentration of COCs in groundwater is distributed equally through entire saturated mass (within normal tidal range). The results of this analysis suggested that the predicted impact of key COCs, notably manganese and chromium (VI), would be detectable at concentrations above the relevant WQS at greater distances away from the site (i.e. potentially up to 200m).

Sensitivity analysis was undertaken on the dilution model assuming a 'High Level' flux by increasing the estimate flux by 50% from that adopted in the model. The results indicated that the majority of COCs in groundwater still would not impact on the harbour water but both Manganese and Chromium VI would be theoretically present at concentrations marginally above their respective WQS values. In this scenario the concentration of Chromium (VI) would also be modelled to be marginally above the WQS at distances up to 50m from the site (i.e. in Zone 4).

A number of sensitivity analyses were undertaken assuming variable flux as a result of changes in hydraulic conductivity (K 1-5) within the flow model and show that this parameter (k) has the most significant influence on the outputs of this assessment.

The key output of this sensitivity analysis shows that decreasing the lateral hydraulic conductivity of the waste material in continuity with the tidal range by just one order of magnitude (i.e. from 2.13E-03m/sec to 3.0E-04m/sec) will remove any predicted impacts in the waters immediately adjacent to the site (0-10m) and beyond. Decreasing the lateral hydraulic conductivity further to 3.0E-06m/sec calculates the predicted concentrations in harbour water to 2-3 orders of magnitude below laboratory detection limits and well below the relevant WQS.

6.7.5 Alternative Flux Calculation Scenario

Basic calculations have been completed to consider a maximum theoretical daily flux. In this scenario, due to the presence of seepages on the foreshore on a low tide it is known that groundwater drains from the waste material into the Cork Harbour although it is considered that this only occurs around the periphery of East Tip. From the average permeability value of 184m/day, it has been calculated that on a 6 hour falling tide groundwater covering a lateral distance of 46m will potentially reach the Cork Harbour. However, if we assume that the waste will be able to drain for a total of 8 hours before the tide rises on the foreshore into the waste, as shown and determined from the hydrographs presented in Figures 15 to 17, then this would be a distance of 61.3m.

Using 865m of shoreline, the area which theoretically can drain into the Cork Harbour over 8 hours is 53,025m^2. The datalogger information for BH314, which is 25m from the foreshore shows a tidal variation of approximately 1.5m in water levels during a cycle. If all the water entrapped within this area is assumed to drain into the sea then the total theoretical flux is 53,025m^2 x 1.5m (tidal variation) x 0.34 (porosity) = 27,043m^3 (rounded up) x 2 cycles per day = 54,086m^3. As noted in Section 6.6.4 consideration of a flux of this magnitude ais considered highly conservative as and no evidence of this volume of water being discharged from the site has ever been observed during walkovers of the foreshore on the East Tip perimeter at falling and low tides. Neither do the hydrographs presented in Figures 15, 16 and 17 suggest that anything approaching that flux is being discharged from the site. .

The maximum theoretical daily flux of 54,086m^3 was inputted into the dilution model resulting in an increase to the predicted impacts as shown in Table 40, with increases to predicted concentrations, increases to the number of contaminants of concern with predicted concentrations that exceed the WQS and increases to the distance from the shoreline that will be impacted.

Table 40 – Maximum Theoretical Flux and Predicted Concentrations

		Predicted Concentrations (µg/l)					
	WQS (µg/l)	Zone 1 (Shoreline perimeter to 10m)	Zone 2 (Shoreline perimeter to 15m)	Zone 3 (Shoreline perimeter to 25m)	Zone 4 (Shoreline perimeter to 50m)	Zone 5 (Shoreline perimeter to 100m)	Zone 6 (Shoreline perimeter to 200m)
Dilution Factor		**1.E+00**	**7.E-01**	**4.E-01**	**2.E-01**	**9.E-02**	**4.E-02**
Chromium VI	**0.6**	22.57	14.92	8.80	4.22	1.95	0.84
Chromium	**4.6**	11.29	7.46	4.40	2.11	0.97	0.42
Copper	**5**	12.31	8.14	4.80	2.30	1.06	0.46
Zinc	**40**	9.23	6.10	3.60	1.73	0.80	0.35
Lead	**7.2**	2.46	1.63	0.96	0.46	0.21	0.09
Manganese	**30**	548.92	362.87	214.01	102.58	47.35	20.52
Nickel	**20**	6.57	4.34	2.56	1.23	0.57	0.25
Mercury	**0.05**	0.21	0.14	0.08	0.04	0.02	0.01

Decreasing the lateral hydraulic conductivity of the waste material in continuity with the tidal range by just one order of magnitude (i.e. from 2.13E-03m/sec to 3.0E-04m/sec) removes most of the predicted impacts with the exception of chromium VI and manganese. Decreasing the hydraulic conductivity of waste material by another order of magnitude (i.e. to 2.13E-05m/sec), removed all the predicted impacts in the waters immediately adjacent to the site (0-10m) and beyond.

6.8 Conclusions

The outputs of the Tier 4 flux and dilution modelling process indicate that there are no theoretical impacts to the waters of Cork Harbour from the majority of the constituents of concern identified by previous tiers of assessment. There is however a theoretical impact to the waters immediately surrounding the shoreline of the site (i.e. within 50m) from chromium (VI) and from manganese but these impacts quickly diminish to negligible concentrations at distances of and beyond 50m of the shoreline. However it should be noted, as presented in Section 3.4, actual concentrations of these contaminants have not been measured in excess of applicable WQSs for samples collected from the Cork Harbour waters close to the site (between 1-50m) and therefore actual impacts have not been identified and that the assessment presented is deliberately conservative having utilised a number of conservative inputs including hydraulic conductivity values, hydraulic gradients and use of mean contaminant concentrations used to calculate flux.

The outputs of the sensitivity analysis indicate that decreasing the lateral hydraulic conductivity by just one order of magnitude i.e. to 10^{-4}m/s would be sufficient to reduce the theoretical impact of dissolved phase contaminant discharge into the harbour to negligible levels and reducing the lateral hydraulic conductivity to 10^{-5}m/s would be sufficient to reduce the impact of the alternative flux calculation scenario.

7 Recommendations for Remediation Arising from Risk Assessment

Haulbowline Island has been determined to have the following Contaminants of Concern for which remediation may be necessary:

- Human Health Receptor: Arsenic, lead and asbestos through direct contact and dust inhalation pathways;
- Water Resources Receptor: Chromium VI and manganese leachate and groundwater discharge to Cork Harbour.

The primary aim of any remediation will be to mitigate risks to human health and reduce the contaminant flux to the Cork Harbour water and secondly to prevent erosion of the waste material into the Cork Harbour.

In reviewing the potential technologies for use at Haulbowline there are a number of factors that have to be taken into consideration.

1. The site is located on an island, any technology that is employed will have to be brought to the island or if waste is produced it must be removed from the island.

2. Asbestos contamination is not limited to a single location, it is widespread across the site, thus any ex-situ remedial technology employed will require H&S precautions be taken to manage any risks.

3. In places the waste is described as massive or monolithic, any attempt to excavate or mix in a treatment will require the use of rock cutting augers (please refer to Appendix BB which presents and Geotechnical Assessment).

4. Thickness of the waste and impacted soil would require dewatering and waste water management for any ex-situ technology.

5. Haulbowline is an island where the groundwater within the natural strata is in direct continuity with the waters of Cork Harbour.

6. Waste material from the site extends onto the foreshore and therefore forms the flood defences which are subject to erosion with eroded waste visible on the foreshore.

Due to the unique situation that the East Tip poses preferred possible approach is one of pathway management involving the use of a capping or cover system across the top of the landfill and installation of a perimeter engineered structure around the whole of the site to prevent further contamination of the coastal sediments.

8 Conclusions

The following conclusions have been determined from the preceding sections:

- Results of an extensive investigation, deemed to be appropriate for a site of this nature, have been presented for the East Tip through sampling and analysis of the waste material and underlying natural sediments including solid and leachability analysis results for a large suite of COCs. Sampling and analysis of groundwater in the waste, underlying natural alluvium, sands and gravels and limestone at depth has also been undertaken.
- The analytical results were compared to relevant GACs to consider risks to human and identified elevated concentrations of arsenic and lead in waste with the potential to cause risks to any users of a potential future park. Asbestos fibres have also been identified as being present within the waste material and in the absence of further risk assessment are considered to pose a potential risk to the health of users of the site.
- The analysis results were compared to relevant WQSs to consider risks to the Cork Harbour including ecology and have identified leachable chromium, chromium VI, copper, lead, limited cadmium, zinc and PAHs. During the generic assessment, groundwater contaminant concentrations associated with the waste material including arsenic, chromium, chromium VI, copper, zinc, lead, manganese, nickel and mercury were found to be present at levels greater than respective conservative screening levels and as a result were further assessed through completion of a bespoke DQRA to evaluate the potential impact upon Cork Harbour waters. However, it should be noted that sampling and analysis of seepages leaving the waste material during low tide onto the foreshore and also sampling of the Cork Harbour waters during low tide have typically not identified contaminant concentrations in excess of relevant WQSs. Currently therefore there is no evidence to suggest actual pollution of Cork Harbour waters is occurring to the extent that WQSs are being exceeded.
- Extensive hydrogeological monitoring was completed to further understand the hydrogeological regime at the East Tip including providing further information on the connectivity's between the underlying strata, waste, alluvium, sands and gravels and limestone and also with the Cork Harbour waters. This was completed by deploying data level loggers into boreholes to monitor groundwater levels over time. The data indicated that there is no 'perched' groundwater table on the site within the waste material. Instead the mass of the waste material is in a perpetual state of hydraulic interaction with the surrounding waters of the Cork Harbour, with tidal hydraulic head fluctuations present in the waste, alluvium, sands and gravels and limestone. Hydraulic conductivity testing has been competed for the different strata and has identified that the waste is highly permeable and heterogeneous as is shown by the engineering logs and the range of hydraulic conductivity estimates, from a maximum of 2.98E-02m/sec to a minimum of 2.10E-07m/sec (see Section 5.5). The waste is underlain by alluvium of a lower permeability which is

confining the underlying limestone. Consequently the limestone is considered to be confined, with the alluvium inhibiting downward groundwater and contaminant movement towards the confined limestone. Evidence of this is also provided by the lower contaminant concentrations measured in groundwater sampled from natural strata when compared to concentrations measured in the waste.

- A bespoke and conservative DQRA flux and dilution modelling process has been completed for contaminants that exceeded WQSs during the GQRA assessment and identified that there are no theoretical impacts to the waters of Cork Harbour from the majority of the constituents of concern identified. However a theoretical impact to the waters immediately surrounding the shoreline of the site (i.e. within 50m) were identified for chromium (VI) and from manganese but these impacts were considered to quickly diminish at distances beyond 100m of the shoreline.

In order to address potential risks to human health and water receptors, Section 7, provides recommendations for remediation including the use of a capping system and engineered perimeter structure. The capping system will break the pathway associated with risks to human health by preventing direct contact with the identified lead, arsenic and asbestos for future site users, and secondly it will reduce infiltration of rainwater and therefore contaminant leaching to groundwater and migration to the Cork Harbour. The engineered perimeter structure will lower groundwater contamination movement and prevent erosion of the waste material into the Cork Harbour. As the outputs of the sensitivity analysis indicate that decreasing the lateral hydraulic conductivity to 10^{-5}m/s would be sufficient to reduce the theoretical impact of dissolved phase contaminant discharge into the harbour. The engineered perimeter structure will have a maximum permeability of 10^{-5}m/s.

Abbreviations

BH	Borehole
BS	British Standard
CCC.	Cork County Council
CIEH	Chartered Institute of Environmental Health
CIRIA	Construction Industry Research and Information Association
CLAIRE	Contaminated Land Applications in the Real Environment
CLEA	Contaminated Land Exposure Assessment
COC	Contaminants of Concern
Conc.	Concentration
CV-AF	Cold Vapour Atomic Fluorescence
DoEHLG	Department of the Environment, Heritage and Local Government
DQRA	Detailed Quantitative Risk Assessment
EA	Environment Agency
EPA	Environmental Protection Agency
EQS	Environmental Quality Standards
FOC	Fractional Organic Content
GSV	Gas Screening Value
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
ICP-OES	Inductively Coupled Plasma Optical Emission Spectrometry
IGVs	Interim Guideline Values
Kd	Partician Co-efficent
LOD	Laboratory Detection Limit
mAOD	Metres Above Ordnance Datum
mbgl	Metres Below Ground Level
NRA	National Rivers Authority
OD	Ordnance Datum
PAHs	Polycyclic aromatic hydrocarbons

PCBs	Polychlorinated biphenyls
PCOC	Preliminary Contaminants of Concern
PGL	Priority Geotechnical Limited
ppm	Parts per Million
PSD	Particle size distribution
QRA	Quantitative Risk Assessment
RTM	Remedial Targets Methodology (developed by the UK's Environment Agency)
SGV	Soil Guideline Values
SI	Site Investigation
SSTL	Site Specific Target Level
SVOC	Semi-Volatile Organic Compounds
TOC	Total Organic Carbon
TP	Trial Pit
TPH	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
UK	United Kingdom
UK EA EQS	United Kingdom (UK) Environment Agency (EA) Environmental Quality Standard (EQS).
US EPA	United States Environmental Protection Agency
VOCs	Volatile organic compounds
WQS	Water Quality Standard
WFD	Waste Framework Directive
WFD	Water Framework Directive

GLOSSARY

Aquifer A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water.

Carboniferous The Carboniferous is a geologic period and system that extends from the end of the Devonian period, about 359.2 ± 2.5 Ma (million years ago), to the beginning of the Permian period, about 299.0 ± 0.8 Ma.

Conceptual Site Model A conceptual model represents the characteristics of a site in diagrammatic or written form that shows the possible relationships between contaminants, pathways and receptors (pollutant linkages).

Contaminant a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of the surrounding environment.

Contaminants of concern refer to contaminants which should be considered within future investigations and risk assessments due to the expectation that they are likely to be present in elevated concentrations. and therefore this determination indicates that further consideration should be given with respect to future investigations and risk assessments. It has not yet been determined that they are capable of causing risks to receptors that would require remedial action.

Composite Sampling – the formation of a composite sample which is obtained by blending or mixing two or more individual samples.

Cyanide Cyanide is any chemical compound that contains the cyano group (C≡N), which consists of a carbon atom triple-bonded to a nitrogen atom.

Dataloggers Instruments placed in boreholes that can record frequent measurements of water levels/

Dioxins and Furans 'Dioxins' is a collective term for the category of 75 polychlorinated dibenzo-para-dioxin compounds (PCDDs) and 135 polychlorinated dibenzofuran compounds (PCDFs). Seventeen PCDD and PCDF compounds are likely to be of toxicological significance. The most toxic of these is 2,3,7,8-tetrachlorodibenzo-pdioxin (2,3,7,8-TCDD). The toxicity of each compound depends on the number and position of the chlorine atoms within the molecules.

EPA Environmental Protection Agency. The agency protects the environment through its licensing, enforcement and monitoring activities in Ireland.

EPA EQS AA Environmental Protection Agency Environmental Quality Standard Annual Average. This means that for each representative monitoring point within the water body, the arithmetic mean of the concentrations measured over a 12 month monitoring period does not exceed the standard.

EPA EQS MAC Environmental Protection Agency Environmental Quality Standard Maximum Allowable Concentration. This means for each representative monitoring point within the water body no measured concentration exceeds the standard.

Foreshore Also known as the intertidal zone, the foreshore is the area that is exposed to the air at low tide and submerged at high tide.

Generic Assessment Criteria (GACs) Contaminant concentrations values used for comparison purposes to assess risk associated with contaminant concentrations found on site and are derived using non-site-specific information.

Groundwater Groundwater is water located beneath the ground surface in soil pore spaces and in the fractures of lithologic formations.

Groundwater abstraction is the process of taking water from a ground source, either temporarily or permanently.

Hexavalent Chromium Chromium a transition metal exists in the environment in a number of oxidation states ranging from -2 to +6. The Cr (III) or trivalent state is the most stable form. Cr(VI) hexavalent chromium is the form primarily used in the manufacture of steel. Both forms are present as cations in solution as well as forming several different oxyanions and oxide or hydroxyl compounds. In natural groundwaters, trivalent Cr is the prevalent form as hexavalent Cr is readily reduced to the trivalent form. Hexavalent chromium is considered toxic to human health through the inhalation pathway.

ICP Inductively Coupled Plasma spectrometry is a technique for elemental analysis which is applicable to most elements over a wide range of concentrations.

Leachate A solution resulting from leaching, as of soluble constituents from soil, landfill, etc., by downward percolating ground water.

Millscale Mill scale is a milling waste generated while rolling the metal in metal extrusion industries.

NRA Leachability Tests A laboratory test derived from the UK's Environment Agency Recommended Test (R&D note 301). The leaching fluid used in this method is intended to represent materials coming into contact with acid rain. Leaching is carried out by adding to the required sample weight, a volume of water left overnight to attain carbonate equilibrium (pH ~ 5.6) to give a 10:1 ratio of water to soil. The bottle is tumbled at a rate of ~0.5 revolutions per minute at room temperature for 24 hours. The resultant leachant can then be analysed for any parameters desired.

PAHs Polycyclic aromatic hydrocarbons are chemical compounds that consist of fused aromatic rings and do not contain heteroatoms or carry substituents. They are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco

Partician Coefficent (Kd) The Kd parameter is a factor related to the partitioning of a contaminant between the solid and aqueous phases.

Pathway a route or means by which a receptor can be exposed to, or affected by, a contaminant.

PCBs Polychlorinated Biphenyls are a class of organic compounds with 1 to 10 chlorine atoms attached to biphenyl which is a molecule composed of two benzene rings each containing six carbon atoms. The chemical formula for all PCBs is C12H10-xClx.

Phenol Phenol is both a manufactured chemical and a natural substance. It is a toxic, colourless crystalline solid with a sweet tarry odour.

Pollutant linkage The relationship between a contaminant, pathway and receptor.

Receptor is something that could be adversely affected by a contaminant, such as people, an ecological system, property or a water body.

Refractory A refractory is a material that retains its strength at high temperatures.

Seepages where groundwater exits the waste during low tide onto the foreshore.

SGV Soil Guideline Values are a series of measurements and values used by the United Kingdom's Department for Environment, Food and Rural Affairs (DEFRA) to measure contamination of the soil.

Slag Slag is the by-product of smelting ore to purify metals.

Source A substance that is capable of causing harm

TPH Total Petroleum Hydrocarbons is a term used to describe a large family of several hundred chemical compounds that originally come from crude oil.

VOCs Volatile Organic Compound(s) are organic chemical compounds that have high enough vapour pressures under normal conditions to significantly vaporize and enter the atmosphere.

Waulsortian Limestone Formation Waulsortian Limestone consists of poorly bedded, dense, pale grey mudstone-wackestone and fine-grained packstonegrainstone.

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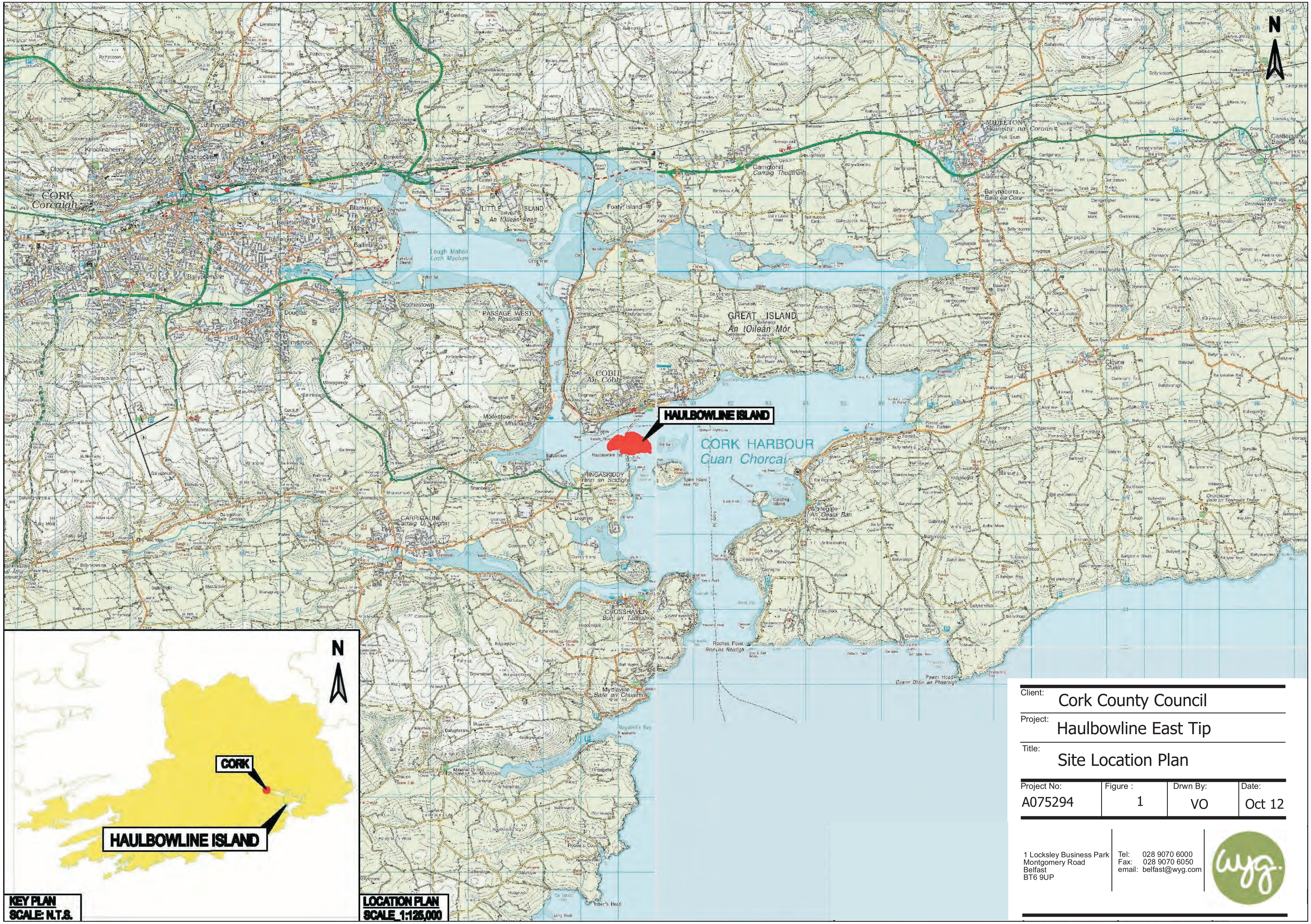
Figures



LOCATION PLAN
SCALE 1:125,000

KEY PLAN
SCALE: N.T.S.

Client:	Cork County Council
Project:	Haulbowline East Tip
Title:	Site Location Plan

Project No:	Figure :	Drwn By:	Date:
A075294	1	VO	Oct 12

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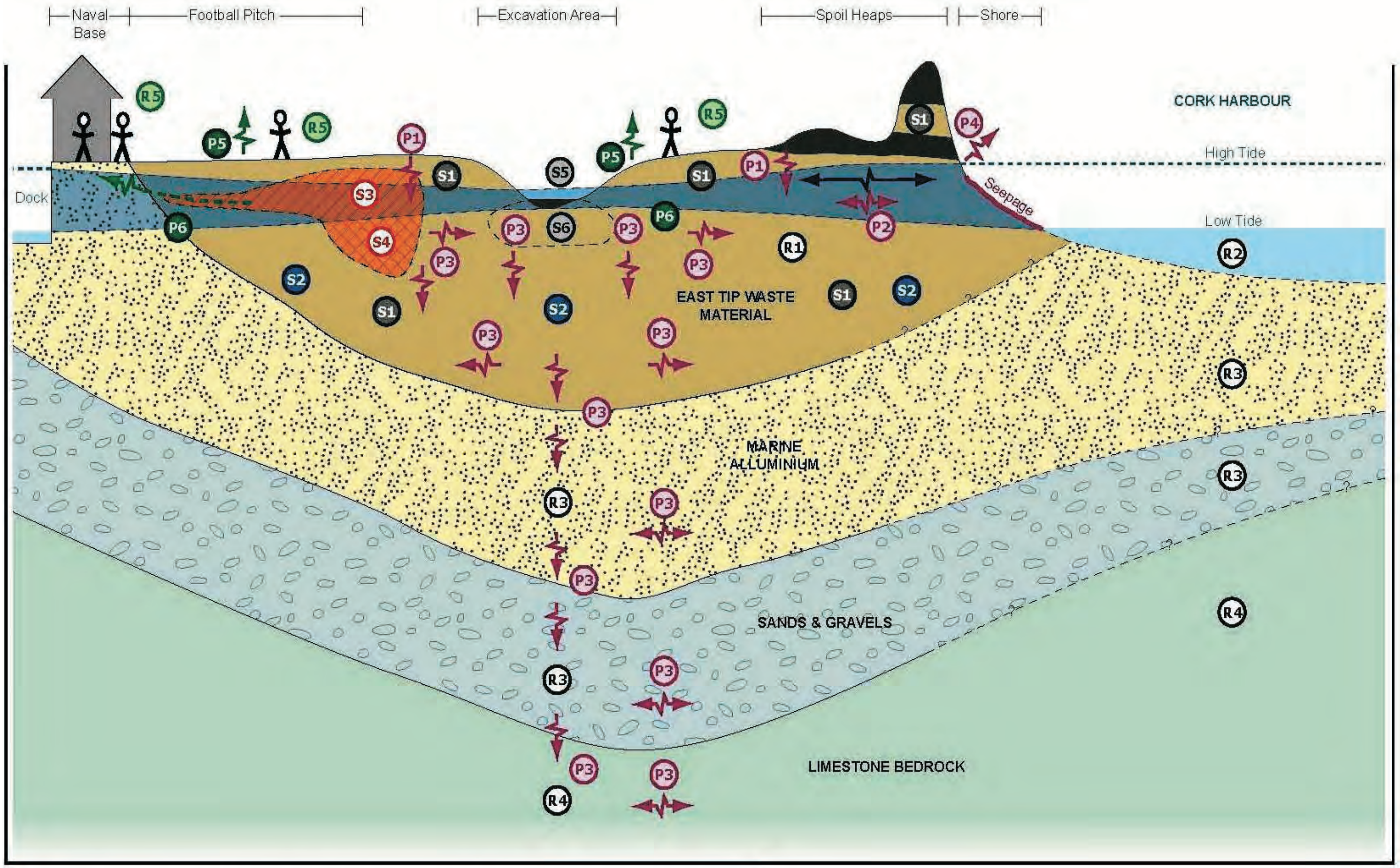
Cork County Council - Haulbowline
Aerial Photograph

Figure No. 2.

Job No. CE08671	**Date.** Aug. 2012
Finalised By - DH	**Office** - 1404
Drawn By: J Farrar - CS2,Illustrator	

NOTE: Drawing is for diagrammatic purposes only. No measurements to be taken.



NOTE: "Drawing not to scale and is for illustrative purposes only, to provide pictorial representation of the pre-investigation conceptual site model as presented in tables 16 and 17. The significance of the various contamination sources, pathways and receptors as shown has yet to be quantified and as a result this drawing should not be used to conclude that actual significant risks due to the presence of contamination in the East Tip are present."

LEGEND

SOURCES

- S1 Slag waste material - *water contaminants(arsenic, lead, nickel, cadmium, water soluble boron, vanadium, aluminium, manganese)*
- S2 Groundwater contaminants - *associated with slag waste material (arsenic, chromium, copper, zinc, minor lead, nickel, cadmium, aluminium, manganese)*
- S3 Domestic type waste (unsaturated soils) - *ammoniacal nitrogen and other potential contaminants*
- S4 Domestic type waste - *ammoniacal nitrogen and other contaminants in groundwater*
- S5 Waste material - *hydrocarbons in sludge pits (speciated TPH + PAHs)*
- S6 Hydrocarbons in groundwater from sludge pits

PATHWAYS

- P1 Leaching from unsaturated zone
- P2 Leaching within tidal zone and wetting and drying
- P3 Lateral and vertical groundwater migration
- P4 Uptake by flora and fauna
- P5 Dermal contact inhalation, injestion
- P6 Ground gas migration

RECEPTORS

- R1 Shallow groundwater in slag material
- R2 Cork Harbour waters
- R3 Groundwater in alluvium and sands and gravels
- R4 Groundwater in limestone
- R5 Human health *(Human health current & future users/Adjacent naval base users/Construction workers)*

- Tidal Movement
- Wetting & Drying Zone
- Spoil Heaps
- East Tip Waste Material (Landfill/made ground including slag, mill scale, scrap metal, refractories, construction and demolition waste).

Client: Cork County Council

Project: Haulbowline East Tip

Title: Preliminary Site Conceptual Model

Project No:	Figure :	Drwn By:	Date:
A075294	3	VO	Oct 12

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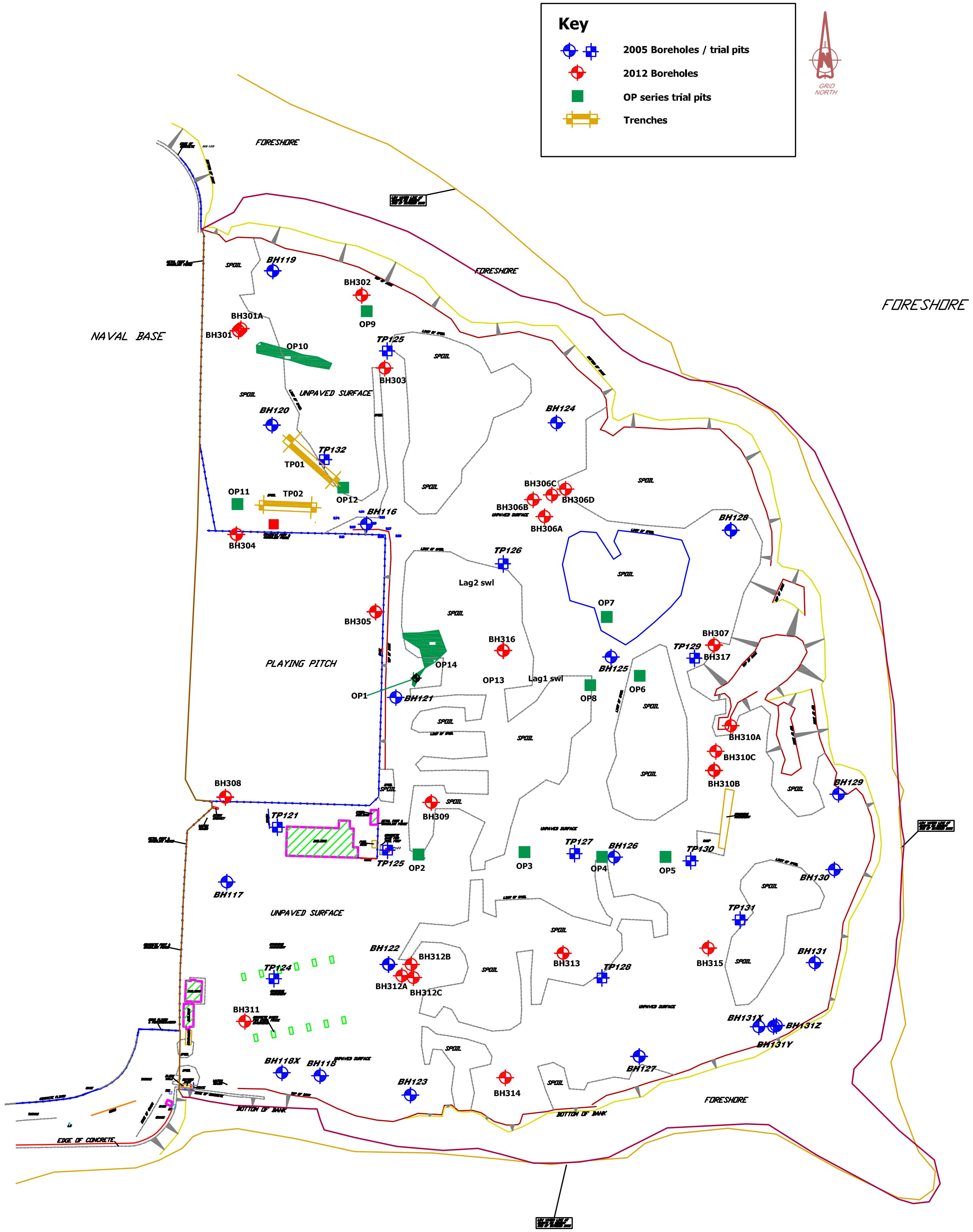

REV	DESCRIPTION	BY	CHK	APP	DATE

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Project:

Haulbowline East Tip

Drawing Title:

Sample Point Location Plan

Scale A3 @ 1:2000	Drawn VO	Date Oct 12	Checked YB	Date Oct 12	Approved Date Oct 12
Project No. A075294	Office 46	Type	Drawing No. Fig. 4		Revision Final

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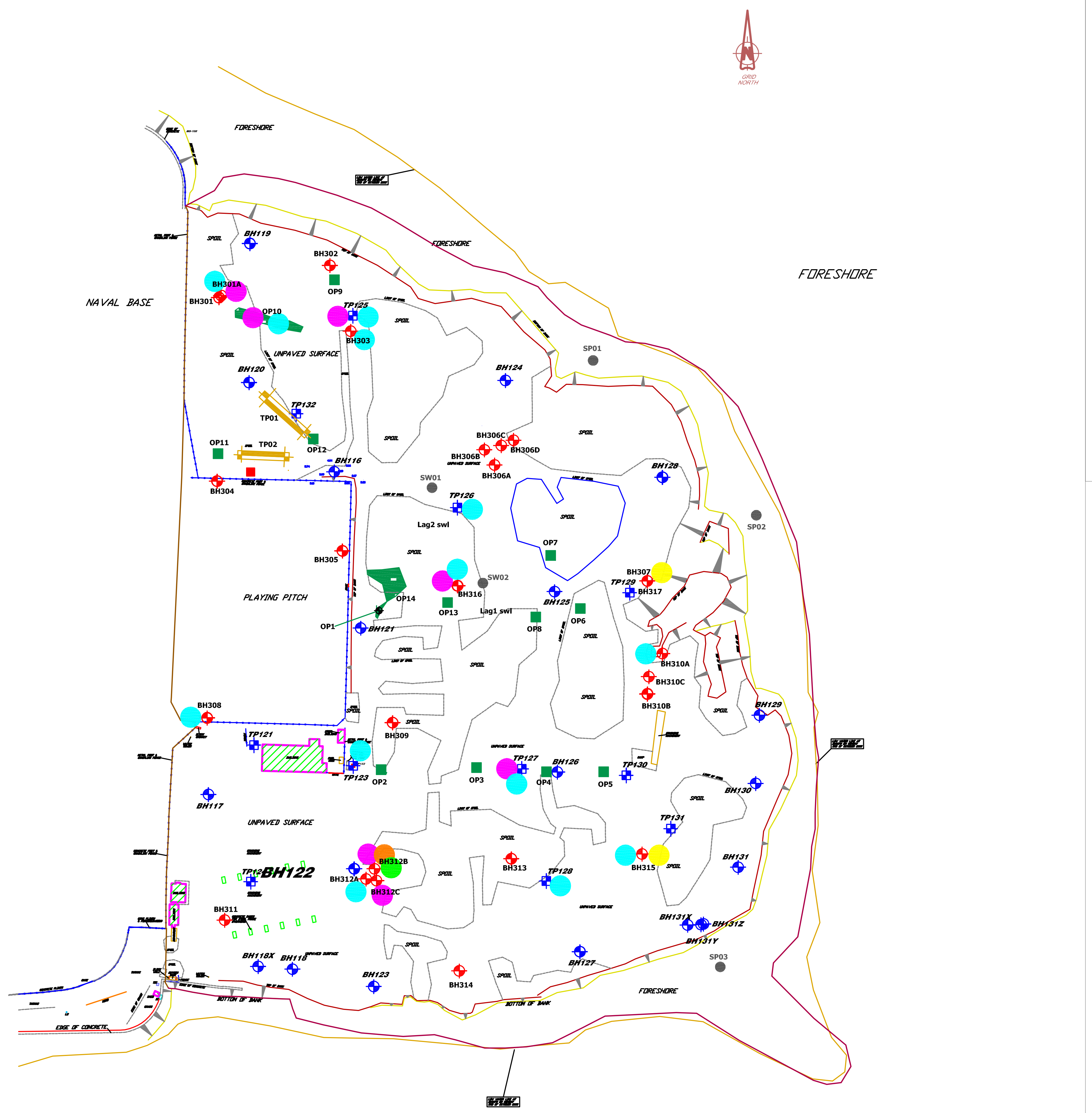

Key

- 2005 Boreholes / trial pits
- 2012 Boreholes
- OP series trial pits
- Trenches
- Surface Water Sample Locations

Near Surface Samples (<1mbgl) in Excess of Park Land Use GACs

- Arsenic
- Cadmium
- Lead
- Vanadium

Near Surface Samples (<1mbgl) in Excess of Commercial Land Use GACs

- Lead

REV	DESCRIPTION	BY	CHK	APP	DATE

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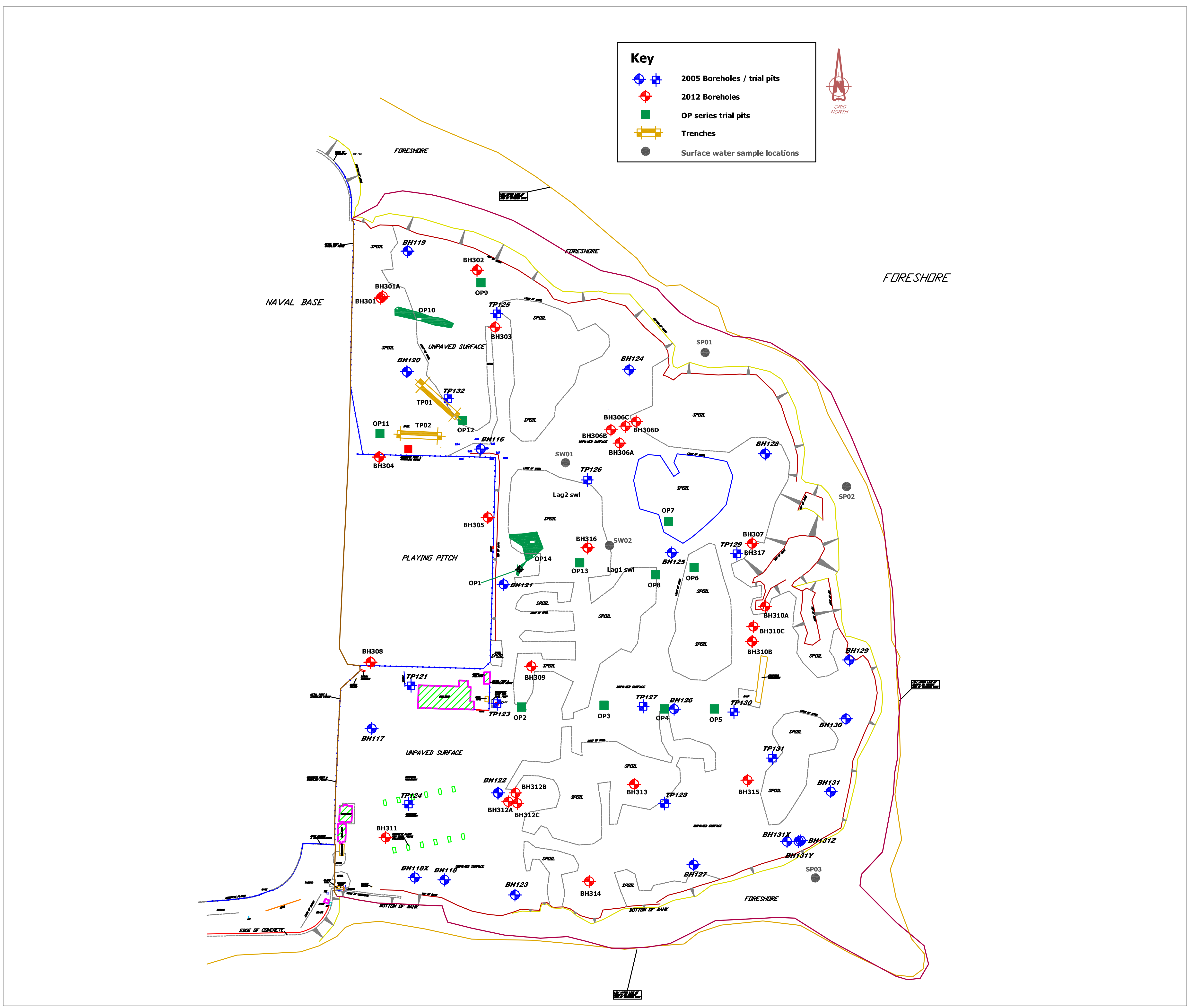
Project:

Haulbowline East Tip

Drawing Title:

Location of Near Surface Samples with Contaminant Concentrations in Excess of Human Health GACs

Scale A3 @ 1:2000	Drawn VO	Date Oct 12	Checked YB	Date Oct 12	Approved	Date Oct 12
Project No. A075294	Office 46	Type	Drawing No. Fig. 5		Revision Final	



DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS

REV	DESCRIPTION	BY	CHK	APP	DATE

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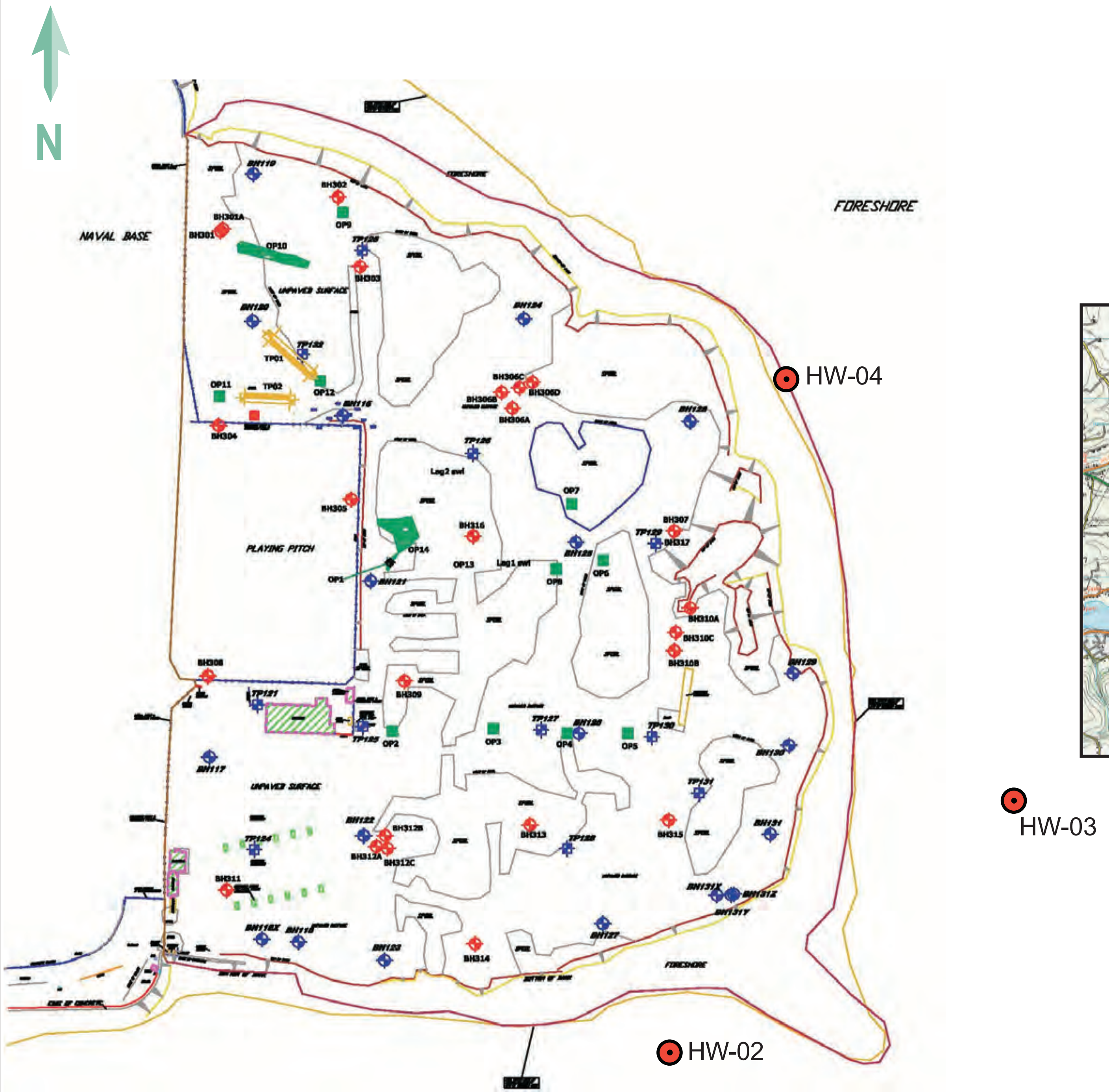
Project:

Haulbowline East Tip

Drawing Title:

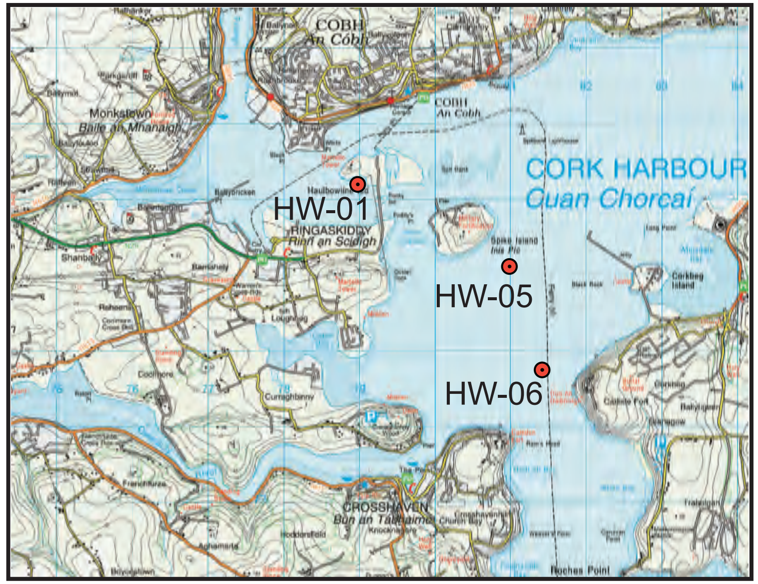
Surface Water Sampling Locations

Scale A3 @ 1:2000	Drawn VO	Date Oct 12	Checked YB	Date Oct 12	Approved Date Oct 12
Project No. A075294	Office 46	Type	Drawing No. Fig. 11		Revision Final



Legend

- Bedrock Groundwater Monitoring Well
- Contractor Trial Pits
- Marine Surface Water Sample
- Surface Sample from Seepage Point
- Groundwater Monitoring Well
- High Tide Intrusion Water Sampling Location



Client:	Cork County Council
Project:	Haulbowline East Tip
Title:	Harbour Water Sampling Locations

Project No:	Figure :	Drwn By:	Date:
A075294	12	VO	Oct 12

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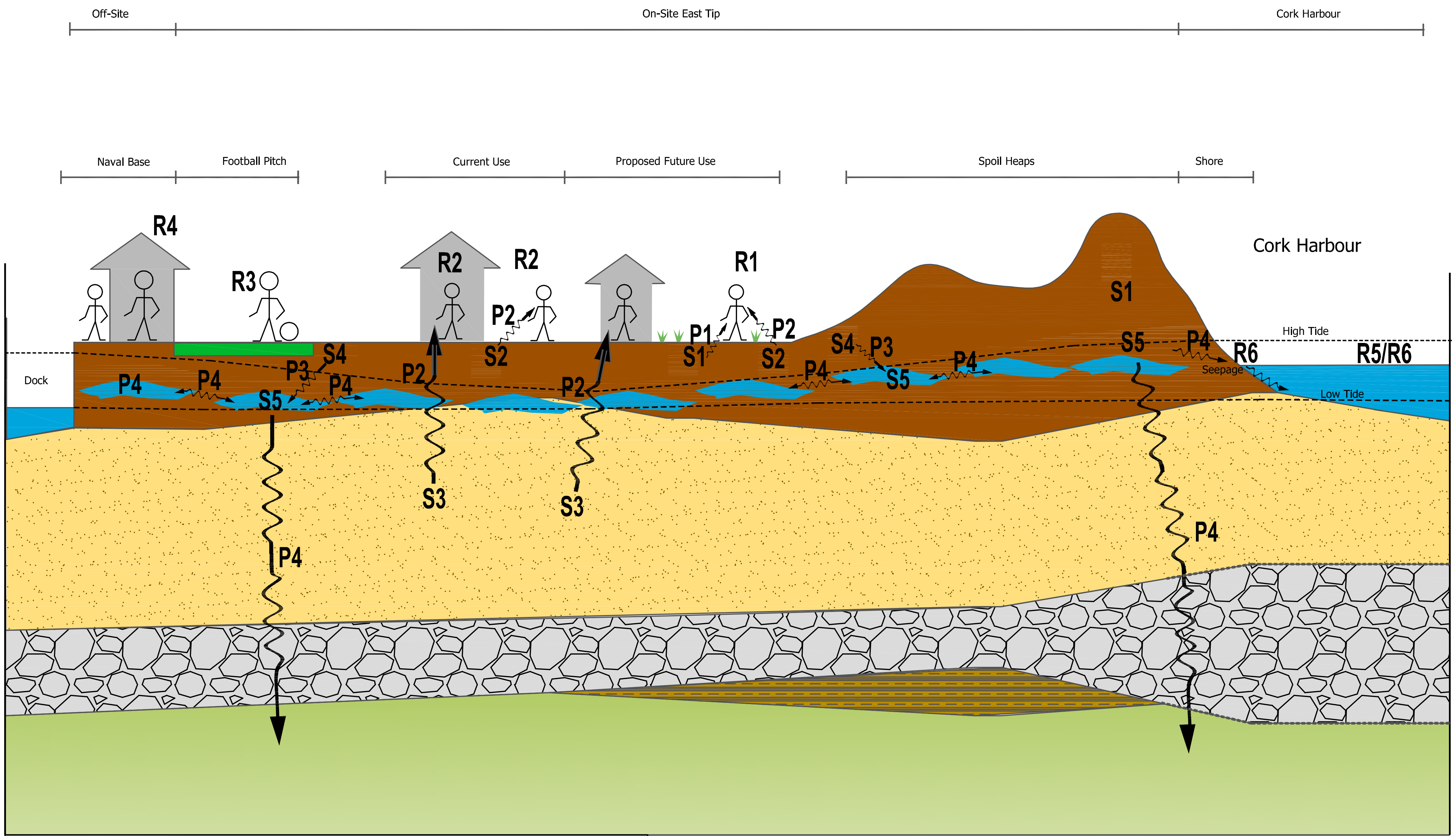

SOURCES:

S1	Arsenic & lead contamination (waste) Hotspots of contamination BH312B, BH314 & OP10
S2	Asbestos (Waste)
S3	Ground Gas (methane) in alluvium
S4	Leachable chromium, chromium VI, copper, lead, cadmium, zinc & PAHs
S5	Groundwater contaminants in waste:- Arsenic, chromium VI, chromium, copper, zinc, lead, manganese, nickel, mercury, benzo(a)pyrene, benzo(k)fluoranthene, fluoranthene

PATHWAYS:

P1	Dermal contact ingestion & inhalation
P2	Inhalation of dusts & vapours
P3	Solid phase leaching to groundwater
P4	Contaminant migration in groundwater

RECEPTORS:

R1	Future park users
R2	Commercial site users / construction workers
R3	Current navy football pitch users
R4	Adjacent navy base
R5	Cork Harbour
R6	Ecology - flora & fauna

Note:
Drawing not to scale and is for illustrative purposes only to provide pictorial presentation of a conceptual site model. The significance of various contamination sources, pathways and receptors, as shown, are yet to be fully quantified and as a result this diagram should not be used to conclude that actual significant risks due to the presence of contamination in the East Tip are present.
Note1:
The conceptual model presented is pre-remediation and does not include future proposed remediation.

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KEY:

WASTE
CLAY
MARINE ALLUVIUM
LIMESTONE
SANDS & GRAVELS
GROUNDWATER
PATHWAYS

CONCEPTUAL SITE MODEL

Client: CORK COUNTY COUNCIL
Project: Haulbowline East Tip
Figure: 13

Appendices

Appendix A – Report Conditions

WYG Environmental (EPT) Ltd

Report Conditions

East Tip, Haulbowline

This report is produced solely for the benefit of Cork County Council and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYGE. In time improved practices, fresh information or amended legislation may necessitate a re-assessment. Opinions and information provided in this report are on the basis of WYGE using due skill and care in the preparation of the report.

This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

This report is limited to those aspects reported on, within the scope and limits agreed with the client under our appointment. It is necessarily restricted and no liability is accepted for any other aspect. It is based on the information sources indicated in the report. Some of the opinions are based on unconfirmed data and information and are presented as the best obtained within the scope for this report.

Reliance has been placed on the documents and information supplied to WYGE by others but no independent verification of these has been made and no warranty is given on them. No liability is accepted or warranty given in relation to the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report.

Whilst skill and care have been used, no investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather related conditions.

Although care is taken to select monitoring and survey periods that are typical of the environmental conditions being measured, within the overall reporting programme constraints, measured conditions may not be fully representative of the actual conditions. Any predictive or modelling work, undertaken as part of the commission will be subject to limitations including the representativeness of data used by the model and the assumptions inherent within the approach used. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions. The potential influence of our assessment and report on other aspects of any development or future planning requires evaluation by other involved parties.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. WYGE accept no liability for issues with performance arising from such factors.

Appendix B Human Health Generic Assessment Criteria (GAC)

Human Health GACs

	CIEH Commercial Industrial GAC (mg/kg)	Atrisk Park Land Use GAC (mg/kg)
Cyanide, Free	36	34
Metals		
Antimony		831
Arsenic	640	41.4
Barium		1570
Beryllium	420	277000
Boron, water soluble	192000	
Cadmium	230	83.6
Chromium	30400	22500
Chromium, Hexavalent	35	239
Copper	71700	12200
Lead	4640	477
Mercury	3640	303
Nickel	1800	922
Selenium	13000	696
Vanadium	3160	422
Zinc	665000	54800
Phenols		
Cresols		9910
Phenol	482	686
Phenols, Total 5 speciated		686
Phenols, Total monohydric		686
TPH Criteria Working Group (TPH CWG)		
Aliphatics >C5C6	3400	324000
Aliphatics >C6C8	8300	326000
Aliphatics >C8C10	2100	6420
Aliphatics >C10C12	10000	6520
Aliphatics >C12C16	61000	6520
Aliphatics >C16C21	1000000	177000
Aliphatics >C21C35	1000000	177000
Aromatics >EC5EC7	28	14.2
Aromatics >EC7EC8	59000	23500
Aromatics >EC8EC10	3700	1940
Aromatics >EC10EC12	17000	2490
Aromatics >EC12EC16	36000	2590
Aromatics >EC16EC21	28000	1610
Aromatics >EC21EC35	28000	1610
Methyl tertiary butyl ether (MTBE)		15600
Benzene	28	14.2
Ethylbenzene	518	10100
m,p,oXylene		14500
m,pXylene	312	14500
oXylene		15700
Toluene	869	23500
mi Volatile Organic Compounds (SVOCs) (Solids)		
2,4Dimethylphenol (S)		1920
2,4Dinitrotoluene (S)		200
2,6Dinitrotoluene		101
2Chloronaphthalene		2450
2Methylphenol		9910
4Methylphenol (S)		9910
Acenaphthene	85000	5570
Acenaphthylene	84000	0
Anthracene	530000	29100
Benzo(a)anthracene	90	9.52
Benzo(a)pyrene	14	1.2
Benzo(b)fluoranthene	100	11.5
Benzo(g,h,i)perylene	650	143
Benzo(k)fluoranthene	140	123
bis(2Ethylhexyl) phthalate		3420
Chrysene	140	993
Dibenzo(a,h)anthracene	13	1.27
Diethyl phthalate		21000
Fluoranthene	23000	3890
Fluorene	64000	3810
Hexachloroethane		51.4
Indeno(1,2,3cd)pyrene	60	11.2
Naphthalene	200	1010
Phenanthrene	22000	
Phenol	0.482	
Pyrene	54000	2920

Human Health GACs

Volatile Organic Compounds (VOCs) (Solids)		
1.1.1.2Tetrachloroethane	120	223
1.1.1Trichloroethane	700	54500
1.1.2.2Tetrachloroethane	290	292
1.1.2Trichloroethane		171
1.1Dichloroethane		9730
1.1Dichloroethene		453
1.2.4Trimethylbenzene		49.7
1.2Dichloroethane	0.71	2.8
1.2Dichloropropane		18.6
Benzene	28	14.2
Bromobenzene		228
Bromodichloromethane		7.71
Bromoform		644
Carbon Disulphide		303
Carbontetrachloride	3	22.4
Chlorobenzene		4920
Chloroethane		272000
Chloroform	110	457
Chloromethane		17.2
cis12Dichloroethene		89.5
Dibromochloromethane		45
Dichloromethane		297
Ethylbenzene	518	10100
Isopropylbenzene		10000
Naphthalene		1010
p/mXylene	312	14500
Propylbenzene		10400
Tetrachloroethene	130	982
Toluene	869	23500
trans12Dichloroethene		212
Trichloroethene	12	88.2
Vinyl Chloride	0.063	0.804

Appendix C Waste Solid Analysis Results

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

	LoD/Units	TSV for Commercial / Industrial Use	Atkins Park Human Health GAC (mg/kg)	slag with occassional bricks and metal	millscale possible flue dust	slag with HC odour	clay with slag and possible millscale, 5% timber, 2% refractory 1% construction and 2% plastic household waste	slag/with possible millscale or slag	slag with bricks, steel and some plastic	slag with 1% pastic, 5% steel in construction form and red brick	slag	slag	topsoil	slag with 10% refractory, 2% pastic and 1% metal	slag, 2% refractory.	topsoil	slag with 20% refractory bricks	slag with 10% scrap metal	slag with metal and fragments of glass	slag	slag with metal, plastic, rope and shells	slag with occ demolition material and refractory bricks	slag with occ demolition material and refractory bricks	slag
Sample Identity				BH301A	BH301A	BH301A	BH302	BH302	BH302	BH303	BH303	BH303	BH304	BH304	BH304	BH305	BH305	BH306a	BH306a	BH306a	BH306a	BH306b	BH306b	BH306b
Depth (m)				0.2 0.3	0.6 1	4	2	5	8	0.2	1	3	0.3	2	4.2	0.3	4 4.5	2	5	7	9	1	2	4
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				15/05/2012	15/05/2012	15/05/2012	17/05/2012	17/05/2012	25/05/2012	09/05/2012	08/05/2012	08/05/2012	25/05/2012	25/05/2012	25/05/2012	24/05/2012	24/05/2012	01/05/2012	01/05/2012	04/05/2012	08/05/2012	24/04/2012	24/04/2012	24/04/2012
Sample Received Date				20/05/2012	20/05/2012	20/05/2012	20/05/2012	20/05/2012	30/05/2012	13/05/2012	13/05/2012	13/05/2012	30/05/2012	30/05/2012	30/05/2012	28/05/2012	28/05/2012	08/05/2012	08/05/2012	09/05/2012	13/05/2012	28/04/2012	28/04/2012	28/04/2012
SDG				1205201	1205201	1205201	1205201	1205201	12053071	12051311	12051311	12051311	12053071	12053071	12053071	12052825	12052825	12050829	12050829	12050946	12051311	12042854	12042854	12042854
Sample Description																								
Colour					Black	Dark Brown	Dark Brown	Dark Brown	Black	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Light Brown	Dark Brown	Grey	Dark Brown	Dark Brown	Black	Dark Brown	Light Brown	Dark Brown
Description					Sand	Loamy Sand	Sandy Loam	Gravel	Sand	Silty Sand	Sand	Sand	Silt Loam	Sand	Sand	Loamy Sand	Sand	Clinker	Clinker	N/A	Sand	Sand	Gravel	Sandy Loam
Grain Size					0.063 0.1 mm	0.063 0.1 mm	0.063 0.1 mm	2 10 mm	2 10 mm	0.063 0.1 mm	0.1 2 mm	0.1 2 mm	0.063 0.1 mm	0.1 2 mm	0.1 2 mm	0.063 0.1 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	2 10 mm	0.1 2 mm
Inclusion 1)					Stones	Stones	Vegetation	Metal	Stones	Stones	Stones	Stones	Stones	Crushed Brick	Stones	Stones	Stones	Crushed Brick	Crushed Brick	Metal	Stones	Stones	Stones	Stones
Inclusion 2)					N/A	Fibres	Stones	Fibres	Vegetation	N/A	N/A	N/A	None	Stones	None	N/A	N/A	N/A	Stones	Stones	N/A	None	N/A	None
Moisture content ratio	%			4.4	6.6	12	16	4	3.6		6.7	7.1	9.2	6.2	0.88	13	2.9	9.2	7.2	11	11	9		8.5
Laboratory data																								
2Butanone	<100 µg/kg					<100									<100									
Acetone	< 50 µg/kg					73.8									<50									
Chloride (soluble)	<5mg/kg			59.2	14.2	3160	28.7	1280	1170		158	1950	<5	115	1740	36.5	1210	3370	2960	2940	3410	2600		2750
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l			0.0497	0.0235	0.615	0.0365	0.197	0.157		0.0807	0.358	<0.008	0.164	0.454	0.0123	<0.008	0.535	0.496	0.462	0.55	0.532		0.532
Carbon																								
Fraction Organic Carbon (FOC)	<0.1					<	<	<	<		<	<		<	<		<			<				
Fraction Organic Carbon (FOC)	<0.002				<								0.00859			0.00414								
Inorganics																								
Ammoniacal Nitrogen as N	<15mg/kg			15	<15	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<		<
Cyanide, Complex	<1 mg/kg			1	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<		<
Cyanide, Free	<1 mg/kg	36	34	1	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<		<
Cyanide, Total	<1 mg/kg			1	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<		<
pH	1 pH Units			12	9.66	9.38	9.42	11.2	11.1		11.8	11.1	6.54	10.4	9.57	7.75	10.6	9.91	10.2	10.2	10.9	10.2		10.4
Sulphate, Total	<0.008 mg/kg			2300	212	4470	622	3600	2590		2150	3350	285	2850	6000	221	2460	5040	5530	5240	8220	6470		7080
Sulphide, Easily liberated	<15mg/kg			15	<15	143	<	<	<		<	<	<	<	29.2	<	<	<	<	38.4	<	<		<
Sulphur, Total	<0.02%				0.0413								<0.02			0.026								
Sulphur, Total	<0.0016%			0.0766		0.149	0.0207	0.12	0.0862		0.0716	0.112	0.00949	0.0948	0.2	0.00736	0.082	0.168	0.184	0.175	0.274	0.216		0.236
Thiocyanate	<1 mg/kg			1	<1	<1	<	<	<		<	<	<	<	<	<	<	<	<	<	<1	<		<
Metals																								
Aluminium	<11 mg/kg			21100	737	7420	5960	18500	21800		20500	24100	10300	16200	16000	11100	1920	21500	16200	15300	21100	20600		20000
Antimony	<0.6 mg/kg		831	87.2	44.1	42.7	27.3	80.5	25.6		35.4	27	4.09	27.3	30.9	1.52	6.89	34	30.9	30.1	41.8	151		147
Arsenic	<0.6 mg/kg	640	41.4	25.6	**85.5**	37	39.4	13.1	7.09		29.1	26.8	16.2	36.9	21.3	16.2	<0.6	12.7	**43.5**	38.8	32.2	<6		<6
Barium	<0.6 mg/kg		1570	769	8.06	270	84.2	660	808		707	691	116	663	543	28.9	68.4	867	737	600	783	770		658
Beryllium	<0.01 mg/kg	420	277000	0.1	0.814	0.244	0.924	<0.1	0.145		<0.25	<0.25	0.393	0.261	0.0686	0.473	<0.01	<0.1	<0.1	0.363	<0.25	<0.1		<0.1
Boron, water soluble	<1 mg/kg	192000		3.75	<	8.38	1.62	5.7	5.68		5.06	5.42	<	3.64	5.59	<	4.26	17.3	9.76	5.45	5.38	11.9		11.4
Cadmium	<0.2 mg/kg	230	83.6	5.58	<0.2	6.64	4.84	4.59	2.31		16.5	6.8	0.301	14.2	8.12	0.377	0.301	2.37	4.04	5.06	5.47	<		<
Calcium	<21mg/kg			165000	1550	61100	45400	167000	213000		180000	217000	2890	136000	176000	1640	161000	197000	167000	123000	173000	4380		214000
Chromium	<0.9 mg/kg	30400	22500	3530	857	1240	462	3290	3660		3540	3390	23.4	1520	2230	25.5	302	6070	4400	3400	4190	6480		6220
Chromium, Hexavalent	<0.6 mg/kg	35	239	3.55	<0.6	<0.6	<	<	<		1.49	<	<	1.06	<	<	<	<	<	<	<	<		<
Copper	<1.4 mg/kg	71700	12200	770	2170	802	1110	604	258		642	498	20.6	652	305	13.9	28.9	309	649	869	763	349		320
Lead	<0.7 mg/kg	4640	477	**660**	24.2	**814**	**568**	**469**	212		**1010**	228	127	**1090**	**645**	36.7	28.4	82.2	281	239	**565**	98.7		53.6
Magnesium	<8mg/kg			30200	485	17700	3580	29900	39900		26500	37000	2280	22100	53300	2780	74000	63000	43100	25100	39200	5740		45400
Manganese	<0.13 mg/kg			38400	5250	13100	3050	35900	31200		40800	39400	1170	16600	29400	1310	11400	28700	26500	21100	35100	31000		32600
Mercury	<0.14 mg/kg	3640	303	1.4	<1.4	<0.14	<1.4	<1.4	<0.7		<0.7	<0.7	0.305	<0.7	<0.7	<	<	<	<	<	<0.7	<		<
Nickel	<0.2 mg/kg	1800	922	232	707	280	381	198	69.4		200	156	21.4	179	78.8	25.8	10.4	83.1	218	307	251	74.7		81.1
Selenium	<1 mg/kg	13000	696	13.5	<10	<10	<10	13.6	16.9		<25	31.2	1.27	9.9	17.5	1.59	1.14	21.8	19.5	13.1	<25	20.8		22.3
Vanadium	<0.2 mg/kg	3160	422	315	3.07	108	24.4	316	351		338	421	22.4	151	**498**	20.5	38.4	**440**	321	253	375	350		385
Zinc	<1.9mg/kg	665000	54800	2470	96.3	3610	2150	2080	847		5480	1500	162	5970	3700	99.6	592	718	2830	1070	639	468		395
Phenols																								
2,3,5 TrimethylPhenol	<0.01 mg/kg				<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<		<
2Isopropyl Phenol	<0.015 mg/kg				<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<		<
Cresols	<0.01 mg/kg		9910		<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<		<
Phenol	<0.01 mg/kg	482	686		<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<		<
Phenols, Total 5 speciated	<0.06 mg/kg		686		<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<		<
Phenols, Total monohydric	<0.035 mg/kg		686		<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<		<
Xylenols	<0.015 mg/kg				<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<		<
Mineral Oil / Oils & Greases																								
Mineral oil >C10C40	<1 mg/kg					752																		
% Surrogate Recovery	%					70.7																		
Surrogate Value						35.4																		

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Atkins Park Human Health GAC (mg/kg)	BH301A	BH301A	BH301A	BH302	BH302	BH302	BH303	BH303	BH303	BH304	BH304	BH304	BH305	BH305	BH306a	BH306a	BH306a	BH306a	BH306b	BH306b	BH306b
Depth (m)				0.2 0.3	0.6 1	4	2	5	8	0.2	1	3	0.3	2	4.2	0.3	4 4.5	2	5	7	9	1	2	4
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				15/05/2012	15/05/2012	15/05/2012	17/05/2012	17/05/2012	25/05/2012	09/05/2012	08/05/2012	08/05/2012	25/05/2012	25/05/2012	25/05/2012	24/05/2012	24/05/2012	01/05/2012	01/05/2012	04/05/2012	08/05/2012	24/04/2012	24/04/2012	24/04/2012
Sample Received Date				20/05/2012	20/05/2012	20/05/2012	20/05/2012	20/05/2012	30/05/2012	13/05/2012	13/05/2012	13/05/2012	30/05/2012	30/05/2012	30/05/2012	28/05/2012	28/05/2012	08/05/2012	08/05/2012	09/05/2012	13/05/2012	28/04/2012	28/04/2012	28/04/2012
SDG				1205201	1205201	1205201	1205201	1205201	12053071	12051311	12051311	12051311	12053071	12053071	12053071	12052825	12052825	12050829	12050829	12050946	12051311	12042854	12042854	12042854
TPH Criteria Working Group (TPH CWG)																								
Aliphatics >C5C6	<10µg/kg	3400000	324000000			<10									<									
Aliphatics >C6C8	<10µg/kg	8300000	326000000			11.3									<									
Aliphatics >C8C10	<10µg/kg	2100000	6420000			46.3									<									
Aliphatics >C10C12	<10µg/kg	10000000	6520000			63.3									<									
Aliphatics >C12C16	<100µg/kg	61000000	6520000			10100									2230									
Aliphatics >C16C21	<100µg/kg	1000000000	177000000			64200									18500									
Aliphatics >C21C35	<100µg/kg	1000000000	177000000			644000									88300									
Aliphatics >C35C44	<100µg/kg					242000									20400									
Aromatics >EC5EC7	<10µg/kg	28000	14200			<									<									
Aromatics >EC7EC8	<10µg/kg	59000000	23500000			<									<									
Aromatics >EC8EC10	<10µg/kg	3700000	1940000			37.3									<									
Aromatics >EC10EC12	<10µg/kg	17000000	2490000			41.8									<									
Aromatics >EC12EC16	<100µg/kg	36000000	2590000			7470									1890									
Aromatics >EC16EC21	<100µg/kg	28000000	1610000			35400									11900									
Aromatics >EC21EC35	<100µg/kg	28000000	1610000			280000									54600									
Aromatics >EC35EC44	<100µg/kg					184000									22900									
Aromatics >EC40EC44	<100µg/kg					80800									8330									
Total Aliphatics >C535	<100µg/kg					719000									109000									
Total Aromatics >C535	<100µg/kg					323000									68400									
Total Aliphatics & Aromatics >C5C44	<100µg/kg					1470000									221000									
Methyl tertiary butyl ether (MTBE)	<5µg/kg		15600000			<									<									
Benzene	<10µg/kg	28000	14200			<									<									
Ethylbenzene	<3µg/kg	518000	10100000			<									<									
m,p,oXylene	<9 µg/kg		14500000			<									<									
m,pXylene	<6µg/kg	312000	14500000			<									<									
oXylene	<3µg/kg		15700000			<									<									
Toluene	<2µg/kg	869000	23500000			<									<									
BTEX, Total	<24µg/kg					<									<									
Rapid PAH Screen																								
Polyaromatic hydrocarbons, Total 17	<10mg/kg				<	21.5	16.7	<	<		<	<	<	11.7	<	<	<	<	<	<	<	<		<
SemiVolatile Organic Compounds (SVOCs)																								
1,2,4Trichlorobenzene	<100µg/kg					<									<									
1,2Dichlorobenzene	<100µg/kg					<									<									
1,3Dichlorobenzene	<100µg/kg					<									<									
1,4Dichlorobenzene	<100µg/kg					<									<									
2,4,5Trichlorophenol	<100µg/kg					<									<									
2,4,6Trichlorophenol (S)	<100µg/kg					<									<									
2,4Dichlorophenol (S)	<100µg/kg					<									<									
2,4Dimethylphenol (S)	<100µg/kg		1920000			<									<									
2,4Dinitrotoluene (S)	<100µg/kg		200000			<									<									
2,6Dinitrotoluene	<100µg/kg		101000			<									<									
2Chloronaphthalene	<100µg/kg		2450000			<									<									
2Chlorophenol (S)	<100µg/kg					<									<									
2Methylnaphthalene	<100µg/kg					<									<									
2Methylphenol	<100µg/kg		9910000			<									<									
2Nitroaniline (S)	<100µg/kg					<									<									
2Nitrophenol (S)	<100µg/kg					<									<									
3Nitroaniline	<100µg/kg					<									<									
4Bromophenylphenylether	<100µg/kg					<									<									
4Chloro3methylphenol (S)	<100µg/kg					<									<									
4Chloroaniline	<100µg/kg					<									<									
4Chlorophenylphenylether	<100µg/kg					<									<									
4Methylphenol (S)	<100µg/kg		9910000			<									<									
4Nitroaniline	<100µg/kg					<									<									
4Nitrophenol (S)	<100µg/kg					<									<									
Acenaphthene	<100µg/kg	85000000	5570000			<									<									
Acenaphthylene	<100µg/kg	84000000				<									<									
Anthracene	<100µg/kg	530000000	29100000			<									150									
Azobenzene	<100µg/kg					<									<									
Benzo(a)anthracene	<100µg/kg	90000	9520			136									381									
Benzo(a)pyrene	<100µg/kg	14000	1200			137									356									
Benzo(b)fluoranthene	<100µg/kg	100000	11500			<									318									
Benzo(g,h,i)perylene	<100µg/kg	650000	143000			<									254									
Benzo(k)fluoranthene	<100µg/kg	140000	123000			119									310									
Bis(2chloroethoxy)methane	<100µg/kg					<									<									
bis(2Chloroethyl)ether	<100µg/kg					<									<									
bis(2Ethylhexyl) phthalate	<100µg/kg		3420000			1920									5380									
Butylbenzyl phthalate	<100µg/kg					<									<									
Carbazole	<100µg/kg					<									<									
Chrysene	<100µg/kg	140000	993000			171									411									
Dibenzo(a,h)anthracene	<100µg/kg	13000	1270			<									<									
Dibenzofuran	<100µg/kg					<									<									
Diethyl phthalate	<100µg/kg		21000000			<									<									
Dimethyl phthalate	<100µg/kg					<									<									
Fluoranthene	<100µg/kg	23000000	3890000			400									904									
Fluorene	<100µg/kg	64000000	3810000			<									<									
Hexachlorobenzene	<100µg/kg					<									<									
Hexachlorobutadiene	<100µg/kg					<									<									
Hexachlorocyclopentadiene	<100µg/kg					<									<									
Hexachloroethane	<100µg/kg		51400			<									<									
Indeno(1,2,3cd)pyrene	<100µg/kg	60000	11200			<									201									
Isophorone	<100µg/kg					<									<									
Naphthalene	<100µg/kg	200000	1010000			<									165									
nDibutyl phthalate	<100µg/kg					250									115									
nDioctyl phthalate	<100µg/kg					<									<									
Nitrobenzene	<100µg/kg					<									<									
nNitrosodipropylamine	<100µg/kg					<									<									
Pentachlorophenol	<100µg/kg					<									<									
Phenanthrene	<100µg/kg	22000000				338									678									
Phenol	<100µg/kg	482				<									<									
Pyrene	<100µg/kg	54000000	2920000			354									703									
Tic Report						See Attached									No TICs identified									

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Atkins Park Human Health GAC (mg/kg)	BH301A	BH301A	BH301A	BH302	BH302	BH302	BH303	BH303	BH303	BH304	BH304	BH304	BH305	BH305	BH306a	BH306a	BH306a	BH306a	BH306b	BH306b	BH306b
Depth (m)				0.2 0.3	0.6 1	4	2	5	8	0.2	1	3	0.3	2	4.2	0.3	4 4.5	2	5	7	9	1	2	4
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				15/05/2012	15/05/2012	15/05/2012	17/05/2012	17/05/2012	25/05/2012	09/05/2012	08/05/2012	08/05/2012	25/05/2012	25/05/2012	25/05/2012	24/05/2012	24/05/2012	01/05/2012	01/05/2012	04/05/2012	08/05/2012	24/04/2012	24/04/2012	24/04/2012
Sample Received Date				20/05/2012	20/05/2012	20/05/2012	20/05/2012	20/05/2012	30/05/2012	13/05/2012	13/05/2012	13/05/2012	30/05/2012	30/05/2012	30/05/2012	28/05/2012	28/05/2012	08/05/2012	08/05/2012	09/05/2012	13/05/2012	28/04/2012	28/04/2012	28/04/2012
SDG				1205201	1205201	1205201	1205201	1205201	12053071	12051311	12051311	12051311	12053071	12053071	12053071	12052825	12052825	12050829	12050829	12050946	12051311	12042854	12042854	12042854
Volatile Organic Compounds (VOCs) (Solids)																								
1.1.1.2Tetrachloroethane	<10µg/kg	120000	223000			<200									<									
1.1.1Trichloroethane	<7µg/kg	700000	54500000			<140									<									
1.1.2.2Tetrachloroethane	<10µg/kg	290000	292000			<200									<									
1.1.2Trichloroethane	<10µg/kg		171000			<200									<									
1.1Dichloroethane	<8µg/kg		9730000			<160									<									
1.1Dichloroethene	<10µg/kg		453000			<200									<									
1.1Dichloropropene	<10µg/kg					<220									<11									
1.2.3Trichlorobenzene	<6µg/kg					<120									<									
1.2.3Trichloropropane	<17µg/kg					<340									<									
1.2.4Trichlorobenzene	<6µg/kg					<120									<									
1.2.4Trimethylbenzene	<9µg/kg		49700			<180									<									
1.2Dibromo3chloropropane	<14µg/kg					<280									<									
1.2Dibromoethane	<12µg/kg					<240									<									
1.2Dichlorobenzene	<12µg/kg					<240									<									
1.2Dichloroethane	<5µg/kg	710	2800			<100									<									
1.2Dichloropropane	<12µg/kg		18600			<240									<									
1.3.5Trimethylbenzene	<8µg/kg					<160									<									
1.3Dichlorobenzene	<6µg/kg					<120									<									
1.3Dichloropropane	<7µg/kg					<140									<									
1.4Dichlorobenzene	<5µg/kg					<100									<									
2.2Dichloropropane	<12µg/kg					<240									<									
2Chlorotoluene	<9µg/kg					<180									<									
4Chlorotoluene	<12µg/kg					<240									<									
4Isopropyltoluene	<11µg/kg					<220									<									
Benzene	<9µg/kg	28000	14200			<180									<									
Bromobenzene	<10µg/kg		228000			<200									<									
Bromochloromethane	<14µg/kg					<280									<									
Bromodichloromethane	<7µg/kg		7710			<140									<									
Bromoform	<10µg/kg		644000			<200									<									
Bromomethane	<13µg/kg					<260									<									
Carbon Disulphide	<7µg/kg		303000			<140									14.7									
Carbontetrachloride	<14µg/kg	3000	22400			<280									<									
Chlorobenzene	<5µg/kg		4920000			<100									<									
Chloroethane	<14µg/kg		272000000			<280									<									
Chloroform	<8µg/kg	110000	457000			<160									<									
Chloromethane	<7µg/kg		17200			<140									<									
cis12Dichloroethene	<5µg/kg		89500			<100									<									
cis13Dichloropropene	<7µg/kg					<280									<14									
Dibromochloromethane	<13µg/kg		45000			<260									<									
Dibromomethane	<9µg/kg					<180									<									
Dichlorodifluoromethane	<4µg/kg					<80									<									
Dichloromethane	<10µg/kg		297000			<200									<									
Ethylbenzene	<3µg/kg	518000	10100000			<80									<4									
Hexachlorobutadiene	<12µg/kg					<240									<									
Isopropylbenzene	<5µg/kg		10000000			<100									<									
Methyl Tertiary Butyl Ether	<11µg/kg					<220									<									
Naphthalene	<13µg/kg		1010000			<260									<									
nButylbenzene	<10µg/kg					<200									<									
oXylene	<3µg/kg					<200									<10									
p/mXylene	<14µg/kg	312000	14500000			<280									<									
Propylbenzene	<11µg/kg		10400000			<220									<									
secButylbenzene	<10µg/kg					<200									<									
Styrene	<10µg/kg					<200									<									
Tertamyl methyl ether	<15µg/kg					<300									<									
tertButylbenzene	<12µg/kg					<240									<									
Tetrachloroethene	<5µg/kg	130000	982000			<100									<									
Toluene	<2µg/kg	869000	23500000			<100									<5									
trans12Dichloroethene	<11µg/kg		212000			<220									<									
trans13Dichloropropene	<14µg/kg					<280									<									
Trichloroethene	<9µg/kg	12000	88200			<180									<									
Trichlorofluorormethane	<6µg/kg					<120									<									
Vinyl Chloride	<10µg/kg	63	804			<200									<									
VOC TIC						No TICs identified									No TICs identified									

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Atkins Park Human Health GAC (mg/kg)	BH301A	BH301A	BH301A	BH302	BH302	BH302	BH303	BH303	BH303	BH304	BH304	BH304	BH305	BH305	BH306a	BH306a	BH306a	BH306a	BH306b	BH306b	BH306b
Depth (m)				0.2 0.3	0.6 1	4	2	5	8	0.2	1	3	0.3	2	4.2	0.3	4 4.5	2	5	7	9	1	2	4
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				15/05/2012	15/05/2012	15/05/2012	17/05/2012	17/05/2012	25/05/2012	09/05/2012	08/05/2012	08/05/2012	25/05/2012	25/05/2012	25/05/2012	24/05/2012	24/05/2012	01/05/2012	01/05/2012	04/05/2012	08/05/2012	24/04/2012	24/04/2012	24/04/2012
Sample Received Date				20/05/2012	20/05/2012	20/05/2012	20/05/2012	20/05/2012	30/05/2012	13/05/2012	13/05/2012	13/05/2012	30/05/2012	30/05/2012	30/05/2012	28/05/2012	28/05/2012	08/05/2012	08/05/2012	09/05/2012	13/05/2012	28/04/2012	28/04/2012	28/04/2012
SDG				1205201	1205201	1205201	1205201	1205201	12053071	12051311	12051311	12051311	12053071	12053071	12053071	12052825	12052825	12050829	12050829	12050946	12051311	12042854	12042854	12042854
Subcontracted: Organics Dioxins/Furans																								
1,2,3,4,6,7,8 HpCDD*	ng/kg				15					20														
1,2,3,4,6,7,8 HpCDF*	ng/kg				12					16														
1,2,3,4,7,8 HxCDD*	ng/kg				<2					<2														
1,2,3,4,7,8 HxCDF*	ng/kg				5.2					5.4														
1,2,3,4,7,8,9 HpCDF*	ng/kg				2.7					3.5														
1,2,3,6,7,8 HxCDD*	ng/kg				<2					3.6														
1,2,3,6,7,8 HxCDF*	ng/kg				5.1					6.1														
1,2,3,7,8 PeCDD*	ng/kg				<2					<2														
1,2,3,7,8 PeCDF*	ng/kg				2.6					2.9														
1,2,3,7,8,9 HxCDD*	ng/kg				<2					2.3														
1,2,3,7,8,9 HxCDF*	ng/kg				<2					3.1														
2,3,4,6,7,8 HxCDF*	ng/kg				4.4					8.7														
2,3,4,7,8 PeCDF*	ng/kg				4.1					3														
2,3,7,8 TCDD*	ng/kg				<2					<2														
2,3,7,8, TCDF*	ng/kg				4.8					<2														
IPCDD/FTEQ Lower Bound*	ng/kg				4.5					5														
IPCDD/FTEQ Upper Bound*	ng/kg				8.3					8.4														
OCDD*	ng/kg				23					38														
OCDF*	ng/kg				8.9					17														
Tolulene Extractable Matter	<500 mg/kg				<								<			<								
PCB's (Solids)																								
PCB congener 101	< 3 µg/kg			20.2	<					5.65														
PCB congener 118	< 3 µg/kg			11.1	<					3.03														
PCB congener 138	< 3 µg/kg			21.4	<					4.41														
PCB congener 153	< 3 µg/kg			19.5	<					3.28														
PCB congener 180	< 3 µg/kg			13.2	<					<														
PCB congener 28	< 3 µg/kg			15.5	<					7.1														
PCB congener 52	< 3 µg/kg			13	<					5.84														
PCBs, Total ICES 7	< 21 µg/kg			114	<					29.3														

Yellow and BOLD TEXT indicates value exceeding Atkins Park Human Health GAC

turquoise indicates value exceeds commercial GAC

Screen Unformatted Data

Screen Formatted Data

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

		Sample De	slag with green ruubble concrete	slag with white lime weathering and <1% refractory	slag	slag with channel iron and aluminium above	topsoil	slag with abundaent refractory brick	slag	processed slag with 5% plastic	processed slag	slag	slag	slag	slag and 10% scrap metal	slag with 3% scrap metal and occassional refractory	slag	slag	processed slag	slag with limecoating	slag with 50% refractory		slag with 1% refractory
Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH306b	BH307	BH307	BH307	BH308	BH308	BH309	BH310a	BH310a	BH310a	BH310a	BH310a	BH310b	BH310b	BH310b	BH310b	BH310c	BH310c	BH311	DUPLICATE 2	BH311
Depth (m)			6.5	0.6	2.5 3	7	0.3	0.7 0.9	5.50 6	1	3	4	6	9	5.4	2	5	8	0.6 0.8	4	0.5 0.6	sames as BH311 0.5 0.6	3.5
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			24/04/2012	21/05/2012	21/05/2012	29/05/2012	25/05/2012	25/05/2012	06/06/2012	24/04/2012	24/04/2012	24/04/2012	24/04/2012	01/05/2012	04/05/2012	04/05/2012	05/04/2012	10/05/2012	21/05/2012	22/05/2012	22/05/2012	23/05/2012	23/05/2012
Sample Received Date			28/04/2012	23/05/2012	23/05/2012	06/06/2012	30/05/2012	30/05/2012	11/06/2012	28/04/2012	28/04/2012	28/04/2012	28/04/2012	08/05/2012	09/05/2012	09/05/2012	05/09/2012	13/05/2012	23/05/2012	28/05/2012	28/05/2012	28/05/2012	28/05/2012
SDG			12042854	12052388	12052388	1206063	12053071	12053071	12061119	12042854	12042854	12042854	12042854	12050829	12050946	12050946	12050946	12051311	12052388	12052825	12052825	12052825	12052825
Sample Description																							
Colour			Dark Brown	Grey	Light Brown	Black	Light Brown	Dark Brown	Grey	Dark Brown	Dark Brown	Grey	Dark Brown	Black	Dark Brown	Black	Dark Brown	Black	Dark Brown	Black	Dark Brown	Dark Brown	Dark Brown
Description			Sandy Loam	N/A	N/A	Sand	Sandy Loam	Sand	Gravel	Loamy Sand	Sand	Gravel	Loamy Sand	Clinker	Gravel	N/A	N/A	Sand	Sand	Sand	Sand	Sand	Sand
Grain Size			0.1 2 mm	2 10 mm	2 10 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	2 10 mm	0.1 2 mm	0.1 2 mm	0.063 0.1 mm	0.1 2 mm	0.1 2 mm	2 10 mm	0.1 2 mm	0.1 2 mm	0.063 0.1 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.063 0.1 mm	0.1 2 mm
Inclusion 1)			Stones	Ash/Soot	Stones	Stones	Stones	Stones	Oil/Petroleum	Stones	Stones	Stones	Stones	N/A	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones
Inclusion 2)			None	Stones	None	N/A	None	None	N/A	Fibres	None	Stones	None	N/A	N/A	N/A	N/A	N/A	None	N/A	N/A	N/A	N/A
Moisture content ratio	%		1.4	2.5	2.7	3.7	12	13	4.3	8.9	6.9		15	4.9		5.3	7.4	2.8	3.7	6.4	7.6	6.6	11
Laboratory data																							
2Butanone	<100 µg/kg																						
Acetone	< 50 µg/kg																						
Chloride (soluble)	<5mg/kg		1440	15.3	1190	2570	57.7	64.1	1660	202	293		4180	1000		45.5	1980	1690	55.3	1850	58.4	72.1	3610
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l		0.056	<0.008	<0.008	0.294	0.0168	0.232	0.149	0.126	0.0493		0.586	0.274		<0.008	0.223	0.454	<0.008	0.293	0.108	0.0683	0.679
Carbon																							
Fraction Organic Carbon (FOC)	<0.1					<		<								<	<			<	<	<	<
Fraction Organic Carbon (FOC)	<0.002			<	<		0.00931												0.00429				
Inorganics																							
Ammoniacal Nitrogen as N	<15mg/kg		<	16.7	<	<	<	<	<	<	<		<	<		<	<	<	102	<	<	<	<
Cyanide, Complex	<1 mg/kg		<	<	<	<	<	<	<	<	<		<	<		<	<	<	<	<	<	<	<
Cyanide, Free	<1 mg/kg	36	<	<	<	<	<	<	<	<	<		<	<		<	<	<	<	<	<	<	<
Cyanide, Total	<1 mg/kg		<	<	<	<	<	<	<	<	<		<	<		<	<	<	<	<	<	<	<
pH	1 pH Units		10.8	11.7	9.3	10.9	7.29	11.9	11.1	11.9	12.4		11.2	10		12.7	11.4	10.8	11.7	11.6	11.6	11.7	10.1
Sulphate, Total	<0.008 mg/kg		4140	1210	2670	6510	244	3750	4570	2700	5490		6050	3700		2050	5870	5580	1660	2150	2580	2920	5870
Sulphide, Easily liberated	<15mg/kg		<	<	<	<	<	<	<	<	<		<	<		<	<	18.9	<	<	<	<	<
Sulphur, Total	<0.02%			0.109	0.197		0.0298		0.302										0.13				
Sulphur, Total	<0.0016%		0.138	0.0403	0.0888	0.217	0.00813	0.125		0.09	0.183		0.202	0.123		0.0683	0.196	0.186	0.0552	0.0718	0.0859	0.0974	0.196
Thiocyanate	<1 mg/kg		<	<	<	<	<	<	<	<	<		<	<		<	<	<	<	<	<	<	<
Metals																							
Aluminium	<11 mg/kg		23100	33400	29800	21300	12600	8310	15000	15000	21800		18800	22000		16500	26800	22400	21600	19200	958	7820	9400
Antimony	<0.6 mg/kg		153	86.7	86.1	33.2	2.32	19.2	21.1	76.3	31		104	35.1		28.9	29.5	28.5	82.5	26.7	5.02	27.8	14
Arsenic	<0.6 mg/kg	640	<6	<6	<6	27.8	17.3	33.4	21.6	19.2	6.06		18.1	27.6		39.9	29.2	32.9	<6	15.9	3.47	37.7	21.8
Barium	<0.6 mg/kg		678	876	878	830	42.5	383	917	558	813		722	944		566	1040	701	786	1080	48.2	344	399
Beryllium	<0.01 mg/kg	420	<0.1	1.7	0.556	<0.05	0.44	0.127	<0.05	0.232	<0.1		0.106	<0.1		0.224	<0.1	<0.25	0.114	0.191	<	<0.05	0.262
Boron, water soluble	<1 mg/kg	192000	4.62	2.42	6.03	7.08	<	4.44	3.4	6.39	1.66		9.58	7.39		2.61	5.71	5.08	4.03	8.76	4.79	6.32	11.3
Cadmium	<0.2 mg/kg	230	<	<	<	0.357	0.627	4.1	4.38	1.51	2.08		<	2.28		3.75	2.85	4.88	0.854	3.19	0.636	10.3	2.41
Calcium	<21mg/kg		242000	264000	245000	243000	2610	101000	166000	152000	249000		156000	238000		146000	227000	236000	221000	177000	91600	67700	117000
Chromium	<0.9 mg/kg	30400	6380	3930	3700	4650	41.3	801	2240	2830	5880		4110	6150		2810	4790	4140	3510	3490	143	996	1100
Chromium, Hexavalent	<0.6 mg/kg	35	<	1.98	<	<	<	0.929	<	9.32	3.89		<	<		6.4	1.55	<	2.63	0.701	2.25	2.23	<
Copper	<1.4 mg/kg	71700	290	175	244	524	75.8	431	215	592	274		552	529		979	667	1040	286	474	44.7	491	160
Lead	<0.7 mg/kg	4640	72.1	34.2	38.8	20.8	66.8	**542**	264	**504**	42.7		277	54		138	152	78.2	220	282	108	**1270**	292
Magnesium	<8mg/kg		41000	29300	25800	26800	3130	99900	50800	78700	31400		48900	33700		19300	50100	23900	41300	64700	178000	254000	53200
Manganese	<0.13 mg/kg		38000	44300	39600	35700	1320	18000	39500	28900	3680		39500	35600		19600	25100	31700	34500	61900	1780	10700	23100
Mercury	<0.14 mg/kg	3640	<	<	<	<0.7	<	<0.7	<0.7	<	<		<	<		<	<	<0.7	<	<0.7	<	<0.7	<0.7
Nickel	<0.2 mg/kg	1800	65.9	32.2	37	211	37.5	131	91.1	217	56.3		146	173		294	174	215	118	102	10.3	93.9	56.8
Selenium	<1 mg/kg	13000	26.6	27.6	22.8	17.4	<	8.42	15.1	12.8	19.5		16.2	19.9		14.8	17.6	<25	26.9	25.8	<	6.16	9.27
Vanadium	<0.2 mg/kg	3160	**470**	**503**	**442**	332	24.1	251	**581**	244	**438**		332	**521**		300	**543**	**431**	361	342	21.6	144	243
Zinc	<1.9mg/kg	665000	779	143	226	374	213	2020	1440	2160	204		784	295		651	591	169	631	418	1070	13200	731
Phenols																							
2,3,5 TrimethylPhenol	<0.01 mg/kg		<	<	<	<	<	<	<	<	<		<	<		<	<	<	<	<	<	<	<
2Isopropyl Phenol	<0.015 mg/kg		<	<	<	<	<	<	<	<	<		<	<		<	<	<	<	<	<	<	<
Cresols	<0.01 mg/kg		<	<	<	<	<	<	<	<	<		<	<		<	<	<	<	<	<	<	<
Phenol	<0.01 mg/kg	482	<	<	<	<	<	<	<	<	<		<	<		0.0106	<	<	<	<	<	<	<
Phenols, Total 5 speciated	<0.06 mg/kg		<	<	<	<	<	<	<	<	<		<	<		<	<	<	<	<	<	<	<
Phenols, Total monohydric	<0.035 mg/kg		<	<	<	<	<	<	<	<	<		<	<		<	<	<	<	<	<	<	<
Xylenols	<0.015 mg/kg		<	<	<	<	<	<	<	<	<		<	<		<	<	<	<	<	<	<	<
Mineral Oil / Oils & Greases									<														
Mineral oil >C10C40	<1 mg/kg											23.6											
% Surrogate Recovery	%											79.4											
Surrogate Value												39.7											

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH306b	BH307	BH307	BH307	BH308	BH308	BH309	BH310a	BH310a	BH310a	BH310a	BH310a	BH310b	BH310b	BH310b	BH310b	BH310c	BH310c	BH311	DUPLICATE 2	BH311
Depth (m)			6.5	0.6	2.5 3	7	0.3	0.7 0.9	5.50 6	1	3	4	6	9	5.4	2	5	8	0.6 0.8	4	0.5 0.6	sames as BH311 0.5 0.6	3.5
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			24/04/2012	21/05/2012	21/05/2012	29/05/2012	25/05/2012	25/05/2012	06/06/2012	24/04/2012	24/04/2012	24/04/2012	24/04/2012	01/05/2012	04/05/2012	04/05/2012	05/04/2012	10/05/2012	21/05/2012	22/05/2012	22/05/2012	23/05/2012	23/05/2012
Sample Received Date			28/04/2012	23/05/2012	23/05/2012	06/06/2012	30/05/2012	30/05/2012	11/06/2012	28/04/2012	28/04/2012	28/04/2012	28/04/2012	08/05/2012	09/05/2012	09/05/2012	05/09/2012	13/05/2012	23/05/2012	28/05/2012	28/05/2012	28/05/2012	28/05/2012
SDG			12042854	12052388	12052388	1206063	12053071	12053071	12061119	12042854	12042854	12042854	12042854	12050829	12050946	12050946	12050946	12051311	12052388	12052825	12052825	12052825	12052825
TPH Criteria Working Group (TPH CWG)																							
Aliphatics >C5C6	<10µg/kg	3400000										<											
Aliphatics >C6C8	<10µg/kg	8300000										<											
Aliphatics >C8C10	<10µg/kg	2100000										<											
Aliphatics >C10C12	<10µg/kg	10000000										<											
Aliphatics >C12C16	<100µg/kg	61000000										5540											
Aliphatics >C16C21	<100µg/kg	1000000000										20900											
Aliphatics >C21C35	<100µg/kg	1000000000										52400											
Aliphatics >C35C44	<100µg/kg											18200											
Aromatics >EC5EC7	<10µg/kg	28000										<											
Aromatics >EC7EC8	<10µg/kg	59000000										<											
Aromatics >EC8EC10	<10µg/kg	3700000										<											
Aromatics >EC10EC12	<10µg/kg	17000000										<											
Aromatics >EC12EC16	<100µg/kg	36000000										8950											
Aromatics >EC16EC21	<100µg/kg	28000000										3080											
Aromatics >EC21EC35	<100µg/kg	28000000										<											
Aromatics >EC35EC44	<100µg/kg											<											
Aromatics >EC40EC44	<100µg/kg											<											
Total Aliphatics >C535	<100µg/kg											78800											
Total Aromatics >C535	<100µg/kg											12000											
Total Aliphatics & Aromatics >C5C44	<100µg/kg											109000											
Methyl tertiary butyl ether (MTBE)	<5µg/kg											<											
Benzene	<10µg/kg	28000										<											
Ethylbenzene	<3µg/kg	518000										<											
m,p,oXylene	<9 µg/kg											<											
m,pXylene	<6µg/kg	312000										<											
oXylene	<3µg/kg											<											
Toluene	<2µg/kg	869000										<											
BTEX, Total	<24µg/kg											<											
Rapid PAH Screen																							
Polyaromatic hydrocarbons, Total 17	<10mg/kg		<	<	<	<	<	<	<	<	<		<	<		<	<	<	``	<	<	<	<
SemiVolatile Organic Compounds (SVOCs)																							
1,2,4Trichlorobenzene	<100µg/kg											<											
1,2Dichlorobenzene	<100µg/kg											<											
1,3Dichlorobenzene	<100µg/kg											<											
1,4Dichlorobenzene	<100µg/kg											<											
2,4,5Trichlorophenol	<100µg/kg											<											
2,4,6Trichlorophenol (S)	<100µg/kg											<											
2,4Dichlorophenol (S)	<100µg/kg											<											
2,4Dimethylphenol (S)	<100µg/kg											<											
2,4Dinitrotoluene (S)	<100µg/kg											<											
2,6Dinitrotoluene	<100µg/kg											<											
2Chloronaphthalene	<100µg/kg											<											
2Chlorophenol (S)	<100µg/kg											<											
2Methylnaphthalene	<100µg/kg											<											
2Methylphenol	<100µg/kg											<											
2Nitroaniline (S)	<100µg/kg											<											
2Nitrophenol (S)	<100µg/kg											<											
3Nitroaniline	<100µg/kg											<											
4Bromophenylphenylether	<100µg/kg											<											
4Chloro3methylphenol (S)	<100µg/kg											<											
4Chloroaniline	<100µg/kg											<											
4Chlorophenylphenylether	<100µg/kg											<											
4Methylphenol (S)	<100µg/kg											<											
4Nitroaniline	<100µg/kg											<											
4Nitrophenol (S)	<100µg/kg											<											
Acenaphthene	<100µg/kg	85000000										<											
Acenaphthylene	<100µg/kg	84000000										<											
Anthracene	<100µg/kg	530000000										<											
Azobenzene	<100µg/kg											<											
Benzo(a)anthracene	<100µg/kg	90000										<											
Benzo(a)pyrene	<100µg/kg	14000										<											
Benzo(b)fluoranthene	<100µg/kg	100000										<											
Benzo(g,h,i)perylene	<100µg/kg	650000										<											
Benzo(k)fluoranthene	<100µg/kg	140000										<											
Bis(2chloroethoxy)methane	<100µg/kg											<											
bis(2Chloroethyl)ether	<100µg/kg											<											
bis(2Ethylhexyl) phthalate	<100µg/kg											<											
Butylbenzyl phthalate	<100µg/kg											<											
Carbazole	<100µg/kg											<											
Chrysene	<100µg/kg	140000										<											
Dibenzo(a,h)anthracene	<100µg/kg	13000										<											
Dibenzofuran	<100µg/kg											<											
Diethyl phthalate	<100µg/kg											<											
Dimethyl phthalate	<100µg/kg											<											
Fluoranthene	<100µg/kg	23000000										<											
Fluorene	<100µg/kg	64000000										<											
Hexachlorobenzene	<100µg/kg											<											
Hexachlorobutadiene	<100µg/kg											<											
Hexachlorocyclopentadiene	<100µg/kg											<											
Hexachloroethane	<100µg/kg											<											
Indeno(1,2,3cd)pyrene	<100µg/kg	60000										<											
Isophorone	<100µg/kg											<											
Naphthalene	<100µg/kg	200000										<											
nDibutyl phthalate	<100µg/kg											<											
nDioctyl phthalate	<100µg/kg											<											
Nitrobenzene	<100µg/kg											<											
nNitrosondipropylamine	<100µg/kg											<											
Pentachlorophenol	<100µg/kg											<											
Phenanthrene	<100µg/kg	22000000										<											
Phenol	<100µg/kg	482										<											
Pyrene	<100µg/kg	54000000										<											
Tic Report												No TICs identified											

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH306b	BH307	BH307	BH307	BH308	BH308	BH309	BH310a	BH310a	BH310a	BH310a	BH310a	BH310b	BH310b	BH310b	BH310b	BH310c	BH310c	BH311	DUPLICATE 2	BH311
Depth (m)			6.5	0.6	2.5 3	7	0.3	0.7 0.9	5.50 6	1	3	4	6	9	5.4	2	5	8	0.6 0.8	4	0.5 0.6	sames as BH311 0.5 0.6	3.5
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			24/04/2012	21/05/2012	21/05/2012	29/05/2012	25/05/2012	25/05/2012	06/06/2012	24/04/2012	24/04/2012	24/04/2012	24/04/2012	01/05/2012	04/05/2012	04/05/2012	05/04/2012	10/05/2012	21/05/2012	22/05/2012	22/05/2012	23/05/2012	23/05/2012
Sample Received Date			28/04/2012	23/05/2012	23/05/2012	06/06/2012	30/05/2012	30/05/2012	11/06/2012	28/04/2012	28/04/2012	28/04/2012	28/04/2012	08/05/2012	09/05/2012	09/05/2012	05/09/2012	13/05/2012	23/05/2012	28/05/2012	28/05/2012	28/05/2012	28/05/2012
SDG			12042854	12052388	12052388	1206063	12053071	12053071	12061119	12042854	12042854	12042854	12042854	12050829	12050946	12050946	12050946	12051311	12052388	12052825	12052825	12052825	12052825
Volatile Organic Compounds (VOCs) (Solids)																							
1.1.1.2Tetrachloroethane	<10µg/kg	120000										<											
1.1.1Trichloroethane	<7µg/kg	700000										<											
1.1.2.2Tetrachloroethane	<10µg/kg	290000										<											
1.1.2Trichloroethane	<10µg/kg											<											
1.1Dichloroethane	<8µg/kg											<											
1.1Dichloroethene	<10µg/kg											<											
1.1Dichloropropene	<10µg/kg											<11											
1.2.3Trichlorobenzene	<6µg/kg											<											
1.2.3Trichloropropane	<17µg/kg											<											
1.2.4Trichlorobenzene	<6µg/kg											<											
1.2.4Trimethylbenzene	<9µg/kg											<											
1.2Dibromo3chloropropane	<14µg/kg											<											
1.2Dibromoethane	<12µg/kg											<											
1.2Dichlorobenzene	<12µg/kg											<											
1.2Dichloroethane	<5µg/kg	710										<											
1.2Dichloropropane	<12µg/kg											<											
1.3.5Trimethylbenzene	<8µg/kg											<											
1.3Dichlorobenzene	<6µg/kg											<											
1.3Dichloropropane	<7µg/kg											<											
1.4Dichlorobenzene	<5µg/kg											<											
2.2Dichloropropane	<12µg/kg											<											
2Chlorotoluene	<9µg/kg											<											
4Chlorotoluene	<12µg/kg											<											
4Isopropyltoluene	<11µg/kg											<											
Benzene	<9µg/kg	28000										<											
Bromobenzene	<10µg/kg											<											
Bromochloromethane	<14µg/kg											<											
Bromodichloromethane	<7µg/kg											<											
Bromoform	<10µg/kg											<											
Bromomethane	<13µg/kg											<											
Carbon Disulphide	<7µg/kg											<											
Carbontetrachloride	<14µg/kg	3000										<											
Chlorobenzene	<5µg/kg											<											
Chloroethane	<14µg/kg											<											
Chloroform	<8µg/kg	110000										<											
Chloromethane	<7µg/kg											<											
cis12Dichloroethene	<5µg/kg											<											
cis13Dichloropropene	<7µg/kg											<14											
Dibromochloromethane	<13µg/kg											<											
Dibromomethane	<9µg/kg											<											
Dichlorodifluoromethane	<4µg/kg											<											
Dichloromethane	<10µg/kg											<											
Ethylbenzene	<3µg/kg	518000										<4											
Hexachlorobutadiene	<12µg/kg											<12											
Isopropylbenzene	<5µg/kg											<											
Methyl Tertiary Butyl Ether	<11µg/kg											<											
Naphthalene	<13µg/kg											<											
nButylbenzene	<10µg/kg											<											
oXylene	<3µg/kg											<10											
p/mXylene	<14µg/kg	312000										<											
Propylbenzene	<11µg/kg											<											
secButylbenzene	<10µg/kg											<											
Styrene	<10µg/kg											<											
Tertamyl methyl ether	<15µg/kg											<											
tertButylbenzene	<12µg/kg											<											
Tetrachloroethene	<5µg/kg	130000										<											
Toluene	<2µg/kg	869000										<											
trans12Dichloroethene	<11µg/kg											<											
trans13Dichloropropene	<14µg/kg											<											
Trichloroethene	<9µg/kg	12000										<											
Trichlorofluorormethane	<6µg/kg											<											
Vinyl Chloride	<10µg/kg	63										<											
VOC TIC												No TICs identified											

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH306b	BH307	BH307	BH307	BH308	BH308	BH309	BH310a	BH310a	BH310a	BH310a	BH310a	BH310b	BH310b	BH310b	BH310b	BH310c	BH310c	BH311	DUPLICATE 2	BH311
Depth (m)			6.5	0.6	2.5 3	7	0.3	0.7 0.9	5.50 6	1	3	4	6	9	5.4	2	5	8	0.6 0.8	4	0.5 0.6	sames as BH311 0.5 0.6	3.5
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			24/04/2012	21/05/2012	21/05/2012	29/05/2012	25/05/2012	25/05/2012	06/06/2012	24/04/2012	24/04/2012	24/04/2012	24/04/2012	01/05/2012	04/05/2012	04/05/2012	05/04/2012	10/05/2012	21/05/2012	22/05/2012	22/05/2012	23/05/2012	23/05/2012
Sample Received Date			28/04/2012	23/05/2012	23/05/2012	06/06/2012	30/05/2012	30/05/2012	11/06/2012	28/04/2012	28/04/2012	28/04/2012	28/04/2012	08/05/2012	09/05/2012	09/05/2012	05/09/2012	13/05/2012	23/05/2012	28/05/2012	28/05/2012	28/05/2012	28/05/2012
SDG			12042854	12052388	12052388	1206063	12053071	12053071	12061119	12042854	12042854	12042854	12042854	12050829	12050946	12050946	12050946	12051311	12052388	12052825	12052825	12052825	12052825
Subcontracted: Organics Dioxins/Furans																							
1,2,3,4,6,7,8 HpCDD*	ng/kg																						
1,2,3,4,6,7,8 HpCDF*	ng/kg																						
1,2,3,4,7,8 HxCDD*	ng/kg																						
1,2,3,4,7,8 HxCDF*	ng/kg																						
1,2,3,4,7,8,9 HpCDF*	ng/kg																						
1,2,3,6,7,8 HxCDD*	ng/kg																						
1,2,3,6,7,8 HxCDF*	ng/kg																						
1,2,3,7,8 PeCDD*	ng/kg																						
1,2,3,7,8 PeCDF*	ng/kg																						
1,2,3,7,8,9 HxCDD*	ng/kg																						
1,2,3,7,8,9 HxCDF*	ng/kg																						
2,3,4,6,7,8 HxCDF*	ng/kg																						
2,3,4,7,8 PeCDF*	ng/kg																						
2,3,7,8 TCDD*	ng/kg																						
2,3,7,8, TCDF*	ng/kg																						
IPCDD/FTEQ Lower Bound*	ng/kg																						
IPCDD/FTEQ Upper Bound*	ng/kg																						
OCDD*	ng/kg																						
OCDF*	ng/kg																						
Tolulene Extractable Matter	<500 mg/kg			<	<	<	<		<										<				
PCB's (Solids)																							
PCB congener 101	< 3 µg/kg																						
PCB congener 118	< 3 µg/kg																						
PCB congener 138	< 3 µg/kg																						
PCB congener 153	< 3 µg/kg																						
PCB congener 180	< 3 µg/kg																						
PCB congener 28	< 3 µg/kg																						
PCB congener 52	< 3 µg/kg																						
PCBs, Total ICES 7	< 21 µg/kg																						

Yellow and BOLD TEXT indicates value exceeding Atkins Park Human Health GAC
turquoise indicates value exceeds commercial GAC

Screen Unformatted Data

Screen Formatt

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

		Sample De	sludge	50% steel wire concrete, red brick and fabric/ 50% cream ash with possible refractory in a clayey sandy gravel	iridscent black sludge surrounded by old barrel	50% sludge, 25% steel wire concrete, red brick and fabric, 25% cream ash possible refractory	millscale with some scrap metal/ occassional amount of refractory brick and minute amount of household waste	millscale	scrap metals with refractory bricks, sands, gravels, black demolition waste and steel barrels with tar inside	scrap metals with refractory bricks, sands, gravels, balck demolition waste and steel barrels with tar inside	slag with cream white slag, 15% wate steel, 5% demolition waste and 1% plastic waste	slag with 5% waste steel, 2,5% refractory and 0.5% oplastic	slag with 20% waste steel and 5% demolition	slag with 12% refractories	slag	processed slag	slag with pockets of black material, many pieces of wire, metal (30%)	slag with 50% demolition waste (plastic, textile, red brick, concrete and refractory		demolition waste: wood, glass, concrete, glass bottles, red brick, oil filters	slag 20% waste steel and <2% household plastic waste
Sample Identity			BH312a	BH312a	BH312a	BH312a	BH312b	BH312b	BH312b	BH312b	BH312c	BH312c	BH312c	BH313	BH313	BH314	BH314	BH314	DUPLICATE 1	BH314	BH315
Depth (m)	LoD/Units	TSV for Commercial / Industrial Use	0.50.6	2-2.1	3.6-3.8	5.00-5.10	1	2.5	4.5	5	1	2.3	3.5	2	5	0 0.5	2.2	3.2	same as BH314 3.2m	5.3	1
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			24/04/2012	24/04/2012	24/04/2012	24/04/2012	30/04/2012	30/04/2012	30/04/2012	30/04/2012	10/05/2012	10/05/2012	10/05/2012	16/05/2012	16/05/2012	24/04/2012	24/04/2012	27/04/2012	27/04/2012	27/04/2012	18/05/2012
Sample Received Date			28/04/2012	28/04/2012	28/04/2012	28/04/2012	03/05/2012	03/05/2012	03/05/2012	03/05/2012	13/05/2012	13/05/2012	13/05/2012	20/05/2012	20/05/2012	28/04/2012	28/04/2012	03/05/2012	03/05/2012	03/05/2012	23/05/2012
SDG			12042854	12042854	12042854	12042854	12050370	12050370	12050370	12050370	12051311	12051311	12051311	Schedule #6	Schedule #6	12042854	12042854	12050370	12050370	12050370	12052388
Sample Description																					
Colour			Dark Brown	Grey	Black	Dark Brown	Dark Brown	Dark Brown	Black	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Grey	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Black	Dark Brown
Description			Loamy Sand	Sand	Sandy Loam	Gravel	Loamy Sand	Loamy Sand	N/A	Sand	Sand	Sand	Sand	Sand	Gravel	Sand	Loamy Sand	Loamy Sand	Loamy Sand	N/A	Sand
Grain Size			0.1 2 mm	0.1 2 mm	0.1 2 mm	2 10 mm	0.063 0.1 mm	0.063 0.1 mm	<0.063 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.063 0.1 mm	0.1 2 mm	2 10 mm	0.1 2 mm	0.1 2 mm	0.063 0.1 mm	0.063 0.1 mm	0.1 2 mm	0.1 2 mm
Inclusion 1)			Stones	Stones	Stones	Stones	Metal	Tile	Tar	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Brick	Stones
Inclusion 2)			None	None	None	None	Stones	Stones	N/A	Vegetation	N/A	N/A	N/A	Vegetation	N/A	None	None	Metal	Tile	Stones	N/A
Moisture content ratio	%		10	14	41		7.8	6.6		14	5.7	8.4	13	9.5	11	5.7	15	9.6	8.2	15	5.1
Laboratory data																					
2Butanone	<100 µg/kg																				
Acetone	< 50 µg/kg																				
Chloride (soluble)	<5mg/kg		164	168	19300		87.6	683		2960	130	1000	3130	787	1740	111	400	1300	1340	3280	104
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l		0.0389	0.462	3.97		0.101	0.0648		0.409	0.0819	0.0571	0.635	0.129	<0.008	<0.008	0.153	0.153	0.15	0.479	<0.008
Carbon																					
Fraction Organic Carbon (FOC)	<0.1			<0.1				<		<			<	<	<			<		<	<
Fraction Organic Carbon (FOC)	<0.002						0.00788				0.00338								0.00756		
Inorganics																					
Ammoniacal Nitrogen as N	<15mg/kg		<	<	<		<	<		<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Complex	<1 mg/kg		<	<	<		<	<		<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Free	<1 mg/kg	36	<	<	<		<	<		<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Total	<1 mg/kg		<	<	<		<	<		<	<	<	<	<	<	<	<	<	<	<	<
pH	1 pH Units		8.96	11.6	9.12		12.4	12.3		10.4	12.3	11.4	9.07	11.9	11.4	12.6	9.17	9.5	9.09	9	11.1
Sulphate, Total	<0.008 mg/kg		1260	11400	22100		2570	2070		3910	1960	2000	4090	4960	2700	2060	1980	878	1090	2590	1290
Sulphide, Easily liberated	<15mg/kg		<	<	11800		<	<		269	<	<	282	<	<	<	<	<	<	39.4	<
Sulphur, Total	<0.02%		0.109				0.101				0.128								0.12		
Sulphur, Total	<0.0016%		0.042	0.381	0.737		0.0856	0.0689		0.13		0.0668	0.136	0.165	0.0899	0.0688	0.066	0.0293	0.0363	0.0864	0.043
Thiocyanate	<1 mg/kg		<	<	<		<	<		<	<	<	<	<	<	<	<	<	<	<	<
Metals																					
Aluminium	<11 mg/kg		9030	10100	5400		7120	6860		8110	11900	15300	9070	12400	27200	22800	8480	1920	2930	9620	27800
Antimony	<0.6 mg/kg		35.1	36.8	37.9		69.4	59.8		56.2	21.6	36.1	75.1	48.3	82.8	20.7	50.6	49.2	38.9	42.5	29.8
Arsenic	<0.6 mg/kg	640	26.5	16.8	**95.6**		**81.20**	**115**		**47.7**	**51.6**	**70.2**	**97.7**	36.1	6.23	9.65	**90.5**	**119**	**69.6**	**48.5**	10.6
Barium	<0.6 mg/kg		405	587	87.9		212	148		374	337	409	331	483	804	712	271	36.6	66.2	253	863
Beryllium	<0.01 mg/kg	420	1.98	0.26	0.946		1.12	1.78		0.905	<0.1	<0.25	1.21	0.521	<	<0.1	<0.1	2.64	2.31	0.888	<0.1
Boron, water soluble	<1 mg/kg	192000	1.23	10.9	11.5		6.81	6.37		4.39	1.47	3.05	4.09	6.78	3.39	3.33	2.05	2.63	1.58	5.59	3.29
Cadmium	<0.2 mg/kg	230	5.75	5.39	21.6		**95.9**	12.1		2.2	7	9.53	71.6	8.42	0.731	2.68	5	<	<	14.3	16.3
Calcium	<21mg/kg		75100	103000	80900		61400	77900		105000	128000	106000	50600	99000	249000	201000	53500	11000	23400	85900	227000
Chromium	<0.9 mg/kg	30400	801	1040	415		1190	872		1630	781	1470	877	1400	3720	3240	5100	697	740	1080	3130
Chromium, Hexavalent	<0.6 mg/kg	35	1.08	<	<		4.68	<		<	1.4	<	<	2.85	<	1.91	3.48	<	<	<	1.12
Copper	<1.4 mg/kg	71700	735	417	718		1680	2340		916	1470	1300	2010	453	329	347	4020	2810	1280	931	495
Lead	<0.7 mg/kg	4640	**1140**	**1250**	**3090**		**5480**	**1300**		**478**	217	378	**5770**	**941**	136	188	**497**	184	137	**2130**	**1590**
Magnesium	<8mg/kg		13000	158000	30200		37800	39200		51900	47300	19100	29400	30400	26400	20200	5350	2990	3490	13400	26400
Manganese	<0.13 mg/kg		16700	13200	2540		11700	7370		10200	16700	18300	9470	15600	4660	3310	10400	4590	5620	13000	37100
Mercury	<0.14 mg/kg	3640	<	<	<		<	<		<	<	<0.7	<	<1.4	<1.4	<	<	<	<	<	<
Nickel	<0.2 mg/kg	1800	199	131	211		472	701		290	308	410	513	150	76.5	91.2	**2860**	750	472	293	162
Selenium	<1 mg/kg	13000	<10	10.5	<10		<10	<10		10.8	<10	<25	<10	12	29.8	18.9	<10	<10	<10	<10	21.6
Vanadium	<0.2 mg/kg	3160	70.6	118	46.6		63.9	42.9		195	97.9	126	55.5	189	**451**	356	121	25.3	40.3	97.7	**498**
Zinc	<1.9mg/kg	665000	4670	2770	12300		31200	6730		2200	1580	2250	37900	3030	742	1500	879	801	563	9310	5910
Phenols																					
2,3,5 TrimethylPhenol	<0.01 mg/kg		<	<	<		<	<		<	<	<	<	<	<	<	<	<	<	<	<
2Isopropyl Phenol	<0.015 mg/kg		<	<	<		<	<		<	<	<	<	<	<	<	<	<	<	<	<
Cresols	<0.01 mg/kg		<	<	<		<	<		<	<	<	<	<	<	<	<	<	<	<	<
Phenol	<0.01 mg/kg	482	<	<	<		<	<		<	0.0106	<	<	<	<	<	<	<	<	<	<
Phenols, Total 5 speciated	<0.06 mg/kg		<	<	<		<	<		<	<	<	<	<	<	<	<	<	<	<	<
Phenols, Total monohydric	<0.035 mg/kg		<	<	<						<	<	<	<	<	<	<				<
Xylenols	<0.015 mg/kg		<	<	<		<	<		<	<	<	<	<	<	<	<	<	<	<	<
Mineral Oil / Oils & Greases																					
Mineral oil >C10C40	<1 mg/kg				1730	2380				699		278	769					210		333	
% Surrogate Recovery	%				88.7	84.7				73.2		78.3	79.2					77.4		87	
Surrogate Value					44.4	42.3				36.6		39.1	39.6					38.7		43.5	

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH312a	BH312a	BH312a	BH312a	BH312b	BH312b	BH312b	BH312b	BH312c	BH312c	BH312c	BH313	BH313	BH314	BH314	BH314	DUPLICATE 1	BH314	BH315
Depth (m)			0.50.6	2-2.1	3.6-3.8	5.00-5.10	1	2.5	4.5	5	1	2.3	3.5	2	5	0 0.5	2.2	3.2	same as BH314 3.2m	5.3	1
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			24/04/2012	24/04/2012	24/04/2012	24/04/2012	30/04/2012	30/04/2012	30/04/2012	30/04/2012	10/05/2012	10/05/2012	10/05/2012	16/05/2012	16/05/2012	24/04/2012	24/04/2012	27/04/2012	27/04/2012	27/04/2012	18/05/2012
Sample Received Date			28/04/2012	28/04/2012	28/04/2012	28/04/2012	03/05/2012	03/05/2012	03/05/2012	03/05/2012	13/05/2012	13/05/2012	13/05/2012	20/05/2012	20/05/2012	28/04/2012	28/04/2012	03/05/2012	03/05/2012	03/05/2012	23/05/2012
SDG			12042854	12042854	12042854	12042854	12050370	12050370	12050370	12050370	12051311	12051311	12051311	Schedule #6	Schedule #6	12042854	12042854	12050370	12050370	12050370	12052388
TPH Criteria Working Group (TPH CWG)																					
Aliphatics >C5C6	<10µg/kg	3400000			10.9	84.7				<		<	20.7					<		<	
Aliphatics >C6C8	<10µg/kg	8300000			63.4	578				48.6		13.1	77.1					<		13.4	
Aliphatics >C8C10	<10µg/kg	2100000			496	2120				204		21.8	54.1					<		20.7	
Aliphatics >C10C12	<10µg/kg	10000000			737	2200				256		111	93.2					<		57.1	
Aliphatics >C12C16	<100µg/kg	61000000			46600	93100				12800		2920	7930					5980		4430	
Aliphatics >C16C21	<100µg/kg	1000000000			231000	372000				82100		21900	72200					25000		25500	
Aliphatics >C21C35	<100µg/kg	1000000000			1250000	1060000				484000		163000	447000					132000		209000	
Aliphatics >C35C44	<100µg/kg				478000	313000				196000		61000	162000					36800		65500	
Aromatics >EC5EC7	<10µg/kg	28000			<	<				<		<	<					<		<	
Aromatics >EC7EC8	<10µg/kg	59000000			<	19.7				<		<	<					<		<	
Aromatics >EC8EC10	<10µg/kg	3700000			329	1450				136		17.5	48.3					<		15.8	
Aromatics >EC10EC12	<10µg/kg	17000000			491	1470				171		74.2	62.1					<		38.9	
Aromatics >EC12EC16	<100µg/kg	36000000			26700	75900				5660		1690	6110					2430		<	
Aromatics >EC16EC21	<100µg/kg	28000000			150000	207000				37000		10200	41600					8620		14300	
Aromatics >EC21EC35	<100µg/kg	28000000			663000	683000				198000		82800	235000					51700		118000	
Aromatics >EC35EC44	<100µg/kg				313000	358000				98300		50500	116000					24000		61400	
Aromatics >EC40EC44	<100µg/kg				132000	155000				43000		20900	46900					10100		26000	
Total Aliphatics >C535	<100µg/kg				1530000	1530000				580000		187000	528000					163000		239000	
Total Aromatics >C535	<100µg/kg				841000	969000				241000		94700	282000					62800		132000	
Total Aliphatics & Aromatics >C5C44	<100µg/kg				3160000	3170000				1110000		394000	1090000					286000		498000	
Methyl tertiary butyl ether (MTBE)	<5µg/kg				<	<				<		<	<					<		<	
Benzene	<10µg/kg	28000			<	<				<		<	<					<		<	
Ethylbenzene	<3µg/kg	518000			<	39.4				<		<	3.45					<		<	
m,p,oXylene	<9 µg/kg				<	<				<		<	10.4					<		<	
m,pXylene	<6µg/kg	312000			<	<				<		<	6.9					<		<	
oXylene	<3µg/kg				<	<				<		<	3.45					<		<	
Toluene	<2µg/kg	869000			<	19.7				<		<	<					<		<	
BTEX, Total	<24µg/kg				<	59.1				<		<	<					<		<	
Rapid PAH Screen																					
Polyaromatic hydrocarbons, Total 17	<10mg/kg		<	<	70		<	<		<	<	<	<	13.3	<	<	<	<	<	<	<
SemiVolatile Organic Compounds (SVOCs)																					
1,2,4Trichlorobenzene	<100µg/kg				<	<				<		<	<					<		<	
1,2Dichlorobenzene	<100µg/kg				<	<				<		<	<					<		<	
1,3Dichlorobenzene	<100µg/kg				<	<				<		<	<					<		<	
1,4Dichlorobenzene	<100µg/kg				<	<				<		<	<					<		<	
2,4,5Trichlorophenol	<100µg/kg				<	<				<		<	<					<		<	
2,4,6Trichlorophenol (S)	<100µg/kg				<	<				<		<	<					<		<	
2,4Dichlorophenol (S)	<100µg/kg				<	<				<		<	<					<		<	
2,4Dimethylphenol (S)	<100µg/kg				<	<				<		<	<					<		<	
2,4Dinitrotoluene (S)	<100µg/kg				<	<				<		<	<					<		<	
2,6Dinitrotoluene	<100µg/kg				<	<				<		<	<					<		<	
2Chloronaphthalene	<100µg/kg				<	<				<		<	<					<		<	
2Chlorophenol (S)	<100µg/kg				<	<				<		<	<					<		<	
2Methylnaphthalene	<100µg/kg				<	1890				<		<	<					<		<	
2Methylphenol	<100µg/kg				<	<				<		<	<					<		<	
2Niitroaniline (S)	<100µg/kg				<	<				<		<	<					<		<	
2Nitrophenol (S)	<100µg/kg				<	<				<		<	<					<		<	
3Nitroaniline	<100µg/kg				<	<				<		<	<					<		<	
4Bromophenylphenylether	<100µg/kg				<	<				<		<	<					<		<	
4Chloro3methylphenol (S)	<100µg/kg				<	<				<		<	<					<		<	
4Chloroaniline	<100µg/kg				<	<				<		<	<					<		<	
4Chlorophenylphenylether	<100µg/kg				<	<				<		<	<					<		<	
4Methylphenol (S)	<100µg/kg				<	<				<		<	<					<		<	
4Nitroaniline	<100µg/kg				<	<				<		<	<					<		<	
4Nitrophenol (S)	<100µg/kg				<	<				<		<	<					<		<	
Acenaphthene	<100µg/kg	85000000			292	164				<		<	<					<		<	
Acenaphthylene	<100µg/kg	84000000			<	<				<		<	<					<		<	
Anthracene	<100µg/kg	530000000			1690	241				169		<	<					<		<	
Azobenzene	<100µg/kg				<	<				<		<	<					<		<	
Benzo(a)anthracene	<100µg/kg	90000			4320	372				415		<	<					<		279	
Benzo(a)pyrene	<100µg/kg	14000			3650	306				368		<	<					<		274	
Benzo(b)fluoranthene	<100µg/kg	100000			2840	259				303		<	133					<		236	
Benzo(g,h,i)perylene	<100µg/kg	650000			1890	181				226		<	139					<		193	
Benzo(k)fluoranthene	<100µg/kg	140000			2950	218				287		<	<					<		240	
Bis(2chloroethoxy)methane	<100µg/kg				<	<				<		<	<					<		<	
bis(2Chloroethyl)ether	<100µg/kg				<	<				<		<	<					<		<	
bis(2Ethylhexyl) phthalate	<100µg/kg				1260	<				294		<	452					<		<	
Butylbenzyl phthalate	<100µg/kg				<	<				<		<	<					<		<	
Carbazole	<100µg/kg				247	<				<		<	<					<		<	
Chrysene	<100µg/kg	140000			4070	549				578		<	159					<		312	
Dibenzo(a,h)anthracene	<100µg/kg	13000			438	<				<		<	<					<		<	
Dibenzofuran	<100µg/kg				200	156				<		<	<					<		<	
Diethyl phthalate	<100µg/kg				<	<				<		<	<					<		<	
Dimethyl phthalate	<100µg/kg				<	<				<		<	<					<		<	
Fluoranthene	<100µg/kg	23000000			10500	753				809		<	213					126		550	
Fluorene	<100µg/kg	64000000			359	332				<		<	<					<		<	
Hexachlorobenzene	<100µg/kg				<	<				<		<	<					<		<	
Hexachlorobutadiene	<100µg/kg				<	<				<		<	<					<		<	
Hexachlorocyclopentadiene	<100µg/kg				<	<				<		<	<					<		<	
Hexachloroethane	<100µg/kg				<	<				<		<	<					<		<	
Indeno(1,2,3cd)pyrene	<100µg/kg	60000			1660	137				217		<	<					<		148	
Isophorone	<100µg/kg				<	<				<		<	<					<		<	
Naphthalene	<100µg/kg	200000			<	733				204		<	<					<		<	
nDibutyl phthalate	<100µg/kg				<	<				2290		<	<					<		<	
nDioctyl phthalate	<100µg/kg				<	<				<		<	2200					<		<	
Nitrobenzene	<100µg/kg				<	<				<		<	<					<		<	
nNitrosondipropylamine	<100µg/kg				<	<				<		<	<					<		<	
Pentachlorophenol	<100µg/kg				<	<				<		<	<					<		<	
Phenanthrene	<100µg/kg	22000000			5280	1500				786		<	140					<		237	
Phenol	<100µg/kg	482			<	<				<		<	<					<		<	
Pyrene	<100µg/kg	54000000			8640	745				752		<	170					<		446	
Tic Report					See Attached	See Attached				See Attached		See Attached	See Attached					No TICs identified		No TICs identified	

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH312a	BH312a	BH312a	BH312a	BH312b	BH312b	BH312b	BH312b	BH312c	BH312c	BH312c	BH313	BH313	BH314	BH314	BH314	DUPLICATE 1 same as BH314 3.2m	BH314	BH315
Depth (m)			0.50.6	2-2.1	3.6-3.8	5.00-5.10	1	2.5	4.5	5	1	2.3	3.5	2	5	0 0.5	2.2	3.2		5.3	1
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			24/04/2012	24/04/2012	24/04/2012	24/04/2012	30/04/2012	30/04/2012	30/04/2012	30/04/2012	10/05/2012	10/05/2012	10/05/2012	16/05/2012	16/05/2012	24/04/2012	24/04/2012	27/04/2012	27/04/2012	27/04/2012	18/05/2012
Sample Received Date			28/04/2012	28/04/2012	28/04/2012	28/04/2012	03/05/2012	03/05/2012	03/05/2012	03/05/2012	13/05/2012	13/05/2012	13/05/2012	20/05/2012	20/05/2012	28/04/2012	28/04/2012	03/05/2012	03/05/2012	03/05/2012	23/05/2012
SDG			12042854	12042854	12042854	12042854	12050370	12050370	12050370	12050370	12051311	12051311	12051311	Schedule #6	Schedule #6	12042854	12042854	12050370	12050370	12050370	12052388
Volatile Organic Compounds (VOCs) (Solids)																					
1.1.1.2Tetrachloroethane	<10µg/kg	120000			<200	<20				<		<200	<					<		<	
1.1.1Trichloroethane	<7µg/kg	700000			<140	<14				<		<140	<					<		<	
1.1.2.2Tetrachloroethane	<10µg/kg	290000			<200	<20				<		<200	<					<		<	
1.1.2Trichloroethane	<10µg/kg				<200	<20				<		<200	<					<		<	
1.1Dichloroethane	<8µg/kg				<160	<16				<		<160	<					<		<	
1.1Dichloroethene	<10µg/kg				<200	<20				<		<200	<					<		<	
1.1Dichloropropene	<10µg/kg				<220	<22				<11		<220	<11					<11		<11	
1.2.3Trichlorobenzene	<6µg/kg				<120	<12				<		<120	<					<		<	
1.2.3Trichloropropane	<17µg/kg				<340	<34				<		<340	<					<		<	
1.2.4Trichlorobenzene	<6µg/kg				<120	<12				<		<120	<					<		<	
1.2.4Trimethylbenzene	<9µg/kg				<180	227				<		<180	<					<		<	
1.2Dibromo3chloropropane	<14µg/kg				<280	<28				<		<280	<					<		<	
1.2Dibromoethane	<12µg/kg				<240	<24				<		<240	<					<		<	
1.2Dichlorobenzene	<12µg/kg				<240	<24				<		<240	<					<		<	
1.2Dichloroethane	<5µg/kg	710			<100	<10				<		<100	<					<		<	
1.2Dichloropropane	<12µg/kg				<240	<24				<		<240	<					<		<	
1.3.5Trimethylbenzene	<8µg/kg				<160	59.6				<		<160	<					<		<	
1.3Dichlorobenzene	<6µg/kg				<120	<12				<		<120	<					<		<	
1.3Dichloropropane	<7µg/kg				<140	<14				<		<140	<					<		<	
1.4Dichlorobenzene	<5µg/kg				<100	<10				<		<100	<					<		<	
2.2Dichloropropane	<12µg/kg				<240	<24				<		<240	<					<		<	
2Chlorotoluene	<9µg/kg				<180	<18				<		<180	<					<		<	
4Chlorotoluene	<12µg/kg				<240	<24				<		<240	<					<		<	
4Isopropyltoluene	<11µg/kg				<220	<22				<		<220	<					<		<	
Benzene	<9µg/kg	28000			<180	<18				<		<180	<					<		<	
Bromobenzene	<10µg/kg				<200	<20				<		<200	<					<		<	
Bromochloromethane	<14µg/kg				<280	<28				<		<280	<					<		<	
Bromodichloromethane	<7µg/kg				<140	<14				<		<140	<					<		<	
Bromoform	<10µg/kg				<200	<20				<		<200	<					<		<	
Bromomethane	<13µg/kg				<260	<26				<		<260	<					<		<	
Carbon Disulphide	<7µg/kg				2050	121				59.7		<140	25.4					<		32.3	
Carbontetrachloride	<14µg/kg	3000			<280	<28				<		<280	<					<		<	
Chlorobenzene	<5µg/kg				<100	<10				<		<100	<					<		<	
Chloroethane	<14µg/kg				<280	<28				<		<280	<					<		<	
Chloroform	<8µg/kg	110000			<160	<16				<		<160	<					<		<	
Chloromethane	<7µg/kg				562	<14				<		<140	<					<		<	
cis12Dichloroethene	<5µg/kg				<100	<10				<		<100	<					<		<	
cis13Dichloropropene	<7µg/kg				<280	<28				<14		<280	<14					<14		<14	
Dibromochloromethane	<13µg/kg				<260	<26				<		<260	<					<		<	
Dibromomethane	<9µg/kg				<180	<18				<		<180	<					<		<	
Dichlorodifluoromethane	<4µg/kg				<80	<8				<		<80	<					<		<	
Dichloromethane	<10µg/kg				<200	<20				<		<200	<					<		<	
Ethylbenzene	<3µg/kg	518000			194	<8				<4		<80	<4					<4		<4	
Hexachlorobutadiene	<12µg/kg				<240	<24				<		<240	<12					<12		<12	
Isopropylbenzene	<5µg/kg				<100	11.8				<		<100	<					<		<	
Methyl Tertiary Butyl Ether	<11µg/kg				<220	<22				<		<220	<					<		<	
Naphthalene	<13µg/kg				<260	1210				<		<260	<					<		<	
nButylbenzene	<10µg/kg				<200	<20				<		<200	<					<		<	
oXylene	<3µg/kg				<200	32.2				<		<200	<10					<10		<10	
p/mXylene	<14µg/kg	312000			<280	51.1				<		<280	<					<		<	
Propylbenzene	<11µg/kg				<220	<22				<		<220	<					<		<	
secButylbenzene	<10µg/kg				<200	23.9				<		<200	<					<		<	
Styrene	<10µg/kg				<200	<20				<		<200	<					<		<	
Tertamyl methyl ether	<15µg/kg				<300	<30				<		<300	<					<		<	
tertButylbenzene	<12µg/kg				<240	<24				<		<240	<					<		<	
Tetrachloroethene	<5µg/kg	130000			<100	<10				<		<100	<					<		<	
Toluene	<2µg/kg	869000			<100	<10				<5		<100	<5					<5		<	
trans12Dichloroethene	<11µg/kg				<220	<22				<		<220	<					<		<	
trans13Dichloropropene	<14µg/kg				<280	<28				<		<280	<					<		<	
Trichloroethene	<9µg/kg	12000			<180	<18				<		<180	<					<		<	
Trichlorofluorormethane	<6µg/kg				<120	<12				<		<120	<					<		<	
Vinyl Chloride	<10µg/kg	63			<200	<20				<		<200	<					<		<	
VOC TIC					No TICs identified	See Attached				No TICs identified		No TICs identified	No TICs identified					No TICs identified		No TICs identified	

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH312a	BH312a	BH312a	BH312a	BH312b	BH312b	BH312b	BH312b	BH312c	BH312c	BH312c	BH313	BH313	BH314	BH314	BH314	DUPLICATE 1	BH314	BH315
Depth (m)			0.50.6	2-2.1	3.6-3.8	5.00-5.10	1	2.5	4.5	5	1	2.3	3.5	2	5	0 0.5	2.2	3.2	same as BH314 3.2m	5.3	1
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			24/04/2012	24/04/2012	24/04/2012	24/04/2012	30/04/2012	30/04/2012	30/04/2012	30/04/2012	10/05/2012	10/05/2012	10/05/2012	16/05/2012	16/05/2012	24/04/2012	24/04/2012	27/04/2012	27/04/2012	27/04/2012	18/05/2012
Sample Received Date			28/04/2012	28/04/2012	28/04/2012	28/04/2012	03/05/2012	03/05/2012	03/05/2012	03/05/2012	13/05/2012	13/05/2012	13/05/2012	20/05/2012	20/05/2012	28/04/2012	28/04/2012	03/05/2012	03/05/2012	03/05/2012	23/05/2012
SDG			12042854	12042854	12042854	12042854	12050370	12050370	12050370	12050370	12051311	12051311	12051311	Schedule #6	Schedule #6	12042854	12042854	12050370	12050370	12050370	12052388
Subcontracted: Organics Dioxins/Furans																					
1,2,3,4,6,7,8 HpCDD*	ng/kg																				
1,2,3,4,6,7,8 HpCDF*	ng/kg																				
1,2,3,4,7,8 HxCDD*	ng/kg																				
1,2,3,4,7,8 HxCDF*	ng/kg																				
1,2,3,4,7,8,9 HpCDF*	ng/kg																				
1,2,3,6,7,8 HxCDD*	ng/kg																				
1,2,3,6,7,8 HxCDF*	ng/kg																				
1,2,3,7,8 PeCDD*	ng/kg																				
1,2,3,7,8 PeCDF*	ng/kg																				
1,2,3,7,8,9 HxCDD*	ng/kg																				
1,2,3,7,8,9 HxCDF*	ng/kg																				
2,3,4,6,7,8 HxCDF*	ng/kg																				
2,3,4,7,8 PeCDF*	ng/kg																				
2,3,7,8 TCDD*	ng/kg																				
2,3,7,8, TCDF*	ng/kg																				
IPCDD/FTEQ Lower Bound*	ng/kg																				
IPCDD/FTEQ Upper Bound*	ng/kg																				
OCDD*	ng/kg																				
OCDF*	ng/kg																				
Tolulene Extractable Matter	<500 mg/kg		<				1400				3400								700		
PCB's (Solids)																					
PCB congener 101	< 3 µg/kg																				
PCB congener 118	< 3 µg/kg																				
PCB congener 138	< 3 µg/kg																				
PCB congener 153	< 3 µg/kg																				
PCB congener 180	< 3 µg/kg																				
PCB congener 28	< 3 µg/kg																				
PCB congener 52	< 3 µg/kg																				
PCBs, Total ICES 7	< 21 µg/kg																				

Yellow and BOLD TEXT indicates value exceeding Atkins Park Human Health GAC
turquoise indicates value exceeds commercial GAC

Screen Unformatted Data

Screen Formatt

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

		Sample De	slag with HC odour	slag	slag	slag with 10% metal waste and 5% naval domestic waste	slag	slag with 20% millscale	slag	flue sludge	milscale	slag
Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH315	BH315	BH316	BH316	BH316	OP10	OP10	OP10	OP14	OP14
Depth (m)			3	6	0.2 0.5	4	5 5.5	0.8	1.1	2	1.1-1.60	1.7
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			18/05/2012	22/05/2012	06/06/2012	06/06/2012	11/06/2012	05/06/2012	05/06/2012	05/06/2012	07/06/2012	07/06/2012
Sample Received Date			23/05/2012	28/05/2012			13/06/2012	06/06/2012	06/06/2012	06/06/2012	08/06/2012	08/06/2012
SDG			12052388	12052825	12061119	12061119	12061381	1206067	1206067	1206067	12061119	12061119
Sample Description												
Colour			Grey	Black	Black	Grey	Dark Brown	Black	Grey	Dark Brown	Black	Grey
Description			Sand	Sand	Sand	Gravel	Sand	Sand	Sand	Silt Loam	N/A	Loamy Sand
Grain Size			0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.063 0.1 mm	0.1 2 mm	0.1 2 mm
Inclusion 1)			Stones	Stones	Stones	Concrete/Aggregate	Ash/Soot	Stones	Stones	N/A	N/A	Concrete/Aggregate
Inclusion 2)			N/A	N/A	Oil/Petroleum	Crushed Brick	Stones	N/A	N/A	N/A	N/A	Stones
Moisture content ratio	%		8.7	5.2	11	5.3	3.7	4.7	5.6	32	5.1	11
Laboratory data												
2Butanone	<100 µg/kg				<			<	<	<	<	<
Acetone	< 50 µg/kg				113			<	<	<	<	<
Chloride (soluble)	<5mg/kg		1960	1420	4480	2200	1740	9.05	299	536	15.1	152
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l		0.313	0.279	0.467	<0.008	0.0369	0.0182	0.0523	1.55	0.0511	0.258
Carbon												
Fraction Organic Carbon (FOC)	<0.1		<	<1								
Fraction Organic Carbon (FOC)	<0.002											
Inorganics												
Ammoniacal Nitrogen as N	<15mg/kg		<	<	<	<	<	<	<	<	<	<
Cyanide, Complex	<1 mg/kg		<	<	<	<	<	<	<	<	<	<
Cyanide, Free	<1 mg/kg	36	<	<	<	<	<	<	<	<	<	<
Cyanide, Total	<1 mg/kg		<	<	<	<	<	<	<	<	<	<
pH	1 pH Units		9.95	11.1	9.06	9.7	10	9.15	11.3	11.4	8.97	10.6
Sulphate, Total	<0.008 mg/kg		6730	5470	3740	6950	5080	156	3480	6340	346	5570
Sulphide, Easily liberated	<15mg/kg		<	<	<	<	<15	<	<	<	<	<
Sulphur, Total	<0.02%							0.0325	0.214	0.254		
Sulphur, Total	<0.0016%		0.224	0.182	0.125	0.232				0.211	0.0115	0.186
Thiocyanate	<1 mg/kg		<	<	<	<	<1	<	<	<	<	<
Metals												
Aluminium	<11 mg/kg		21700	2040	1700	130000	19700	632	27500	5170	470	3320
Antimony	<0.6 mg/kg		32.1	7.97	30.4	<15	19.3	34.2	26.9	130	32	3.72
Arsenic	<0.6 mg/kg	640	11	<0.06	**80**	<15	23	**62.9**	13.8	**75.2**	**45.2**	4.38
Barium	<0.6 mg/kg		860	74.2	333	54.8	622	17.5	947	559	<15	119
Beryllium	<0.01 mg/kg	420	<0.1	<	<0.25	0.76	<0.05	<0.25	<0.05	<0.25	<0.25	<0.05
Boron, water soluble	<1 mg/kg	192000	13.9	4.7	2.5	2.59	3.77	<	1.23	<	<	2.63
Cadmium	<0.2 mg/kg	230	2.25	0.114	8.94	<0.5	4	17.7	2.75	**553**	0.811	0.544
Calcium	<21mg/kg		216000	167000	51000	173000	188000	2330	189000	24200	1450	132000
Chromium	<0.9 mg/kg	30400	4220	351	854	34.6	2140	592	3880	3280	1140	369
Chromium, Hexavalent	<0.6 mg/kg	35	0.882	<	<	<	<0.6	0.835	0.657	8.6	<	<
Copper	<1.4 mg/kg	71700	290	33.6	1390	<35	397	1510	287	3460	1800	66.5
Lead	<0.7 mg/kg	4640	127	29.3	**425**	37.3	289	**966**	165	**41700**	39.4	38.5
Magnesium	<8mg/kg		48300	63200	24000	48800	58300	410	39400	13900	1590	52300
Manganese	<0.13 mg/kg		45300	11300	2700	274	29800	5560	70800	46200	27300	40000
Mercury	<0.14 mg/kg	3640	<	<	<0.7	<3.5	<0.7	<3.5	<0.7	<3.5	<3.5	<0.7
Nickel	<0.2 mg/kg	1800	64.7	8.09	379	37	103	505	72.2	236	537	20.8
Selenium	<1 mg/kg	13000	21.2	2.02	<25	<25	16.9	<25	22.5	<25	<25	<5
Vanadium	<0.2 mg/kg	3160	421	28.7	77.3	48.8	169	11.8	**423**	123	26.2	62.8
Zinc	<1.9mg/kg	665000	709	95.2	2460	140	1740	4410	1090	**189000**	562	215
Phenols												
2,3,5 TrimethylPhenol	<0.01 mg/kg		<	<	<	<	<	<	<	0.0146	<	<
2Isopropyl Phenol	<0.015 mg/kg		<	<	<	<	<	<	<	<	<	<
Cresols	<0.01 mg/kg		<	<	<	<	<	<	<	<	<	<
Phenol	<0.01 mg/kg	482	<	<	0.0113	<	0.0104	<	<	<	<	<
Phenols, Total 5 speciated	<0.06 mg/kg		<	<	<	<	<	<	<	<	<	<
Phenols, Total monohydric	<0.035 mg/kg		<	<	<	<	<	<	<	<	<	<
Xylenols	<0.015 mg/kg		<	<	<	<	<	<	<	<	<	<
Mineral Oil / Oils & Greases												
Mineral oil >C10C40	<1 mg/kg		89.7		1760			57	68.8	95.7	195	925
% Surrogate Recovery	%		89.3		72.4			78.2	82.3	79.9	85.2	73.3
Surrogate Value			44.7		36.2			39.1	41.2	39.9	42.6	36.6

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH315	BH315	BH316	BH316	BH316	OP10	OP10	OP10	OP14	OP14
Depth (m)			3	6	0.2 0.5	4	5 5.5	0.8	1.1	2	1.1-1.60	1.7
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			18/05/2012	22/05/2012	06/06/2012	06/06/2012	11/06/2012	05/06/2012	05/06/2012	05/06/2012	07/06/2012	07/06/2012
Sample Received Date			23/05/2012	28/05/2012			13/06/2012	06/06/2012	06/06/2012	06/06/2012	08/06/2012	08/06/2012
SDG			12052388	12052825	12061119	12061119	12061381	1206067	1206067	1206067	12061119	12061119
TPH Criteria Working Group (TPH CWG)												
Aliphatics >C5C6	<10µg/kg	3400000	<		99.4			<	<	<	<	<
Aliphatics >C6C8	<10µg/kg	8300000	<		415			<	<	<	<	19
Aliphatics >C8C10	<10µg/kg	2100000	<		235			<	<	<	<	409
Aliphatics >C10C12	<10µg/kg	10000000	<10		113			<	<	<	<	375
Aliphatics >C12C16	<100µg/kg	61000000	<100		6650			1430	<	<	<	68300
Aliphatics >C16C21	<100µg/kg	1000000000	8430		45300			3770	2160	4680	5380	79200
Aliphatics >C21C35	<100µg/kg	1000000000	64200		1220000			38000	36200	67900	148000	617000
Aliphatics >C35C44	<100µg/kg		15700		814000			19000	6680	17100	45700	221000
Aromatics >EC5EC7	<10µg/kg	28000	<		<			<	<	<	<	<
Aromatics >EC7EC8	<10µg/kg	59000000	<		<			<	<	<	<	<
Aromatics >EC8EC10	<10µg/kg	3700000	<		159			<	<	<	<	272
Aromatics >EC10EC12	<10µg/kg	17000000	<		74.6			<	<	<	<	251
Aromatics >EC12EC16	<100µg/kg	36000000	<		5300			<	<	<	<	11200
Aromatics >EC16EC21	<100µg/kg	28000000	4520		20000			1020	1190	3190	1890	30700
Aromatics >EC21EC35	<100µg/kg	28000000	24200		544000			4650	9250	28600	49800	190000
Aromatics >EC35EC44	<100µg/kg		14200		575000			3430	4770	9350	26100	99600
Aromatics >EC40EC44	<100µg/kg		6070		310000			1060	1960	3420	10200	41200
Total Aliphatics >C535	<100µg/kg		72600		1270000			43200	38400	72600	153000	765000
Total Aromatics >C535	<100µg/kg		28800		569000			5670	10400	31800	51700	232000
Total Aliphatics & Aromatics >C5C44	<100µg/kg		131000		3230000			71300	60300	131000	277000	1320000
Methyl tertiary butyl ether (MTBE)	<5µg/kg		<		<			<	<	<	<	<
Benzene	<10µg/kg	28000	<		<			<	<	<	<	<
Ethylbenzene	<3µg/kg	518000	<		<			<	<	<	<	<
m,p,oXylene	<9 µg/kg		<		<			<	<	<	<	<
m,pXylene	<6µg/kg	312000	<		<			<	<	<	<	<
oXylene	<3µg/kg		<		<			<	<	<	<	<
Toluene	<2µg/kg	869000	<		<			<	<	<	<	<
BTEX, Total	<24µg/kg		<		<			<	<	<	<	<
Rapid PAH Screen												
Polyaromatic hydrocarbons, Total 17	<10mg/kg		<	<	<	<	<	<	<	<	<	<
SemiVolatile Organic Compounds (SVOCs)												
1,2,4Trichlorobenzene	<100µg/kg		<		<			<	<	<	<	<
1,2Dichlorobenzene	<100µg/kg		<		<			<	<	<	<	<
1,3Dichlorobenzene	<100µg/kg		<		<			<	<	<	<	<
1,4Dichlorobenzene	<100µg/kg		<		<			<	<	<	<	<
2,4,5Trichlorophenol	<100µg/kg		<		<			<	<	<	<	<
2,4,6Trichlorophenol (S)	<100µg/kg		<		<			<	<	<	<	<
2,4Dichlorophenol (S)	<100µg/kg		<		<			<	<	<	<	<
2,4Dimethylphenol (S)	<100µg/kg		<		<			<	<	<	<	<
2,4Dinitrotoluene (S)	<100µg/kg		<		<			<	<	<	<	<
2,6Dinitrotoluene	<100µg/kg		<		<			<	<	<	<	<
2Chloronaphthalene	<100µg/kg		<		<			<	<	<	<	<
2Chlorophenol (S)	<100µg/kg		<		<			<	<	<	<	<
2Methylnaphthalene	<100µg/kg		<		<			<	<	<	<	<
2Methylphenol	<100µg/kg		<		<			<	<	<	<	<
2Niitroaniline (S)	<100µg/kg		<		<			<	<	<	<	<
2Nitrophenol (S)	<100µg/kg		<		<			<	<	<	<	<
3Nitroaniline	<100µg/kg		<		<			<	<	<	<	<
4Bromophenylphenylether	<100µg/kg		<		<			<	<	<	<	<
4Chloro3methylphenol (S)	<100µg/kg		<		<			<	<	<	<	<
4Chloroaniline	<100µg/kg		<		<			<	<	<	<	<
4Chlorophenylphenylether	<100µg/kg		<		<			<	<	<	<	<
4Methylphenol (S)	<100µg/kg		<		<			<	<	<	<	<
4Nitroaniline	<100µg/kg		<		<			<	<	<	<	<
4Nitrophenol (S)	<100µg/kg		<		<			<	<	<	<	<
Acenaphthene	<100µg/kg	85000000	<		<			<	<	<	<	<
Acenaphthylene	<100µg/kg	84000000	<		<			<	<	<	<	<
Anthracene	<100µg/kg	530000000	<		<			<	<	<	<	<
Azobenzene	<100µg/kg		<		<			<	<	<	<	<
Benzo(a)anthracene	<100µg/kg	90000	<		<			<	<	<	<	124
Benzo(a)pyrene	<100µg/kg	14000	<		<			<	<	<	<	116
Benzo(b)fluoranthene	<100µg/kg	100000	<		<			<	<	<	<	116
Benzo(g,h,i)perylene	<100µg/kg	650000	<		<			<	<	<	<	<
Benzo(k)fluoranthene	<100µg/kg	140000	<		<			<	<	<	<	<
Bis(2chloroethoxy)methane	<100µg/kg		<		<			<	<	<	<	<
bis(2Chloroethyl)ether	<100µg/kg		<		<			<	<	<	<	<
bis(2Ethylhexyl) phthalate	<100µg/kg		<		<			<	<	274	<	241
Butylbenzyl phthalate	<100µg/kg		<		<			<	<	<	<	<
Carbazole	<100µg/kg		<		<			<	<	<	<	<
Chrysene	<100µg/kg	140000	<		<			<	<	<	<	164
Dibenzo(a,h)anthracene	<100µg/kg	13000	<		<			<	<	<	<	<
Dibenzofuran	<100µg/kg		<		<			<	<	<	<	<
Diethyl phthalate	<100µg/kg		<		<			<	<	<	<	<
Dimethyl phthalate	<100µg/kg		<		<			<	<	<	<	<
Fluoranthene	<100µg/kg	23000000	<		<			<	<	148	<	225
Fluorene	<100µg/kg	64000000	<		<			<	<	<	<	<
Hexachlorobenzene	<100µg/kg		<		<			<	<	<	<	<
Hexachlorobutadiene	<100µg/kg		<		<			<	<	<	<	<
Hexachlorocyclopentadiene	<100µg/kg		<		<			<	<	<	<	<
Hexachloroethane	<100µg/kg		<		<			<	<	<	<	<
Indeno(1,2,3cd)pyrene	<100µg/kg	60000	<		<			<	<	<	<	<
Isophorone	<100µg/kg		<		<			<	<	<	<	<
Naphthalene	<100µg/kg	200000	<		<			<	<	<	<	<
nDibutyl phthalate	<100µg/kg		<		<			<	<	<	<	<
nDioctyl phthalate	<100µg/kg		<		<			<	<	<	<	<
Nitrobenzene	<100µg/kg		<		<			<	<	<	<	<
nNitrosondipropylamine	<100µg/kg		<		<			<	<	<	<	<
Pentachlorophenol	<100µg/kg		<		<			<	<	<	<	<
Phenanthrene	<100µg/kg	22000000	<		<			<	<	<	<	128
Phenol	<100µg/kg	482	<		<			<	<	<	<	<
Pyrene	<100µg/kg	54000000	<		<			<	<	<	<	194
Tic Report			No TICs identified		See Attached			No TICs identified	No TICs identified	No TICs identified	No TICs identified	No TICs identified

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH315	BH315	BH316	BH316	BH316	OP10	OP10	OP10	OP14	OP14
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Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			18/05/2012	22/05/2012	06/06/2012	06/06/2012	11/06/2012	05/06/2012	05/06/2012	05/06/2012	07/06/2012	07/06/2012
Sample Received Date			23/05/2012	28/05/2012			13/06/2012	06/06/2012	06/06/2012	06/06/2012	08/06/2012	08/06/2012
SDG			12052388	12052825	12061119	12061119	12061381	1206067	1206067	1206067	12061119	12061119
Volatile Organic Compounds (VOCs) (Solids)												
1.1.1.2Tetrachloroethane	<10µg/kg	120000	<		<200			<	<200	<	<	<
1.1.1Trichloroethane	<7µg/kg	700000	<		<140			<	<140	<	<	<
1.1.2.2Tetrachloroethane	<10µg/kg	290000	<		<200			<	<200	<	<	<
1.1.2Trichloroethane	<10µg/kg		<		<200			<	<200	<	<	<
1.1Dichloroethane	<8µg/kg		<		<160			<	<160	<	<	<
1.1Dichloroethene	<10µg/kg		<		<200			<	<200	<	<	<
1.1Dichloropropene	<10µg/kg		<11		<220			<11	<220	<11	<11	<11
1.2.3Trichlorobenzene	<6µg/kg		<		<120			<	<120	<	<	<
1.2.3Trichloropropane	<17µg/kg		<		<340			<	<340	<	<	<
1.2.4Trichlorobenzene	<6µg/kg		<		<120			<	<120	<	<	<
1.2.4Trimethylbenzene	<9µg/kg		<		<180			<	<180	<	<	<
1.2Dibromo3chloropropane	<14µg/kg		<		<280			<	<280	<	<	<
1.2Dibromoethane	<12µg/kg		<		<240			<	<240	<	<	<
1.2Dichlorobenzene	<12µg/kg		<		<240			<	<240	<	<	<
1.2Dichloroethane	<5µg/kg	710	<		<100			<	<100	<	<	<
1.2Dichloropropane	<12µg/kg		<		<240			<	<240	<	<	<
1.3.5Trimethylbenzene	<8µg/kg		<		<160			<	<160	<	<	<
1.3Dichlorobenzene	<6µg/kg		<		<120			<	<120	<	<	<
1.3Dichloropropane	<7µg/kg		<		<140			<	<140	<	<	<
1.4Dichlorobenzene	<5µg/kg		<		<100			<	<100	<	<	<
2.2Dichloropropane	<12µg/kg		<		<240			<	<240	<	<	<
2Chlorotoluene	<9µg/kg		<		<180			<	<180	<	<	<
4Chlorotoluene	<12µg/kg		<		<240			<	<240	<	<	<
4Isopropyltoluene	<11µg/kg		<		<220			<	<220	<	<	<
Benzene	<9µg/kg	28000	<		<180			<	<180	<	<	<
Bromobenzene	<10µg/kg		<		<200			<	<200	<	<	<
Bromochloromethane	<14µg/kg		<		<280			<	<280	<	<	<
Bromodichloromethane	<7µg/kg		<		<140			<	<140	<	<	<
Bromoform	<10µg/kg		<		<200			<	<200	<	<	<
Bromomethane	<13µg/kg		<		<260			<	<260	<	<	<
Carbon Disulphide	<7µg/kg		<		372			<	<140	<	<	<
Carbontetrachloride	<14µg/kg	3000	<		<280			<	<280	<	<	<
Chlorobenzene	<5µg/kg		<		<100			<	<100	<	<	<
Chloroethane	<14µg/kg		<		<280			<	<280	<	<	<
Chloroform	<8µg/kg	110000	<		<160			<	<160	<	<	<
Chloromethane	<7µg/kg		<		<140			<	<140	<	<	<
cis12Dichloroethene	<5µg/kg		<		<100			<	<100	<	<	<
cis13Dichloropropene	<7µg/kg		<14		<280			<14	<280	<14	<14	<14
Dibromochloromethane	<13µg/kg		<		<260			<	<260	<	<	<
Dibromomethane	<9µg/kg		<		<180			<	<180	<	<	<
Dichlorodifluoromethane	<4µg/kg		<		<80			<	<80	<	<	<
Dichloromethane	<10µg/kg		<		<200			<	<200	<	<	<
Ethylbenzene	<3µg/kg	518000	<4		<80			<4	<80	<4	<4	<4
Hexachlorobutadiene	<12µg/kg		<12		<240			<	<240	<	<	<
Isopropylbenzene	<5µg/kg		<		<100			<	<100	<	<	<
Methyl Tertiary Butyl Ether	<11µg/kg		<		<220			<	<220	<	<	<
Naphthalene	<13µg/kg		<		<260			<	420	40.4	<	26.7
nButylbenzene	<10µg/kg		<		<200			<	<200	<	<	<
oXylene	<3µg/kg		<10		<200			<10	<200	<10	<10	<10
p/mXylene	<14µg/kg	312000	<		<280			<	<280	<	<	<
Propylbenzene	<11µg/kg		<		<220			<	<220	<	<	<
secButylbenzene	<10µg/kg		<		<200			<	<200	<	<	<
Styrene	<10µg/kg		<		<200			<	<200	<	<	<
Tertamyl methyl ether	<15µg/kg		<		<300			<	<300	<	<	<
tertButylbenzene	<12µg/kg		<		<240			<	<240	<	<	<
Tetrachloroethene	<5µg/kg	130000	<		<100			<	<100	<	<	<
Toluene	<2µg/kg	869000	<5		<100			<5	<100	<5	<5	<5
trans12Dichloroethene	<11µg/kg		<		<220			<	<220	<	<	<
trans13Dichloropropene	<14µg/kg		<		<280			<	<280	<	<	<
Trichloroethene	<9µg/kg	12000	<		<180			<	<180	<	<	<
Trichlorofluorormethane	<6µg/kg		<		<120			<	<120	<	<	<
Vinyl Chloride	<10µg/kg	63	<		<200			<	<200	<	<	<
VOC TIC			No TICs identified		No TICs identified			No TICs identified	No TICs identified	No TICs identified	No TICs identified	No TICs identified

East Tip 2012 Borehole Solid Waste Samples, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH315	BH315	BH316	BH316	BH316	OP10	OP10	OP10	OP14	OP14
Depth (m)			3	6	0.2 0.5	4	5 5.5	0.8	1.1	2	1.1-1.60	1.7
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			18/05/2012	22/05/2012	06/06/2012	06/06/2012	11/06/2012	05/06/2012	05/06/2012	05/06/2012	07/06/2012	07/06/2012
Sample Received Date			23/05/2012	28/05/2012			13/06/2012	06/06/2012	06/06/2012	06/06/2012	08/06/2012	08/06/2012
SDG			12052388	12052825	12061119	12061119	12061381	1206067	1206067	1206067	12061119	12061119
Subcontracted: Organics Dioxins/Furans												
1,2,3,4,6,7,8 HpCDD*	ng/kg							7	12	2500		
1,2,3,4,6,7,8 HpCDF*	ng/kg							15	12	2800		
1,2,3,4,7,8 HxCDD*	ng/kg							<2	<2	120		
1,2,3,4,7,8 HxCDF*	ng/kg							4.5	3.8	780		
1,2,3,4,7,8,9 HpCDF*	ng/kg							<2	<2	470		
1,2,3,6,7,8 HxCDD*	ng/kg							2.5	2.8	470		
1,2,3,6,7,8 HxCDF*	ng/kg							5.1	<2	910		
1,2,3,7,8 PeCDD*	ng/kg							<2	<2	210		
1,2,3,7,8 PeCDF*	ng/kg							2.5	<2	400		
1,2,3,7,8,9 HxCDD*	ng/kg							<2	4.4	380		
1,2,3,7,8,9 HxCDF*	ng/kg							<2	<2	250		
2,3,4,6,7,8 HxCDF*	ng/kg							4.9	3.8	1200		
2,3,4,7,8 PeCDF*	ng/kg							3.3	2.4	560		
2,3,7,8 TCDD*	ng/kg							<2	<2	7.5		
2,3,7,8, TCDF*	ng/kg							3.6	3.7	400		
IPCDD/FTEQ Lower Bound*	ng/kg							4.1	3.4	920		
IPCDD/FTEQ Upper Bound*	ng/kg							7.7	7.1	920		
OCDD*	ng/kg							14	44	2500		
OCDF*	ng/kg							13	6.1	2200		
Tolulene Extractable Matter	<500 mg/kg							<	<	<		
PCB's (Solids)												
PCB congener 101	< 3 µg/kg				8.37			<	<	<	<	10.3
PCB congener 118	< 3 µg/kg				5.97			<	<	<	<	7.71
PCB congener 138	< 3 µg/kg				7.76			<	<	7.44	<	11.2
PCB congener 153	< 3 µg/kg				6.58			<	<	5.67	<	8.56
PCB congener 180	< 3 µg/kg				<3			<	<	5.58	<	5.15
PCB congener 28	< 3 µg/kg				7.52			<	3.93	<	<	10.4
PCB congener 52	< 3 µg/kg				7.81			<	<	<	<	8.91
PCBs, Total ICES 7	< 21 µg/kg				44			<	<	<	<	62.3

Yellow and BOLD TEXT indicates value exceeding Atkins Park Human Health GAC

turquoise indicates value exceeds commercial GAC

Screen Unformatted Data

Screen Formatt

East Tip Waste Solid Samples, Laboratory Analysis
2005 and 2008 Data

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)		BH117	BH117	BH117	BH117	BH117	BH118/A	BH118/A	BH119	BH120	BH122/B	BH125	BH125	BH127	BH128	BH131	DIS 101	DIS 102	DIS 103	DIS 104	TP121	TP121	TP123	TP123	TP124	TP124
Depth (m)					1.5	2.5	4.2	6	6.5	4	6.5	7.2	6.5	6	2.5	10.3	7.75	12	8	0	0	0	0	0-0.4	1.5	0-0.5	1.6	0-1	2.7
Sample Type																													
Sampled Date					2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2008	2008	2008	2008	2005	2005	2005	2005	2005	2005
Sample Received Date																													
SDG																													
Asbestos																													
Asbestos Screen							NFD		NFD	NFD	NFD	NFD		NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD
Carbon																													
TOC	<0.1			<																									
Fraction Organic Carbon (FOC)	<0.002						NT		NT	NT	NT	NT		NT	NT	NT	0.005	NT	NT					0.008	NT	NT	NT	NT	0.014
Inorganics																													
Ammoniacal Nitrogen as NO	<0.3mg/kg	-		<			<1		35.40	9.60	48.20	NT		37.60	NT	17.40	<5.5	37.70	<5.5	<15	<15	<15	<15	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Cyanide, Complex	<1 mg/kg	-		<			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<2.5	<2.5	<2.5	<2.5	<1	<1	<1	<1	<1	<1
Cyanide, Free	<1 mg/kg	36	34	<			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<1	<1	<1	<1	<1	<1
Cyanide, Total	<1 mg/kg	-		<			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
pH	1 pH Units						9.63		8.05	12.44	8.39	8.11		8.06	9.75	8.24	8.32	8.76	10.01	7.71	8.45	10.86	9.61	10.92	11.62	11.27	10.84	10.41	11.24
Sulphate, Total	<50 mg/kg						1181		2850	19190	5123	3418		2078	4505	2946	2498	1969	5496					5279	5169	4072	3615	2466	7529
Water Soluble Sulphate	1g/l						0.27		0.55	0.05	0.37	0.39		0.43	0.32	0.40	0.44	0.30	0.33	0.58	0.26	0.05	0.01	0.00	0.06	<0.003	0.02	0.05	0.48
Acid Soluble Sulphide	0.003g/l				<0.01	<0.01	<0.01	<0.01	<0.01	<50	<50	<50		<50	244.00	1427.00	<50	<50	95.00	6.00	5.00	27.00	5.00	<50	91.00	72.00	76	<50	<50
Thiocyanate	<0.01 mg/kg	-		<			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Metals																													
Aluminium	<1 mg/kg	-																		258	310	13730	399						
Antimony	<1 mg/kg	-	831																	58	53	62	58						
Arsenic	<1 mg/kg	640	41.4				6		4	30	4	3		<1	**126**	6	2	5	19	**60**	**93**	22	**47**	30	15	38	**59**	10	34
Barium	<1 mg/kg	-	1570																	8	10	500	8						
Boron, water soluble	<1 mg/kg	192000			2110	1690	1820	1260	3380	11	8	6		<1	3	2	9	9	22	NT	NT	NT	NT	12	8	11	6	9	15
Cadmium	<1 mg/kg	230	83.6				<1		<1	4	2	<1		2	19	<1	<1	<1	<1	<1	<1	14	<1	52	4	12	10	6	3
Calcium	<1mg/kg	-																		585	1620	90150	1621						
Chromium	<1 mg/kg	30400	22500				25		39	1389	705	27		466	513	210	135	751	1265	727	559	2276	848	1500	1389	2315	1849	2329	1543
Chromium, Hexavalent	<50 mg/kg	35	239				<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	0.40	<0.1	1.70	0.60	3.10	1.00	0.50	0.50
Copper	<1 mg/kg	71700	12200				21		8	139	151	3		148	2596	834	7	39	744	2660	2094	803	2259	687	189	653	994	675	299
Lead	<1 mg/kg	4640	477				26		7	454	134	17		143	**798**	36	9	8	200	60	116	**1035**	131	**1885**	469	**668**	**638**	406	416
Magnesium	<1 mg/kg	-																		509	474	39350	629						
Manganese	<1 mg/kg	-																		3705	3782	19130	5608						
Mercury	<1 mg/kg	3640	303	<			<1		<1	<1	<1	<1		<1	1.00	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Nickel	<1 mg/kg	1800	922				26		14	84	45	12		34	734	72	19	11	134	883	610	230	662	174	55	158	178	131	87
Selenium	<1 mg/kg	13000	696				<3		<3	<3	<3	<3		<3	<3	<3	<3	<3	<3	<1	<1	6	<1	<3	<3	<3	<3	<3	<3
Vanadium	<1 mg/kg	3160	422				18		46	272	149	18		80	30	40	34	179	220	6	6	290	11	245	362	353	245	281	341
Zinc	<1 mg/kg	665000	54800				95		67	1893	6055	53		628	6095	221	69	103	1728	3750	4045	4086	718	8492	1169	3523	3082	4482	1615
Phenols																													
Phenol	<0.3 mg/kg	482	686	<			0.02		<0.01	<0.01	<0.01	<0.01		<0.01	0.10	<0.01	<0.01	<0.01	<0.01	0.01	0.07	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	<0.01	0.02
TPH Criteria Working Group (TPH CWG)																													
Aliphatics >C5-C6	<10mg/kg	3400	324000																	<0.01	<0.01	<0.01	<0.01						
Aliphatics >C6-C8	<10mg/kg	8300	326000				<10		<10	<10	<10	<10		<10	<10	<10	<10	<10	<10	<0.01	<0.01	<0.01	<0.01	<10	<10	<10	<10	<10	<10
Aliphatics >C8-C10	<10mg/kg	2100	6420				<10		<10	<10	<10	<10		<10	<10	<10	<10	<10	<10	<0.01	<0.01	<0.01	<0.01	<10	<10	<10	<10	<10	<10
Aliphatics >C10-C12	<10mg/kg	10000	6520				<10		<10	<10	<10	<10		<10	64	<10	<10	<10	<10	<0.01	<0.01	<0.01	<0.01	<10	<10	<10	<10	<10	<10
Aliphatics >C12-C16	<10mg/kg	61000	6520				<10		<10	<10	<10	<10		<10	224	<10	<10	<10	<10	<0.1	178	<0.1	<0.1	<10	<10	746	465	11	<10
Aliphatics >C16-C21	<10mg/kg	1000000	177000				<10		<10	15	<10	<10		<10	367	<10	<10	<10	18	187	1252	60	<0.1	62	20	2469	1609	205	106
Aliphatics >C21-C35	<10mg/kg	1000000	177000				<10		<10	54	<10	<10		<10	6342	<10	<10	<10	147	11286	15058	1840	992	431	62	4134	2787	8659	3630
Aliphatics >C35-C40	<10mg/kg						<10		<10	<10	<10	<10		<10	1555	<10	<10	<10	<10					119	<10	987	442	1844	529
Total Aliphatics >C6-C40 (Min Oils)							<10		<10	68	<10	<10		<10	8552	<10	<10	<10	165	11473	16488	1900	992	615	82	8343	5302	10720	4275
Aromatics >EC6-EC7	<10mg/kg	28	14.2				<10		<10	<10	<10	<10		<10	<10	<10	<10	<10	<10	<0.01	<0.01	<0.01	<0.01	<10	<10	<10	<10	<10	<10
Aromatics >EC7-EC8	<10mg/kg	59000	23500				<10		<10	<10	<10	<10		<10	<10	<10	<10	<10	<10	<0.01	<0.01	<0.01	<0.01	<10	<10	<10	<10	<10	<10
Aromatics >EC8-EC10	<10mg/kg	3700	1940				<10		<10	<10	<10	<10		<10	<10	<10	<10	<10	<10	<0.01	<0.01	<0.01	<0.01	<10	<10	<10	<10	<10	<10
Aromatics >EC10-EC12	<10mg/kg	17000	2490				<10		<10	<10	<10	<10		<10	<10	<10	<10	<10	<10	<0.01	<0.01	<0.01	<0.01	<10	<10	<10	<10	<10	<10
Aromatics >EC12-EC16	<10mg/kg	36000	2590				<10		<10	<10	<10	<10		<10	28	<10	<10	<10	<10	0	<0.1	<0.1	<0.1	<10	<10	149	40	<10	<10
Aromatics >EC16-EC21	<10mg/kg	28000	1610				<10		<10	12	<10	<10		<10	113	<10	<10	<10	<10	0	<0.1	<0.1	<0.1	11	<10	721	385	298	29
Aromatics >EC21-EC40	<10mg/kg	28000	1610				<10		<10	31	<10	<10		<10	714	<10	<10	<10	20	<0.1	<0.1	<0.1	<0.1	45	19	715	459	1313	860
Total Aromatics >C6-40	<10mg/kg	-					<10		<10	44	<10	<10		<10	855	<10	<10	<10	25	1	<0.1	<0.1	<0.1	56	29	1585	884	1611	889
Total Aliphatics & Aromatics >C6-C40	<10mg/kg						<10		<10	112	<10	<10		<10	10347	<10	<10	<10	190	11474	16488	1900	992	671	111	9928	6186	12330	5164
Methyl tertiary butyl ether (MTBE)	<0.01mg/kg		15600																										
Benzene	<0.01mg/kg	28	14.2																	<0.01	<0.01	<0.01	<0.01						
Ethylbenzene	<0.01mg/kg	518	10100																	<0.01	<0.01	<0.01	<0.01						
Xylene	<0.01mg/kg																			<0.01	<0.01	<0.01	<0.01						
m,p,o-Xylene			14500																										
m,p-Xylene		312	14500																										
o-Xylene		-	15700																										
Toluene	<0.01mg/kg	869	23500																	<0.01	<0.01	<0.01	<0.01						
BTEX, Total																													

East Tip Waste Solid Samples, Laboratory Analysis
2005 and 2008 Data

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)	BH117	BH117	BH117	BH117	BH117	BH118/ A	BH118/A	BH119	BH120	BH122/B	BH125	BH125	BH127	BH128	BH131	DIS 101	DIS 102	DIS 103	DIS 104	TP121	TP121	TP123	TP123	TP124	TP124
Depth (m)				1.5	2.5	4.2	6	6.5	4	6.5	7.2	6.5	6	2.5	10.3	7.75	12	8	0	0	0	0	0-0.4	1.5	0-0.5	1.6	0-1	2.7
Sample Type																												
Sampled Date				2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2008	2008	2008	2008	2005	2005	2005	2005	2005	2005
Sample Received Date																												
SDG																												
Rapid PAH Screen																												
Acenaphthene	<0.05mg/kg	85000	5570			<0.05		<0.05	<0.05	<0.05	1.25		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	0.08	0.17	0.16	0.09	<0.05	0.16
Acenaphthylene	<0.05mg/kg	84000				<0.05		<0.05	<0.05	<0.05	0.51		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	0.08	0.11	0.11	0.08	<0.05	0.09
Anthracene	<0.05mg/kg	530000	29100			<0.05		<0.05	0.19	0.09	1.42		<0.05	0.10	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.05	0.12	0.75	0.11	<0.05	0.21
Benzo(a)anthracene	<0.05mg/kg	90	9.52			<0.05		<0.05	0.28	0.21	3.25		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.05	0.21	<0.05	<0.05	<0.05	0.57
Benzo(a)pyrene	<0.05mg/kg	14	1.2			<0.05		<0.05	<0.05	0.24	**2.88**		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.05	0.24	<0.05	<0.05	<0.05	0.33
Benzo(b)fluoranthene	<0.05mg/kg	100	11.5			<0.05		<0.05	<0.05	0.24	2.82		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.05	0.26	<0.05	<0.05	<0.05	0.42
Benzo(ghi)perylene	<0.05mg/kg	650	143			<0.05		<0.05	<0.05	0.12	1.80		<0.05	1.01	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	<0.05mg/kg	140	123			<0.05		<0.05	<0.05	0.09	0.80		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.05	0.05	<0.05	<0.05	<0.05	0.09
Chrysene	<0.05mg/kg	140	993			<0.05		<0.05	0.33	0.29	3.27		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.05	0.28	<0.05	<0.05	<0.05	0.75
Dibenzo(ah)anthracene	<0.05mg/kg	13	1.27			<0.05		<0.05	<0.05	<0.05	0.56		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoranthene	<0.05mg/kg	23000	3890			<0.05		<0.05	0.81	0.81	8.49		<0.05	0.29	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.05	0.59	0.57	0.58	0.50	1.48
Fluorene	<0.05mg/kg	64000	3810			<0.05		<0.05	<0.05	<0.05	1.57		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	0.06	0.07	0.08	0.26	<0.05	0.06
Indeno(123cd)pyrene	<0.05mg/kg	60	11.2			<0.05		<0.05	<0.05	0.12	1.79		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Naphthalene	<0.05mg/kg	200	1010			<0.05		<0.05	0.15	<0.05	1.03		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	0.12	0.22	0.24	0.21	<0.05	0.16
Phenanthrene	<0.05mg/kg	22000				<0.05		<0.05	0.86	0.59	7.61		<0.05	0.34	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	0.25	0.88	1.06	0.54	0.26	1.31
Pyrene	<0.05mg/kg	54000	2920			<0.05		<0.05	0.63	0.64	7.92		<0.05	0.28	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.05	0.57	0.43	0.61	0.43	1.37
PAH 16 Total	<0.05mg/kg					<0.05		<0.05	3.25	3.44	46.97		<0.05	1.01	<0.05	<0.05	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	0.59	3.77	3.40	2.48	1.19	7.00
Volatile Organic Compounds (VOCs) - (Solids)																												
1.1.1.2-Tetrachloroethane	<1µg/kg	120000	223000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.1.1-Trichloroethane	<1µg/kg	700000	54500000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.1.2.2-Tetrachloroethane	<1µg/kg	290000	292000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.1.2-Trichloroethane	<1µg/kg	-	171000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.1-Dichloroethane	<1µg/kg	-	9730000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.1-Dichloroethene	<1µg/kg		453000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.1-Dichloropropene	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.2.3-Trichlorobenzene	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.2.3-Trichloropropane	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.2.4-Trichlorobenzene	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.2.4-Trimethylbenzene	<1µg/kg	-	49700			214		<1	<1	<1	<1		<1	45	<1	<1	<1	<1	<1		<1	<1	<1	<1	744	32	<1	<1
1.2-Dibromo-3-chloropropane	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.2-Dibromoethane	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.2-Dichlorobenzene	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.2-Dichloroethane	<1µg/kg	710	2800			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.2-Dichloropropane	<1µg/kg	-	18600			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.3.5-Trimethylbenzene	<1µg/kg	-				173		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	403	50	<1	<1
1.3-Dichlorobenzene	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.3-Dichloropropane	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
1.4-Dichlorobenzene	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
2.2-Dichloropropane	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
2-Chlorotoluene	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
4-Chlorotoluene	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
4-Isopropyltoluene	<1µg/kg	-				68		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Benzene	<1µg/kg	28000	14200			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Bromobenzene	<1µg/kg	-	228000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Bromochloromethane	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Bromodichloromethane	<1µg/kg	-	7710			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Bromoform	<1µg/kg	-	644000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Bromomethane	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Carbon Disulphide	<1µg/kg	-	303			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Carbontetrachloride	<1µg/kg	3000	22400			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Chlorobenzene	<1µg/kg	-	4920000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Chloroethane	<1µg/kg	-	272000000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Chloroform	<1µg/kg	110000	457000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Chloromethane	<1µg/kg	-	17200			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
cis-1-2-Dichloroethene	<1µg/kg	-	89500			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
cis-1-3-Dichloropropene	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Dibromochloromethane	<1µg/kg	-	45000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Dibromomethane	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Dichlorodifluoromethane	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Dichloromethane	<1µg/kg	-	297000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	<1µg/kg	518000	10100000			7		<1	<1	<1	<1		<1	42	<1	<1	<1	<1	<1		<1	<1	<1	<1	115	3	<1	<1
Hexachlorobutadiene	<1µg/kg					<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Isopropylbenzene	<1µg/kg	-	10000000			16		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	86	<1	<1	<1
Methyl Tertiary Butyl Ether	<1µg/kg					<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	<1µg/kg	-	1010000			234		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	1639	<1	<1	<1
n-Butylbenzene	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
o-Xylene	<1µg/kg	-				19		<1	<1	<1	<1		<1	31	<1	<1	<1	<1	<1		<1	<1	<1	<1	376	12	<1	<1
p/m-Xylene	<1µg/kg	312000	14500000			24		<1	<1	<1	<1		<1	66	<1	<1	<1	<1	<1		<1	<1	<1	<1	472	4	<1	<1
Propylbenzene	<1µg/kg	-	10400000			41		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	159	4	<1	<1
sec-Butylbenzene	<1µg/kg	-				36		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	100	8	<1	<1
Styrene	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
tert-Butylbenzene	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Tetrachloroethene	<1µg/kg	130000	982000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Toluene	<1µg/kg	869000	23500000			5		<1	<1	<1	<1		<1	39	<1	<1	<1	<1	<1		<1	<1	<1	2	31	2	4	3
trans-1-2-Dichloroethene	<1µg/kg	-	212000			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
trans-1-3-Dichloropropene	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Trichloroethene	<1µg/kg	12000	88200			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	2	<1	<1	<1
Trichlorofluorormethane	<1µg/kg	-				<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
Vinyl Chloride	<1µg/kg	63	804			<1		<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<1	<1	<1
VOC TIC																												

East Tip Waste Solid Samples, Laboratory Analysis
2005 and 2008 Data

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)	BH117	BH117	BH117	BH117	BH117	BH118/A	BH118/A	BH119	BH120	BH122/B	BH125	BH125	BH127	BH128	BH131	DIS 101	DIS 102	DIS 103	DIS 104	TP121	TP121	TP123	TP123	TP124	TP124
Depth (m)				1.5	2.5	4.2	6	6.5	4	6.5	7.2	6.5	6	2.5	10.3	7.75	12	8	0	0	0	0	0-0.4	1.5	0-0.5	1.6	0-1	2.7
Sample Type																												
Sampled Date				2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2008	2008	2008	2008	2005	2005	2005	2005	2005	2005
Sample Received Date																												
SDG																												
Subcontracted: Organics - Dioxins/Furans																												
1,2,3,4,6,7,8 HpCDD*	ng/kg																											38.0
1,2,3,4,6,7,8 HpCDF*	ng/kg																											41.0
1,2,3,4,7,8 HxCDD*	ng/kg																											<2
1,2,3,4,7,8 HxCDF*	ng/kg																											12.0
1,2,3,4,7,8,9 HpCDF*	ng/kg																											3.6
1,2,3,6,7,8 HxCDD*	ng/kg																											5.1
1,2,3,6,7,8 HxCDF*	ng/kg																											7.7
1,2,3,7,8 PeCDD*	ng/kg																											2.8
1,2,3,7,8 PeCDF*	ng/kg																											76.0
1,2,3,7,8,9 HxCDD*	ng/kg																											4.1
1,2,3,7,8,9 HxCDF*	ng/kg																											2.6
2,3,4,6,7,8 HxCDF*	ng/kg																											10.0
2,3,4,7,8 PeCDF*	ng/kg																											9.0
2,3,7,8 TCDD*	ng/kg																											<2
2,3,7,8, TCDF*	ng/kg																											75.0
HpCDF	ng/kg																											44.6
HxCDD	ng/kg																											9.2
HxCDF	ng/kg																											32.3
OCDD*	ng/kg																											120.0
OCDF*	ng/kg																											41.0
PeCDF	ng/kg																											85.0
I-PCDD/F-TEQ Lower Bound*	ng/kg																											12.0
I-PCDD/F-TEQ Upper Bound*	ng/kg																											14.0
PCB's - (Solids)																												
PCB congener 101	< 1 µg/kg																		<1	<1	7.00	<1						
PCB congener 118	< 1 µg/kg																		<1	<1	<1	<1						
PCB congener 138	< 1 µg/kg																		<1	<1	<1	<1						
PCB congener 153	< 1 µg/kg																		<1	<1	<1	<1						
PCB congener 180	< 1 µg/kg																		<1	<1	<1	<1						
PCB congener 28	< 1 µg/kg																		<1	<1	5.00	<1						
PCB congener 52	< 1 µg/kg																		<1	<1	7.00	<1						
PCBs, Total ICES 7	< 1 µg/kg					<1		<20	<1	<20	<1		<20	<1	<20	<20	441	407	<1	<1	19	<1	115	<1	158	515	<1	<1

Yellow and BOLD TEXT indicates value exceeding Atkins Park Human Health GAC

turquoise indicates value exceeds commercial GAC

Screen Unformatted Data

Screen Formatted Data

East Tip Waste Solid Samples, Laboratory Analysis
2005 and 2008 Data

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)	TP125	TP125	TP125a	TP126	TP126	TP127	TP127	TP128	TP128	TP128	TP129A	TP129	TP129	TP129	TP129	TP130	TP130	TP130	TP131	TP131	TP131	TP132	TP132	TP132
Depth (m)				0.3	3.3	0-2	0-1	3-4.2	0-0.5	2.2	1	0-0.5	3.4	0-0.6	1	1.5	2.7	3.5	0.5	1.6	2.7	0-0.5	1.8	2.8	0-1	2.5-3.5	4.2
Sample Type																											
Sampled Date				2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005
Sample Received Date																											
SDG																											
Asbestos																											
Asbestos Screen				NFD		NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD	NFD
Carbon																											
TOC	<0.1																										
Fraction Organic Carbon (FOC)	<0.002			NT	0.001	NT	0.008	0.007	0.009	NT	NT	0.004	0.003	NT	NT	NT	NT	0.001	0.019	NT	NT	NT	NT	0.003	NT	NT	0.029
Inorganics																											
Ammoniacal Nitrogen as NO	<0.3mg/kg	-		<0.3	<0.3	14.80	6.30	7.20	<5.5	<5.5	8.70	<5.5	9.50	2.90	4.70	4.50	6.70	<5.5	1.40	1.90	0.90	<5.5	<5.5	<5.5	<5.5	6.40	7.30
Cyanide, Complex	<1 mg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cyanide, Free	<1 mg/kg	36	34	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cyanide, Total	<1 mg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
pH	1 pH Units			10.76	10.41	8.26	10.41	8.20	10.18	9.92	10.60	11.27	12.40	10.36	11.47	11.38	9.59	9.84	10.25	11.57	11.82	12.39	12.41	12.23	7.99	9.65	11.84
Sulphate, Total	<50 mg/kg			3874	6141	623	4231	979	5527	6514	1362	2152	5051	2044	2773	4621	4673	4136	2822	3354	5834	3342	2848	8472	856	1578	2702
Water Soluble Sulphate	1g/l			0.02	0.01	<0.003	0.25	0.05	0.01	0.00	<0.003	<0.003	<0.003	0.00	<0.003	<0.003	<0.003	<0.003	0.01	<0.003	<0.003	<0.003	<0.003	0.01	0.02	0.09	0.13
Acid Soluble Sulphide	0.003g/l			<50	<50	<50	<50	<50	<50	<50	91	<50	<50	64	<50	63	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Thiocyanate	<0.01 mg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	4	<1	<1
Metals																											
Aluminium	<1 mg/kg	-			258	310	13730	399																			
Antimony	<1 mg/kg	-	831		58	53	62	58																			
Arsenic	<1 mg/kg	640	41.4	**47**	3	**57**	22	**111**	**55**	23	<1	25	11	<1	4	<1	<1	<1	11	<1	<1	2	**44**	9	24	**65**	**89**
Barium	<1 mg/kg	-	1570																								
Boron, water soluble	<1 mg/kg	192000		12	15	<1	16	<1	7	7	5	12	10	7	7	8	17	14	7	13	11	12	12	11	<1	3	3
Cadmium	<1 mg/kg	230	83.6	10	51	<1	27	1	25	7	<1	10	1	<1	1	<1	2	<1	<1	<1	<1	2	3	<1	2	<1	<1
Calcium	<1mg/kg	-																									
Chromium	<1 mg/kg	30400	22500	1399	2230	696	2126	718	1836	2282	2413	2241	2578	1902	2268	1993	3076	1852	1868	1763	1960	2350	2214	4587	108	970	1078
Chromium, Hexavalent	<50 mg/kg	35	239	1.70	2.10	<0.3	2.90	<0.3	1.20	0.30	1.90	3.50	6.10	0.80	2.80	2.30	0.90	<0.3	2.80	7.10	9.70	14.70	5.70	7.10	<0.3	<0.3	<0.3
Copper	<1 mg/kg	71700	12200	810	522	2202	1438	3058	656	434	159	1434	506	398	274	214	202	195	283	206	194	395	1150	458	150	1643	2108
Lead	<1 mg/kg	4640	477	**1365**	**2228**	30	**3043**	282	**898**	227	65	**749**	127	46	161	41	126	73	205	58	56	159	445	54	196	142	133
Magnesium	<1 mg/kg	-																									
Manganese	<1 mg/kg	-																									
Mercury	<1 mg/kg	3640	303	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Nickel	<1 mg/kg	1800	922	217	114	707	291	770	137	79	32	140	150	143	94	48	59	36	78	37	40	99	282	115	59	509	649
Selenium	<1 mg/kg	13000	696	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Vanadium	<1 mg/kg	3160	422	158	270	9	191	4	186	228	306	363	338	421	331	254	399	378	271	236	237	372	241	247	25	44	68
Zinc	<1 mg/kg	665000	54800	3992	10670	192	11160	3477	4912	2063	480	3700	843	390	1413	370	1078	638	661	535	454	889	1758	389	25	44	68
Phenols																											
Phenol	<0.3 mg/kg	482	686	<0.01	0.01	<0.01	<0.01	1.11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	<0.01	0.01	<0.01	0.08
TPH Criteria Working Group (TPH CWG)																											
Aliphatics >C5-C6	<10mg/kg	3400	324000																								
Aliphatics >C6-C8	<10mg/kg	8300	326000	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aliphatics >C8-C10	<10mg/kg	2100	6420	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aliphatics >C10-C12	<10mg/kg	10000	6520	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aliphatics >C12-C16	<10mg/kg	61000	6520	11	<10	<10	<10	15	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	82	<10	<10	<10	12	34
Aliphatics >C16-C21	<10mg/kg	1000000	177000	114	18	<10	335	76	12	<10	16	37	26	<10	<10	<10	<10	<10	36	14	<10	417	39	19	<10	103	222
Aliphatics >C21-C35	<10mg/kg	1000000	177000	1375	162	40	606	3549	217	<10	27	279	217	<10	<10	<10	<10	<10	254	44	26	221	173	72	13	1572	1647
Aliphatics >C35-C40	<10mg/kg			71	<10	<10	132	1911	<10	<10	<10	13	63	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	365	1183
Total Aliphatics >C6-C40 (Min Oils)				1571	184	40	1073	5552	228	<10	43	328	306	<10	<10	<10	<10	<10	298	62	33	720	217	95	21	2050	5911
Aromatics >EC6-EC7	<10mg/kg	28	14.2	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aromatics >EC7-EC8	<10mg/kg	59000	23500	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aromatics >EC8-EC10	<10mg/kg	3700	1940	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aromatics >EC10-EC12	<10mg/kg	17000	2490	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Aromatics >EC12-EC16	<10mg/kg	36000	2590	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	22	<10	<10	<10	<10	14
Aromatics >EC16-EC21	<10mg/kg	28000	1610	50	14	<10	18	14	11	<10	<10	15	<10	<10	<10	<10	<10	<10	12	<10	<10	108	<10	<10	<10	35	86
Aromatics >EC21-EC40	<10mg/kg	28000	1610	372	43	<10	274	971	210	<10	<10	85	<10	<10	<10	<10	<10	<10	39	<10	<10	80	<10	<10	<10	343	1103
Total Aromatics >C6-40	<10mg/kg	-		423	57	<10	291	991	221	<10	<10	100	<10	<10	<10	<10	<10	<10	51	<10	<10	210	<10	<10	<10	35	86
Total Aliphatics & Aromatics >C6-C40	<10mg/kg			1994	241	40	1364	6543	449	<10	43	428	306	<10	<10	<10	<10	<10	349	62	33	931	217	95	21	2428	7113
Methyl tertiary butyl ether (MTBE)	<0.01mg/kg		15600																								
Benzene	<0.01mg/kg	28	14.2																								
Ethylbenzene	<0.01mg/kg	518	10100																								
Xylene	<0.01mg/kg																										
m,p,o-Xylene			14500																								
m,p-Xylene		312	14500																								
o-Xylene		-	15700																								
Toluene	<0.01mg/kg	869	23500																								
BTEX, Total																											

East Tip Waste Solid Samples, Laboratory Analysis
2005 and 2008 Data

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)	TP125	TP125	TP125a	TP126	TP126	TP127	TP127	TP128	TP128	TP128	TP129A	TP129	TP129	TP129	TP129	TP130	TP130	TP130	TP131	TP131	TP131	TP132	TP132	TP132
Depth (m)				0.3	3.3	0-2	0-1	3-4.2	0-0.5	2.2	1	0-0.5	3.4	0-0.6	1	1.5	2.7	3.5	0.5	1.6	2.7	0-0.5	1.8	2.8	0-1	2.5-3.5	4.2
Sample Type																											
Sampled Date				2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005
Sample Received Date																											
SDG																											
Rapid PAH Screen																											
Acenaphthene	<0.05mg/kg	85000	5570	0.19	0.21	<0.05	0.07	0.18	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.15	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthylene	<0.05mg/kg	84000		0.18	0.12	<0.05	0.06	0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anthracene	<0.05mg/kg	530000	29100	0.08	0.31	<0.05	0.08	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	<0.05	0.05	<0.05	<0.05	<0.05	0.06	0.27
Benzo(a)anthracene	<0.05mg/kg	90	9.52	<0.05	0.17	<0.05	0.06	0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.10	<0.05	<0.05	<0.05	0.31
Benzo(a)pyrene	<0.05mg/kg	14	1.2	<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	<0.05	<0.05	<0.05	<0.05
Benzo(b)fluoranthene	<0.05mg/kg	100	11.5	<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	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(ghi)perylene	<0.05mg/kg	650	143	<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	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	<0.05mg/kg	140	123	<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	<0.05	<0.05	<0.05	<0.05
Chrysene	<0.05mg/kg	140	993	<0.05	0.20	<0.05	0.09	0.21	<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	0.19	<0.05	<0.05	<0.05	0.42
Dibenzo(ah)anthracene	<0.05mg/kg	13	1.27	<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	<0.05	<0.05	<0.05	<0.05
Fluoranthene	<0.05mg/kg	23000	3890	0.70	0.61	<0.05	0.49	0.43	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.35	<0.05	<0.05	0.08	0.43	<0.05	0.08	0.17	0.54
Fluorene	<0.05mg/kg	64000	3810	0.09	0.15	<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	<0.05	<0.05
Indeno(123cd)pyrene	<0.05mg/kg	60	11.2	<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	<0.05	<0.05	<0.05	<0.05
Naphthalene	<0.05mg/kg	200	1010	0.65	0.19	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.24	<0.05	0.20	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	<0.05mg/kg	22000		0.68	0.98	<0.05	0.45	0.27	<0.05	0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.20	<0.05	<0.05	0.30	0.17	<0.05	0.16	0.31	1.05
Pyrene	<0.05mg/kg	54000	2920	0.57	0.63	<0.05	0.46	0.35	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.26	<0.05	<0.05	0.07	0.38	<0.05	0.07	0.12	0.45
PAH 16 Total	<0.05mg/kg			3.14	3.57	<0.05	1.83	1.72	0.05	0.17	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1.23	<0.05	<0.05	0.50	1.27	<0.05	0.31	0.66	3.04
Volatile Organic Compounds (VOCs) - (Solids)																											
1.1.1.2-Tetrachloroethane	<1µg/kg	120000	223000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.1.1-Trichloroethane	<1µg/kg	700000	54500000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.1.2.2-Tetrachloroethane	<1µg/kg	290000	292000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.1.2-Trichloroethane	<1µg/kg	-	171000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.1-Dichloroethane	<1µg/kg	-	9730000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.1-Dichloroethene	<1µg/kg		453000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.1-Dichloropropene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2.3-Trichlorobenzene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2.3-Trichloropropane	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2.4-Trichlorobenzene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2.4-Trimethylbenzene	<1µg/kg	-	49700	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	53
1.2-Dibromo-3-chloropropane	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2-Dibromoethane	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2-Dichlorobenzene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2-Dichloroethane	<1µg/kg	710	2800	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.2-Dichloropropane	<1µg/kg	-	18600	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.3.5-Trimethylbenzene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.3-Dichlorobenzene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.3-Dichloropropane	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1.4-Dichlorobenzene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2.2-Dichloropropane	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2-Chlorotoluene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
4-Chlorotoluene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
4-Isopropyltoluene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzene	<1µg/kg	28000	14200	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bromobenzene	<1µg/kg	-	228000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bromochloromethane	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bromodichloromethane	<1µg/kg	-	7710	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bromoform	<1µg/kg	-	644000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bromomethane	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbon Disulphide	<1µg/kg	-	303	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbontetrachloride	<1µg/kg	3000	22400	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chlorobenzene	<1µg/kg	-	4920000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroethane	<1µg/kg	-	272000000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroform	<1µg/kg	110000	457000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloromethane	<1µg/kg	-	17200	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
cis-1-2-Dichloroethene	<1µg/kg	-	89500	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
cis-1-3-Dichloropropene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibromochloromethane	<1µg/kg	-	45000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibromomethane	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dichlorodifluoromethane	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dichloromethane	<1µg/kg	-	297000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	<1µg/kg	518000	10100000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	4	29
Hexachlorobutadiene	<1µg/kg			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Isopropylbenzene	<1µg/kg	-	10000000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Methyl Tertiary Butyl Ether	<1µg/kg			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	<1µg/kg	-	1010000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
n-Butylbenzene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
o-Xylene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3	27
p/m-Xylene	<1µg/kg	312000	14500000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	6	42
Propylbenzene	<1µg/kg	-	10400000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
sec-Butylbenzene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Styrene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
tert-Butylbenzene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Tetrachloroethene	<1µg/kg	130000	982000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	<1µg/kg	869000	23500000	<1	<1	<1	2	6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2	<1	<1	<1	<1	<1	<1	4	28
trans-1-2-Dichloroethene	<1µg/kg	-	212000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
trans-1-3-Dichloropropene	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Trichloroethene	<1µg/kg	12000	88200	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Trichlorofluorormethane	<1µg/kg	-		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Vinyl Chloride	<1µg/kg	63	804	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
VOC TIC																											

East Tip Waste Solid Samples, Laboratory Analysis
2005 and 2008 Data

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)	TP125	TP125	TP125a	TP126	TP126	TP127	TP127	TP128	TP128	TP128	TP129A	TP129	TP129	TP129	TP129	TP130	TP130	TP130	TP131	TP131	TP131	TP132	TP132	TP132
Depth (m)				0.3	3.3	0-2	0-1	3-4.2	0-0.5	2.2	1	0-0.5	3.4	0-0.6	1	1.5	2.7	3.5	0.5	1.6	2.7	0-0.5	1.8	2.8	0-1	2.5-3.5	4.2
Sample Type																											
Sampled Date				2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005
Sample Received Date																											
SDG																											
Subcontracted: Organics - Dioxins/Furans																											
1,2,3,4,6,7,8 HpCDD*	ng/kg							17.0					81.0			4.7							220.0			20.0	
1,2,3,4,6,7,8 HpCDF*	ng/kg							48.0					17.0			<2							27.0			13.0	
1,2,3,4,7,8 HxCDD*	ng/kg							<2					<2			<2							<2			<2	
1,2,3,4,7,8 HxCDF*	ng/kg							5.9					7.4			<2							12.0			4.0	
1,2,3,4,7,8,9 HpCDF*	ng/kg							8.0					3.7			<2							3.2			3.0	
1,2,3,6,7,8 HxCDD*	ng/kg							3.5					7.4			<2							13.0			3.4	
1,2,3,6,7,8 HxCDF*	ng/kg							7.4					5.1			<2							6.9			3.3	
1,2,3,7,8 PeCDD*	ng/kg							3.7					2.3			<2							<2			<2	
1,2,3,7,8 PeCDF*	ng/kg							5.6					6.0			<2							14.0			3.4	
1,2,3,7,8,9 HxCDD*	ng/kg							3.5					5.8			<2							6.8			3.0	
1,2,3,7,8,9 HxCDF*	ng/kg							2.3					2.0			<2							<2			<2	
2,3,4,6,7,8 HxCDF*	ng/kg							13.0					8.6			<2							7.7			6.1	
2,3,4,7,8 PeCDF*	ng/kg							7.6					12.0			<2							22.0			5.7	
2,3,7,8 TCDD*	ng/kg							2.8					<2			<2							<2			<2	
2,3,7,8, TCDF*	ng/kg							4.5					12.0			<2							49.0			7.0	
HpCDF	ng/kg							56.0					20.7			0.0							30.2			16.0	
HxCDD	ng/kg							7.0					13.2			0.0							19.8			6.4	
HxCDF	ng/kg							28.6					23.1			0.0							26.6			13.4	
OCDD*	ng/kg							56.0					220.0			19.0							1100.0			94.0	
OCDF*	ng/kg							64.0					16.0			<2							31.0			15.0	
PeCDF	ng/kg							13.2					18.0			0.0							36.0			9.1	
I-PCDD/F-TEQ Lower Bound*	ng/kg							14.0					13.0			<2							25.0			6.2	
I-PCDD/F-TEQ Upper Bound*	ng/kg							14.0					16.0			5.8							28.0			9.6	
PCB's - (Solids)																											
PCB congener 101	< 1 µg/kg																										
PCB congener 118	< 1 µg/kg																										
PCB congener 138	< 1 µg/kg																										
PCB congener 153	< 1 µg/kg																										
PCB congener 180	< 1 µg/kg																										
PCB congener 28	< 1 µg/kg																										
PCB congener 52	< 1 µg/kg																										
PCBs, Total ICES 7	< 1 µg/kg			1544		24	40	<1	18	8	<1	24	<1	<1	105	<1	44	14	207	62	40	<1	<1	<1	<1	<1	<1

Yellow and BOLD TEXT indicates value exceeding Atkins Park Human Health GAC
turquoise indicates value exceeds commercial GAC

Screen Unformatted Data

Screen Formatted Data

Appendix D Slag Waste Solid Analysis Results

East Tip 2012 Solid Samples 100% Slag, Laboratory Analysis Results

				slag with HC odour	slag	slag	slag	slag	slag	slag	processed slag	slag	slag	slag	slag	slag	processed slag	slag with limecoating	slag	processed slag	slag with HC odour	slag	slag	slag	slag	slag
Sample Identity	**LoD/Units**	**TSV for Commercial / Industrial Use**	**Atrisk Park Human Health GAC (mg/kg)**	**BH301A**	**BH303**	**BH303**	**BH306a**	**BH306b**	**BH307**	**BH309**	**BH310a**	**BH310a**	**BH310a**	**BH310a**	**BH310b**	**BH310b**	**BH310c**	**BH310c**	**BH313**	**BH314**	**BH315**	**BH315**	**BH316**	**BH316**	**OP10**	**OP14**
Depth (m)				**4**	**1**	**3**	**7**	**4**	**2.5-3**	**5.50-6**	**3**	**4**	**6**	**9**	**5**	**8**	**0.6-0.8**	**4**	**5**	**0-0.5**	**3**	**6**	**0.2-0.5**	**5-5.5**	**1.1**	**1.7**
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				15/05/2012	08/05/2012	08/05/2012	04/05/2012	24/04/2012	21/05/2012	06/06/2012	24/04/2012	24/04/2012	24/04/2012	01/05/2012	05/04/2012	10/05/2012	21/05/2012	22/05/2012	16/05/2012	24/04/2012	18/05/2012	22/05/2012	06/06/2012	11/06/2012	05/06/2012	07/06/2012
Sample Received Date				20/05/2012	13/05/2012	13/05/2012	09/05/2012	28/04/2012	23/05/2012	11/06/2012	28/04/2012	28/04/2012	28/04/2012	08/05/2012	05/09/2012	13/05/2012	23/05/2012	28/05/2012	20/05/2012	28/04/2012	23/05/2012	28/05/2012		13/06/2012	06/06/2012	08/06/2012
SDG				1205201	12051311	12051311	12050946	12042854	12052388	12061119	12042854	12042854	12042854	12050829	12050946	12051311	12052388	12052825	Schedule #6	12042854	12052388	12052825	12061119	12061381	1206067	12061119
Sample Description																										
Colour				Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Light Brown	Grey	Dark Brown	Grey	Dark Brown	Black	Dark Brown	Black	Dark Brown	Black	Grey	Dark Brown	Grey	Black	Black	Dark Brown	Grey	Grey
Description				Loamy Sand	Sand	Sand	N/A	Sandy Loam	N/A	Gravel	Sand	Gravel	Loamy Sand	Clinker	N/A	Sand	Sand	Sand	Gravel	Sand	Sand	Sand	Sand	Sand	Sand	Loamy Sand
Grain Size				0.063 0.1 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	2 10 mm	2 10 mm	0.1 2 mm	0.063 0.1 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.063 0.1 mm	0.1 2 mm	0.1 2 mm	2 10 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm
Inclusion 1)				Stones	Stones	Stones	Metal	Stones	Stones	Oil/Petroleum	Stones	Stones	Stones	N/A	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Ash/Soot	Stones	Concrete/Aggregate
Inclusion 2)				Fibres	N/A	N/A	Stones	None	None	N/A	None	Stones	None	N/A	N/A	N/A	None	N/A	N/A	None	N/A	N/A	Oil/Petroleum	Stones	N/A	Stones
Moisture content ratio	%			12	6.7	7.1	11	8.5	2.7	4.3	6.9		15	4.9	7.4	2.8	3.7	6.4	11	5.7	8.7	5.2	11	3.7	5.6	11
Laboratory data																										
2Butanone	<100 µg/kg			<100																			<		<	<
Acetone	< 50 µg/kg			73.8																			113		<	<
Chloride (soluble)	<5mg/kg			3160	158	1950	2940	2750	1190	1660	293		4180	1000	1980	1690	55.3	1850	1740	111	1960	1420	4480	1740	299	152
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l			0.615	0.0807	0.358	0.462	0.532	<0.008	0.149	0.0493		0.586	0.274	0.223	0.454	<0.008	0.293	<0.008	<0.008	0.313	0.279	0.467	0.0369	0.0523	0.258
Carbon																										
Fraction Organic Carbon (FOC)	<0.1			<	<	<	<								<			<	<		<	<1				
Fraction Organic Carbon (FOC)	<0.002								<								0.00429									
Inorganics																										
Ammoniacal Nitrogen as N	<15mg/kg			<	<	<	<	<	<	<	<		<	<	<	<	102	<	<	<	<	<	<	<	<	<
Cyanide, Complex	<1 mg/kg			<	<	<	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Free	<1 mg/kg	36	34	<	<	<	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Total	<1 mg/kg			<	<	<	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<	<	<
pH	1 pH Units			9.38	11.8	11.1	10.2	10.4	9.3	11.1	12.4		11.2	10	11.4	10.8	11.7	11.6	11.4	12.6	9.95	11.1	9.06	10	11.3	10.6
Sulphate, Total	<0.008 mg/kg			4470	2150	3350	5240	7080	2670	4570	5490		6050	3700	5870	5580	1660	2150	2700	2060	6730	5470	3740	5080	3480	5570
Sulphide, Easily liberated	<15mg/kg			143	<	<	38.4	<	<	<	<		<	<	<	18.9	<	<	<	<	<	<	<	<15	<	<
Sulphur, Total	<0.02%								0.197	0.302							0.13								0.214	
Sulphur, Total	<0.0016%			0.149	0.0716	0.112	0.175	0.236	0.0888		0.183		0.202	0.123	0.196	0.186	0.0552	0.0718	0.0899	0.0688	0.224	0.182	0.125			0.186
Thiocyanate	<1 mg/kg			<1	<	<	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<1	<	<
Metals																										
Aluminium	<11 mg/kg			7420	20500	24100	15300	20000	29800	15000	21800		18800	22000	26800	22400	21600	19200	27200	22800	21700	2040	1700	19700	27500	3320
Antimony	<0.6 mg/kg		831	42.7	35.4	27	30.1	147	86.1	21.1	31		104	35.1	29.5	28.5	82.5	26.7	82.8	20.7	32.1	7.97	30.4	19.3	26.9	3.72
Arsenic	<0.6 mg/kg	640	41.4	37	29.1	26.8	38.8	<6	<6	21.6	6.06		18.1	27.6	29.2	32.9	<6	15.9	6.23	9.65	11	<0.06	**80**	23	13.8	4.38
Barium	<0.6 mg/kg		1570	270	707	691	600	658	878	917	813		722	944	1040	701	786	1080	804	712	860	74.2	333	622	947	119
Beryllium	<0.01 mg/kg	420	277000	0.244	<0.25	<0.25	0.363	<0.1	0.556	<0.05	<0.1		0.106	<0.1	<0.1	<0.25	0.114	0.191	<	<0.1	<0.1	<	<0.25	<0.05	<0.05	<0.05
Boron, water soluble	<1 mg/kg	192000		8.38	5.06	5.42	5.45	11.4	6.03	3.4	1.66		9.58	7.39	5.71	5.08	4.03	8.76	3.39	3.33	13.9	4.7	2.5	3.77	1.23	2.63
Cadmium	<0.2 mg/kg	230	83.6	6.64	16.5	6.8	5.06	<	<	4.38	2.08		<	2.28	2.85	4.88	0.854	3.19	0.731	2.68	2.25	0.114	8.94	4	2.75	0.544
Calcium	<21mg/kg			61100	180000	217000	123000	214000	245000	166000	249000		156000	238000	227000	236000	221000	177000	249000	201000	216000	167000	51000	188000	189000	132000
Chromium	<0.9 mg/kg	30400	22500	1240	3540	3390	3400	6220	3700	2240	5880		4110	6150	4790	4140	3510	3490	3720	3240	4220	351	854	2140	3880	369
Chromium, Hexavalent	<0.6 mg/kg	35	239	<0.6	1.49	<	<	<	<	<	3.89		<	<	1.55	<	2.63	0.701	<	1.91	0.882	<	<	<0.6	0.657	<
Copper	<1.4 mg/kg	71700	12200	802	642	498	869	320	244	215	274		552	529	667	1040	286	474	329	347	290	33.6	1390	397	287	66.5
Lead	<0.7 mg/kg	4640	477	**814**	**1010**	228	239	53.6	38.8	264	42.7		277	54	152	78.2	220	282	136	188	127	29.3	**425**	289	165	38.5
Magnesium	<8mg/kg			17700	26500	37000	25100	45400	25800	50800	31400		48900	33700	50100	23900	41300	64700	26400	20200	48300	63200	24000	58300	39400	52300
Manganese	<0.13 mg/kg			13100	40800	39400	21100	32600	39600	39500	3680		39500	35600	25100	31700	34500	61900	4660	3310	45300	11300	2700	29800	70800	40000
Mercury	<0.14 mg/kg	3640	303	<0.14	<0.7	<0.7	<	<	<	<0.7	<		<	<	<	<0.7	<	<0.7	<1.4	<	<	<	<0.7	<0.7	<0.7	<0.7
Nickel	<0.2 mg/kg	1800	922	280	200	156	307	81.1	37	91.1	56.3		146	173	174	215	118	102	76.5	91.2	64.7	8.09	379	103	72.2	20.8
Selenium	<1 mg/kg	13000	696	<10	<25	31.2	13.1	22.3	22.8	15.1	19.5		16.2	19.9	17.6	<25	26.9	25.8	29.8	18.9	21.2	2.02	<25	16.9	22.5	<5
Vanadium	<0.2 mg/kg	3160	422	108	338	421	253	385	442	**581**	**438**		332	**521**	**543**	**431**	361	342	**451**	356	421	28.7	77.3	169	**423**	62.8
Zinc	<1.9mg/kg	665000	54800	3610	5480	1500	1070	395	226	1440	204		784	295	591	169	631	418	742	1500	709	95.2	2460	1740	1090	215
Phenols																										
2,3,5 TrimethylPhenol	<0.01 mg/kg			<	<	<	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<	<	<
2Isopropyl Phenol	<0.015 mg/kg			<	<	<	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cresols	<0.01 mg/kg		9910	<	<	<	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<	<	<
Phenol	<0.01 mg/kg	482	686	<	<	<	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	0.0113	0.0104	<	<
Phenols, Total 5 speciated	<0.06 mg/kg		686	<	<	<	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<	<	<
Phenols, Total monohydric	0.035 mg/kg		686	<	<	<	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<	<	<
Xylenols	<0.015 mg/kg			<	<	<	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<	<	<
Mineral Oil / Oils & Greases																										
Mineral oil >C10C40	<1 mg/kg			752								23.6									89.7		1760		68.8	925
% Surrogate Recovery	%			70.7								79.4									89.3		72.4		82.3	73.3
Surrogate Value				35.4								39.7									44.7		36.2		41.2	36.6

East Tip 2012 Solid Samples 100% Slag, Laboratory Analysis Results

Sample Identity	LoD / Units	TSV for Commercial / Industrial Use	Atrisk Park Human Health GAC (mg/kg)	BH301A	BH303	BH303	BH306a	BH306b	BH307	BH309	BH310a	BH310a	BH310a	BH310a	BH310b	BH310b	BH310c	BH310c	BH313	BH314	BH315	BH315	BH316	BH316	OP10	OP14
Depth (m)				4	1	3	7	4	2.5-3	5.50-6	3	4	6	9	5	8	0.6-0.8	4	5	0-0.5	3	6	0.2-0.5	5-5.5	1.1	1.7
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				15/05/2012	08/05/2012	08/05/2012	04/05/2012	24/04/2012	21/05/2012	06/06/2012	24/04/2012	24/04/2012	24/04/2012	01/05/2012	05/04/2012	10/05/2012	21/05/2012	22/05/2012	16/05/2012	24/04/2012	18/05/2012	22/05/2012	06/06/2012	11/06/2012	05/06/2012	07/06/2012
Sample Received Date				20/05/2012	13/05/2012	13/05/2012	09/05/2012	28/04/2012	23/05/2012	11/06/2012	28/04/2012	28/04/2012	28/04/2012	08/05/2012	05/09/2012	13/05/2012	23/05/2012	28/05/2012	20/05/2012	28/04/2012	23/05/2012	28/05/2012		13/06/2012	06/06/2012	08/06/2012
SDG				1205201	12051311	12051311	12050946	12042854	12052388	12061119	12042854	12042854	12042854	12050829	12050946	12051311	12052388	12052825	Schedule #6	12042854	12052388	12052825	12061119	12061381	1206067	12061119
TPH Criteria Working Group (TPH CWG)																										
Aliphatics >C5C6	<10µg/kg	3400000	324000000	<10								<									<		99.4		<	<
Aliphatics >C6C8	<10µg/kg	8300000	326000000	11.3								<									<		415		<	19
Aliphatics >C8C10	<10µg/kg	2100000	6420000	46.3								<									<		235		<	409
Aliphatics >C10C12	<10µg/kg	10000000	6520000	63.3								<									<10		113		<	375
Aliphatics >C12C16	<100µg/kg	61000000	6520000	10100								5540									<100		6650		<	68300
Aliphatics >C16C21	<100µg/kg	1000000000	177000000	64200								20900									8430		45300		2160	79200
Aliphatics >C21C35	<100µg/kg	1000000000	177000000	644000								52400									64200		1220000		36200	617000
Aliphatics >C35C44	<100µg/kg			242000								18200									15700		814000		6680	221000
Aromatics >EC5EC7	<10µg/kg	28000	14200	<								<									<		<		<	<
Aromatics >EC7EC8	<10µg/kg	59000000	23500000	<								<									<		<		<	<
Aromatics >EC8EC10	<10µg/kg	3700000	1940000	37.3								<									<		159		<	272
Aromatics >EC10EC12	<10µg/kg	17000000	2490000	41.8								<									<		74.6		<	251
Aromatics >EC12EC16	<100µg/kg	36000000	2590000	7470								8950									<		5300		<	11200
Aromatics >EC16EC21	<100µg/kg	28000000	1610000	35400								3080									4520		20000		1190	30700
Aromatics >EC21EC35	<100µg/kg	28000000	1610000	280000								<									24200		544000		9250	190000
Aromatics >EC35EC44	<100µg/kg			184000								<									14200		575000		4770	99600
Aromatics >EC40EC44	<100µg/kg			80800								<									6070		310000		1960	41200
Total Aliphatics >C535	<100µg/kg			719000								78800									72600		1270000		38400	765000
Total Aromatics >C535	<100µg/kg			323000								12000									28800		569000		10400	232000
Total Aliphatics & Aromatics >C5C44	<100µg/kg			1470000								109000									131000		3230000		60300	1320000
Methyl tertiary butyl ether (MTBE)	<5µg/kg		15600000	<								<									<		<		<	<
Benzene	<10µg/kg	28000	14200	<								<									<		<		<	<
Ethylbenzene	<3µg/kg	518000	10100000	<								<									<		<		<	<
m,p,oXylene	<9 µg/kg		14500000	<								<									<		<		<	<
m,pXylene	<6µg/kg	312000	14500000	<								<									<		<		<	<
oXylene	<3µg/kg		15700000	<								<									<		<		<	<
Toluene	<2µg/kg	869000	23500000	<								<									<		<		<	<
BTEX, Total	<24µg/kg			<								<									<		<		<	<
Rapid PAH Screen																										
Polyaromatic hydrocarbons, Total 17	<10mg/kg			21.5	<	<	<	<	<	<	<		<	<	<	<	``	<	<	<	<	<	<	<	<	<
SemiVolatile Organic Compounds (SVOCs)																										
1,2,4Trichlorobenzene	<100µg/kg			<								<									<		<		<	<
1,2Dichlorobenzene	<100µg/kg			<								<									<		<		<	<
1,3Dichlorobenzene	<100µg/kg			<								<									<		<		<	<
1,4Dichlorobenzene	<100µg/kg			<								<									<		<		<	<
2,4,5Trichlorophenol	<100µg/kg			<								<									<		<		<	<
2,4,6Trichlorophenol (S)	<100µg/kg			<								<									<		<		<	<
2,4Dichlorophenol (S)	<100µg/kg			<								<									<		<		<	<
2,4Dimethylphenol (S)	<100µg/kg		1920000	<								<									<		<		<	<
2,4Dinitrotoluene (S)	<100µg/kg		200000	<								<									<		<		<	<
2,6Dinitrotoluene	<100µg/kg		101000	<								<									<		<		<	<
2Chloronaphthalene	<100µg/kg		2450000	<								<									<		<		<	<
2Chlorophenol (S)	<100µg/kg			<								<									<		<		<	<
2Methylnaphthalene	<100µg/kg			<								<									<		<		<	<
2Methylphenol	<100µg/kg		9910000	<								<									<		<		<	<
2Niitroaniline (S)	<100µg/kg			<								<									<		<		<	<
2Nitrophenol (S)	<100µg/kg			<								<									<		<		<	<
3Nitroaniline	<100µg/kg			<								<									<		<		<	<
4Bromophenylphenylether	<100µg/kg			<								<									<		<		<	<
4Chloro3methylphenol (S)	<100µg/kg			<								<									<		<		<	<
4Chloroaniline	<100µg/kg			<								<									<		<		<	<
4Chlorophenylphenylether	<100µg/kg			<								<									<		<		<	<
4Methylphenol (S)	<100µg/kg		9910000	<								<									<		<		<	<
4Nitroaniline	<100µg/kg			<								<									<		<		<	<
4Nitrophenol (S)	<100µg/kg			<								<									<		<		<	<
Acenaphthene	<100µg/kg	85000000	5570000	<								<									<		<		<	<
Acenaphthylene	<100µg/kg	84000000		<								<									<		<		<	<
Anthracene	<100µg/kg	530000000	29100000	<								<									<		<		<	<
Azobenzene	<100µg/kg			<								<									<		<		<	<
Benzo(a)anthracene	<100µg/kg	90000	9520	136								<									<		<		<	124
Benzo(a)pyrene	<100µg/kg	14000	1200	137								<									<		<		<	116
Benzo(b)fluoranthene	<100µg/kg	100000	11500	<								<									<		<		<	116
Benzo(g,h,i)perylene	<100µg/kg	650000	143000	<								<									<		<		<	<
Benzo(k)fluoranthene	<100µg/kg	140000	123000	119								<									<		<		<	<
Bis(2chloroethoxy)methane	<100µg/kg			<								<									<		<		<	<
bis(2Chloroethyl)ether	<100µg/kg			<								<									<		<		<	<
bis(2Ethylhexyl) phthalate	<100µg/kg		3420000	1920								<									<		<		<	241
Butylbenzyl phthalate	<100µg/kg			<								<									<		<		<	<
Carbazole	<100µg/kg			<								<									<		<		<	<
Chrysene	<100µg/kg	140000	993000	171								<									<		<		<	164
Dibenzo(a,h)anthracene	<100µg/kg	13000	1270	<								<									<		<		<	<
Dibenzofuran	<100µg/kg			<								<									<		<		<	<
Diethyl phthalate	<100µg/kg		21000000	<								<									<		<		<	<
Dimethyl phthalate	<100µg/kg			<								<									<		<		<	<
Fluoranthene	<100µg/kg	23000000	3890000	400								<									<		<		<	225
Fluorene	<100µg/kg	64000000	3810000	<								<									<		<		<	<
Hexachlorobenzene	<100µg/kg			<								<									<		<		<	<
Hexachlorobutadiene	<100µg/kg			<								<									<		<		<	<
Hexachlorocyclopentadiene	<100µg/kg			<								<									<		<		<	<
Hexachloroethane	<100µg/kg		51400	<								<									<		<		<	<
Indeno(1,2,3cd)pyrene	<100µg/kg	60000	11200	<								<									<		<		<	<
Isophorone	<100µg/kg			<								<									<		<		<	<
Naphthalene	<100µg/kg	200000	1010000	<								<									<		<		<	<
nDibutyl phthalate	<100µg/kg			250								<									<		<		<	<
nDioctyl phthalate	<100µg/kg			<								<									<		<		<	<
Nitrobenzene	<100µg/kg			<								<									<		<		<	<
nNitrosondipropylamine	<100µg/kg			<								<									<		<		<	<
Pentachlorophenol	<100µg/kg			<								<									<		<		<	<
Phenanthrene	<100µg/kg	22000000		338								<									<		<		<	128
Phenol	<100µg/kg	482		<								<									<		<		<	<
Pyrene	<100µg/kg	54000000	2920000	354								<									<		<		<	194
Tic Report				See Attached								No TICs identified									No TICs identified		See Attached		No TICs identified	No TICs identified

East Tip 2012 Solid Samples 100% Slag, Laboratory Analysis Results

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Atrisk Park Human Health GAC (mg/kg)	BH301A	BH303	BH303	BH306a	BH306b	BH307	BH309	BH310a	BH310a	BH310a	BH310a	BH310b	BH310b	BH310c	BH310c	BH313	BH314	BH315	BH315	BH316	BH316	OP10	OP14
Depth (m)				4	1	3	7	4	2.5-3	5.50-6	3	4	6	9	5	8	0.6-0.8	4	5	0-0.5	3	6	0.2-0.5	5-5.5	1.1	1.7
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				15/05/2012	08/05/2012	08/05/2012	04/05/2012	24/04/2012	21/05/2012	06/06/2012	24/04/2012	24/04/2012	24/04/2012	01/05/2012	05/04/2012	10/05/2012	21/05/2012	22/05/2012	16/05/2012	24/04/2012	18/05/2012	22/05/2012	06/06/2012	11/06/2012	05/06/2012	07/06/2012
Sample Received Date				20/05/2012	13/05/2012	13/05/2012	09/05/2012	28/04/2012	23/05/2012	11/06/2012	28/04/2012	28/04/2012	28/04/2012	08/05/2012	05/09/2012	13/05/2012	23/05/2012	28/05/2012	20/05/2012	28/04/2012	23/05/2012	28/05/2012		13/06/2012	06/06/2012	08/06/2012
SDG				1205201	12051311	12051311	12050946	12042854	12052388	12061119	12042854	12042854	12042854	12050829	12050946	12051311	12052388	12052825	Schedule #6	12042854	12052388	12052825	12061119	12061381	1206067	12061119
Volatile Organic Compounds (VOCs) (Solids)																										
1.1.1.2Tetrachloroethane	<10µg/kg	120000	223000	<200								<									<		<200		<200	<
1.1.1Trichloroethane	<7µg/kg	700000	54500000	<140								<									<		<140		<140	<
1.1.2.2Tetrachloroethane	<10µg/kg	290000	292000	<200								<									<		<200		<200	<
1.1.2Trichloroethane	<10µg/kg		171000	<200								<									<		<200		<200	<
1.1Dichloroethane	<8µg/kg		9730000	<160								<									<		<160		<160	<
1.1Dichloroethene	<10µg/kg		453000	<200								<									<		<200		<200	<
1.1Dichloropropene	<10µg/kg			<220								<11									<11		<220		<220	<11
1.2.3Trichlorobenzene	<6µg/kg			<120								<									<		<120		<120	<
1.2.3Trichloropropane	<17µg/kg			<340								<									<		<340		<340	<
1.2.4Trichlorobenzene	<6µg/kg			<120								<									<		<120		<120	<
1.2.4Trimethylbenzene	<9µg/kg		49700	<180								<									<		<180		<180	<
1.2Dibromo3chloropropane	<14µg/kg			<280								<									<		<280		<280	<
1.2Dibromoethane	<12µg/kg			<240								<									<		<240		<240	<
1.2Dichlorobenzene	<12µg/kg			<240								<									<		<240		<240	<
1.2Dichloroethane	<5µg/kg	710	2800	<100								<									<		<100		<100	<
1.2Dichloropropane	<12µg/kg		18600	<240								<									<		<240		<240	<
1.3.5Trimethylbenzene	<8µg/kg			<160								<									<		<160		<160	<
1.3Dichlorobenzene	<6µg/kg			<120								<									<		<120		<120	<
1.3Dichloropropane	<7µg/kg			<140								<									<		<140		<140	<
1.4Dichlorobenzene	<5µg/kg			<100								<									<		<100		<100	<
2.2Dichloropropane	<12µg/kg			<240								<									<		<240		<240	<
2Chlorotoluene	<9µg/kg			<180								<									<		<180		<180	<
4Chlorotoluene	<12µg/kg			<240								<									<		<240		<240	<
4Isopropyltoluene	<11µg/kg			<220								<									<		<220		<220	<
Benzene	<9µg/kg	28000	14200	<180								<									<		<180		<180	<
Bromobenzene	<10µg/kg		228000	<200								<									<		<200		<200	<
Bromochloromethane	<14µg/kg			<280								<									<		<280		<280	<
Bromodichloromethane	<7µg/kg		7710	<140								<									<		<140		<140	<
Bromoform	<10µg/kg		644000	<200								<									<		<200		<200	<
Bromomethane	<13µg/kg			<260								<									<		<260		<260	<
Carbon Disulphide	<7µg/kg		303	<140								<									<		**372**		<140	<
Carbontetrachloride	<14µg/kg	3000	22400	<280								<									<		<280		<280	<
Chlorobenzene	<5µg/kg		4920000	<100								<									<		<100		<100	<
Chloroethane	<14µg/kg		272000000	<280								<									<		<280		<280	<
Chloroform	<8µg/kg	110000	457000	<160								<									<		<160		<160	<
Chloromethane	<7µg/kg		17200	<140								<									<		<140		<140	<
cis12Dichloroethene	<5µg/kg		89500	<100								<									<		<100		<100	<
cis13Dichloropropene	<7µg/kg			<280								<14									<14		<280		<280	<14
Dibromochloromethane	<13µg/kg		45000	<260								<									<		<260		<260	<
Dibromomethane	<9µg/kg			<180								<									<		<180		<180	<
Dichlorodifluoromethane	<4µg/kg			<80								<									<		<80		<80	<
Dichloromethane	<10µg/kg		297000	<200								<									<		<200		<200	<
Ethylbenzene	<3µg/kg	518000	10100000	<80								<4									<4		<80		<80	<4
Hexachlorobutadiene	<12µg/kg			<240								<12									<12		<240		<240	<
Isopropylbenzene	<5µg/kg		10000000	<100								<									<		<100		<100	<
Methyl Tertiary Butyl Ether	<11µg/kg			<220								<									<		<220		<220	<
Naphthalene	<13µg/kg		1010000	<260								<									<		<260		420	26.7
nButylbenzene	<10µg/kg			<200								<									<		<200		<200	<
oXylene	<3µg/kg			<200								<10									<10		<200		<200	<10
p/mXylene	<14µg/kg	312000	14500000	<280								<									<		<280		<280	<
Propylbenzene	<11µg/kg		10400000	<220								<									<		<220		<220	<
secButylbenzene	<10µg/kg			<200								<									<		<200		<200	<
Styrene	<10µg/kg			<200								<									<		<200		<200	<
Tertamyl methyl ether	<15µg/kg			<300								<									<		<300		<300	<
tertButylbenzene	<12µg/kg			<240								<									<		<240		<240	<
Tetrachloroethene	<5µg/kg	130000	982000	<100								<									<		<100		<100	<
Toluene	<2µg/kg	869000	23500000	<100								<									<5		<100		<100	<5
trans12Dichloroethene	<11µg/kg		212000	<220								<									<		<220		<220	<
trans13Dichloropropene	<14µg/kg			<280								<									<		<280		<280	<
Trichloroethene	<9µg/kg	12000	88200	<180								<									<		<180		<180	<
Trichlorofluorormethane	<6µg/kg			<120								<									<		<120		<120	<
Vinyl Chloride	<10µg/kg	63	804	<200								<									<		<200		<200	<
VOC TIC				No TICs identified								No TICs identified									No TICs identified		No TICs identified		No TICs identified	No TICs identified

East Tip 2012 Solid Samples 100% Slag, Laboratory Analysis Results

Sample Identity	LoD / Units	TSV for Commercial / Industrial Use	Atrisk Park Human Health GAC (mg/kg)	BH301A	BH303	BH303	BH306a	BH306b	BH307	BH309	BH310a	BH310a	BH310a	BH310a	BH310b	BH310b	BH310c	BH310c	BH313	BH314	BH315	BH315	BH316	BH316	OP10	OP14
Depth (m)				4	1	3	7	4	2.5-3	5.50-6	3	4	6	9	5	8	0.6-0.8	4	5	0-0.5	3	6	0.2-0.5	5-5.5	1.1	1.7
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				15/05/2012	08/05/2012	08/05/2012	04/05/2012	24/04/2012	21/05/2012	06/06/2012	24/04/2012	24/04/2012	24/04/2012	01/05/2012	05/04/2012	10/05/2012	21/05/2012	22/05/2012	16/05/2012	24/04/2012	18/05/2012	22/05/2012	06/06/2012	11/06/2012	05/06/2012	07/06/2012
Sample Received Date				20/05/2012	13/05/2012	13/05/2012	09/05/2012	28/04/2012	23/05/2012	11/06/2012	28/04/2012	28/04/2012	28/04/2012	08/05/2012	05/09/2012	13/05/2012	23/05/2012	28/05/2012	20/05/2012	28/04/2012	23/05/2012	28/05/2012		13/06/2012	06/06/2012	08/06/2012
SDG				1205201	12051311	12051311	12050946	12042854	12052388	12061119	12042854	12042854	12042854	12050829	12050946	12051311	12052388	12052825	Schedule #6	12042854	12052388	12052825	12061119	12061381	1206067	12061119
Subcontracted: Organics Dioxins/Furans																										
1,2,3,4,6,7,8 HpCDD*	ng/kg																								12	
1,2,3,4,6,7,8 HpCDF*	ng/kg																								12	
1,2,3,4,7,8 HxCDD*	ng/kg																								<2	
1,2,3,4,7,8 HxCDF*	ng/kg																								3.8	
1,2,3,4,7,8,9 HpCDF*	ng/kg																								<2	
1,2,3,6,7,8 HxCDD*	ng/kg																								2.8	
1,2,3,6,7,8 HxCDF*	ng/kg																								<2	
1,2,3,7,8 PeCDD*	ng/kg																								<2	
1,2,3,7,8 PeCDF*	ng/kg																								<2	
1,2,3,7,8,9 HxCDD*	ng/kg																								4.4	
1,2,3,7,8,9 HxCDF*	ng/kg																								<2	
2,3,4,6,7,8 HxCDF*	ng/kg																								3.8	
2,3,4,7,8 PeCDF*	ng/kg																								2.4	
2,3,7,8 TCDD*	ng/kg																								<2	
2,3,7,8, TCDF*	ng/kg																								3.7	
IPCDD/FTEQ Lower Bound*	ng/kg																								3.4	
IPCDD/FTEQ Upper Bound*	ng/kg																								7.1	
OCDD*	ng/kg																								44	
OCDF*	ng/kg																								6.1	
Tolulene Extractable Matter	<500 mg/kg								<	<							<								<	
PCB's (Solids)																										
PCB congener 101	< 3 µg/kg																						8.37		<	10.3
PCB congener 118	< 3 µg/kg																						5.97		<	7.71
PCB congener 138	< 3 µg/kg																						7.76		<	11.2
PCB congener 153	< 3 µg/kg																						6.58		<	8.56
PCB congener 180	< 3 µg/kg																						<3		<	5.15
PCB congener 28	< 3 µg/kg																						7.52		3.93	10.4
PCB congener 52	< 3 µg/kg																						7.81		<	8.91
PCBs, Total ICES 7	< 21 µg/kg																						44		<	62.3

BOLD and yellow indicates value exceeding Atrisk Park Human Health GAC

turquoise indicates value exceeds commercial GAC

Screen Unformatted Data

Screen Formatted Data

Appendix E Refractory Waste Solid Analysis Results

East Tip 2012 Borehole Solid Samples, Refractory Waste, Laboratory Analysis Results

	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)		slag with 10% refractory, 2% pastic and 1% metal	slag, 2% refractory. HC	slag with 20% refractory bricks	slag with occ. demolition material and refractory bricks	slag with abundent refractory brick	slag with 50% refractory		50% steel wite conrtete, red brick and fabric/ 50% cream ash with possible refractory in a clayey sandy gravel	scrap metals with refractory bricks, sands, gravels, black demolition waste and steel barrels with tar inside	slag with 5% waste steel, 2,5% refractory and 0.5% plastic	slag with 12% refractories	slag with 50% demolition waste (plastic, textile, red brick, concrete and refractory	
Sample Identity					BH304	BH304	BH305	BH306b	BH308	BH311	DUPLICATE 2	BH312a	BH312b	BH312c	BH313	BH314	DUPLICATE 1
Depth (m)					2	4.2	4 4.5	1	0.7 0.9	0.5 0.6	sames as BH311 0.5 0.6	2 2.1	5	2.3	2	3.2	same as BH314 3.2m
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date					25/05/2012	25/05/2012	24/05/2012	24/04/2012	25/05/2012	22/05/2012	23/05/2012	24/04/2012	30/04/2012	10/05/2012	16/05/2012	27/04/2012	27/04/2012
Sample Received Date					30/05/2012	30/05/2012	28/05/2012	28/04/2012	30/05/2012	28/05/2012	28/05/2012	28/04/2012	03/05/2012	13/05/2012	20/05/2012	03/05/2012	03/05/2012
SDG					12053071	12053071	12052825	12042854	12053071	12052825	12052825	12042854	12050370	12051311	Schedule #6	12050370	12050370
Sample Description																	
Colour					Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Grey	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown
Description					Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Loamy Sand	Loamy Sand
Grain Size					0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.063 0.1 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	0.063 0.1 mm	0.063 0.1 mm
Inclusion 1)					Crushed Brick	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones
Inclusion 2)					Stones	None	N/A	None	None	N/A	N/A	None	Vegetation	N/A	Vegetation	Metal	Tile
Moisture content ratio	%				6.2	0.88	2.9	9	13	7.6	6.6	14	14	8.4	9.5	9.6	8.2
Laboratory data																	
2Butanone	<100 µg/kg					<100											
Acetone	< 50 µg/kg					<50											
Chloride (soluble)	<5mg/kg				115	1740	1210	2600	64.1	58.4	72.1	168	2960	1000	787	1300	1340
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l				0.164	0.454	<0.008	0.532	0.232	0.108	0.0683	0.462	0.409	0.0571	0.129	0.153	0.15
Carbon																	
Fraction Organic Carbon (FOC)	<0.1			<	<	<	<		<	<	<	<0.1	<		<	<	
Fraction Organic Carbon (FOC)	<0.002																0.00756
Inorganics																	
Ammoniacal Nitrogen as N	<15mg/kg			<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Complex	<1 mg/kg			<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Free	<1 mg/kg	36	34	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Total	<1 mg/kg			<	<	<	<	<	<	<	<	<	<	<	<	<	<
pH	1 pH Units				10.4	9.57	10.6	10.2	11.9	11.6	11.7	11.6	10.4	11.4	11.9	9.5	9.09
Sulphate, Total	<0.008 mg/kg				2850	6000	2460	6470	3750	2580	2920	11400	3910	2000	4960	878	1090
Sulphide, Easily liberated	<15mg/kg			<	<	29.2	<	<	<	<	<	<	269	<	<	<	<
Sulphur, Total	<0.02%																0.12
Sulphur, Total	<0.0016%				0.0948	0.2	0.082	0.216	0.125	0.0859	0.0974	0.381	0.13	0.0668	0.165	0.0293	0.0363
Thiocyanate	<1 mg/kg			<	<	<	<	<	<	<	<	<	<	<	<	<	<
Metals																	
Aluminium	<11 mg/kg				16200	16000	1920	20600	8310	958	7820	10100	8110	15300	12400	1920	2930
Antimony	<0.6 mg/kg		831		27.3	30.9	6.89	151	19.2	5.02	27.8	36.8	56.2	36.1	48.3	49.2	38.9
Arsenic	<0.6 mg/kg	640	41.4		36.9	21.3	<0.6	<6	33.4	3.47	37.7	16.8	**47.7**	**70.2**	36.1	**119**	**69.6**
Barium	<0.6 mg/kg		1570		663	543	68.4	770	383	48.2	344	587	374	409	483	36.6	66.2
Beryllium	<0.01 mg/kg	420	277000	<	0.261	0.0686	<0.01	<0.1	0.127	<	<0.05	0.26	0.905	<0.25	0.521	2.64	2.31
Boron, water soluble	<1 mg/kg	192000			3.64	5.59	4.26	11.9	4.44	4.79	6.32	10.9	4.39	3.05	6.78	2.63	1.58
Cadmium	<0.2 mg/kg	230	83.6		14.2	8.12	0.301	<	4.1	0.636	10.3	5.39	2.2	9.53	8.42	<	<
Calcium	<21mg/kg				136000	176000	161000	4380	101000	91600	67700	103000	105000	106000	99000	11000	23400
Chromium	<0.9 mg/kg	30400	22500		1520	2230	302	6480	801	143	996	1040	1630	1470	1400	697	740
Chromium, Hexavalent	<0.6 mg/kg	35	239		1.06	<	<	<	0.929	2.25	2.23	<	<	<	2.85	<	<
Copper	<1.4 mg/kg	71700	12200		652	305	28.9	349	431	44.7	491	417	916	1300	453	2810	1280
Lead	<0.7 mg/kg	4640	477		**1090**	**645**	28.4	98.7	**542**	108	**1270**	**1250**	**478**	378	**941**	184	137
Magnesium	<8mg/kg				22100	53300	74000	5740	99900	178000	254000	158000	51900	19100	30400	2990	3490
Manganese	<0.13 mg/kg				16600	29400	11400	31000	18000	1780	10700	13200	10200	18300	15600	4590	5620
Mercury	<0.14 mg/kg	3640	303	<	<0.7	<0.7	<	<	<0.7	<	<0.7	<	<	<0.7	<1.4	<	<
Nickel	<0.2 mg/kg	1800	922		179	78.8	10.4	74.7	131	10.3	93.9	131	290	410	150	750	472
Selenium	<1 mg/kg	13000	696		9.9	17.5	1.14	20.8	8.42	<	6.16	10.5	10.8	<25	12	<10	<10
Vanadium	<0.2 mg/kg	3160	422		151	**498**	38.4	350	251	21.6	144	118	195	126	189	25.3	40.3
Zinc	<1.9mg/kg	665000	54800		5970	3700	592	468	2020	1070	13200	2770	2200	2250	3030	801	563
Phenols																	
2,3,5 TrimethylPhenol	<0.01 mg/kg			<	<	<	<	<	<	<	<	<	<	<	<	<	<
2Isopropyl Phenol	<0.015 mg/kg			<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cresols	<0.01 mg/kg		9910	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Phenol	<0.01 mg/kg	482	686	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Phenols, Total 5 speciated	<0.06 mg/kg		686	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Phenols, Total monohydric	<0.035 mg/kg		686	<	<	<	<	<	<	<	<	<		<	<		
Xylenols	<0.015 mg/kg			<	<	<	<	<	<	<	<	<	<	<	<	<	<
Mineral Oil / Oils & Greases																	
Mineral oil >C10C40	<1 mg/kg												699	278		210	
% Surrogate Recovery	%												73.2	78.3		77.4	
Surrogate Value													36.6	39.1		38.7	

East Tip 2012 Borehole Solid Samples, Refractory Waste, Laboratory Analysis Results

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)		BH304	BH304	BH305	BH306b	BH308	BH311	DUPLICATE 2	BH312a	BH312b	BH312c	BH313	BH314	DUPLICATE 1
Depth (m)					2	4.2	4 4.5	1	0.7 0.9	0.5 0.6	sames as BH311 0.5 0.6	2 2.1	5	2.3	2	3.2	same as BH314 3.2m
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date					25/05/2012	25/05/2012	24/05/2012	24/04/2012	25/05/2012	22/05/2012	23/05/2012	24/04/2012	30/04/2012	10/05/2012	16/05/2012	27/04/2012	27/04/2012
Sample Received Date					30/05/2012	30/05/2012	28/05/2012	28/04/2012	30/05/2012	28/05/2012	28/05/2012	28/04/2012	03/05/2012	13/05/2012	20/05/2012	03/05/2012	03/05/2012
SDG					12053071	12053071	12052825	12042854	12053071	12052825	12052825	12042854	12050370	12051311	Schedule #6	12050370	12050370
TPH Criteria Working Group (TPH CWG)																	
Aliphatics >C5C6	<10µg/kg	3400000	324000000			<							<	<		<	
Aliphatics >C6C8	<10µg/kg	8300000	326000000			<							48.6	13.1		<	
Aliphatics >C8C10	<10µg/kg	2100000	6420000			<							204	21.8		<	
Aliphatics >C10C12	<10µg/kg	10000000	6520000			<							256	111		<	
Aliphatics >C12C16	<100µg/kg	61000000	6520000			2230							12800	2920		5980	
Aliphatics >C16C21	<100µg/kg	1000000000	177000000			18500							82100	21900		25000	
Aliphatics >C21C35	<100µg/kg	1000000000	177000000			88300							484000	163000		132000	
Aliphatics >C35C44	<100µg/kg					20400							196000	61000		36800	
Aromatics >EC5EC7	<10µg/kg	28000	14200			<							<	<		<	
Aromatics >EC7EC8	<10µg/kg	59000000	23500000			<							<	<		<	
Aromatics >EC8EC10	<10µg/kg	3700000	1940000			<							136	17.5		<	
Aromatics >EC10EC12	<10µg/kg	17000000	2490000			<							171	74.2		<	
Aromatics >EC12EC16	<100µg/kg	36000000	2590000			1890							5660	1690		2430	
Aromatics >EC16EC21	<100µg/kg	28000000	1610000			11900							37000	10200		8620	
Aromatics >EC21EC35	<100µg/kg	28000000	1610000			54600							198000	82800		51700	
Aromatics >EC35EC44	<100µg/kg					22900							98300	50500		24000	
Aromatics >EC40EC44	<100µg/kg					8330							43000	20900		10100	
Total Aliphatics >C535	<100µg/kg					109000							580000	187000		163000	
Total Aromatics >C535	<100µg/kg					68400							241000	94700		62800	
Total Aliphatics & Aromatics >C5C44	<100µg/kg					221000							1110000	394000		286000	
Methyl tertiary butyl ether (MTBE)	<5µg/kg		15600000			<							<	<		<	
Benzene	<10µg/kg	28000	14200			<							<	<		<	
Ethylbenzene	<3µg/kg	518000	10100000			<							<	<		<	
m,p,oXylene	<9 µg/kg		14500000			<							<	<		<	
m,pXylene	<6µg/kg	312000	14500000			<							<	<		<	
oXylene	<3µg/kg		15700000			<							<	<		<	
Toluene	<2µg/kg	869000	23500000			<							<	<		<	
BTEX, Total	<24µg/kg					<							<	<		<	
Rapid PAH Screen																	
Polyaromatic hydrocarbons, Total 17	<10mg/kg			<	11.7	<	<	<	<	<	<	<	<	<	13.3	<	<
SemiVolatile Organic Compounds (SVOCs)																	
1,2,4Trichlorobenzene	<100µg/kg					<							<	<		<	
1,2Dichlorobenzene	<100µg/kg					<							<	<		<	
1,3Dichlorobenzene	<100µg/kg					<							<	<		<	
1,4Dichlorobenzene	<100µg/kg					<							<	<		<	
2,4,5Trichlorophenol	<100µg/kg					<							<	<		<	
2,4,6Trichlorophenol (S)	<100µg/kg					<							<	<		<	
2,4Dichlorophenol (S)	<100µg/kg					<							<	<		<	
2,4Dimethylphenol (S)	<100µg/kg		1920000			<							<	<		<	
2,4Dinitrotoluene (S)	<100µg/kg		200000			<							<	<		<	
2,6Dinitrotoluene	<100µg/kg		101000			<							<	<		<	
2Chloronaphthalene	<100µg/kg		2450000			<							<	<		<	
2Chlorophenol (S)	<100µg/kg					<							<	<		<	
2Methylnaphthalene	<100µg/kg					<							<	<		<	
2Methylphenol	<100µg/kg		9910000			<							<	<		<	
2Niitroaniline (S)	<100µg/kg					<							<	<		<	
2Nitrophenol (S)	<100µg/kg					<							<	<		<	
3Nitroaniline	<100µg/kg					<							<	<		<	
4Bromophenylphenylether	<100µg/kg					<							<	<		<	
4Chloro3methylphenol (S)	<100µg/kg					<							<	<		<	
4Chloroaniline	<100µg/kg					<							<	<		<	
4Chlorophenylphenylether	<100µg/kg					<							<	<		<	
4Methylphenol (S)	<100µg/kg		9910000			<							<	<		<	
4Nitroaniline	<100µg/kg					<							<	<		<	
4Nitrophenol (S)	<100µg/kg					<							<	<		<	
Acenaphthene	<100µg/kg	85000000	5570000			<							<	<		<	
Acenaphthylene	<100µg/kg	84000000				<							<	<		<	
Anthracene	<100µg/kg	530000000	29100000			150							169	<		<	
Azobenzene	<100µg/kg					<							<	<		<	
Benzo(a)anthracene	<100µg/kg	90000	9520			381							415	<		<	
Benzo(a)pyrene	<100µg/kg	14000	1200			356							368	<		<	
Benzo(b)fluoranthene	<100µg/kg	100000	11500			318							303	<		<	
Benzo(g,h,i)perylene	<100µg/kg	650000	143000			254							226	<		<	
Benzo(k)fluoranthene	<100µg/kg	140000	123000			310							287	<		<	
Bis(2chloroethoxy)methane	<100µg/kg					<							<	<		<	
bis(2Chloroethyl)ether	<100µg/kg					<							<	<		<	
bis(2Ethylhexyl) phthalate	<100µg/kg		3420000			5380							294	<		<	
Butylbenzyl phthalate	<100µg/kg					<							<	<		<	
Carbazole	<100µg/kg					<							<	<		<	
Chrysene	<100µg/kg	140000	993000			411							578	<		<	
Dibenzo(a,h)anthracene	<100µg/kg	13000	1270			<							<	<		<	
Dibenzofuran	<100µg/kg					<							<	<		<	
Diethyl phthalate	<100µg/kg		21000000			<							<	<		<	
Dimethyl phthalate	<100µg/kg					<							<	<		<	
Fluoranthene	<100µg/kg	23000000	3890000			904							809	<		126	
Fluorene	<100µg/kg	64000000	3810000			<							<	<		<	
Hexachlorobenzene	<100µg/kg					<							<	<		<	
Hexachlorobutadiene	<100µg/kg					<							<	<		<	
Hexachlorocyclopentadiene	<100µg/kg					<							<	<		<	
Hexachloroethane	<100µg/kg		51400			<							<	<		<	
Indeno(1,2,3cd)pyrene	<100µg/kg	60000	11200			201							217	<		<	
Isophorone	<100µg/kg					<							<	<		<	
Naphthalene	<100µg/kg	200000	1010000			165							204	<		<	
nDibutyl phthalate	<100µg/kg					115							2290	<		<	
nDioctyl phthalate	<100µg/kg					<							<	<		<	
Nitrobenzene	<100µg/kg					<							<	<		<	
nNitrosondipropylamine	<100µg/kg					<							<	<		<	
Pentachlorophenol	<100µg/kg					<							<	<		<	
Phenanthrene	<100µg/kg	22000000				678							786	<		<	
Phenol	<100µg/kg	482				<							<	<		<	
Pyrene	<100µg/kg	54000000	2920000			703							752	<		<	
Tic Report						No TICs identified							See Attached	See Attached		No TICs identified	

East Tip 2012 Borehole Solid Samples, Refractory Waste, Laboratory Analysis Results

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)	BH304	BH304	BH305	BH306b	BH308	BH311	DUPLICATE 2	BH312a	BH312b	BH312c	BH313	BH314	DUPLICATE 1
Depth (m)				2	4.2	4 4.5	1	0.7 0.9	0.5 0.6	sames as BH311 0.5 0.6	2 2.1	5	2.3	2	3.2	same as BH314 3.2m
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				25/05/2012	25/05/2012	24/05/2012	24/04/2012	25/05/2012	22/05/2012	23/05/2012	24/04/2012	30/04/2012	10/05/2012	16/05/2012	27/04/2012	27/04/2012
Sample Received Date				30/05/2012	30/05/2012	28/05/2012	28/04/2012	30/05/2012	28/05/2012	28/05/2012	28/04/2012	03/05/2012	13/05/2012	20/05/2012	03/05/2012	03/05/2012
SDG				12053071	12053071	12052825	12042854	12053071	12052825	12052825	12042854	12050370	12051311	Schedule #6	12050370	12050370
Volatile Organic Compounds (VOCs) (Solids)																
1.1.1.2Tetrachloroethane	<10µg/kg	120000	223000		<							<	<200		<	
1.1.1Trichloroethane	<7µg/kg	700000	54500000		<							<	<140		<	
1.1.2.2Tetrachloroethane	<10µg/kg	290000	292000		<							<	<200		<	
1.1.2Trichloroethane	<10µg/kg		171000		<							<	<200		<	
1.1Dichloroethane	<8µg/kg		9730000		<							<	<160		<	
1.1Dichloroethene	<10µg/kg		453000		<							<	<200		<	
1.1Dichloropropene	<10µg/kg				<11							<11	<220		<11	
1.2.3Trichlorobenzene	<6µg/kg				<							<	<120		<	
1.2.3Trichloropropane	<17µg/kg				<							<	<340		<	
1.2.4Trichlorobenzene	<6µg/kg				<							<	<120		<	
1.2.4Trimethylbenzene	<9µg/kg		49700		<							<	<180		<	
1.2Dibromo3chloropropane	<14µg/kg				<							<	<280		<	
1.2Dibromoethane	<12µg/kg				<							<	<240		<	
1.2Dichlorobenzene	<12µg/kg				<							<	<240		<	
1.2Dichloroethane	<5µg/kg	710	2800		<							<	<100		<	
1.2Dichloropropane	<12µg/kg		18600		<							<	<240		<	
1.3.5Trimethylbenzene	<8µg/kg				<							<	<160		<	
1.3Dichlorobenzene	<6µg/kg				<							<	<120		<	
1.3Dichloropropane	<7µg/kg				<							<	<140		<	
1.4Dichlorobenzene	<5µg/kg				<							<	<100		<	
2.2Dichloropropane	<12µg/kg				<							<	<240		<	
2Chlorotoluene	<9µg/kg				<							<	<180		<	
4Chlorotoluene	<12µg/kg				<							<	<240		<	
4Isopropyltoluene	<11µg/kg				<							<	<220		<	
Benzene	<9µg/kg	28000	14200		<							<	<180		<	
Bromobenzene	<10µg/kg		228000		<							<	<200		<	
Bromochloromethane	<14µg/kg				<							<	<280		<	
Bromodichloromethane	<7µg/kg		7710		<							<	<140		<	
Bromoform	<10µg/kg		644000		<							<	<200		<	
Bromomethane	<13µg/kg				<							<	<260		<	
Carbon Disulphide	<7µg/kg		303		14.7							59.7	<140		<	
Carbontetrachloride	<14µg/kg	3000	22400		<							<	<280		<	
Chlorobenzene	<5µg/kg		4920000		<							<	<100		<	
Chloroethane	<14µg/kg		272000000		<							<	<280		<	
Chloroform	<8µg/kg	110000	457000		<							<	<160		<	
Chloromethane	<7µg/kg		17200		<							<	<140		<	
cis12Dichloroethene	<5µg/kg		89500		<							<	<100		<	
cis13Dichloropropene	<7µg/kg				<14							<14	<280		<14	
Dibromochloromethane	<13µg/kg		45000		<							<	<260		<	
Dibromomethane	<9µg/kg				<							<	<180		<	
Dichlorodifluoromethane	<4µg/kg				<							<	<80		<	
Dichloromethane	<10µg/kg		297000		<							<	<200		<	
Ethylbenzene	<3µg/kg	518000	10100000		<4							<4	<80		<4	
Hexachlorobutadiene	<12µg/kg				<							<	<240		<12	
Isopropylbenzene	<5µg/kg		10000000		<							<	<100		<	
Methyl Tertiary Butyl Ether	<11µg/kg				<							<	<220		<	
Naphthalene	<13µg/kg		1010000		<							<	<260		<	
nButylbenzene	<10µg/kg				<							<	<200		<	
oXylene	<3µg/kg				<10							<	<200		<10	
p/mXylene	<14µg/kg	312000	14500000		<							<	<280		<	
Propylbenzene	<11µg/kg		10400000		<							<	<220		<	
secButylbenzene	<10µg/kg				<							<	<200		<	
Styrene	<10µg/kg				<							<	<200		<	
Tertamyl methyl ether	<15µg/kg				<							<	<300		<	
tertButylbenzene	<12µg/kg				<							<	<240		<	
Tetrachloroethene	<5µg/kg	130000	982000		<							<	<100		<	
Toluene	<2µg/kg	869000	23500000		<5							<5	<100		<5	
trans12Dichloroethene	<11µg/kg		212000		<							<	<220		<	
trans13Dichloropropene	<14µg/kg				<							<	<280		<	
Trichloroethene	<9µg/kg	12000	88200		<							<	<180		<	
Trichlorofluorormethane	<6µg/kg				<							<	<120		<	
Vinyl Chloride	<10µg/kg	63	804		<							<	<200		<	
VOC TIC					No TICs identified							No TICs identified	No TICs identified		No TICs identified	
Subcontracted: Organics Dioxins/Furans																
1,2,3,4,6,7,8 HpCDD*	ng/kg															
1,2,3,4,6,7,8 HpCDF*	ng/kg															
1,2,3,4,7,8 HxCDD*	ng/kg															
1,2,3,4,7,8 HxCDF*	ng/kg															
1,2,3,4,7,8,9 HpCDF*	ng/kg															
1,2,3,6,7,8 HxCDD*	ng/kg															
1,2,3,6,7,8 HxCDF*	ng/kg															
1,2,3,7,8 PeCDD*	ng/kg															
1,2,3,7,8 PeCDF*	ng/kg															
1,2,3,7,8,9 HxCDD*	ng/kg															
1,2,3,7,8,9 HxCDF*	ng/kg															
2,3,4,6,7,8 HxCDF*	ng/kg															
2,3,4,7,8 PeCDF*	ng/kg															
2,3,7,8 TCDD*	ng/kg															
2,3,7,8, TCDF*	ng/kg															
IPCDD/FTEQ Lower Bound*	ng/kg															
IPCDD/FTEQ Upper Bound*	ng/kg															
OCDD*	ng/kg															
OCDF*	ng/kg															
Toluene Extractable Matter	<500 mg/kg															700

BOLD and yellow indicates value exceeding Atrisk Park Human Health GAC

turquoise indicates value exceeds commercial GAC

East Tip 2012 Borehole Solid Samples, Refractory Waste, Laboratory Analysis Results

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)	BH304	BH304	BH305	BH306b	BH308	BH311	DUPLICATE 2	BH312a	BH312b	BH312c	BH313	BH314	DUPLICATE 1
Depth (m)				2	4.2	4 4.5	1	0.7 0.9	0.5 0.6	sames as BH311 0.5 0.6	2 2.1	5	2.3	2	3.2	same as BH314 3.2m
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				25/05/2012	25/05/2012	24/05/2012	24/04/2012	25/05/2012	22/05/2012	23/05/2012	24/04/2012	30/04/2012	10/05/2012	16/05/2012	27/04/2012	27/04/2012
Sample Received Date				30/05/2012	30/05/2012	28/05/2012	28/04/2012	30/05/2012	28/05/2012	28/05/2012	28/04/2012	03/05/2012	13/05/2012	20/05/2012	03/05/2012	03/05/2012
SDG				12053071	12053071	12052825	12042854	12053071	12052825	12052825	12042854	12050370	12051311	Schedule #6	12050370	12050370

Screen Unformatted Data

Screen Formatted Data

Appendix F Millscale Waste Solid Analysis Results

East Tip 2012 Borehole Solid Samples Millscale, Laboratory Analysis

	LoD/Units	TSV for Commercial / Industrial Use	Atrisk Park Human Health GAC (mg/kg)		millscale possible flue dust	clay with slag and possible millscale, 5% timber, 2% refractory 1% construction and 2% plastic household waste	slag/with possible millscale or slag	millscale with some scrap metal/ occassional amount of refractory brick and minute amount of household waste	millscale	slag with 20% millscale	millscale
Sample Identity					BH301A	BH302	BH302	BH312b	BH312b	OP10	OP14
Depth (m)					0.6-1	2	5	1	2.5	0.8	1.1-1.60
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date					15/05/2012	17/05/2012	17/05/2012	30/04/2012	30/04/2012	05/06/2012	07/06/2012
Sample Received Date					20/05/2012	20/05/2012	20/05/2012	03/05/2012	03/05/2012	06/06/2012	08/06/2012
SDG					1205201	1205201	1205201	12050370	12050370	1206067	12061119
Sample Description											
Colour					Black	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Black	Black
Description					Sand	Sandy Loam	Gravel	Loamy Sand	Loamy Sand	Sand	N/A
Grain Size					0.063 0.1 mm	0.063 0.1 mm	2 10 mm	0.063 0.1 mm	0.063 0.1 mm	0.1 2 mm	0.1 2 mm
Inclusion 1)					Stones	Vegetation	Metal	Metal	Tile	Stones	N/A
Inclusion 2)					N/A	Stones	Fibres	Stones	Stones	N/A	N/A
Moisture content ratio	%				6.6	16	4	7.8	6.6	4.7	5.1
Laboratory data											
2Butanone	<100 µg/kg									<	<
Acetone	< 50 µg/kg									<	<
Chloride (soluble)	<5mg/kg				14.2	28.7	1280	87.6	683	9.05	15.1
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l				0.0235	0.0365	0.197	0.101	0.0648	0.0182	0.0511
Carbon											
Fraction Organic Carbon (FOC)	<0.1			<		<	<		<		
Fraction Organic Carbon (FOC)	<0.002				<			0.00788			
Inorganics											
Ammoniacal Nitrogen as N	<15mg/kg			<	<15	<	<	<	<	<	<
Cyanide, Complex	<1 mg/kg			<	<	<	<	<	<	<	<
Cyanide, Free	<1 mg/kg	36	34	<	<	<	<	<	<	<	<
Cyanide, Total	<1 mg/kg			<	<	<	<	<	<	<	<
pH	1 pH Units				9.66	9.42	11.2	12.4	12.3	9.15	8.97
Sulphate, Total	<0.008 mg/kg				212	622	3600	2570	2070	156	346
Sulphide, Easily liberated	<15mg/kg			<	<15	<	<	<	<	<	<
Sulphur, Total	<0.02%				0.0413			0.101		0.0325	
Sulphur, Total	<0.0016%					0.0207	0.12	0.0856	0.0689		0.0115
Thiocyanate	<1 mg/kg			<	<1	<	<	<	<	<	<
Metals											
Aluminium	<11 mg/kg				737	5960	18500	7120	6860	632	470
Antimony	<0.6 mg/kg		831		44.1	27.3	80.5	69.4	59.8	34.2	32
Arsenic	<0.6 mg/kg	640	41.4		**85.5**	39.4	13.1	**81.20**	**115**	**62.9**	**45.2**
Barium	<0.6 mg/kg		1570		8.06	84.2	660	212	148	17.5	<15
Beryllium	<0.01 mg/kg	420	277000	<	0.814	0.924	<0.1	1.12	1.78	<0.25	<0.25
Boron, water soluble	<1 mg/kg	192000			<	1.62	5.7	6.81	6.37	<	<
Cadmium	<0.2 mg/kg	230	83.6		<0.2	4.84	4.59	**95.9**	12.1	17.7	0.811
Calcium	<21mg/kg				1550	45400	167000	61400	77900	2330	1450
Chromium	<0.9 mg/kg	30400	22500		857	462	3290	1190	872	592	1140
Chromium, Hexavalent	<0.6 mg/kg	35	239		<0.6	<	<	4.68	<	0.835	<
Copper	<1.4 mg/kg	71700	12200		2170	1110	604	1680	2340	1510	1800
Lead	<0.7 mg/kg	4640	477		24.2	**568**	**469**	**5480**	**1300**	**966**	39.4
Magnesium	<8mg/kg				485	3580	29900	37800	39200	410	1590
Manganese	<0.13 mg/kg				5250	3050	35900	11700	7370	5560	27300
Mercury	<0.14 mg/kg	3640	303	<	<1.4	<1.4	<1.4	<	<	<3.5	<3.5
Nickel	<0.2 mg/kg	1800	922		707	381	198	472	701	505	537
Selenium	<1 mg/kg	13000	696		<10	<10	13.6	<10	<10	<25	<25
Vanadium	<0.2 mg/kg	3160	422		3.07	24.4	316	63.9	42.9	11.8	26.2
Zinc	<1.9mg/kg	665000	54800		96.3	2150	2080	31200	6730	4410	562
Phenols											
2,3,5 TrimethylPhenol	<0.01 mg/kg			<	<	<	<	<	<	<	<
2Isopropyl Phenol	<0.015 mg/kg			<	<	<	<	<	<	<	<
Cresols	<0.01 mg/kg		9910	<	<	<	<	<	<	<	<
Phenol	<0.01 mg/kg	482	686	<	<	<	<	<	<	<	<
Phenols, Total 5 speciated	<0.06 mg/kg		686	<	<	<	<	<	<	<	<
Phenols, Total monohydric	0.035 mg/kg		686	<	<	<	<			<	<
Xylenols	<0.015 mg/kg			<	<	<	<	<	<	<	<
Mineral Oil / Oils & Greases											
Mineral oil >C10C40	<1 mg/kg									57	195
% Surrogate Recovery	%									78.2	85.2
Surrogate Value										39.1	42.6
TPH Criteria Working Group (TPH CWG)											
Aliphatics >C5C6	<10µg/kg	3400000	324000000							<	<
Aliphatics >C6C8	<10µg/kg	8300000	326000000							<	<
Aliphatics >C8C10	<10µg/kg	2100000	6420000							<	<
Aliphatics >C10C12	<10µg/kg	10000000	6520000							<	<
Aliphatics >C12C16	<100µg/kg	61000000	6520000							1430	<
Aliphatics >C16C21	<100µg/kg	1000000000	177000000							3770	5380
Aliphatics >C21C35	<100µg/kg	1000000000	177000000							38000	148000
Aliphatics >C35C44	<100µg/kg									19000	45700
Aromatics >EC5EC7	<10µg/kg	28000	14200							<	<
Aromatics >EC7EC8	<10µg/kg	59000000	23500000							<	<
Aromatics >EC8EC10	<10µg/kg	3700000	1940000							<	<
Aromatics >EC10EC12	<10µg/kg	17000000	2490000							<	<
Aromatics >EC12EC16	<100µg/kg	36000000	2590000							<	<
Aromatics >EC16EC21	<100µg/kg	28000000	1610000							1020	1890
Aromatics >EC21EC35	<100µg/kg	28000000	1610000							4650	49800
Aromatics >EC35EC44	<100µg/kg									3430	26100
Aromatics >EC40EC44	<100µg/kg									1060	10200
Total Aliphatics >C535	<100µg/kg									43200	153000
Total Aromatics >C535	<100µg/kg									5670	51700
Total Aliphatics & Aromatics >C5C44	<100µg/kg									71300	277000
Methyl tertiary butyl ether (MTBE)	<5µg/kg		15600000							<	<
Benzene	<10µg/kg	28000	14200							<	<
Ethylbenzene	<3µg/kg	518000	10100000							<	<
m,p,oXylene	<9 µg/kg		14500000							<	<
m,pXylene	<6µg/kg	312000	14500000							<	<
oXylene	<3µg/kg		15700000							<	<
Toluene	<2µg/kg	869000	23500000							<	<
BTEX, Total	<24µg/kg									<	<

East Tip 2012 Borehole Solid Samples Millscale, Laboratory Analysis

Sample Identity	LoD / Units	TSV for Commercial / Industrial Use	Atrisk Park Human Health GAC (mg/kg)		BH301A	BH302	BH302	BH312b	BH312b	OP10	OP14
Depth (m)					0.6-1	2	5	1	2.5	0.8	1.1-1.60
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date					15/05/2012	17/05/2012	17/05/2012	30/04/2012	30/04/2012	05/06/2012	07/06/2012
Sample Received Date					20/05/2012	20/05/2012	20/05/2012	03/05/2012	03/05/2012	06/06/2012	08/06/2012
SDG					1205201	1205201	1205201	12050370	12050370	1206067	12061119
Rapid PAH Screen											
Polyaromatic hydrocarbons, Total 17	<10mg/kg			<	<	16.7	<	<	<	<	<
SemiVolatile Organic Compounds (SVOCs)											
1,2,4Trichlorobenzene	<100µg/kg									<	<
1,2Dichlorobenzene	<100µg/kg									<	<
1,3Dichlorobenzene	<100µg/kg									<	<
1,4Dichlorobenzene	<100µg/kg									<	<
2,4,5Trichlorophenol	<100µg/kg									<	<
2,4,6Trichlorophenol (S)	<100µg/kg									<	<
2,4Dichlorophenol (S)	<100µg/kg									<	<
2,4Dimethylphenol (S)	<100µg/kg		1920000							<	<
2,4Dinitrotoluene (S)	<100µg/kg		200000							<	<
2,6Dinitrotoluene	<100µg/kg		101000							<	<
2Chloronaphthalene	<100µg/kg		2450000							<	<
2Chlorophenol (S)	<100µg/kg									<	<
2Methylnaphthalene	<100µg/kg									<	<
2Methylphenol	<100µg/kg		9910000							<	<
2Niitroaniline (S)	<100µg/kg									<	<
2Nitrophenol (S)	<100µg/kg									<	<
3Nitroaniline	<100µg/kg									<	<
4Bromophenylphenylether	<100µg/kg									<	<
4Chloro3methylphenol (S)	<100µg/kg									<	<
4Chloroaniline	<100µg/kg									<	<
4Chlorophenylphenylether	<100µg/kg									<	<
4Methylphenol (S)	<100µg/kg		9910000							<	<
4Nitroaniline	<100µg/kg									<	<
4Nitrophenol (S)	<100µg/kg									<	<
Acenaphthene	<100µg/kg	85000000	5570000							<	<
Acenaphthylene	<100µg/kg	84000000								<	<
Anthracene	<100µg/kg	530000000	29100000							<	<
Azobenzene	<100µg/kg									<	<
Benzo(a)anthracene	<100µg/kg	90000	9520							<	<
Benzo(a)pyrene	<100µg/kg	14000	1200							<	<
Benzo(b)fluoranthene	<100µg/kg	100000	11500							<	<
Benzo(g,h,i)perylene	<100µg/kg	650000	143000							<	<
Benzo(k)fluoranthene	<100µg/kg	140000	123000							<	<
Bis(2chloroethoxy)methane	<100µg/kg									<	<
bis(2Chloroethyl)ether	<100µg/kg									<	<
bis(2Ethylhexyl) phthalate	<100µg/kg		3420000							<	<
Butylbenzyl phthalate	<100µg/kg									<	<
Carbazole	<100µg/kg									<	<
Chrysene	<100µg/kg	140000	993000							<	<
Dibenzo(a,h)anthracene	<100µg/kg	13000	1270							<	<
Dibenzofuran	<100µg/kg									<	<
Diethyl phthalate	<100µg/kg		21000000							<	<
Dimethyl phthalate	<100µg/kg									<	<
Fluoranthene	<100µg/kg	23000000	3890000							<	<
Fluorene	<100µg/kg	64000000	3810000							<	<
Hexachlorobenzene	<100µg/kg									<	<
Hexachlorobutadiene	<100µg/kg									<	<
Hexachlorocyclopentadiene	<100µg/kg									<	<
Hexachloroethane	<100µg/kg		51400							<	<
Indeno(1,2,3cd)pyrene	<100µg/kg	60000	11200							<	<
Isophorone	<100µg/kg									<	<
Naphthalene	<100µg/kg	200000	1010000							<	<
nDibutyl phthalate	<100µg/kg									<	<
nDioctyl phthalate	<100µg/kg									<	<
Nitrobenzene	<100µg/kg									<	<
nNitrosondipropylamine	<100µg/kg									<	<
Pentachlorophenol	<100µg/kg									<	<
Phenanthrene	<100µg/kg	22000000								<	<
Phenol	<100µg/kg	482								<	<
Pyrene	<100µg/kg	54000000	2920000							<	<
Tic Report										No TICs identified	No TICs identified

East Tip 2012 Borehole Solid Samples Millscale, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Atrisk Park Human Health GAC (mg/kg)		BH301A	BH302	BH302	BH312b	BH312b	OP10	OP14
Depth (m)					0.6-1	2	5	1	2.5	0.8	1.1-1.60
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date					15/05/2012	17/05/2012	17/05/2012	30/04/2012	30/04/2012	05/06/2012	07/06/2012
Sample Received Date					20/05/2012	20/05/2012	20/05/2012	03/05/2012	03/05/2012	06/06/2012	08/06/2012
SDG					1205201	1205201	1205201	12050370	12050370	1206067	12061119
Volatile Organic Compounds (VOCs) (Solids)											
1.1.1.2Tetrachloroethane	<10µg/kg	120000	223000							<	<
1.1.1Trichloroethane	<7µg/kg	700000	54500000							<	<
1.1.2.2Tetrachloroethane	<10µg/kg	290000	292000							<	<
1.1.2Trichloroethane	<10µg/kg		171000							<	<
1.1Dichloroethane	<8µg/kg		9730000							<	<
1.1Dichloroethene	<10µg/kg		453000							<	<
1.1Dichloropropene	<10µg/kg									<11	<11
1.2.3Trichlorobenzene	<6µg/kg									<	<
1.2.3Trichloropropane	<17µg/kg									<	<
1.2.4Trichlorobenzene	<6µg/kg									<	<
1.2.4Trimethylbenzene	<9µg/kg		49700							<	<
1.2Dibromo3chloropropane	<14µg/kg									<	<
1.2Dibromoethane	<12µg/kg									<	<
1.2Dichlorobenzene	<12µg/kg									<	<
1.2Dichloroethane	<5µg/kg	710	2800							<	<
1.2Dichloropropane	<12µg/kg		18600							<	<
1.3.5Trimethylbenzene	<8µg/kg									<	<
1.3Dichlorobenzene	<6µg/kg									<	<
1.3Dichloropropane	<7µg/kg									<	<
1.4Dichlorobenzene	<5µg/kg									<	<
2.2Dichloropropane	<12µg/kg									<	<
2Chlorotoluene	<9µg/kg									<	<
4Chlorotoluene	<12µg/kg									<	<
4Isopropyltoluene	<11µg/kg									<	<
Benzene	<9µg/kg	28000	14200							<	<
Bromobenzene	<10µg/kg		228000							<	<
Bromochloromethane	<14µg/kg									<	<
Bromodichloromethane	<7µg/kg		7710							<	<
Bromoform	<10µg/kg		644000							<	<
Bromomethane	<13µg/kg									<	<
Carbon Disulphide	<7µg/kg		303							<	<
Carbontetrachloride	<14µg/kg	3000	22400							<	<
Chlorobenzene	<5µg/kg		4920000							<	<
Chloroethane	<14µg/kg		272000000							<	<
Chloroform	<8µg/kg	110000	457000							<	<
Chloromethane	<7µg/kg		17200							<	<
cis12Dichloroethene	<5µg/kg		89500							<	<
cis13Dichloropropene	<7µg/kg									<14	<14
Dibromochloromethane	<13µg/kg		45000							<	<
Dibromomethane	<9µg/kg									<	<
Dichlorodifluoromethane	<4µg/kg									<	<
Dichloromethane	<10µg/kg		297000							<	<
Ethylbenzene	<3µg/kg	518000	10100000							<4	<4
Hexachlorobutadiene	<12µg/kg									<	<
Isopropylbenzene	<5µg/kg		10000000							<	<
Methyl Tertiary Butyl Ether	<11µg/kg									<	<
Naphthalene	<13µg/kg		1010000							<	<
nButylbenzene	<10µg/kg									<	<
oXylene	<3µg/kg									<10	<10
p/mXylene	<14µg/kg	312000	14500000							<	<
Propylbenzene	<11µg/kg		10400000							<	<
secButylbenzene	<10µg/kg									<	<
Styrene	<10µg/kg									<	<
Tertamyl methyl ether	<15µg/kg									<	<
tertButylbenzene	<12µg/kg									<	<
Tetrachloroethene	<5µg/kg	130000	982000							<	<
Toluene	<2µg/kg	869000	23500000							<5	<5
trans12Dichloroethene	<11µg/kg		212000							<	<
trans13Dichloropropene	<14µg/kg									<	<
Trichloroethene	<9µg/kg	12000	88200							<	<
Trichlorofluorormethane	<6µg/kg									<	<
Vinyl Chloride	<10µg/kg	63	804							<	<
VOC TIC										No TICs identified	No TICs identified

East Tip 2012 Borehole Solid Samples Millscale, Laboratory Analysis

Sample Identity	LoD / Units	TSV for Commercial / Industrial Use	Atrisk Park Human Health GAC (mg/kg)	BH301A	BH302	BH302	BH312b	BH312b	OP10	OP14
Depth (m)				0.6-1	2	5	1	2.5	0.8	1.1-1.60
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				15/05/2012	17/05/2012	17/05/2012	30/04/2012	30/04/2012	05/06/2012	07/06/2012
Sample Received Date				20/05/2012	20/05/2012	20/05/2012	03/05/2012	03/05/2012	06/06/2012	08/06/2012
SDG				1205201	1205201	1205201	12050370	12050370	1206067	12061119
Subcontracted: Organics Dioxins/Furans										
1,2,3,4,6,7,8 HpCDD*	ng/kg			15					7	
1,2,3,4,6,7,8 HpCDF*	ng/kg			12					15	
1,2,3,4,7,8 HxCDD*	ng/kg			<2					<2	
1,2,3,4,7,8 HxCDF*	ng/kg			5.2					4.5	
1,2,3,4,7,8,9 HpCDF*	ng/kg			2.7					<2	
1,2,3,6,7,8 HxCDD*	ng/kg			<2					2.5	
1,2,3,6,7,8 HxCDF*	ng/kg			5.1					5.1	
1,2,3,7,8 PeCDD*	ng/kg			<2					<2	
1,2,3,7,8 PeCDF*	ng/kg			2.6					2.5	
1,2,3,7,8,9 HxCDD*	ng/kg			<2					<2	
1,2,3,7,8,9 HxCDF*	ng/kg			<2					<2	
2,3,4,6,7,8 HxCDF*	ng/kg			4.4					4.9	
2,3,4,7,8 PeCDF*	ng/kg			4.1					3.3	
2,3,7,8 TCDD*	ng/kg			<2					<2	
2,3,7,8, TCDF*	ng/kg			4.8					3.6	
IPCDD/FTEQ Lower Bound*	ng/kg			4.5					4.1	
IPCDD/FTEQ Upper Bound*	ng/kg			8.3					7.7	
OCDD*	ng/kg			23					14	
OCDF*	ng/kg			8.9					13	
Tolulene Extractable Matter	<500 mg/kg			<			1400		<	
PCB's (Solids)										
PCB congener 101	< 3 µg/kg			<					<	<
PCB congener 118	< 3 µg/kg			<					<	<
PCB congener 138	< 3 µg/kg			<					<	<
PCB congener 153	< 3 µg/kg			<					<	<
PCB congener 180	< 3 µg/kg			<					<	<
PCB congener 28	< 3 µg/kg			<					<	<
PCB congener 52	< 3 µg/kg			<					<	<
PCBs, Total ICES 7	< 21 µg/kg			<					<	<

BOLD and yellow indicates value exceeding Atrisk Park Human Health GAC

turquoise indicates value exceeds commercial GAC

Screen Unformatted Data

Screen Formatted Data

Appendix G Sludge and Flue Dust Waste Solid Analysis Results

East Tip 2012 Borehole Solid Samples Sludge and Flue Dust Laboratory Analysis

					sludge	iridscent black sludge surrounded by old barrel	50% sludge, 25% steel wire concrete, red brick and fabric, 25% cream ash possible refractory	slag with pockets of black material, many pieces of wire, metal (30%)		Flue Dust
Sample Identity	**LoD/Units**	**TSV for Commercial / Industrial Use**	**Atrisk Park Human Health GAC (mg/kg)**		BH312a	BH312a	BH312a	BH314		OP10
Depth (m)					0.5-0.6	3.6-3.8	5.00-5.10	2.2		2
Sample Type					SOLID	SOLID	SOLID	SOLID		SOLID
Sampled Date					24/04/2012	24/04/2012	24/04/2012	24/04/2012		05/06/2012
Sample Received Date					28/04/2012	28/04/2012	28/04/2012	28/04/2012		06/06/2012
SDG					12042854	12042854	12042854	12042854		1206067
Sample Description										
Colour					Dark Brown	Black	Dark Brown	Dark Brown		Dark Brown
Description					Loamy Sand	Sandy Loam	Gravel	Loamy Sand		Silt Loam
Grain Size					0.1 2 mm	0.1 2 mm	2 10 mm	0.1 2 mm		0.063 0.1 mm
Inclusion 1)					Stones	Stones	Stones	Stones		N/A
Inclusion 2)					None	None	None	None		N/A
Moisture content ratio	%				10	41		15		32
Laboratory data										
2Butanone	<100 µg/kg									<
Acetone	< 50 µg/kg									<
Chloride (soluble)	<5mg/kg				164	19300		400		536
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l				0.0389	3.97		0.153		1.55
Carbon										
Fraction Organic Carbon (FOC)	<0.1			<						
Fraction Organic Carbon (FOC)	<0.002									
Inorganics										
Ammoniacal Nitrogen as N	<15mg/kg			<	<	<		<		<
Cyanide, Complex	<1 mg/kg			<	<	<		<		<
Cyanide, Free	<1 mg/kg	36	34	<	<	<		<		<
Cyanide, Total	<1 mg/kg			<	<	<		<		<
pH	1 pH Units				8.96	9.12		9.17		11.4
Sulphate, Total	<0.008 mg/kg				1260	22100		1980		6340
Sulphide, Easily liberated	<15mg/kg			<	<	11800		<		<
Sulphur, Total	<0.02%				0.109					0.254
Sulphur, Total	<0.0016%				0.042	0.737		0.066		0.211
Thiocyanate	<1 mg/kg			<	<	<		<		<
Metals										
Aluminium	<11 mg/kg				9030	5400		8480		5170
Antimony	<0.6 mg/kg		831		35.1	37.9		50.6		130
Arsenic	<0.6 mg/kg	640	41.4		26.5	**95.6**		**90.5**		**75.2**
Barium	<0.6 mg/kg		1570		405	87.9		271		559
Beryllium	<0.01 mg/kg	420	277000	<	1.98	0.946		<0.1		<0.25
Boron, water soluble	<1 mg/kg	192000			1.23	11.5		2.05		<
Cadmium	<0.2 mg/kg	230	83.6		5.75	21.6		5		**553**
Calcium	<21mg/kg				75100	80900		53500		24200
Chromium	<0.9 mg/kg	30400	22500		801	415		5100		3280
Chromium, Hexavalent	<0.6 mg/kg	35	239		1.08	<		3.48		8.6
Copper	<1.4 mg/kg	71700	12200		735	718		4020		3460
Lead	<0.7 mg/kg	4640	477		**1140**	**3090**		**497**		**41700**
Magnesium	<8mg/kg				13000	30200		5350		13900
Manganese	<0.13 mg/kg				16700	2540		10400		46200
Mercury	<0.14 mg/kg	3640	303	<	<	<		<		<3.5
Nickel	<0.2 mg/kg	1800	922		199	211		**2860**		236
Selenium	<1 mg/kg	13000	696		<10	<10		<10		<25
Vanadium	<0.2 mg/kg	3160	422		70.6	46.6		121		123
Zinc	<1.9mg/kg	665000	54800		4670	12300		879		**189000**
Phenols										
2,3,5 TrimethylPhenol	<0.01 mg/kg			<	<	<		<		0.0146
2Isopropyl Phenol	<0.015 mg/kg			<	<	<		<		<
Cresols	<0.01 mg/kg		9910	<	<	<		<		<
Phenol	<0.01 mg/kg	482	686	<	<	<		<		<
Phenols, Total 5 speciated	<0.06 mg/kg		686	<	<	<		<		<
Phenols, Total monohydric	<0.035 mg/kg		686	<	<	<		<		<
Xylenols	<0.015 mg/kg			<	<	<		<		<
Mineral Oil / Oils & Greases										
Mineral oil >C10C40	<1 mg/kg					1730	2380			95.7
% Surrogate Recovery	%					88.7	84.7			79.9
Surrogate Value						44.4	42.3			39.9
TPH Criteria Working Group (TPH CWG)										
Aliphatics >C5C6	<10µg/kg	3400000	324000000			10.9	84.7			<
Aliphatics >C6C8	<10µg/kg	8300000	326000000			63.4	578			<
Aliphatics >C8C10	<10µg/kg	2100000	6420000			496	2120			<
Aliphatics >C10C12	<10µg/kg	10000000	6520000			737	2200			<
Aliphatics >C12C16	<100µg/kg	61000000	6520000			46600	93100			<
Aliphatics >C16C21	<100µg/kg	1000000000	177000000			231000	372000			4680
Aliphatics >C21C35	<100µg/kg	1000000000	177000000			1250000	1060000			67900
Aliphatics >C35C44	<100µg/kg					478000	313000			17100
Aromatics >EC5EC7	<10µg/kg	28000	14200			<	<			<
Aromatics >EC7EC8	<10µg/kg	59000000	23500000			<	19.7			<
Aromatics >EC8EC10	<10µg/kg	3700000	1940000			329	1450			<
Aromatics >EC10EC12	<10µg/kg	17000000	2490000			491	1470			<
Aromatics >EC12EC16	<100µg/kg	36000000	2590000			26700	75900			<
Aromatics >EC16EC21	<100µg/kg	28000000	1610000			150000	207000			3190
Aromatics >EC21EC35	<100µg/kg	28000000	1610000			663000	683000			28600
Aromatics >EC35EC44	<100µg/kg					313000	358000			9350
Aromatics >EC40EC44	<100µg/kg					132000	155000			3420
Total Aliphatics >C535	<100µg/kg					1530000	1530000			72600
Total Aromatics >C535	<100µg/kg					841000	969000			31800
Total Aliphatics & Aromatics >C5C44	<100µg/kg					3160000	3170000			131000
Methyl tertiary butyl ether (MTBE)	<5µg/kg		15600000			<	<			<
Benzene	<10µg/kg	28000	14200			<	<			<
Ethylbenzene	<3µg/kg	518000	10100000			<	39.4			<
m,p,oXylene	<9 µg/kg		14500000			<	<			<
m,pXylene	<6µg/kg	312000	14500000			<	<			<
oXylene	<3µg/kg		15700000			<	<			<
Toluene	<2µg/kg	869000	23500000			<	19.7			<
BTEX, Total	<24µg/kg					<	59.1			<
Rapid PAH Screen										
Polyaromatic hydrocarbons, Total 17	<10mg/kg			<	<	70		<		<

East Tip 2012 Borehole Solid Samples Sludge and Flue Dust Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Atrisk Park Human Health GAC (mg/kg)	BH312a	BH312a	BH312a	BH314	OP10
Depth (m)				0.5-0.6	3.6-3.8	5.00-5.10	2.2	2
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				24/04/2012	24/04/2012	24/04/2012	24/04/2012	05/06/2012
Sample Received Date				28/04/2012	28/04/2012	28/04/2012	28/04/2012	06/06/2012
SDG				12042854	12042854	12042854	12042854	1206067
SemiVolatile Organic Compounds (SVOCs)								
1,2,4Trichlorobenzene	<100µg/kg				<	<		<
1,2Dichlorobenzene	<100µg/kg				<	<		<
1,3Dichlorobenzene	<100µg/kg				<	<		<
1,4Dichlorobenzene	<100µg/kg				<	<		<
2,4,5Trichlorophenol	<100µg/kg				<	<		<
2,4,6Trichlorophenol (S)	<100µg/kg				<	<		<
2,4Dichlorophenol (S)	<100µg/kg				<	<		<
2,4Dimethylphenol (S)	<100µg/kg		1920000		<	<		<
2,4Dinitrotoluene (S)	<100µg/kg		200000		<	<		<
2,6Dinitrotoluene	<100µg/kg		101000		<	<		<
2Chloronaphthalene	<100µg/kg		2450000		<	<		<
2Chlorophenol (S)	<100µg/kg				<	<		<
2Methylnaphthalene	<100µg/kg				<	1890		<
2Methylphenol	<100µg/kg		9910000		<	<		<
2Niitroaniline (S)	<100µg/kg				<	<		<
2Nitrophenol (S)	<100µg/kg				<	<		<
3Nitroaniline	<100µg/kg				<	<		<
4Bromophenylphenylether	<100µg/kg				<	<		<
4Chloro3methylphenol (S)	<100µg/kg				<	<		<
4Chloroaniline	<100µg/kg				<	<		<
4Chlorophenylphenylether	<100µg/kg				<	<		<
4Methylphenol (S)	<100µg/kg		9910000		<	<		<
4Nitroaniline	<100µg/kg				<	<		<
4Nitrophenol (S)	<100µg/kg				<	<		<
Acenaphthene	<100µg/kg	85000000	5570000		292	164		<
Acenaphthylene	<100µg/kg	84000000			<	<		<
Anthracene	<100µg/kg	530000000	29100000		1690	241		<
Azobenzene	<100µg/kg				<	<		<
Benzo(a)anthracene	<100µg/kg	90000	9520		4320	372		<
Benzo(a)pyrene	<100µg/kg	14000	1200		3650	306		<
Benzo(b)fluoranthene	<100µg/kg	100000	11500		2840	259		<
Benzo(g,h,i)perylene	<100µg/kg	650000	143000		1890	181		<
Benzo(k)fluoranthene	<100µg/kg	140000	123000		2950	218		<
Bis(2chloroethoxy)methane	<100µg/kg				<	<		<
bis(2Chloroethyl)ether	<100µg/kg				<	<		<
bis(2Ethylhexyl) phthalate	<100µg/kg		3420000		1260	<		274
Butylbenzyl phthalate	<100µg/kg				<	<		<
Carbazole	<100µg/kg				247	<		<
Chrysene	<100µg/kg	140000	993000		4070	549		<
Dibenzo(a,h)anthracene	<100µg/kg	13000	1270		438	<		<
Dibenzofuran	<100µg/kg				200	156		<
Diethyl phthalate	<100µg/kg		21000000		<	<		<
Dimethyl phthalate	<100µg/kg				<	<		<
Fluoranthene	<100µg/kg	23000000	3890000		10500	753		148
Fluorene	<100µg/kg	64000000	3810000		359	332		<
Hexachlorobenzene	<100µg/kg				<	<		<
Hexachlorobutadiene	<100µg/kg				<	<		<
Hexachlorocyclopentadiene	<100µg/kg				<	<		<
Hexachloroethane	<100µg/kg		51400		<	<		<
Indeno(1,2,3cd)pyrene	<100µg/kg	60000	11200		1660	137		<
Isophorone	<100µg/kg				<	<		<
Naphthalene	<100µg/kg	200000	1010000		<	733		<
nDibutyl phthalate	<100µg/kg				<	<		<
nDioctyl phthalate	<100µg/kg				<	<		<
Nitrobenzene	<100µg/kg				<	<		<
nNitrosondipropylamine	<100µg/kg				<	<		<
Pentachlorophenol	<100µg/kg				<	<		<
Phenanthrene	<100µg/kg	22000000			5280	1500		<
Phenol	<100µg/kg	482			<	<		<
Pyrene	<100µg/kg	54000000	2920000		8640	745		<
Tic Report					794mg/kg Hydrocarbon C10-C36 20% aromatic	1058mg/kg Hydrocarbon C6-C36 10% aromatic		No TICs identified
Volatile Organic Compounds (VOCs) (Solids)								
1.1.1.2Tetrachloroethane	<10µg/kg	120000	223000		<200	<20		<
1.1.1Trichloroethane	<7µg/kg	700000	54500000		<140	<14		<
1.1.2.2Tetrachloroethane	<10µg/kg	290000	292000		<200	<20		<
1.1.2Trichloroethane	<10µg/kg		171000		<200	<20		<
1.1Dichloroethane	<8µg/kg		9730000		<160	<16		<
1.1Dichloroethene	<10µg/kg		453000		<200	<20		<
1.1Dichloropropene	<10µg/kg				<220	<22		<11
1.2.3Trichlorobenzene	<6µg/kg				<120	<12		<
1.2.3Trichloropropane	<17µg/kg				<340	<34		<
1.2.4Trichlorobenzene	<6µg/kg				<120	<12		<
1.2.4Trimethylbenzene	<9µg/kg		49700		<180	227		<
1.2Dibromo3chloropropane	<14µg/kg				<280	<28		<
1.2Dibromoethane	<12µg/kg				<240	<24		<
1.2Dichlorobenzene	<12µg/kg				<240	<24		<
1.2Dichloroethane	<5µg/kg	710	2800		<100	<10		<
1.2Dichloropropane	<12µg/kg		18600		<240	<24		<
1.3.5Trimethylbenzene	<8µg/kg				<160	59.6		<
1.3Dichlorobenzene	<6µg/kg				<120	<12		<
1.3Dichloropropane	<7µg/kg				<140	<14		<
1.4Dichlorobenzene	<5µg/kg				<100	<10		<
2.2Dichloropropane	<12µg/kg				<240	<24		<
2Chlorotoluene	<9µg/kg				<180	<18		<
4Chlorotoluene	<12µg/kg				<240	<24		<
4Isopropyltoluene	<11µg/kg				<220	<22		<
Benzene	<9µg/kg	28000	14200		<180	<18		<
Bromobenzene	<10µg/kg		228000		<200	<20		<
Bromochloromethane	<14µg/kg				<280	<28		<
Bromodichloromethane	<7µg/kg		7710		<140	<14		<
Bromoform	<10µg/kg		644000		<200	<20		<
Bromomethane	<13µg/kg				<260	<26		<
Carbon Disulphide	<7µg/kg		303		2050	121		<
Carbontetrachloride	<14µg/kg	3000	22400		<280	<28		<
Chlorobenzene	<5µg/kg		4920000		<100	<10		<
Chloroethane	<14µg/kg		272000000		<280	<28		<
Chloroform	<8µg/kg	110000	457000		<160	<16		<
Chloromethane	<7µg/kg		17200		562	<14		<
cis12Dichloroethene	<5µg/kg		89500		<100	<10		<
cis13Dichloropropene	<7µg/kg				<280	<28		<14
Dibromochloromethane	<13µg/kg		45000		<260	<26		<
Dibromomethane	<9µg/kg				<180	<18		<
Dichlorodifluoromethane	<4µg/kg				<80	<8		<
Dichloromethane	<10µg/kg		297000		<200	<20		<
Ethylbenzene	<3µg/kg	518000	10100000		194	<8		<4
Hexachlorobutadiene	<12µg/kg				<240	<24		<
Isopropylbenzene	<5µg/kg		10000000		<100	11.8		<
Methyl Tertiary Butyl Ether	<11µg/kg				<220	<22		<
Naphthalene	<13µg/kg		1010000		<260	1210		40.4
nButylbenzene	<10µg/kg				<200	<20		<
oXylene	<3µg/kg				<200	32.2		<10
p/mXylene	<14µg/kg	312000	14500000		<280	51.1		<
Propylbenzene	<11µg/kg		10400000		<220	<22		<
secButylbenzene	<10µg/kg				<200	23.9		<
Styrene	<10µg/kg				<200	<20		<
Tertamyl methyl ether	<15µg/kg				<300	<30		<
tertButylbenzene	<12µg/kg				<240	<24		<
Tetrachloroethene	<5µg/kg	130000	982000		<100	<10		<
Toluene	<2µg/kg	869000	23500000		<100	<10		<5
trans12Dichloroethene	<11µg/kg		212000		<220	<22		<
trans13Dichloropropene	<14µg/kg				<280	<28		<
Trichloroethene	<9µg/kg	12000	88200		<180	<18		<
Trichlorofluorormethane	<6µg/kg				<120	<12		<
Vinyl Chloride	<10µg/kg	63	804		<200	<20		<
VOC TIC					No TICs identified	5451µg/kg C5-C12 hydrocarbons		No TICs identified

East Tip 2012 Borehole Solid Samples Sludge and Flue Dust Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Atrisk Park Human Health GAC (mg/kg)		BH312a	BH312a	BH312a	BH314		OP10
Depth (m)					0.5-0.6	3.6-3.8	5.00-5.10	2.2		2
Sample Type					SOLID	SOLID	SOLID	SOLID		SOLID
Sampled Date					24/04/2012	24/04/2012	24/04/2012	24/04/2012		05/06/2012
Sample Received Date					28/04/2012	28/04/2012	28/04/2012	28/04/2012		06/06/2012
SDG					12042854	12042854	12042854	12042854		1206067
Subcontracted: Organics Dioxins/Furans										
1,2,3,4,6,7,8 HpCDD*	ng/kg									2500
1,2,3,4,6,7,8 HpCDF*	ng/kg									2800
1,2,3,4,7,8 HxCDD*	ng/kg									120
1,2,3,4,7,8 HxCDF*	ng/kg									780
1,2,3,4,7,8,9 HpCDF*	ng/kg									470
1,2,3,6,7,8 HxCDD*	ng/kg									470
1,2,3,6,7,8 HxCDF*	ng/kg									910
1,2,3,7,8 PeCDD*	ng/kg									210
1,2,3,7,8 PeCDF*	ng/kg									400
1,2,3,7,8,9 HxCDD*	ng/kg									380
1,2,3,7,8,9 HxCDF*	ng/kg									250
2,3,4,6,7,8 HxCDF*	ng/kg									1200
2,3,4,7,8 PeCDF*	ng/kg									560
2,3,7,8 TCDD*	ng/kg									7.5
2,3,7,8, TCDF*	ng/kg									400
IPCDD/FTEQ Lower Bound*	ng/kg									920
IPCDD/FTEQ Upper Bound*	ng/kg									920
OCDD*	ng/kg									2500
OCDF*	ng/kg									2200
Tolulene Extractable Matter	<500 mg/kg				<					<
PCB's (Solids)										
PCB congener 101	< 3 µg/kg									<
PCB congener 118	< 3 µg/kg									<
PCB congener 138	< 3 µg/kg									7.44
PCB congener 153	< 3 µg/kg									5.67
PCB congener 180	< 3 µg/kg									5.58
PCB congener 28	< 3 µg/kg									<
PCB congener 52	< 3 µg/kg									<
PCBs, Total ICES 7	< 21 µg/kg									<

BOLD and yellow indicates value exceeding Atrisk Park Human Health GAC

turquoise indicates value exceeds commercial GAC

Screen Unformatted Data

Screen Formatted Data

Appendix H Construction and Demolition Waste Solid Analysis Results

East Tip 2012 Borehole Solid Samples Demolition Waste, Laboratory Analysis

	LoD/Units	TSV for Commercial / Industrial Use	Atrisk Park Human Health GAC (mg/kg)	clay with slag and possible millscale, 5% timber, 2% refractory 1% construction and 2% plastic household waste	slag with 1% plastic, 5% steel in construction form and red brick	slag with occ demolition material and refractory bricks	slag with green ruubble concrete	50% steel wire concrete, red brick and fabric/ 50% cream ash with possible refractory in a clayey sandy gravel	50% sludge, 25% steel wire concrete, red brick and fabric, 25% cream ash possible refractory	scrap metals with refractory bricks, sands, gravels, black demolition waste and steel barrels with tar inside	slag with cream white slag, 15% wate steel, 5% demolition waste and 1% plastic waste	slag with 20% waste steel and 5% demoltion	slag with 50% demolition waste (plastic, textile, red brick, concrete and refractory		demolition waste: wood, glass, concrete, glass bottles, red brick, oil filters
Sample Identity				BH302	BH303	BH306b	BH306b	BH312a	BH312a	BH312b	BH312c	BH312c	BH314	DUPLICATE 1 same as BH314 3.2m	BH314
Depth (m)				2	0.2	1	6.5	2-2.1	5.00-5.10	5	1	3.5	3.2		5.3
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				17/05/2012	09/05/2012	24/04/2012	24/04/2012	24/04/2012	24/04/2012	30/04/2012	10/05/2012	10/05/2012	27/04/2012	27/04/2012	27/04/2012
Sample Received Date				20/05/2012	13/05/2012	28/04/2012	28/04/2012	28/04/2012	28/04/2012	03/05/2012	13/05/2012	13/05/2012	03/05/2012	03/05/2012	03/05/2012
SDG				1205201	12051311	12042854	12042854	12042854	12042854	12050370	12051311	12051311	12050370	12050370	12050370
Sample Description															
Colour				Dark Brown	Dark Brown	Dark Brown	Dark Brown	Grey	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Black
Description				Sandy Loam	Silty Sand	Sand	Sandy Loam	Sand	Gravel	Sand	Sand	Sand	Loamy Sand	Loamy Sand	N/A
Grain Size				0.063 0.1 mm	0.063 0.1 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm	2 10 mm	0.1 2 mm	0.1 2 mm	0.063 0.1 mm	0.063 0.1 mm	0.063 0.1 mm	0.1 2 mm
Inclusion 1)				Vegetation	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones	Brick
Inclusion 2)				Stones	N/A	None	None	None	None	Vegetation	N/A	N/A	Metal	Tile	Stones
Moisture content ratio	%			16		9	1.4	14		14	5.7	13	9.6	8.2	15
Laboratory data															
2Butanone	<100 µg/kg														
Acetone	< 50 µg/kg														
Chloride (soluble)	<5mg/kg			28.7		2600	1440	168		2960	130	3130	1300	1340	3280
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l			0.0365		0.532	0.056	0.462		0.409	0.0819	0.635	0.153	0.15	0.479
Carbon															
Fraction Organic Carbon (FOC)	<0.1			<				<0.1		<		<	<		<
Fraction Organic Carbon (FOC)	<0.002										0.00338			0.00756	
Inorganics															
Ammoniacal Nitrogen as N	<15mg/kg			<		<	<	<		<	<	<	<	<	<
Cyanide, Complex	<1 mg/kg			<		<	<	<		<	<	<	<	<	<
Cyanide, Free	<1 mg/kg	36	34	<		<	<	<		<	<	<	<	<	<
Cyanide, Total	<1 mg/kg			<		<	<	<		<	<	<	<	<	<
pH	1 pH Units			9.42		10.2	10.8	11.6		10.4	12.3	9.07	9.5	9.09	9
Sulphate, Total	<0.008 mg/kg			622		6470	4140	11400		3910	1960	4090	878	1090	2590
Sulphide, Easily liberated	<15mg/kg			<		<	<	<		269	<	282	<	<	39.4
Sulphur, Total	<0.02%										0.128			0.12	
Sulphur, Total	<0.0016%			0.0207		0.216	0.138	0.381		0.13		0.136	0.0293	0.0363	0.0864
Thiocyanate	<1 mg/kg			<		<	<	<		<	<	<	<	<	<
Metals															
Aluminium	<11 mg/kg			5960		20600	23100	10100		8110	11900	9070	1920	2930	9620
Antimony	<0.6 mg/kg		831	27.3		151	153	36.8		56.2	21.6	75.1	49.2	38.9	42.5
Arsenic	<0.6 mg/kg	640	41.4	39.4		<6	<6	16.8		**47.7**	**51.6**	**97.7**	**119**	**69.6**	**48.5**
Barium	<0.6 mg/kg		1570	84.2		770	678	587		374	337	331	36.6	66.2	253
Beryllium	<0.01 mg/kg	420	277000	0.924		<0.1	<0.1	0.26		0.905	<0.1	1.21	2.64	2.31	0.888
Boron, water soluble	<1 mg/kg	192000		1.62		11.9	4.62	10.9		4.39	1.47	4.09	2.63	1.58	5.59
Cadmium	<0.2 mg/kg	230	83.6	4.84		<	<	5.39		2.2	7	71.6	<	<	14.3
Calcium	<21mg/kg			45400		4380	242000	103000		105000	128000	50600	11000	23400	85900
Chromium	<0.9 mg/kg	30400	22500	462		6480	6380	1040		1630	781	877	697	740	1080
Chromium, Hexavalent	<0.6 mg/kg	35	239	<		<	<	<		<	1.4	<	<	<	<
Copper	<1.4 mg/kg	71700	12200	1110		349	290	417		916	1470	2010	2810	1280	931
Lead	<0.7 mg/kg	4640	477	**568**		98.7	72.1	**1250**		**478**	217	**5770**	184	137	**2130**
Magnesium	<8mg/kg			3580		5740	41000	158000		51900	47300	29400	2990	3490	13400
Manganese	<0.13 mg/kg			3050		31000	38000	13200		10200	16700	9470	4590	5620	13000
Mercury	<0.14 mg/kg	3640	303	<1.4		<	<	<		<	<	<	<	<	<
Nickel	<0.2 mg/kg	1800	922	381		74.7	65.9	131		290	308	513	750	472	293
Selenium	<1 mg/kg	13000	696	<10		20.8	26.6	10.5		10.8	<10	<10	<10	<10	<10
Vanadium	<0.2 mg/kg	3160	422	24.4		350	**470**	118		195	97.9	55.5	25.3	40.3	97.7
Zinc	<1.9mg/kg	665000	54800	2150		468	779	2770		2200	1580	37900	801	563	9310
Phenols															
2,3,5 TrimethylPhenol	<0.01 mg/kg			<		<	<	<		<	<	<	<	<	<
2Isopropyl Phenol	<0.015 mg/kg			<		<	<	<		<	<	<	<	<	<
Cresols	<0.01 mg/kg		9910	<		<	<	<		<	<	<	<	<	<
Phenol	<0.01 mg/kg	482	686	<		<	<	<		<	0.0106	<	<	<	<
Phenols, Total 5 speciated	<0.06 mg/kg		686	<		<	<	<		<	<	<	<	<	<
Phenols, Total monohydric	0.035 mg/kg		686	<		<	<	<			<	<			
Xylenols	<0.015 mg/kg			<		<	<	<		<	<	<	<	<	<
Mineral Oil / Oils & Greases															
Mineral oil >C10C40	<1 mg/kg								2380	699		769	210		333
% Surrogate Recovery	%								84.7	73.2		79.2	77.4		87
Surrogate Value									42.3	36.6		39.6	38.7		43.5

East Tip 2012 Borehole Solid Samples Demolition Waste, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Atrisk Park Human Health GAC (mg/kg)	BH302	BH303	BH306b	BH306b	BH312a	BH312a	BH312b	BH312c	BH312c	BH314	DUPLICATE 1 same as BH314 3.2m	BH314
Depth (m)				2	0.2	1	6.5	2-2.1	5.00-5.10	5	1	3.5	3.2		5.3
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				17/05/2012	09/05/2012	24/04/2012	24/04/2012	24/04/2012	24/04/2012	30/04/2012	10/05/2012	10/05/2012	27/04/2012	27/04/2012	27/04/2012
Sample Received Date				20/05/2012	13/05/2012	28/04/2012	28/04/2012	28/04/2012	28/04/2012	03/05/2012	13/05/2012	13/05/2012	03/05/2012	03/05/2012	03/05/2012
SDG				1205201	12051311	12042854	12042854	12042854	12042854	12050370	12051311	12051311	12050370	12050370	12050370
TPH Criteria Working Group (TPH CWG)															
Aliphatics >C5C6	<10µg/kg	3400000	324000000						84.7	<		20.7	<		<
Aliphatics >C6C8	<10µg/kg	8300000	326000000						578	48.6		77.1	<		13.4
Aliphatics >C8C10	<10µg/kg	2100000	6420000						2120	204		54.1	<		20.7
Aliphatics >C10C12	<10µg/kg	10000000	6520000						2200	256		93.2	<		57.1
Aliphatics >C12C16	<100µg/kg	61000000	6520000						93100	12800		7930	5980		4430
Aliphatics >C16C21	<100µg/kg	1000000000	177000000						372000	82100		72200	25000		25500
Aliphatics >C21C35	<100µg/kg	1000000000	177000000						1060000	484000		447000	132000		209000
Aliphatics >C35C44	<100µg/kg								313000	196000		162000	36800		65500
Aromatics >EC5EC7	<10µg/kg	28000	14200						<	<		<	<		<
Aromatics >EC7EC8	<10µg/kg	59000000	23500000						19.7	<		<	<		<
Aromatics >EC8EC10	<10µg/kg	3700000	1940000						1450	136		48.3	<		15.8
Aromatics >EC10EC12	<10µg/kg	17000000	2490000						1470	171		62.1	<		38.9
Aromatics >EC12EC16	<100µg/kg	36000000	2590000						75900	5660		6110	2430		<
Aromatics >EC16EC21	<100µg/kg	28000000	1610000						207000	37000		41600	8620		14300
Aromatics >EC21EC35	<100µg/kg	28000000	1610000						683000	198000		235000	51700		118000
Aromatics >EC35EC44	<100µg/kg								358000	98300		116000	24000		61400
Aromatics >EC40EC44	<100µg/kg								155000	43000		46900	10100		26000
Total Aliphatics >C535	<100µg/kg								1530000	580000		528000	163000		239000
Total Aromatics >C535	<100µg/kg								969000	241000		282000	62800		132000
Total Aliphatics & Aromatics >C5C44	<100µg/kg								3170000	1110000		1090000	286000		498000
Methyl tertiary butyl ether (MTBE)	<5µg/kg		15600000						<	<		<	<		<
Benzene	<10µg/kg	28000	14200						<	<		<	<		<
Ethylbenzene	<3µg/kg	518000	10100000						39.4	<		3.45	<		<
m,p,oXylene	<9 µg/kg		14500000						<	<		10.4	<		<
m,pXylene	<6µg/kg	312000	14500000						<	<		6.9	<		<
oXylene	<3µg/kg		15700000						<	<		3.45	<		<
Toluene	<2µg/kg	869000	23500000						19.7	<		<	<		<
BTEX, Total	<24µg/kg								59.1	<		<	<		<
Rapid PAH Screen															
Polyaromatic hydrocarbons, Total 17	<10mg/kg			16.7		<	<	<		<	<	<	<	<	<
SemiVolatile Organic Compounds (SVOCs)															
1,2,4Trichlorobenzene	<100µg/kg								<	<		<	<		<
1,2Dichlorobenzene	<100µg/kg								<	<		<	<		<
1,3Dichlorobenzene	<100µg/kg								<	<		<	<		<
1,4Dichlorobenzene	<100µg/kg								<	<		<	<		<
2,4,5Trichlorophenol	<100µg/kg								<	<		<	<		<
2,4,6Trichlorophenol (S)	<100µg/kg								<	<		<	<		<
2,4Dichlorophenol (S)	<100µg/kg								<	<		<	<		<
2,4Dimethylphenol (S)	<100µg/kg		1920000						<	<		<	<		<
2,4Dinitrotoluene (S)	<100µg/kg		200000						<	<		<	<		<
2,6Dinitrotoluene	<100µg/kg		101000						<	<		<	<		<
2Chloronaphthalene	<100µg/kg		2450000						<	<		<	<		<
2Chlorophenol (S)	<100µg/kg								<	<		<	<		<
2Methylnaphthalene	<100µg/kg								1890	<		<	<		<
2Methylphenol	<100µg/kg		9910000						<	<		<	<		<
2Niitroaniline (S)	<100µg/kg								<	<		<	<		<
2Nitrophenol (S)	<100µg/kg								<	<		<	<		<
3Nitroaniline	<100µg/kg								<	<		<	<		<
4Bromophenylphenylether	<100µg/kg								<	<		<	<		<
4Chloro3methylphenol (S)	<100µg/kg								<	<		<	<		<
4Chloroaniline	<100µg/kg								<	<		<	<		<
4Chlorophenylphenylether	<100µg/kg								<	<		<	<		<
4Methylphenol (S)	<100µg/kg		9910000						<	<		<	<		<
4Nitroaniline	<100µg/kg								<	<		<	<		<
4Nitrophenol (S)	<100µg/kg								<	<		<	<		<
Acenaphthene	<100µg/kg	85000000	5570000						164	<		<	<		<
Acenaphthylene	<100µg/kg	84000000							<	<		<	<		<
Anthracene	<100µg/kg	530000000	29100000						241	169		<	<		<
Azobenzene	<100µg/kg								<	<		<	<		<
Benzo(a)anthracene	<100µg/kg	90000	9520						372	415		<	<		279
Benzo(a)pyrene	<100µg/kg	14000	1200						306	368		<	<		274
Benzo(b)fluoranthene	<100µg/kg	100000	11500						259	303		133	<		236
Benzo(g,h,i)perylene	<100µg/kg	650000	143000						181	226		139	<		193
Benzo(k)fluoranthene	<100µg/kg	140000	123000						218	287		<	<		240
Bis(2chloroethoxy)methane	<100µg/kg								<	<		<	<		<
bis(2Chloroethyl)ether	<100µg/kg								<	<		<	<		<
bis(2Ethylhexyl) phthalate	<100µg/kg		3420000						<	294		452	<		<
Butylbenzyl phthalate	<100µg/kg								<	<		<	<		<
Carbazole	<100µg/kg								<	<		<	<		<
Chrysene	<100µg/kg	140000	993000						549	578		159	<		312
Dibenzo(a,h)anthracene	<100µg/kg	13000	1270						<	<		<	<		<
Dibenzofuran	<100µg/kg								156	<		<	<		<
Diethyl phthalate	<100µg/kg		21000000						<	<		<	<		<
Dimethyl phthalate	<100µg/kg								<	<		<	<		<
Fluoranthene	<100µg/kg	23000000	3890000						753	809		213	126		550
Fluorene	<100µg/kg	64000000	3810000						332	<		<	<		<
Hexachlorobenzene	<100µg/kg								<	<		<	<		<
Hexachlorobutadiene	<100µg/kg								<	<		<	<		<
Hexachlorocyclopentadiene	<100µg/kg								<	<		<	<		<
Hexachloroethane	<100µg/kg		51400						<	<		<	<		<
Indeno(1,2,3cd)pyrene	<100µg/kg	60000	11200						137	217		<	<		148
Isophorone	<100µg/kg								<	<		<	<		<
Naphthalene	<100µg/kg	200000	1010000						733	204		<	<		<
nDibutyl phthalate	<100µg/kg								<	2290		<	<		<
nDioctyl phthalate	<100µg/kg								<	<		2200	<		<
Nitrobenzene	<100µg/kg								<	<		<	<		<
nNitrosondipropylamine	<100µg/kg								<	<		<	<		<
Pentachlorophenol	<100µg/kg								<	<		<	<		<
Phenanthrene	<100µg/kg	22000000							1500	786		140	<		237
Phenol	<100µg/kg	482							<	<		<	<		<
Pyrene	<100µg/kg	54000000	2920000						745	752		170	<		446
Tic Report									See Attached	See Attached		See Attached	No TICs identified		No TICs identified

East Tip 2012 Borehole Solid Samples Demolition Waste, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Atrisk Park Human Health GAC (mg/kg)	BH302	BH303	BH306b	BH306b	BH312a	BH312a	BH312b	BH312c	BH312c	BH314	DUPLICATE 1 same as BH314 3.2m	BH314
Depth (m)				2	0.2	1	6.5	2-2.1	5.00-5.10	5	1	3.5	3.2		5.3
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				17/05/2012	09/05/2012	24/04/2012	24/04/2012	24/04/2012	24/04/2012	30/04/2012	10/05/2012	10/05/2012	27/04/2012	27/04/2012	27/04/2012
Sample Received Date				20/05/2012	13/05/2012	28/04/2012	28/04/2012	28/04/2012	28/04/2012	03/05/2012	13/05/2012	13/05/2012	03/05/2012	03/05/2012	03/05/2012
SDG				1205201	12051311	12042854	12042854	12042854	12042854	12050370	12051311	12051311	12050370	12050370	12050370
Volatile Organic Compounds (VOCs) (Solids)															
1.1.1.2Tetrachloroethane	<10μg/kg	120000	223000						<20	<		<	<		<
1.1.1Trichloroethane	<7μg/kg	700000	54500000						<14	<		<	<		<
1.1.2.2Tetrachloroethane	<10μg/kg	290000	292000						<20	<		<	<		<
1.1.2Trichloroethane	<10μg/kg		171000						<20	<		<	<		<
1.1Dichloroethane	<8μg/kg		9730000						<16	<		<	<		<
1.1Dichloroethene	<10μg/kg		453000						<20	<		<	<		<
1.1Dichloropropene	<10μg/kg								<22	<11		<11	<11		<11
1.2.3Trichlorobenzene	<6μg/kg								<12	<		<	<		<
1.2.3Trichloropropane	<17μg/kg								<34	<		<	<		<
1.2.4Trichlorobenzene	<6μg/kg								<12	<		<	<		<
1.2.4Trimethylbenzene	<9μg/kg		49700						227	<		<	<		<
1.2Dibromo3chloropropane	<14μg/kg								<28	<		<	<		<
1.2Dibromoethane	<12μg/kg								<24	<		<	<		<
1.2Dichlorobenzene	<12μg/kg								<24	<		<	<		<
1.2Dichloroethane	<5μg/kg	710	2800						<10	<		<	<		<
1.2Dichloropropane	<12μg/kg		18600						<24	<		<	<		<
1.3.5Trimethylbenzene	<8μg/kg								59.6	<		<	<		<
1.3Dichlorobenzene	<6μg/kg								<12	<		<	<		<
1.3Dichloropropane	<7μg/kg								<14	<		<	<		<
1.4Dichlorobenzene	<5μg/kg								<10	<		<	<		<
2.2Dichloropropane	<12μg/kg								<24	<		<	<		<
2Chlorotoluene	<9μg/kg								<18	<		<	<		<
4Chlorotoluene	<12μg/kg								<24	<		<	<		<
4Isopropyltoluene	<11μg/kg								<22	<		<	<		<
Benzene	<9μg/kg	28000	14200						<18	<		<	<		<
Bromobenzene	<10μg/kg		228000						<20	<		<	<		<
Bromochloromethane	<14μg/kg								<28	<		<	<		<
Bromodichloromethane	<7μg/kg		7710						<14	<		<	<		<
Bromoform	<10μg/kg		644000						<20	<		<	<		<
Bromomethane	<13μg/kg								<26	<		<	<		<
Carbon Disulphide	<7μg/kg		303						121	59.7		25.4	<		32.3
Carbontetrachloride	<14μg/kg	3000	22400						<28	<		<	<		<
Chlorobenzene	<5μg/kg		4920000						<10	<		<	<		<
Chloroethane	<14μg/kg		272000000						<28	<		<	<		<
Chloroform	<8μg/kg	110000	457000						<16	<		<	<		<
Chloromethane	<7μg/kg		17200						<14	<		<	<		<
cis12Dichloroethene	<5μg/kg		89500						<10	<		<	<		<
cis13Dichloropropene	<7μg/kg								<28	<14		<14	<14		<14
Dibromochloromethane	<13μg/kg		45000						<26	<		<	<		<
Dibromomethane	<9μg/kg								<18	<		<	<		<
Dichlorodifluoromethane	<4μg/kg								<8	<		<	<		<
Dichloromethane	<10μg/kg		297000						<20	<		<	<		<
Ethylbenzene	<3μg/kg	518000	10100000						<8	<4		<4	<4		<4
Hexachlorobutadiene	<12μg/kg								<24	<		<12	<12		<12
Isopropylbenzene	<5μg/kg		10000000						11.8	<		<	<		<
Methyl Tertiary Butyl Ether	<11μg/kg								<22	<		<	<		<
Naphthalene	<13μg/kg		1010000						1210	<		<	<		<
nButylbenzene	<10μg/kg								<20	<		<	<		<
oXylene	<3μg/kg								32.2	<		<10	<10		<10
p/mXylene	<14μg/kg	312000	14500000						51.1	<		<	<		<
Propylbenzene	<11μg/kg		10400000						<22	<		<	<		<
secButylbenzene	<10μg/kg								23.9	<		<	<		<
Styrene	<10μg/kg								<20	<		<	<		<
Tertamyl methyl ether	<15μg/kg								<30	<		<	<		<
tertButylbenzene	<12μg/kg								<24	<		<	<		<
Tetrachloroethene	<5μg/kg	130000	982000						<10	<		<	<		<
Toluene	<2μg/kg	869000	23500000						<10	<5		<5	<5		<
trans12Dichloroethene	<11μg/kg		212000						<22	<		<	<		<
trans13Dichloropropene	<14μg/kg								<28	<		<	<		<
Trichloroethene	<9μg/kg	12000	88200						<18	<		<	<		<
Trichlorofluorormethane	<6μg/kg								<12	<		<	<		<
Vinyl Chloride	<10μg/kg	63	804						<20	<		<	<		<
VOC TIC									See Attached	No TICs identified		No TICs identified	No TICs identified		No TICs identified

East Tip 2012 Borehole Solid Samples Demolition Waste, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Atrisk Park Human Health GAC (mg/kg)	BH302	BH303	BH306b	BH306b	BH312a	BH312a	BH312b	BH312c	BH312c	BH314	DUPLICATE 1 same as BH314 3.2m	BH314
Depth (m)				2	0.2	1	6.5	2-2.1	5.00-5.10	5	1	3.5	3.2		5.3
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				17/05/2012	09/05/2012	24/04/2012	24/04/2012	24/04/2012	24/04/2012	30/04/2012	10/05/2012	10/05/2012	27/04/2012	27/04/2012	27/04/2012
Sample Received Date				20/05/2012	13/05/2012	28/04/2012	28/04/2012	28/04/2012	28/04/2012	03/05/2012	13/05/2012	13/05/2012	03/05/2012	03/05/2012	03/05/2012
SDG				1205201	12051311	12042854	12042854	12042854	12042854	12050370	12051311	12051311	12050370	12050370	12050370
Subcontracted: Organics Dioxins/Furans															
1,2,3,4,6,7,8 HpCDD*	ng/kg				20										
1,2,3,4,6,7,8 HpCDF*	ng/kg				16										
1,2,3,4,7,8 HxCDD*	ng/kg				<2										
1,2,3,4,7,8 HxCDF*	ng/kg				5.4										
1,2,3,4,7,8,9 HpCDF*	ng/kg				3.5										
1,2,3,6,7,8 HxCDD*	ng/kg				3.6										
1,2,3,6,7,8 HxCDF*	ng/kg				6.1										
1,2,3,7,8 PeCDD*	ng/kg				<2										
1,2,3,7,8 PeCDF*	ng/kg				2.9										
1,2,3,7,8,9 HxCDD*	ng/kg				2.3										
1,2,3,7,8,9 HxCDF*	ng/kg				3.1										
2,3,4,6,7,8 HxCDF*	ng/kg				8.7										
2,3,4,7,8 PeCDF*	ng/kg				3										
2,3,7,8 TCDD*	ng/kg				<2										
2,3,7,8, TCDF*	ng/kg				<2										
IPCDD/FTEQ Lower Bound*	ng/kg				5										
IPCDD/FTEQ Upper Bound*	ng/kg				8.4										
OCDD*	ng/kg				38										
OCDF*	ng/kg				17										
Tolulene Extractable Matter	<500 mg/kg										3400			700	
PCB's (Solids)															
PCB congener 101	< 3 µg/kg				5.65										
PCB congener 118	< 3 µg/kg				3.03										
PCB congener 138	< 3 µg/kg				4.41										
PCB congener 153	< 3 µg/kg				3.28										
PCB congener 180	< 3 µg/kg				<										
PCB congener 28	< 3 µg/kg				7.1										
PCB congener 52	< 3 µg/kg				5.84										
PCBs, Total ICES 7	< 21 µg/kg				29.3										

BOLD and yellow indicates value exceeding Atrisk Park Human Health GAC
turquoise indicates value exceeds commercial GAC

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Appendix I Natural Sediments Analysis Results

East Tip 2012 Borehole Solid Samples, Natural Soils, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)	BH301A	BH301A	BH301A	BH302	BH302	BH303	BH303	BH304	BH304	BH305	BH306d	BH306d	BH307	BH308	BH308	BH308	BH309	BH309	BH309	DUPLICATE 3 same as BH309 15.5 - 16
Depth (m)				7.5	14	16.5	11	14	8	10	6.5 - 7	16.5 - 17	7.5 - 8	14	18	12	3.5 - 4	7 - 7.5	11.5 - 12	7.5 - 8	13.5 - 14	15.5 - 16	
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				15/05/2012	15/05/2012	18/05/2012	05/06/2012	05/06/2012	14/05/2012	19/05/2012	06/06/2012	07/06/2012	31/05/2012	11/06/2012	13/06/2012	30/05/2012	25/05/2012	29/05/2012	29/05/2012	06/06/2012	07/06/2012	07/06/2012	07/06/2012
Sample Received Date				20/05/2012	20/05/2012	23/05/2012		11/06/2012	16/05/2012	20/05/2012	11/06/2012	11/06/2012	06/06/2012	18/06/2012	18/06/2012	06/06/2012	30/05/2012	06/06/2012	06/06/2012	11/06/2012	11/06/2012	11/06/2012	12/06/2012
SDG				120520-1	120520-1	120523-88	120611-19	120611-19	120516-77	Schedule #6	120611-19	120611-19	120606-3	120618-1	120618-1	120606-3	120530-71	120606-3	120606-3	120611-19	120611-19	120611-19	120611-19
Sample Description																							
Colour				Grey	Grey	Light Brown	Grey	Grey	Grey	Grey	Grey	Light Brown	Grey	Grey	Grey	Grey	Beige	Grey	Light Brown	Grey	Grey	Grey	Grey
Description				Silt Loam	Silt Loam	Clay	Sandy Silt Loam	Silt Loam	Silt Loam	Clay	Silt Loam	Sandy Silt Loam	Sandy Clay	Silty Clay Loam	Sandy Clay Loam	Clay	Sandy Clay	Clay	Clay	Silt Loam	Silt Loam	N/A	Silt Loam
Grain Size				<0.063 mm	<0.063 mm	<0.063 mm	0.1 - 2 mm	0.063 - 0.1 mm	0.063 - 0.1 mm	<0.063 mm	<0.063 mm	0.1 - 2 mm	<0.063 mm	<0.063 mm	<0.063 mm	<0.063 mm	0.063 - 0.1 mm	<0.063 mm	<0.063 mm	<0.063 mm	0.063 - 0.1 mm	<0.063 mm	0.063 - 0.1 mm
Inclusion 1)				N/A	N/A	Stones	Stones	Stones	Stones	Stones	N/A	Stones	Stones	None	N/A	Stones	Stones	Stones	Stones	N/A	Stones	N/A	None
Inclusion 2)				N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	None	N/A	N/A	None	N/A	N/A	N/A	N/A	N/A	None
Moisture content ratio	%			23	26	14	27	35	27	15	24	11	29	23	33	29	15	30	31	25	32	34	-
Laboratory data																							
2-Butanone	<100 µg/kg			<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetone	< 50 µg/kg			93.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride (soluble)	<5mg/kg	-		7710	6710	3380	5060	9420	6450	6270	5390	1140	6760	10000	8650	7650	138	6060	6220	5640	6200	7680	6820
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l			0.381	0.604	0.0875	0.498	0.471	0.14	0.206	0.427	0.0162	0.191	0.951	0.443	0.544	0.253	0.322	0.406	0.494	0.409	0.318	0.297
Carbon																							
Fraction Organic Carbon (FOC)	<0.1			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fraction Organic Carbon (FOC)	<0.002			-	0.00663	<	-	-	-	0.00945	-	-	0.00703	-	-	0.00841	0.00278	0.0101	0.00727	-	-	-	-
Inorganics																							
Ammoniacal Nitrogen as N	<15mg/kg	-		32.1	41.1	<	<	71.3	42	28.3	<	<	<	76.8	66.7	54.7	<	37.5	31.7	<	30.8	36.6	<
Cyanide, Complex	<1 mg/kg	-		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Free	<1 mg/kg	36	34	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Total	<1 mg/kg	-		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
pH	1 pH Units			7.93	7.94	8.45	8.62	8.16	8.03	8.79	7.99	8.91	8.55	7.98	8.55	8.03	7.94	8.09	7.85	8.41	9.17	8.98	9
Sulphate, Total	<0.008 mg/kg			5790	2930	481	3250	3310	4310	2480	3090	125	2900	5790	2070	3080	1230	1520	1310	3230	4320	3290	2690
Sulphide, Easily liberated	<15mg/kg			19.9	30.2	<	<	72	53.2	32.1	36.5	<	<	67.7	51.6	<	23.7	43.2	26.6	66	<	70.1	38.9
Sulphur, Total	<0.02%			-	0.927	0.0557	0.676	0.909	0.747	-	0.558	0.0226	0.533	1.06	0.396	0.807	0.407	0.773	0.752	0.7	-	0.85	1.03
Sulphur, Total	<0.0016%			0.193	-	0.016	-	-	0.144	0.725	-	-	0.0967	0.193	0.0691	0.103		0.0505	0.0438	-	0.144	-	-
Thiocyanate	<1 mg/kg	-		<1	<1	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Metals																							
Aluminium	<11 mg/kg	-		8790	9880	11900	1380	9750	9170	8560	1100	53900	7330	12000	9020	9800	10800	9350	9690	1780	11800	10900	11700
Antimony	<0.6 mg/kg	-	831	1.05	0.917	1.2	<	<	1.09	<	<3	8.36	0.853	1.22	0.964	1.33	1.11	<	0.792	<3	10.7	<3	0.965
Arsenic	<0.6 mg/kg	640	41.4	5.56	7.91	11	1.13	7.98	4.53	7.72	<3	92.4	4.14	7.98	7.72	4.8	12	4.34	6.23	<3	12.2	7.63	8.57
Barium	<0.6 mg/kg	-	1570	12.7	9.08	15.8	24.4	33.2	16.1	9.59	<3	160	41.5	22.4	20.1	43.2	19.9	12.3	10.4	20.4	239	63.9	30
Beryllium	<0.01 mg/kg	420	277000	0.56	0.487	0.848	0.0413	0.283	0.652	<	<0.05	3.05	0.29	0.535	0.39	0.466	0.683	0.459	0.413	0.0566	<0.1	0.344	0.526
Boron, water soluble	<1 mg/kg	192000		7.17	5.48	3.18	5.74	10.4	7.75	6.35	3.67	1.43	4.66	8.88	5.33	6.39	2.05	10.4	6.46	4.59	5.56	4.98	5.93
Cadmium	<0.2 mg/kg	230	83.6	0.29	0.139	0.222	0.0948	0.403	0.412	<	<0.1	1.02	0.195	0.338	0.291	0.201	0.321	0.168	0.271	<0.1	1.36	0.349	0.0979
Calcium	<21mg/kg	-		63500	47400	1270	105000	60800	98100	57400	83600	1660	96100	53300	66800	97000	22600	91500	63000	77500	92500	57500	45200
Chromium	<0.9 mg/kg	30400	22500	25.6	19.5	18.4	25.3	105	38.5	24.4	<4.5	171	102	53.2	31	135	19.9	23.2	23.7	52.4	889	148	67.8
Chromium, Hexavalent	<0.6 mg/kg	35	239	<0.6	<0.6	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Copper	<1.4 mg/kg	71700	12200	11.8	8.49	20.9	6.23	20.9	8.01	<14	<7	210	9.46	21	21.9	19.6	18.6	6.79	19.7	<7	97.8	17	13
Lead	<0.7 mg/kg	4640	477	21.5	12.4	27	63.1	32.3	11.7	15.2	<3.5	116	7.75	31.8	29.8	15.3	26.9	10.1	13.3	<3.5	184	22.7	15.8
Magnesium	<8mg/kg	-		6320	7220	4290	5950	6920	5740	6380	4620	4490	6500	8890	7840	8360	4530	5900	6410	8480	18200	10200	8220
Manganese	<0.13 mg/kg	-		293	329	365	193	1100	356	283	49.8	2950	1790	938	528	2770	306	271	318	788	13000	1970	821
Mercury	<0.14 mg/kg	3640	303	<0.14	<0.14	<	<	<	<	<1.4	<0.7	<0.7	<	<	<	<	<	<	<	<0.7	<1.4	<0.7	<
Nickel	<0.2 mg/kg	1800	922	20.4	20.8	33	4.95	29.2	19.2	21.2	2.59	209	13.4	25.5	22.4	22.3	27.5	16.3	22.2	3.59	50	27.2	22.6
Selenium	<1 mg/kg	13000	696	<1	<1	<	<	<10	<	<10	<5	<5	1.12	<	<	1.55	<	<	<	<5	<10	<5	<
Vanadium	<0.2 mg/kg	3160	422	23.4	21.3	13.7	4.54	30.7	21.2	22.9	2.69	96.9	26	26.6	19	28.5	16.8	23.2	21.4	14.2	238	57.2	32.7
Zinc	<1.9mg/kg	665000	54800	78.7	63.4	106	92.8	117	68.1	63.5	18.3	675	62.1	145	95	77.9	96.8	47.5	69.6	15.6	789	107	72.2
Phenols																							
2,3,5 Trimethyl-Phenol	<0.01 mg/kg	-		<	<	<	<	<	<	<	<	<	<			<	<	<	<	<	<	<	<
2-Isopropyl Phenol	<0.015 mg/kg	-		<	<	<	<	<	<	<	<	<	<			<	<	<	<	<	<	<	<
Cresols	<0.01 mg/kg		9910	<	<	<	<	<	<	<	<	<	<			<	<	<	<	<	0.0444	0.0304	0.0138
Phenol	<0.01 mg/kg	482	686	<	<	<	<	<	<	<	<	<	<			<	<	<	<	<	<	0.0304	0.0138
Phenols, Total 5 speciated	<0.06 mg/kg		686	<	<	<	<	<	<	<	<	<	<			<	<	<	<	<	<	<	<
Phenols, Total monohydric	<0.035 mg/kg		686	<	<	<	<	<	<		<	<	<	<	<	<	<	<	<	<	<	<	<
Xylenols	<0.015 mg/kg	-		<	<	<	<	<	<	<	<	<	<			<	<	<	<	<	<	<	<
Mineral Oil / Oils & Greases																							
Mineral oil >C10-C40	<1 mg/kg			20.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
% Surrogate Recovery	%			81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Surrogate Value	-			40.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

East Tip 2012 Borehole Solid Samples, Natural Soils, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)	BH301A	BH301A	BH301A	BH302	BH302	BH303	BH303	BH304	BH304	BH304	BH305	BH306d	BH306d	BH307	BH308	BH308	BH308	BH309	BH309	BH309	DUPLICATE 3 same as BH309 15.5 - 16
Depth (m)				7.5	14	16.5	11	14	8	10	6.5 - 7	6.5 - 7	16.5 - 17	7.5 - 8	14	18	12	3.5 - 4	7 - 7.5	11.5 - 12	7.5 - 8	13.5 - 14	15.5 - 16	
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				15/05/2012	15/05/2012	18/05/2012	05/06/2012	05/06/2012	14/05/2012	19/05/2012	06/06/2012	06/06/2012	07/06/2012	31/05/2012	11/06/2012	13/06/2012	30/05/2012	25/05/2012	29/05/2012	29/05/2012	06/06/2012	07/06/2012	07/06/2012	07/06/2012
Sample Received Date				20/05/2012	20/05/2012	23/05/2012		11/06/2012	16/05/2012	20/05/2012	11/06/2012	11/06/2012	11/06/2012	06/06/2012	18/06/2012	18/06/2012	06/06/2012	30/05/2012	06/06/2012	06/06/2012	11/06/2012	11/06/2012	11/06/2012	12/06/2012
SDG				120520-1	120520-1	120523-88	120611-19	120611-19	120516-77	Schedule #6	120611-19	120611-19	120611-19	120606-3	120618-1	120618-1	120606-3	120530-71	120606-3	120606-3	120611-19	120611-19	120611-19	120611-19
TPH Criteria Working Group (TPH CWG)																								
Aliphatics >C5-C6	<10µg/kg	3400000	324000000	15.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C6-C8	<10µg/kg	8300000	326000000	32.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C8-C10	<10µg/kg	2100000	6420000	116	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C10-C12	<10µg/kg	10000000	6520000	170	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C12-C16	<100µg/kg	61000000	6520000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C16-C21	<100µg/kg	1000000000	177000000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C21-C35	<100µg/kg	1000000000	177000000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C35-C44	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC5-EC7	<10µg/kg	28000	14200	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC7-EC8	<10µg/kg	59000000	23500000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC8-EC10	<10µg/kg	3700000	1940000	84.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC10-EC12	<10µg/kg	17000000	2490000	113	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC12-EC16	<100µg/kg	36000000	2590000	2550	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC16-EC21	<100µg/kg	28000000	1610000	5180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC21-EC35	<100µg/kg	28000000	1610000	23700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC35-EC44	<100µg/kg			8170	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC40-EC44	<100µg/kg			2520	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Aliphatics >C5-35	<100µg/kg	-		333	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Aromatics >C5-35	<100µg/kg	-		31700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Aliphatics & Aromatics >C5-C44	<100µg/kg			40200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl tertiary butyl ether (MTBE)	<5µg/kg		15600000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	<10µg/kg	28000	14200	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<3µg/kg	518000	10100000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m,p,o-Xylene	<9 µg/kg		14500000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m,p-Xylene	<6µg/kg	312000	14500000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	<3µg/kg	-	15700000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	<2µg/kg	869000	23500000	2.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BTEX, Total	<24µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rapid PAH Screen																								
Polyaromatic hydrocarbons, Total 17	<10mg/kg			<	<	<	<	<	<	<	<	<	<	<			<	<	<	<	<	<	<	<
Semi-Volatile Organic Compounds (SVOCs)																								
1,2,4-Trichlorobenzene	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4,5-Trichlorophenol	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4,6-Trichlorophenol (S)	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dichlorophenol (S)	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dimethylphenol (S)	<100µg/kg		1920000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-Dinitrotoluene (S)	<100µg/kg		200000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,6-Dinitrotoluene	<100µg/kg		101000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chloronaphthalene	<100µg/kg		2450000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorophenol (S)	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylphenol	<100µg/kg		9910000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Niitroaniline (S)	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Nitrophenol (S)	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3-Nitroaniline	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Bromophenylphenylether	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chloro-3-methylphenol (S)	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chloroaniline	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorophenylphenylether	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Methylphenol (S)	<100µg/kg		9910000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitroaniline	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Nitrophenol (S)	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	<100µg/kg	85000000	5570000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	<100µg/kg	84000000		<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	<100µg/kg	530000000	29100000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Azobenzene	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	<100µg/kg	90000	9520	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	<100µg/kg	14000	1200	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	<100µg/kg	100000	11500	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	<100µg/kg	650000	143000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	<100µg/kg	140000	123000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethoxy)methane	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
bis(2-Chloroethyl)ether	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
bis(2-Ethylhexyl) phthalate	<100µg/kg		3420000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Butylbenzyl phthalate	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	<100µg/kg	140000	993000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzo(a,h)anthracene	<100µg/kg	13000	1270	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diethyl phthalate	<100µg/kg		21000000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dimethyl phthalate	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	<100µg/kg	23000000	3890000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	<100µg/kg	64000000	3810000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobenzene	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorocyclopentadiene	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachloroethane	<100µg/kg		51400	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	<100µg/kg	60000	11200	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isophorone	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	<100µg/kg	200000	1010000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Dibutyl phthalate	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Dioctyl phthalate	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrobenzene	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Nitroso-n-dipropylamine	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pentachlorophenol	<100µg/kg			<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	<100µg/kg	22000000		<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	<100µg/kg	482		<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	<100µg/kg	54000000	2920000	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tic Report				No TICs identifie	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

East Tip 2012 Borehole Solid Samples, Natural Soils, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)	BH301A	BH301A	BH301A	BH302	BH302	BH303	BH303	BH304	BH304	BH305	BH306d	BH306d	BH307	BH308	BH308	BH308	BH309	BH309	BH309	DUPLICATE 3 same as BH309 15.5 - 16
Depth (m)				7.5	14	16.5	11	14	8	10	6.5 - 7	16.5 - 17	7.5 - 8	14	18	12	3.5 - 4	7 - 7.5	11.5 - 12	7.5 - 8	13.5 - 14	15.5 - 16	
Sample Type				SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date				15/05/2012	15/05/2012	18/05/2012	05/06/2012	05/06/2012	14/05/2012	19/05/2012	06/06/2012	07/06/2012	31/05/2012	11/06/2012	13/06/2012	30/05/2012	25/05/2012	29/05/2012	29/05/2012	06/06/2012	07/06/2012	07/06/2012	07/06/2012
Sample Received Date				20/05/2012	20/05/2012	23/05/2012		11/06/2012	16/05/2012	20/05/2012	11/06/2012	11/06/2012	06/06/2012	18/06/2012	18/06/2012	06/06/2012	30/05/2012	06/06/2012	06/06/2012	11/06/2012	11/06/2012	11/06/2012	12/06/2012
SDG				120520-1	120520-1	120523-88	120611-19	120611-19	120516-77	Schedule #6	120611-19	120611-19	120606-3	120618-1	120618-1	120606-3	120530-71	120606-3	120606-3	120611-19	120611-19	120611-19	120611-19
Volatile Organic Compounds (VOCs) - (Solids)																							
1.1.1.2-Tetrachloroethane	<10µg/kg	120000	223000	<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1.1-Trichloroethane	<7µg/kg	700000	54500000	<140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1.2.2-Tetrachloroethane	<10µg/kg	290000	292000	<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1.2-Trichloroethane	<10µg/kg	-	171000	<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1-Dichloroethane	<8µg/kg	-	9730000	<160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1-Dichloroethene	<10µg/kg		453000	<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.1-Dichloropropene	<10µg/kg	-		<220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2.3-Trichlorobenzene	<6µg/kg	-		<120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2.3-Trichloropropane	<17µg/kg	-		<340	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2.4-Trichlorobenzene	<6µg/kg	-		<120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2.4-Trimethylbenzene	<9µg/kg	-	49700	<180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2-Dibromo-3-chloropropane	<14µg/kg	-		<280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2-Dibromoethane	<12µg/kg	-		<240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2-Dichlorobenzene	<12µg/kg	-		<240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2-Dichloroethane	<5µg/kg	710	2800	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2-Dichloropropane	<12µg/kg	-	18600	<240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.3.5-Trimethylbenzene	<8µg/kg	-		<160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.3-Dichlorobenzene	<6µg/kg	-		<120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.3-Dichloropropane	<7µg/kg	-		<140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.4-Dichlorobenzene	<5µg/kg	-		<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.2-Dichloropropane	<12µg/kg	-		<240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	<9µg/kg	-		<180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	<12µg/kg	-		<240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	<11µg/kg	-		<220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	<9µg/kg	28000	14200	<180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	<10µg/kg	-	228000	<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	<14µg/kg	-		<280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	<7µg/kg	-	7710	<140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromoform	<10µg/kg	-	644000	<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromomethane	<13µg/kg	-		<260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon Disulphide	<7µg/kg	-	303	464	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbontetrachloride	<14µg/kg	3000	22400	<280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	<5µg/kg	-	4920000	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	<14µg/kg	-	272000000	<280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	<8µg/kg	110000	457000	<160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloromethane	<7µg/kg	-	17200	<140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cis-1-2-Dichloroethene	<5µg/kg	-	89500	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cis-1-3-Dichloropropene	<7µg/kg	-		<280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	<13µg/kg	-	45000	<260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	<9µg/kg	-		<180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichlorodifluoromethane	<4µg/kg	-		<80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloromethane	<10µg/kg	-	297000	<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	<3µg/kg	518000	10100000	<80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	<12µg/kg			<240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	<5µg/kg	-	10000000	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methyl Tertiary Butyl Ether	<11µg/kg			<220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	<13µg/kg	-	1010000	<260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	<10µg/kg	-		<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	<3µg/kg	-		<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
p/m-Xylene	<14µg/kg	312000	14500000	<280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Propylbenzene	<11µg/kg	-	10400000	<220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	<10µg/kg	-		<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	<10µg/kg	-		<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tert-amyl methyl ether	<15µg/kg			<300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	<12µg/kg	-		<240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	<5µg/kg	130000	982000	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	<2µg/kg	869000	23500000	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1-2-Dichloroethene	<11µg/kg	-	212000	<220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1-3-Dichloropropene	<14µg/kg	-		<280	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethene	<9µg/kg	12000	88200	<180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluorormethane	<6µg/kg	-		<120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<10µg/kg	63	804	<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VOC TIC				No TICs identified	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subcontracted: Organics - Dioxins/Furans																							
1,2,3,4,6,7,8 HpCDD*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3,4,6,7,8 HpCDF*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3,4,7,8 HxCDD*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3,4,7,8 HxCDF*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3,4,7,8,9 HpCDF*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3,6,7,8 HxCDD*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3,6,7,8 HxCDF*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3,7,8 PeCDD*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3,7,8 PeCDF*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3,7,8,9 HxCDD*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3,7,8,9 HxCDF*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,3,4,6,7,8 HxCDF*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,3,4,7,8 PeCDF*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,3,7,8 TCDD*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,3,7,8, TCDF*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I-PCDD/F-TEQ Lower Bound*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I-PCDD/F-TEQ Upper Bound*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OCDD*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OCDF*	ng/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tolulene Extractable Matter	<500 mg/kg			-	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	-	<	<
PCB's - (Solids)																							
PCB congener 101	< 3 µg/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB congener 118	< 3 µg/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB congener 138	< 3 µg/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB congener 153	< 3 µg/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB congener 180	< 3 µg/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB congener 28	< 3 µg/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB congener 52	< 3 µg/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs, Total ICES 7	< 21 µg/kg			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

BOLD and yellow indicates value exceeding Atrisk Park Human Health GAC

turquoise indicates value exceeds commercial GAC

East Tip 2012 Borehole Solid Samples, Natural Soils, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH309	BH310b	BH312a	BH312b	BH312b	BH313	BH316	BH316
Depth (m)			19.5	11	6 - 6.1	5.5	11.5	8	6.5 - 7	10.5 - 11
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			08/06/2012	11/05/2012	24/04/2012	01/05/2012	01/05/2012	18/05/2012	12/06/2012	12/06/2012
Sample Received Date			13/06/2012	16/05/2012	28/04/2012	08/05/2012	08/05/2012	23/05/2012	18/06/2012	18/06/2012
SDG			120613-81	120516-77	120428-54	120508-29	120508-29	120523-88	120618-1	120618-1
Sample Description										
Colour			Grey	Grey	Grey	Black	Grey	Grey	Grey	Dark Brown
Description			Silt Loam	Silty Clay	Loamy Sand	Silt Loam	Silty Clay	Clay	Silty Clay Loam	Clay
Grain Size			0.063 - 0.1 mm	0.063 - 0.1 mm	0.1 - 2 mm	<0.063 mm	<0.063 mm	<0.063 mm	<0.063 mm	<0.063 mm
Inclusion 1)			None	None	None	Stones	Stones	N/A	Stones	Stones
Inclusion 2)			None	None	None	N/A	N/A	N/A	N/A	N/A
Moisture content ratio	%		28	29	24	20	26	19	24	30
Laboratory data										
2-Butanone	<100 µg/kg		-	-	-	-	-	-	-	-
Acetone	< 50 µg/kg		-	-	-	-	-	-	-	-
Chloride (soluble)	<5mg/kg	-	4860	7190	5490	5010	6530	6240	4970	7360
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l		0.258	0.306	0.147	0.581	0.258	0.151	0.374	0.437
Carbon										
Fraction Organic Carbon (FOC)	<0.1		-	-	-	<0.1	-	-	-	-
Fraction Organic Carbon (FOC)	<0.002		-	-	-	-	0.00585	0.00862	-	-
Inorganics										
Ammoniacal Nitrogen as N	<15mg/kg	-	<15	65.3	<	20.5	47.3	45.9	25.5	<
Cyanide, Complex	<1 mg/kg	-	<	<	<	<	<	<	<	<
Cyanide, Free	<1 mg/kg	36	<	<	<	<	<	<	<	<
Cyanide, Total	<1 mg/kg	-	<	<	<	<	<	<	<	<
pH	1 pH Units		8.86	8.42	8.29	8.4	7.97	7.98	8.71	8.64
Sulphate, Total	<0.008 mg/kg		2820	4440	1450	2400	7290	2880	3410	3810
Sulphide, Easily liberated	<15mg/kg		60.4	76.4	41.5	43.6	<	<	37.6	40.6
Sulphur, Total	<0.02%		0.472	1.1	-	-	0.979	0.801	0.481	0.839
Sulphur, Total	<0.0016%		-	0.148	0.0484	0.0798	0.243	0.0958	0.114	0.117
Thiocyanate	<1 mg/kg	-	<1	<	<	<	<	<	<	<
Metals										
Aluminium	<11 mg/kg	-	9060	11300	6530	6700	10400	9560	7150	9690
Antimony	<0.6 mg/kg	-	<6	1.03	<	7.75	<	<6	<0.6	<0.6
Arsenic	<0.6 mg/kg	640	<6	5.76	3.02	14.1	7.19	6.08	3.98	5.99
Barium	<0.6 mg/kg	-	25.5	18.6	21.9	80.1	12.2	11.1	7.89	10.3
Beryllium	<0.01 mg/kg	420	0.325	0.739	0.2	0.425	0.457	0.25	0.317	0.425
Boron, water soluble	<1 mg/kg	192000	3.61	9.59	2.73	5.57	5.62	6.81	4.21	7.78
Cadmium	<0.2 mg/kg	230	0.312	0.302	0.292	1.02	0.28	0.266	0.205	0.251
Calcium	<21mg/kg	-	36300	66800	22900	43500	30100	45300	91100	56100
Chromium	<0.9 mg/kg	30400	40.5	37.4	19.1	169	30.2	28.4	16.4	20.6
Chromium, Hexavalent	<0.6 mg/kg	35	<	<	<	<	<	<	<	<
Copper	<1.4 mg/kg	71700	<14	10.4	7.2	132	10.3	<14	4.47	8.53
Lead	<0.7 mg/kg	4640	25.2	13.5	23.5	149	13.1	16.9	9.07	14.8
Magnesium	<8mg/kg	-	7050	7380	2970	7230	6050	7430	5600	7380
Manganese	<0.13 mg/kg	-	634	370	258	2500	426	333	222	300
Mercury	<0.14 mg/kg	3640	<1.4	<	<	<	<	<	<	<
Nickel	<0.2 mg/kg	1800	26.6	23.9	14.2	56.1	21.1	23.6	13.6	20
Selenium	<1 mg/kg	13000	<10	<	<1	<	<	<	<	<
Vanadium	<0.2 mg/kg	3160	23	25.8	11.7	33	21.8	26.1	14	20.7
Zinc	<1.9mg/kg	665000	151	69.9	73.9	534	64.9	71.6	65.1	84.1
Phenols										
2,3,5 Trimethyl-Phenol	<0.01 mg/kg	-	<	<	<	<	<	<		
2-Isopropyl Phenol	<0.015 mg/kg	-	<	<	<	<	<	<		
Cresols	<0.01 mg/kg		0.014	<	<	<	<	<		
Phenol	<0.01 mg/kg	482	0.014	<	<	<	<	<		
Phenols, Total 5 speciated	<0.06 mg/kg		<	<	<	<	<	<		
Phenols, Total monohydric	<0.035 mg/kg		<	<	<	<	<	<	<	<
Xylenols	<0.015 mg/kg	-	<	<	<	<	<	<		
Mineral Oil / Oils & Greases										
Mineral oil >C10-C40	<1 mg/kg		-	-	-	-	-	-	-	-
% Surrogate Recovery	%		-	-	-	-	-	-	-	-
Surrogate Value	-		-	-	-	-	-	-	-	-

East Tip 2012 Borehole Solid Samples, Natural Soils, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH309	BH310b	BH312a	BH312b	BH312b	BH313	BH316	BH316
Depth (m)			19.5	11	6 - 6.1	5.5	11.5	8	6.5 - 7	10.5 - 11
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			08/06/2012	11/05/2012	24/04/2012	01/05/2012	01/05/2012	18/05/2012	12/06/2012	12/06/2012
Sample Received Date			13/06/2012	16/05/2012	28/04/2012	08/05/2012	08/05/2012	23/05/2012	18/06/2012	18/06/2012
SDG			120613-81	120516-77	120428-54	120508-29	120508-29	120523-88	120618-1	120618-1
TPH Criteria Working Group (TPH CWG)										
Aliphatics >C5-C6	<10µg/kg	3400000	-	-	-	<	-	-	-	-
Aliphatics >C6-C8	<10µg/kg	8300000	-	-	-	21.1	-	-	-	-
Aliphatics >C8-C10	<10µg/kg	2100000	-	-	-	62	-	-	-	-
Aliphatics >C10-C12	<10µg/kg	10000000	-	-	-	139	-	-	-	-
Aliphatics >C12-C16	<100µg/kg	61000000	-	-	-	5510	-	-	-	-
Aliphatics >C16-C21	<100µg/kg	1000000000	-	-	-	35200	-	-	-	-
Aliphatics >C21-C35	<100µg/kg	1000000000	-	-	-	150000	-	-	-	-
Aliphatics >C35-C44	<100µg/kg		-	-	-	45100	-	-	-	-
Aromatics >EC5-EC7	<10µg/kg	28000	-	-	-	<	-	-	-	-
Aromatics >EC7-EC8	<10µg/kg	59000000	-	-	-	<	-	-	-	-
Aromatics >EC8-EC10	<10µg/kg	3700000	-	-	-	47.1	-	-	-	-
Aromatics >EC10-EC12	<10µg/kg	17000000	-	-	-	93	-	-	-	-
Aromatics >EC12-EC16	<100µg/kg	36000000	-	-	-	4190	-	-	-	-
Aromatics >EC16-EC21	<100µg/kg	28000000	-	-	-	26000	-	-	-	-
Aromatics >EC21-EC35	<100µg/kg	28000000	-	-	-	121000	-	-	-	-
Aromatics >EC35-EC44	<100µg/kg		-	-	-	51800	-	-	-	-
Aromatics >EC40-EC44	<100µg/kg		-	-	-	20000	-	-	-	-
Total Aliphatics >C5-35	<100µg/kg	-	-	-	-	191000	-	-	-	-
Total Aromatics >C5-35	<100µg/kg	-	-	-	-	151000	-	-	-	-
Total Aliphatics & Aromatics >C5-C44	<100µg/kg		-	-	-	439000	-	-	-	-
Methyl tertiary butyl ether (MTBE)	<5µg/kg		-	-	-	<	-	-	-	-
Benzene	<10µg/kg	28000	-	-	-	<	-	-	-	-
Ethylbenzene	<3µg/kg	518000	-	-	-	<	-	-	-	-
m,p,o-Xylene	<9 µg/kg		-	-	-	<	-	-	-	-
m,p-Xylene	<6µg/kg	312000	-	-	-	<	-	-	-	-
o-Xylene	<3µg/kg	-	-	-	-	<	-	-	-	-
Toluene	<2µg/kg	869000	-	-	-	<	-	-	-	-
BTEX, Total	<24µg/kg		-	-	-	<	-	-	-	-
Rapid PAH Screen										
Polyaromatic hydrocarbons, Total 17	<10mg/kg		<	<	<	<	<	<	-	-
Semi-Volatile Organic Compounds (SVOCs)										
1,2,4-Trichlorobenzene	<100µg/kg		-	-	-	<	-	-	-	-
1,2-Dichlorobenzene	<100µg/kg		-	-	-	<	-	-	-	-
1,3-Dichlorobenzene	<100µg/kg		-	-	-	<	-	-	-	-
1,4-Dichlorobenzene	<100µg/kg		-	-	-	<	-	-	-	-
2,4,5-Trichlorophenol	<100µg/kg		-	-	-	<	-	-	-	-
2,4,6-Trichlorophenol (S)	<100µg/kg		-	-	-	<	-	-	-	-
2,4-Dichlorophenol (S)	<100µg/kg		-	-	-	<	-	-	-	-
2,4-Dimethylphenol (S)	<100µg/kg		-	-	-	<	-	-	-	-
2,4-Dinitrotoluene (S)	<100µg/kg		-	-	-	<	-	-	-	-
2,6-Dinitrotoluene	<100µg/kg		-	-	-	<	-	-	-	-
2-Chloronaphthalene	<100µg/kg		-	-	-	<	-	-	-	-
2-Chlorophenol (S)	<100µg/kg		-	-	-	<	-	-	-	-
2-Methylnaphthalene	<100µg/kg		-	-	-	<	-	-	-	-
2-Methylphenol	<100µg/kg		-	-	-	<	-	-	-	-
2-Niitroaniline (S)	<100µg/kg		-	-	-	<	-	-	-	-
2-Nitrophenol (S)	<100µg/kg		-	-	-	<	-	-	-	-
3-Nitroaniline	<100µg/kg		-	-	-	<	-	-	-	-
4-Bromophenylphenylether	<100µg/kg		-	-	-	<	-	-	-	-
4-Chloro-3-methylphenol (S)	<100µg/kg		-	-	-	<	-	-	-	-
4-Chloroaniline	<100µg/kg		-	-	-	<	-	-	-	-
4-Chlorophenylphenylether	<100µg/kg		-	-	-	<	-	-	-	-
4-Methylphenol (S)	<100µg/kg		-	-	-	<	-	-	-	-
4-Nitroaniline	<100µg/kg		-	-	-	<	-	-	-	-
4-Nitrophenol (S)	<100µg/kg		-	-	-	<	-	-	-	-
Acenaphthene	<100µg/kg	85000000	-	-	-	<	-	-	-	-
Acenaphthylene	<100µg/kg	84000000	-	-	-	<	-	-	-	-
Anthracene	<100µg/kg	530000000	-	-	-	<	-	-	-	-
Azobenzene	<100µg/kg		-	-	-	<	-	-	-	-
Benzo(a)anthracene	<100µg/kg	90000	-	-	-	143	-	-	-	-
Benzo(a)pyrene	<100µg/kg	14000	-	-	-	<	-	-	-	-
Benzo(b)fluoranthene	<100µg/kg	100000	-	-	-	<	-	-	-	-
Benzo(g,h,i)perylene	<100µg/kg	650000	-	-	-	<	-	-	-	-
Benzo(k)fluoranthene	<100µg/kg	140000	-	-	-	<	-	-	-	-
Bis(2-chloroethoxy)methane	<100µg/kg		-	-	-	<	-	-	-	-
bis(2-Chloroethyl)ether	<100µg/kg		-	-	-	<	-	-	-	-
bis(2-Ethylhexyl) phthalate	<100µg/kg		-	-	-	<	-	-	-	-
Butylbenzyl phthalate	<100µg/kg		-	-	-	<	-	-	-	-
Carbazole	<100µg/kg		-	-	-	<	-	-	-	-
Chrysene	<100µg/kg	140000	-	-	-	188	-	-	-	-
Dibenzo(a,h)anthracene	<100µg/kg	13000	-	-	-	<	-	-	-	-
Dibenzofuran	<100µg/kg		-	-	-	<	-	-	-	-
Diethyl phthalate	<100µg/kg		-	-	-	<	-	-	-	-
Dimethyl phthalate	<100µg/kg		-	-	-	<	-	-	-	-
Fluoranthene	<100µg/kg	23000000	-	-	-	392	-	-	-	-
Fluorene	<100µg/kg	64000000	-	-	-	<	-	-	-	-
Hexachlorobenzene	<100µg/kg		-	-	-	<	-	-	-	-
Hexachlorobutadiene	<100µg/kg		-	-	-	<	-	-	-	-
Hexachlorocyclopentadiene	<100µg/kg		-	-	-	<	-	-	-	-
Hexachloroethane	<100µg/kg		-	-	-	<	-	-	-	-
Indeno(1,2,3-cd)pyrene	<100µg/kg	60000	-	-	-	<	-	-	-	-
Isophorone	<100µg/kg		-	-	-	<	-	-	-	-
Naphthalene	<100µg/kg	200000	-	-	-	<	-	-	-	-
n-Dibutyl phthalate	<100µg/kg		-	-	-	<	-	-	-	-
n-Dioctyl phthalate	<100µg/kg		-	-	-	<	-	-	-	-
Nitrobenzene	<100µg/kg		-	-	-	<	-	-	-	-
n-Nitroso-n-dipropylamine	<100µg/kg		-	-	-	<	-	-	-	-
Pentachlorophenol	<100µg/kg		-	-	-	<	-	-	-	-
Phenanthrene	<100µg/kg	22000000	-	-	-	265	-	-	-	-
Phenol	<100µg/kg	482	-	-	-	<	-	-	-	-
Pyrene	<100µg/kg	54000000	-	-	-	319	-	-	-	-
Tic Report			-	-	-	No TICs identified	-	-	-	-

East Tip 2012 Borehole Solid Samples, Natural Soils, Laboratory Analysis

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	BH309	BH310b	BH312a	BH312b	BH312b	BH313	BH316	BH316
Depth (m)			19.5	11	6 - 6.1	5.5	11.5	8	6.5 - 7	10.5 - 11
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			**08/06/2012**	11/05/2012	24/04/2012	01/05/2012	01/05/2012	18/05/2012	12/06/2012	12/06/2012
Sample Received Date			13/06/2012	16/05/2012	28/04/2012	08/05/2012	08/05/2012	23/05/2012	18/06/2012	18/06/2012
SDG			120613-81	120516-77	120428-54	120508-29	120508-29	120523-88	120618-1	120618-1
Volatile Organic Compounds (VOCs) - (Solids)										
1.1.1.2-Tetrachloroethane	<10µg/kg	120000	-	-	-	<	-	-	-	-
1.1.1-Trichloroethane	<7µg/kg	700000	-	-	-	<	-	-	-	-
1.1.2.2-Tetrachloroethane	<10µg/kg	290000	-	-	-	<	-	-	-	-
1.1.2-Trichloroethane	<10µg/kg	-	-	-	-	<	-	-	-	-
1.1-Dichloroethane	<8µg/kg	-	-	-	-	<	-	-	-	-
1.1-Dichloroethene	<10µg/kg		-	-	-	<	-	-	-	-
1.1-Dichloropropene	<10µg/kg	-	-	-	-	<11	-	-	-	-
1.2.3-Trichlorobenzene	<6µg/kg	-	-	-	-	<	-	-	-	-
1.2.3-Trichloropropane	<17µg/kg	-	-	-	-	<	-	-	-	-
1.2.4-Trichlorobenzene	<6µg/kg	-	-	-	-	<	-	-	-	-
1.2.4-Trimethylbenzene	<9µg/kg	-	-	-	-	<	-	-	-	-
1.2-Dibromo-3-chloropropane	<14µg/kg	-	-	-	-	<	-	-	-	-
1.2-Dibromoethane	<12µg/kg	-	-	-	-	<	-	-	-	-
1.2-Dichlorobenzene	<12µg/kg	-	-	-	-	<	-	-	-	-
1.2-Dichloroethane	<5µg/kg	710	-	-	-	<	-	-	-	-
1.2-Dichloropropane	<12µg/kg	-	-	-	-	<	-	-	-	-
1.3.5-Trimethylbenzene	<8µg/kg	-	-	-	-	<	-	-	-	-
1.3-Dichlorobenzene	<6µg/kg	-	-	-	-	<	-	-	-	-
1.3-Dichloropropane	<7µg/kg	-	-	-	-	<	-	-	-	-
1.4-Dichlorobenzene	<5µg/kg	-	-	-	-	<	-	-	-	-
2.2-Dichloropropane	<12µg/kg	-	-	-	-	<	-	-	-	-
2-Chlorotoluene	<9µg/kg	-	-	-	-	<	-	-	-	-
4-Chlorotoluene	<12µg/kg	-	-	-	-	<	-	-	-	-
4-Isopropyltoluene	<11µg/kg	-	-	-	-	<	-	-	-	-
Benzene	<9µg/kg	28000	-	-	-	<	-	-	-	-
Bromobenzene	<10µg/kg	-	-	-	-	<	-	-	-	-
Bromochloromethane	<14µg/kg	-	-	-	-	<	-	-	-	-
Bromodichloromethane	<7µg/kg	-	-	-	-	<	-	-	-	-
Bromoform	<10µg/kg	-	-	-	-	<	-	-	-	-
Bromomethane	<13µg/kg	-	-	-	-	<	-	-	-	-
Carbon Disulphide	<7µg/kg	-	-	-	-	197	-	-	-	-
Carbontetrachloride	<14µg/kg	3000	-	-	-	<15	-	-	-	-
Chlorobenzene	<5µg/kg	-	-	-	-	<	-	-	-	-
Chloroethane	<14µg/kg	-	-	-	-	<	-	-	-	-
Chloroform	<8µg/kg	110000	-	-	-	<	-	-	-	-
Chloromethane	<7µg/kg	-	-	-	-	<	-	-	-	-
cis-1-2-Dichloroethene	<5µg/kg	-	-	-	-	<	-	-	-	-
cis-1-3-Dichloropropene	<7µg/kg	-	-	-	-	<14	-	-	-	-
Dibromochloromethane	<13µg/kg	-	-	-	-	<	-	-	-	-
Dibromomethane	<9µg/kg	-	-	-	-	<	-	-	-	-
Dichlorodifluoromethane	<4µg/kg	-	-	-	-	<	-	-	-	-
Dichloromethane	<10µg/kg	-	-	-	-	14.3	-	-	-	-
Ethylbenzene	<3µg/kg	518000	-	-	-	<4	-	-	-	-
Hexachlorobutadiene	<12µg/kg		-	-	-	<	-	-	-	-
Isopropylbenzene	<5µg/kg	-	-	-	-	<	-	-	-	-
Methyl Tertiary Butyl Ether	<11µg/kg		-	-	-	<	-	-	-	-
Naphthalene	<13µg/kg	-	-	-	-	355	-	-	-	-
n-Butylbenzene	<10µg/kg	-	-	-	-	<	-	-	-	-
o-Xylene	<3µg/kg	-	-	-	-	<10	-	-	-	-
p/m-Xylene	<14µg/kg	312000	-	-	-	<	-	-	-	-
Propylbenzene	<11µg/kg	-	-	-	-	<	-	-	-	-
sec-Butylbenzene	<10µg/kg	-	-	-	-	<	-	-	-	-
Styrene	<10µg/kg	-	-	-	-	<	-	-	-	-
Tert-amyl methyl ether	<15µg/kg		-	-	-	<	-	-	-	-
tert-Butylbenzene	<12µg/kg	-	-	-	-	<	-	-	-	-
Tetrachloroethene	<5µg/kg	130000	-	-	-	<	-	-	-	-
Toluene	<2µg/kg	869000	-	-	-	<5	-	-	-	-
trans-1-2-Dichloroethene	<11µg/kg	-	-	-	-	<	-	-	-	-
trans-1-3-Dichloropropene	<14µg/kg	-	-	-	-	<	-	-	-	-
Trichloroethene	<9µg/kg	12000	-	-	-	<	-	-	-	-
Trichlorofluorormethane	<6µg/kg	-	-	-	-	<	-	-	-	-
Vinyl Chloride	<10µg/kg	63	-	-	-	<	-	-	-	-
VOC TIC			-	-	-	No TICs identified	-	-	-	-
Subcontracted: Organics - Dioxins/Furans										
1,2,3,4,6,7,8 HpCDD*	ng/kg		-	-	-	-	-	-	-	-
1,2,3,4,6,7,8 HpCDF*	ng/kg		-	-	-	-	-	-	-	-
1,2,3,4,7,8 HxCDD*	ng/kg		-	-	-	-	-	-	-	-
1,2,3,4,7,8 HxCDF*	ng/kg		-	-	-	-	-	-	-	-
1,2,3,4,7,8,9 HpCDF*	ng/kg		-	-	-	-	-	-	-	-
1,2,3,6,7,8 HxCDD*	ng/kg		-	-	-	-	-	-	-	-
1,2,3,6,7,8 HxCDF*	ng/kg		-	-	-	-	-	-	-	-
1,2,3,7,8 PeCDD*	ng/kg		-	-	-	-	-	-	-	-
1,2,3,7,8 PeCDF*	ng/kg		-	-	-	-	-	-	-	-
1,2,3,7,8,9 HxCDD*	ng/kg		-	-	-	-	-	-	-	-
1,2,3,7,8,9 HxCDF*	ng/kg		-	-	-	-	-	-	-	-
2,3,4,6,7,8 HxCDF*	ng/kg		-	-	-	-	-	-	-	-
2,3,4,7,8 PeCDF*	ng/kg		-	-	-	-	-	-	-	-
2,3,7,8 TCDD*	ng/kg		-	-	-	-	-	-	-	-
2,3,7,8, TCDF*	ng/kg		-	-	-	-	-	-	-	-
I-PCDD/F-TEQ Lower Bound*	ng/kg		-	-	-	-	-	-	-	-
I-PCDD/F-TEQ Upper Bound*	ng/kg		-	-	-	-	-	-	-	-
OCDD*	ng/kg		-	-	-	-	-	-	-	-
OCDF*	ng/kg		-	-	-	-	-	-	-	-
Tolulene Extractable Matter	<500 mg/kg		-	<	-	-	<	<	<	<
PCB's - (Solids)										
PCB congener 101	< 3 µg/kg		-	-	-	-	-	-	-	-
PCB congener 118	< 3 µg/kg		-	-	-	-	-	-	-	-
PCB congener 138	< 3 µg/kg		-	-	-	-	-	-	-	-
PCB congener 153	< 3 µg/kg		-	-	-	-	-	-	-	-
PCB congener 180	< 3 µg/kg		-	-	-	-	-	-	-	-
PCB congener 28	< 3 µg/kg		-	-	-	-	-	-	-	-
PCB congener 52	< 3 µg/kg		-	-	-	-	-	-	-	-
PCBs, Total ICES 7	< 21 µg/kg		-	-	-	-	-	-	-	-

BOLD and yellow indicates value exceeding Atrisk Park Human Health GAC

turquoise indicates value exceeds commercial GAC

East Tip Solid Samples, Laboratory Analysis, Natural Soils, 2005 and 2008 Data

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)		BH117	BH117	BH117	BH117	BH117	BH117	BH117	BH118/A	BH118/A	BH119	BH119	BH119	BH120	BH120	BH120	BH120	BH120	BH120	BH120	BH122/B	BH122/B	BH125	BH125	BH126	BH126	BH126	BH126	BH126	BH126	BH127	BH128	BH131	BH131
Depth (m)					7	7.45	8	9	9.45	10	13.5	7.5	9	8.7	11.7	19.5	7	7.5	8	9	10.5	11	17.7	8.5	9	10.5	12.3	5	6	6.45	7	11	21	8.5	24.1	8	15
Sample Type																																					
Sampled Date					2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005
Sample Received Date																																					
SDG																																					
Asbestos																																					
Asbestos Screen														NFD		NFD	NFD											NFD					NFD			NFD	NFD
Carbon																																					
TOC	<0.1			<																					1	2.2			1.4			0.9		1.2			
Fraction Organic Carbon (FOC)	<0.002						0.007				0.001	0.008	0.002	0.011	0.012	NT	NT			0.01			0.001	0.01			0.011	NT			0.009		0.002		0.001	NT	NT
Inorganics																																					
Ammoniacal Nitrogen as NO	<0.3mg/kg	-		<										NT		NT	21.60											42.50					66.10			<5.5	15.10
Cyanide, Complex	<1 mg/kg	-		<										<1		<1	<1											1.00					<1			<1	<1
Cyanide, Free	<1 mg/kg	36	34	<										<1		<1	<1											<1					<1			<1	<1
Cyanide, Total	<1 mg/kg	-		<										<1		<1	<1											1.00					<1			<1	<1
pH	1 pH Units													7.58		8.27	8.38								7.50	8.00		8.86	7.50			6.50	8.26	7.50		10.01	9.53
Sulphate, Total	<50 mg/kg													2382		3751	2080											2196					611			5496	6508
Water Soluble Sulphate	1g/l													0.29		0.04	0.22								0.03	0.09		0.42				0.09	0.08	0.06		0.33	0.41
Acid Soluble Sulphide	0.003g/l				<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<50		<50	<50											168.00	0.07				<50			95.00	<50
Thiocyanate	<0.01 mg/kg	-		<										<1		<1	<1											3.00					<1			<1	<1
Metals																																					
Aluminium	<1 mg/kg	-																																			
Antimony	<1 mg/kg	-	831																																		
Arsenic	<1 mg/kg	640	41.4											2		7	7											2					5			19	<1
Barium	<1 mg/kg	-	1570																																		
Boron, water soluble	<1 mg/kg	192000			3500									12		4	8											8					4			22	7
Cadmium	<1 mg/kg	230	83.6											<1		<1	<1											<1					<1			<1	<1
Calcium	<1mg/kg	-																																			
Chromium	<1 mg/kg	30400	22500											28		21	43											176					21			1265	1593
Chromium, Hexavalent	<50 mg/kg	35	239											<0.3		0.30	<0.3											<0.3					<0.3			<0.3	<3
Copper	<1 mg/kg	71700	12200											<1		25	35											12					7			744	70
Lead	<1 mg/kg	4640	477											9		35	23											23					20			200	26
Magnesium	<1 mg/kg	-																																			
Manganese	<1 mg/kg	-																																			
Mercury	<1 mg/kg	3640	303	<										<1		<1	<1											<1					<1			<1	<1
Nickel	<1 mg/kg	1800	922											19		31	19											16					33			134	26
Selenium	<1 mg/kg	13000	696											<3		<3	<3											<3					<3			<3	<3
Vanadium	<1 mg/kg	3160	422											30		18	34											42					18			220	181
Zinc	<1 mg/kg	665000	54800											72		136	163											161					116			1728	137
Phenols																																					
Phenol	<0.3 mg/kg	482	686	<										<0.01		<0.01	<0.01											<0.01	<0.01	<0.01			0.04			<0.01	<0.01
TPH Criteria Working Group (TPH CWG)																																					
Aliphatics >C5-C6	<10mg/kg	3400	324000																																		
Aliphatics >C6-C8	<10mg/kg	8300	326000											<10		<10	<10											<10					<10			<10	<10
Aliphatics >C8-C10	<10mg/kg	2100	6420											<10		<10	<10											<10					<10			<10	<10
Aliphatics >C10-C12	<10mg/kg	10000	6520											<10		<10	<10											<10					<10			<10	<10
Aliphatics >C12-C16	<10mg/kg	61000	6520											<10		<10	<10											<10					<10			<10	<10
Aliphatics >C16-C21	<10mg/kg	1000000	177000											<10		<10	<10											<10					<10			18	<10
Aliphatics >C21-C35	<10mg/kg	1000000	177000											<10		<10	<10											<10					<10			147	<10
Aliphatics >C35-C40	<10mg/kg													<10		<10	<10											<10					<10			<10	<10
Total Aliphatics >C6-C40 (Min Oils)														<10		<10	<10											<10					<10			165	<10
Aromatics >EC6-EC7	<10mg/kg	28	14.2											<10		<10	<10											<10					<10			<10	<10
Aromatics >EC7-EC8	<10mg/kg	59000	23500											<10		<10	<10											<10					<10			<10	<10
Aromatics >EC8-EC10	<10mg/kg	3700	1940											<10		<10	<10											<10					<10			<10	<10
Aromatics >EC10-EC12	<10mg/kg	17000	2490											<10		<10	<10											<10					<10			<10	<10
Aromatics >EC12-EC16	<10mg/kg	36000	2590											<10		<10	<10											<10					<10			<10	<10
Aromatics >EC16-EC21	<10mg/kg	28000	1610											<10		<10	<10											<10					<10			<10	<10
Aromatics >EC21-EC40	<10mg/kg	28000	1610											<10		<10	<10											<10					<10			20	<10
Total Aromatics >C6-40	<10mg/kg	-												<10		<10	<10											<10					<10			25	<10
Total Aliphatics & Aromatics >C6-C40	<10mg/kg													<10		<10	<10											<10					<10			190	<10
Methyl tertiary butyl ether (MTBE)	<0.01mg/kg		15600																																		
Benzene	<0.01mg/kg	28	14.2																																		
Ethylbenzene	<0.01mg/kg	518	10100																																		
Xylene	<0.01mg/kg																																				
m,p,o-Xylene			14500																																		
m,p-Xylene		312	14500																																		
o-Xylene		-	15700																																		
Toluene	<0.01mg/kg	869	23500																																		
BTEX, Total																																					
Rapid PAH Screen																																					
Acenaphthene	<0.05mg/kg	85000	5570											0.06		<0.05	<0.05											<0.05					<0.05			<0.05	<0.05
Acenaphthylene	<0.05mg/kg	84000												<0.05		<0.05	<0.05											<0.05					<0.05			<0.05	<0.05
Anthracene	<0.05mg/kg	530000	29100											<0.05		<0.05	0.06											<0.05					<0.05			<0.05	<0.05
Benzo(a)anthracene	<0.05mg/kg	90	9.52											<0.05		<0.05	0.08											<0.05					<0.05			<0.05	<0.05
Benzo(a)pyrene	<0.05mg/kg	14	1.2											<0.05		<0.05	<0.05											<0.05					<0.05			<0.05	<0.05
Benzo(b)fluoranthene	<0.05mg/kg	100	11.5											<0.05		<0.05	<0.05											<0.05					<0.05			<0.05	<0.05
Benzo(ghi)perylene	<0.05mg/kg	650	143											<0.05		<0.05	<0.05											<0.05					<0.05			<0.05	<0.05
Benzo(k)fluoranthene	<0.05mg/kg	140	123											<0.05		<0.05	<0.05											<0.05					<0.05			<0.05	<0.05
Chrysene	<0.05mg/kg	140	993											<0.05		<0.05	0.10											<0.05					<0.05			<0.05	<0.05
Dibenzo(ah)anthracene	<0.05mg/kg	13	1.27											<0.05		<0.05	<0.05											<0.05					<0.05			<0.05	<0.05
Fluoranthene	<0.05mg/kg	23000	3890											<0.05		<0.05	0.50											<0.05					<0.05			<0.05	<0.05
Fluorene	<0.05mg/kg	64000	3810											0.38		<0.05	<0.05											<0.05					<0.05			<0.05	<0.05
Indeno(123cd)pyrene	<0.05mg/kg	60	11.2											<0.05		<0.05	<0.05											<0.05					<0.05			<0.05	<0.05
Naphthalene	<0.05mg/kg	200	1010											0.15		<0.05	<0.05											<0.05					<0.05			<0.05	<0.05
Phenanthrene	<0.05mg/kg	22000												0.11		<0.05	0.45											<0.05					<0.05			<0.05	<0.05
Pyrene	<0.05mg/kg	54000	2920											<0.05		<0.05	0.47											<0.05					<0.05			<0.05	<0.05
PAH 16 Total	<0.05mg/kg													0.70		<0.05	1.66											<0.05					<0.05			<0.05	<0.05
Volatile Organic Compounds (VOCs) - (Solids)																																					
1.1.1.2-Tetrachloroethane	<1µg/kg	120000	223000											<1	<1	<1	<1											<1					<1			<1	<1
1.1.1-Trichloroethane	<1µg/kg	700000	54500000											<1	<1	<1	<1											<1					<1			<1	<1
1.1.2.2-Tetrachloroethane	<1µg/kg	290000	292000											<1	<1	<1	<1											<1					<1			<1	<1
1.1.2-Trichloroethane	<1µg/kg	-	171000											<1	<1	<1	<1											<1					<1			<1	<1
1.1-Dichloroethane	<1µg/kg	-	9730000											<1	<1	<1	<1											<1					<1			<1	<1
1.1-Dichloroethene	<1µg/kg		453000											<1	<1	<1	<1											<1					<1			<1	<1
1.1-Dichloropropene	<1µg/kg	-												<1	<1	<1	<1											<1					<1			<1	<1
1.2.3-Trichlorobenzene	<1µg/kg	-												<1	<1	<1	<1											<1					<1			<1	<1
1.2.3-Trichloropropane	<1µg/kg	-												<1	<1	<1	<1											<1					<1			<1	<1
1.2.4-Trichlorobenzene	<1µg/kg	-												<1	<1	<1	<1											<1					<1			<1	<1
1.2.4-Trimethylbenzene	<1µg/kg	-	49700											<1	<1	<1	<1											<1					<1			<1	<1
1.2-Dibromo-3-chloropropane	<1µg/kg	-												<1	<1	<1	<1											<1					<1			<1	<1
1.2-Dibromoethane	<1µg/kg	-												<1	<1	<1	<1											<1					<1			<1	<1
1.2-Dichlorobenzene	<1µg/kg	-												<1	<1	<1	<1											<1					<1			<1	<1
1.2-Dichloroethane	<1µg/kg	710	2800											<1	<1	<1	<1											<1					<1			<1	<1
1.2-Dichloropropane	<1µg/kg	-	18600											<1	<1	<1	<1											<1					<1			<1	<1
1.3.5-Trimethylbenzene	<1µg/kg	-												<1	<1	<1	<1											<1					<1			<1	<1
1.3-Dichlorobenzene	<1µg/kg	-												<1	<1	<1	<1											<1					<1			<1	<1

East Tip Solid Samples, Laboratory Analysis, Natural Soils, 2005 and 2008 Data

Sample Identity	LoD/Units	TSV for Commercial / Industrial Use	Park Human Health GAC (mg/kg)	BH117	BH117	BH117	BH117	BH117	BH117	BH117	BH118/A	BH118/A	BH119	BH119	BH119	BH120	BH120	BH120	BH120	BH120	BH120	BH120	BH122/B	BH122/B	BH125	BH125	BH126	BH126	BH126	BH126	BH126	BH126	BH127	BH128	BH131	BH131
Depth (m)				7	7.45	8	9	9.45	10	13.5	7.5	9	8.7	11.7	19.5	7	7.5	8	9	10.5	11	17.7	8.5	9	10.5	12.3	5	6	6.45	7	11	21	8.5	24.1	8	15
Sample Type																																				
Sampled Date				2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005
Sample Received Date																																				
SDG																																				
1.3-Dichloropropane	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
1.4-Dichlorobenzene	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
2.2-Dichloropropane	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
2-Chlorotoluene	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
4-Chlorotoluene	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
4-Isopropyltoluene	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
Benzene	<1μg/kg	28000	14200										<1	<1	<1	<1											<1					<1			<1	<1
Bromobenzene	<1μg/kg	-	228000										<1	<1	<1	<1											<1					<1			<1	<1
Bromochloromethane	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
Bromodichloromethane	<1μg/kg	-	7710										<1	<1	<1	<1											<1					<1			<1	<1
Bromoform	<1μg/kg	-	644000										<1	<1	<1	<1											<1					<1			<1	<1
Bromomethane	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
Carbon Disulphide	<1μg/kg	-	303										<1	<1	<1	<1											<1					<1			<1	<1
Carbontetrachloride	<1μg/kg	3000	22400										<1	<1	<1	<1											<1					<1			<1	<1
Chlorobenzene	<1μg/kg	-	4920000										<1	<1	<1	<1											<1					<1			<1	<1
Chloroethane	<1μg/kg	-	272000000										<1	<1	<1	<1											<1					<1			<1	<1
Chloroform	<1μg/kg	110000	457000										<1	<1	<1	<1											<1					<1			<1	<1
Chloromethane	<1μg/kg	-	17200										<1	<1	<1	<1											<1					<1			<1	<1
cis-1-2-Dichloroethene	<1μg/kg	-	89500										<1	<1	<1	<1											<1					<1			<1	<1
cis-1-3-Dichloropropene	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
Dibromochloromethane	<1μg/kg	-	45000										<1	<1	<1	<1											<1					<1			<1	<1
Dibromomethane	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
Dichlorodifluoromethane	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
Dichloromethane	<1μg/kg	-	297000										<1	<1	<1	<1											<1					<1			<1	<1
Ethylbenzene	<1μg/kg	518000	10100000										<1	<1	<1	<1											<1					<1			<1	<1
Hexachlorobutadiene	<1μg/kg												<1	<1	<1	<1											<1					<1			<1	<1
Isopropylbenzene	<1μg/kg	-	10000000										<1	<1	<1	<1											<1					<1			<1	<1
Methyl Tertiary Butyl Ether	<1μg/kg												<1	<1	<1	<1											<1					<1			<1	<1
Naphthalene	<1μg/kg	-	1010000										<1	<1	<1	<1											<1					<1			<1	<1
n-Butylbenzene	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
o-Xylene	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
p/m-Xylene	<1μg/kg	312000	14500000										<1	<1	<1	<1											<1					<1			<1	<1
Propylbenzene	<1μg/kg	-	10400000										<1	<1	<1	<1											<1					<1			<1	<1
sec-Butylbenzene	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
Styrene	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
tert-Butylbenzene	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
Tetrachloroethene	<1μg/kg	130000	982000										<1	<1	<1	<1											<1					<1			<1	<1
Toluene	<1μg/kg	869000	23500000										<1	<1	<1	<1											<1					<1			<1	<1
trans-1-2-Dichloroethene	<1μg/kg	-	212000										<1	<1	<1	<1											<1					<1			<1	<1
trans-1-3-Dichloropropene	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
Trichloroethene	<1μg/kg	12000	88200										<1	<1	<1	<1											<1					<1			<1	<1
Trichlorofluoromethane	<1μg/kg	-											<1	<1	<1	<1											<1					<1			<1	<1
Vinyl Chloride	<1μg/kg	63	804										<1	<1	<1	<1											<1					<1			<1	<1
VOC TIC																																				
Subcontracted: Organics - Dioxins/Furans																																				
1,2,3,4,6,7,8 HpCDD*	ng/kg																																			
1,2,3,4,6,7,8 HpCDF*	ng/kg																																			
1,2,3,4,7,8 HxCDD*	ng/kg																																			
1,2,3,4,7,8 HxCDF*	ng/kg																																			
1,2,3,4,7,8,9 HpCDF*	ng/kg																																			
1,2,3,6,7,8 HxCDD*	ng/kg																																			
1,2,3,6,7,8 HxCDF*	ng/kg																																			
1,2,3,7,8 PeCDD*	ng/kg																																			
1,2,3,7,8 PeCDF*	ng/kg																																			
1,2,3,7,8,9 HxCDD*	ng/kg																																			
1,2,3,7,8,9 HxCDF*	ng/kg																																			
2,3,4,6,7,8 HxCDF*	ng/kg																																			
2,3,4,7,8 PeCDF*	ng/kg																																			
2,3,7,8 TCDD*	ng/kg																																			
2,3,7,8, TCDF*	ng/kg																																			
HpCDF	ng/kg																																			
HxCDD	ng/kg																																			
HxCDF	ng/kg																																			
OCDD*	ng/kg																																			
OCDF*	ng/kg																																			
PeCDF	ng/kg																																			
I-PCDD/F-TEQ Lower Bound*	ng/kg																																			
I-PCDD/F-TEQ Upper Bound*	ng/kg																																			
PCB's - (Solids)																																				
PCB congener 101	< 1 μg/kg																																			
PCB congener 118	< 1 μg/kg																																			
PCB congener 138	< 1 μg/kg																																			
PCB congener 153	< 1 μg/kg																																			
PCB congener 180	< 1 μg/kg																																			
PCB congener 28	< 1 μg/kg																																			
PCB congener 52	< 1 μg/kg																																			
PCBs, Total ICES 7	< 1 μg/kg												<1		<1	<20											<20					<20			407.00	<20

Yellow and BOLD TEXT indicates value exceeding Atkins Park Human Health GAC
turquoise indicates value exceeds commercial GAC

Screen Unformatted Data

Screen Formatted Data

Appendix J Statistical Analysis Methodology

Statistical Analysis Methodology

In May 2008, "*Guidance on comparing soil contamination data with a critical concentration*" was jointly published by the Chartered Institute of Environmental Health (CIEH) and CL:AIRE (CIEH, CLAIRE, 2008). This document provides guidance on statistical techniques and methods for data assessment purposes, specifically comparing a critical concentration with an unbiased sample data set of soil contaminant results.

For the purposes of this report, solid contaminant concentration data that is deemed to exceed the relevant GAC values will be assessed from the perspective of the planning system. The key statistical question under this scenario is as follows:

"Is there sufficient evidence that the true mean concentration of the contaminant (μ) is less than the critical concentration (Cc)?"

Statistical convention defines the null hypothesis as H_0 and the alternative hypothesis as H_1. In the planning scenario the null hypothesis is: the true average mean concentration (μ), of a given contaminant, is more than the critical concentration (Cc). For illustration purposes the contaminant could be nickel, and the relevant critical concentration (for nickel) could be selected as the UK's Soil Guideline Value (SGV) for residential land use with gardens (in this instance 50mg/kg). The data set, which is assessed against the chosen critical concentration (in this instance 50mg/kg), could for example be: twenty sample results for nickel concentrations in soil, sampled on a 25m grid pattern across a given site area.

The alternative hypothesis (H_1) in the planning scenario is that: the true mean contaminant concentration is less than the critical concentration (Cc).

If the null hypothesis is rejected, in favour of the alternative hypothesis, it can be concluded that there is good evidence that the true mean concentration of the contaminant is less than the critical concentration, and no further action needs to be taken. Further action could in this instance include precautionary remedial measures (e.g. excavation of nickel impacted soils) or further data collection.

If however, it is found, following statistical analysis that the null hypothesis should not be rejected, then it should be concluded that the true mean contaminant concentration is greater than the critical concentration. In these circumstances precautionary remedial measures or further data collection could be undertaken.

The statistical testing itself is undertaken at a confidence limit of 95%, the chance of this being the wrong decision would be less than 5%.

The type of statistical test selected to answer the question under consideration (see above) is determined after consideration of the sample size and the data distribution (lognormal or normal distribution). The statistical test chosen is likely to vary from one dataset to the next; the assumptions made for each data set will be considered in the assessment section of this report.

Appendix K Leachability Analysis Results

2012 Borehole Waste Solid Samples, Laboratory Analysis Leachability

	Sample Description		slag with metal bolts and tin	slag and 1% plastic, 5% waste steel in construction form and occasional	slag with 10% waste steel and 5% refractory	slag	slag with 20% refractory	slag	slag with occ. demolition and refractory	shells with metal debris	slag	slag with 5% plastic and metals	slag with 10% metal	slag with 50% refractory waste	sludge with HC	slag with 5% steel, 2.5% refractories and 0.5% waste plastic	slag with 20%waste steel and 5% demolition	slag	millscale
Sample Identity	LoD/Units	**WQS**	BH302 E28	BH303 E16	BH303 E10	BH304 E19	BH305 E16	BH306A E18	BH306B E6	BH307 E18	BH309 E22	BH310A E4	BH310B E16	BH311 E7	BH312A E14	BH312C E7	BH312C E13	BH316 E3	OP10 E2
Depth (m)			9.00-	0.20-	3.00-	5.50-6.00	4.00-4.50	7.00-	2.00-	10.00-	6.50-7.00	1.00-	5.40-	0.50-0.60	4.00-4.10	2.60-	4.50-	0.20-0.50	0.8
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			01/06/2012	09/05/2012	08/05/2012	06/06/2012	24/05/2012	04/05/2012	24/04/2012	30/05/2012	06/06/2012	24/04/2012	04/05/2012	22/05/2012	24/04/2012	10/05/2012	10/05/2012	06/06/2012	05/06/2012
Sample Received Date			06/06/2012	13/05/2012	13/05/2012	11/06/2012	28/05/2012	09/05/2012	28/04/2012	06/06/2012	11/06/2012	27/04/2012	09/05/2012	28/05/2012	28/04/2012	13/05/2012	13/05/2012	08/06/2012	05/06/2012
SDG			120606-7	120513-11	120513-11	120611-19	120528-25	120509-46	120428-54	120606-3	120611-19	120428-54	120509-46	120528-25	120428-54	120513-11	120513-11	120611-19	120606-7
Laboratory data																			
NRA - Leachant Volume	ml		980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	
Carbon																			
NRA - Carbon, Organic (diss.filt)	mg/l		<3	<3	<3	<3	<3	<3	<3	7.4	<3	<3	<3	<3	<3	3.8	<3	<3	<3
Inorganics																			
NRA - Alkalinity, Carbonate as CaCO3	mg/l		-	-	-	-	70			<2	-	-	-	50					
NRA - Alkalinity, Carbonate as CaCO3 (diss.filt)	<2 mg/l		60	60	40	29	-		<		41.9	40			<	60	<	23.9	2
NRA - Ammoniacal Nitrogen as N	<0.01 mg/l		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
NRA - Chloride	<0.0003 mg/l		109	27.5	3.5	141	188	349	188	470	140	3.6	273	9.9	279	116	339	152	<2
NRA - COD, unfiltered	<7 mg/l		<	<	<	<	<	8.96	<	17.3	<	<	<	<	9.69	13.1	<	<	<
NRA - Conductivity @ 20 deg.C	<0.005 mS/cm		0.843	0.181	1.16	0.587	0.969	1.17	0.64	1.69	0.603	1.18	0.983	0.869	0.995	0.98	1.22	0.684	0.0828
NRA - Cyanide, Complex	<0.05 mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Cyanide, Free	<0.05 mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Cyanide, Total	<0.05 mg/l		<	<	<	-	<	<	<	<		<	<	<	<	<	<	-	<
NRA - Dissolved solids, Total (gravimetric)	<10 mg/l		457	196	584	-	694	3610	541	1030			792	395	703	4660	981	-	53.7
NRA - Dissolved solids, Total (meter)	<10 mg/l		-	-	-	456	-				469	938						547	
NRA - Fluoride	<0.5 mg/l		0.565	<	<	<	0.518	<	<	<	<	<	<	<	<	<	<	<	0.794
NRA - Nitrate as NO3	<0.3 mg/l		<	0.592	0.355	<	<0.3	<	<	<	0.497	0.379	0.745	0.963	<	0.588	<	<	<
NRA - pH	pH Units	<4.5, >9	11.5	9.63	11.8	10.3	11.4	8.44	8.99	8.18	10.5	11.8	9.75	11.8	7.52	11.5	7.29	10.4	9.52
NRA - Sulphate	<2 mg/l		29.5	3.8	10	40	41.1	59.3	35.5	123	28.7	10.2	61.5	14.1	72	38.7	138	83	4.2
NRA - Sulphide	<0.01 mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Sulphur, Free	<0.05 mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Thiocyanate	<0.05 mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Filtered (Dissolved) Metals																			
NRA - Aluminium (diss.filt)	<2.9 µg/l	200	1140	13.8	1190	81.3	6840	<	<	113	35.5	1220	13.7	665	<	1050	233	241	494
NRA - Antimony (diss.filt)	<0.16 µg/l		3.48	15.4	2.13	1.74	2.69	2	0.613	1.23	1.03	2.29	0.738	3.45	3.45	8.79	1	4.91	8.92
NRA - Arsenic (diss.filt)	<0.12 µg/l	20	0.661	6.4	0.55	0.838	3.84	0.834	0.412	7.25	0.649	0.428	0.608	3.42	1.36	5.01	1.02	4.78	1.66
NRA - Barium (diss.filt)	<0.03 µg/l		159	22.8	483	116	283	193	273	3.75	421	478	188	497	119	160	88.9	72	56.8
NRA - Boron (diss.filt)	<9.4 µg/l	7000	759	63	32.8	628	786	482	755	444	1020	38	721	137	524	254	441	746	52.9
NRA - Cadmium (diss.filt)	<0.1 µg/l	0.2	<	<	<	-	<	<	<	0.139		<	<	<	<	<	<		<
NRA - Cadmium (diss.filt) Low Level	<0.03 µg/l	0.2	-	-	-	<	-				<							0.075	
NRA - Calcium (diss.filt)	< 0.012 mg/l		83.1	8.37	119	48.6	122	66.2	46.3	20.4	69.4	106	80.1	114	48.3	79.4	93.7	91.5	14.9
NRA - Chromium (diss.filt)	<0.22 µg/l	4.6	3.37	15.9	418	0.27	1.26	0.438	1.45	0.686	0.591	429	4.51	192	0.538	36.8	0.562	<0.22	37.9
NRA - Chromium, Hexavalent	<0.03 mg/l	0.0006	<	<	0.442	<	<	0.034	<	<	<	0.457	<	0.221	<	0.044	<	<	0.039
NRA - Cobalt (diss.filt)	<0.06 µg/l		<	0.1	0.177	<	0.101	<	<	0.06	<0.06	0.171	<	0.157	<0.06	<	<	0.071	<
NRA - Copper (diss.filt)	<0.85 µg/l	5	<	10.9	3.4		1.63	<	<	1.29		3.53	0.889	9.81	<	20	<		5.02
NRA - Copper Ultra low	µg/l	5				0.608					0.348							0.673	
NRA - Iron (diss.filt)	<0.019 mg/l		<	<	<	-	<	<	<	0.0551		<	<	0.0285	<	<	<		<
NRA - Lead (diss.filt)	<0.02 µg/l	7.2	0.276	0.646	5.13		3.62	0.812	0.56	0.332		6.93	0.702	15.6	1.94	4.72	1.16		0.344
NRA - Lead Ultra low	µg/l	7.2				<0.1					<0.1							<0.1	
NRA - Magnesium (diss.filt)	<0.036 mg/l		0.108	11.5	<0.036	1.47	0.0488	4.56	6.49	21.9	0.76	<0.036	0.476	0.0839	6.47	0.0414	8.82	1.1	1.53
NRA - Manganese (diss.filt)	<0.04 µg/l	30	<	0.568	0.098	-	0.433	0.104	0.148	15		0.187	0.136	0.724	1.15	0.097	11.6		0.3
NRA - Mercury (diss.filt)	<0.01 µg/l	0.05	<	<	0.019	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Molybdenum (diss.filt)	<0.24 µg/l		6.75	12.7	44.4	3.5	6.22	4.68	0.678	62.3	1.3	44.2	17.4	20.4	14.1	25.8	11.7	45	21
NRA - Nickel (diss.filt)	<0.15 µg/l	20	0.588	0.603	0.549	-	1.18	0.49	0.319	0.503		0.566	0.572	1.11	0.427	0.794	0.558		0.487
NRA - Nickel Ultra low	<0.1 µg/l	20	-	-	-	<	-	-			<							<	
NRA - Phosphorus (diss.filt)	<6.3 µg/l		<	<	<	<	<	<	<	173	<	<	<	<	<	<	<	<	16.8
NRA - Potassium (diss.filt)	<2.335 mg/l		<2.34	<2.34	<2.34	4.42	3.72	8.22	4.66	25.1	3.37	<2.34	6.64	<2.34	8.63	4.43	6.84	4.16	<2.34
NRA - Selenium (diss.filt)	<0.39 µg/l		1.49	0.922	1.83	1.21	2.88	1.79	0.799	4.47	1.25	1.97	1.17	0.902	1.24	1.44	1.63	1.83	7.37
NRA - Sodium (diss.filt)	0.076 mg/l		50.1	16.7	0.59	73	66.3	186	80	315	52.7	0.734	132	0.164	163	62.3	161	56.9	0.108
NRA - Thallium Dissolved	<0.96 µg/l		<	1.9	<	<	<	6.48	6.93	<	<	1.72	9.49	<0.96	6.81	4.29	7.93	<	<
NRA - Tin (diss.filt)	<0.36 µg/l		<	0.758	<	<	1.21	<	<	0.538	<	<	<	0.636	<0.36	0.373	<	<	<
NRA - Vanadium (diss.filt)	<0.24 µg/l		13.1	1.18	11.3	9.62	11.6	1.3	0.837	64.2	4.44	11.8	2.72	6.24	1.03	2.08	<0.24	1.41	<
NRA - Zinc (diss.filt)	<0.41 µg/l	40	<	1.53	6.18	<	2.89	<	<	0.791	0.892	5.3	<	9.57	0.848	19.4	4.19	<	4.35

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Sample Identity	LoD/Units	WQS	BH302 E28	BH303 E16	BH303 E10	BH304 E19	BH305 E16	BH306A E18	BH306B E6	BH307 E18	BH309 E22	BH310A E4	BH310B E16	BH311 E7	BH312A E14	BH312C E7	BH312C E13	BH316 E3	OP10 E2
Depth (m)			9.00-	0.20-	3.00-	5.50-6.00	4.00-4.50	7.00-	2.00-	10.00-	6.50-7.00	1.00-	5.40-	0.50-0.60	4.00-4.10	2.60-	4.50-	0.20-0.50	0.8
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			01/06/2012	09/05/2012	08/05/2012	06/06/2012	24/05/2012	04/05/2012	24/04/2012	30/05/2012	06/06/2012	24/04/2012	04/05/2012	22/05/2012	24/04/2012	10/05/2012	10/05/2012	06/06/2012	05/06/2012
Sample Received Date			06/06/2012	13/05/2012	13/05/2012	11/06/2012	28/05/2012	09/05/2012	28/04/2012	06/06/2012	11/06/2012	27/04/2012	09/05/2012	28/05/2012	28/04/2012	13/05/2012	13/05/2012	08/06/2012	05/06/2012
SDG			120606-7	120513-11	120513-11	120611-19	120528-25	120509-46	120428-54	120606-3	120611-19	120428-54	120509-46	120528-25	120428-54	120513-11	120513-11	120611-19	120606-7
Unfiltered (Total) Metals																			
NRA - Chromium (tot.unfilt)	µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NRA - Mercury (tot.unfilt)	µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NRA - Selenium (tot.unfilt)	µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NRA - Zinc (tot.unfilt)	µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenols																			
2.3.5 Trimethyl-Phenol	mg/l		-	<0.003	<0.003	-	-	<0.003	<0.003	-	-	<0.003	<0.003	-	<0.003	<0.003	<0.003	-	-
2-Isopropyl Phenol	mg/l		-	<0.006	<0.006	-	-	<0.006	<0.006	-	-	<0.006	<0.006	-	<0.006	<0.006	<0.006	-	-
NRA - Cresols	mg/l		-	<0.006	<0.006	-	-	<0.006	<0.006	-	-	<0.006	<0.006	-	<0.006	<0.006	<0.006	-	-
NRA - Phenol	<0.002 mg/l		-	<	<	-	-	<	<	-	-	<	<	-	<	<	<	-	-
NRA - Phenols, Total 5 speciated	<0.025 mg/l	0.008	-	<0.025	<0.025	-	-	<0.025	<0.025	-	-	<0.025	<0.025	-	<0.025	<0.025	<0.025	-	-
NRA - Phenols, Total monohydric	<0.016 mg/l		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
NRA - Xylenols	mg/l		-	<0.008	<0.008	-	-	<0.008	<0.008	-	-	<0.008	<0.008	-	<0.008	<0.008	<0.008	-	-
Mineral Oil / Oils & Greases																			
NRA - TPH / Oil & Greases	<1 mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
TPH Criteria Working Group (TPH CWG)																			
NRA - Aliphatics >C10-C12	µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	23	-	-	-	-
NRA - Aliphatics >C12-C16 (aq)	µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
NRA - Aliphatics >C16-C21 (aq)	µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
NRA - Aliphatics >C21-C35 (aq)	µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
NRA - Aliphatics >C5-C6	<5 µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
NRA - Aliphatics >C6-C8	<5 µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
NRA - Aliphatics >C8-C10	<5 µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
NRA - Aromatics >EC10-EC12	<10 µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	16	-	-	-	-
NRA - Aromatics >EC12-EC16 (aq)	<10 µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
NRA - Aromatics >EC16-EC21 (aq)	<10 µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
NRA - Aromatics >EC21-EC35 (aq)	<10 µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
NRA - Aromatics >EC5-EC7	µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
NRA - Aromatics >EC7-EC8	µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
NRA - Aromatics >EC8-EC10	µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
NRA - Benzene	<5 µg/l		-	-	-	-	-	<7	<7	-	-	<7	<7	-	<7	-	-	-	-
NRA - Ethylbenzene	µg/l		-	-	-	-	-	<5	<5	-	-	<5	<5	-	<5	-	-	-	-
NRA - GRO >C5-C12	µg/l		-	-	-	-	-	<50	<50	-	-	<50	<50	-	65	-	-	-	-
NRA - m,p-Xylene	µg/l		-	-	-	-	-	<8	<8	-	-	<8	<8	-	<8	-	-	-	-
NRA - Methyl tertiary butyl ether (MTBE)	µg/l		-	-	-	-	-	<3	<3	-	-	<3	<3	-	<3	-	-	-	-
NRA - o-Xylene	µg/l		-	-	-	-	-	<3	<3	-	-	<3	<3	-	<3	-	-	-	-
NRA - BTEX, Total	µg/l		-	-	-	-	-	<28	<28	-	-	<28	<28	-	<28	-	-	-	-
NRA - m,p,o-Xylene	µg/l		-	-	-	-	-	<11	<11	-	-	<11	<11	-	<11	-	-	-	-
NRA - Toluene	<5 µg/l		-	-	-	-	-	7	<4	-	-	<4	<4	-	<4	-	-	-	-
NRA - Total Aliphatics & Aromatics >C5-35 (aq)	µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	65	-	-	-	-
NRA - Total Aliphatics >C12-C35 (aq)	µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
NRA - Total Aromatics >EC12-EC35 (aq)	µg/l		-	-	-	-	-	<10	<10	-	-	<10	<10	-	<10	-	-	-	-
Polyaromatic Hydrocarbons (PAHs)																			
NRA - Acenaphthene (aq)	<0.015 µg/l		0.121	0.521	0.496	0.0646	0.139	1.09	0.0802	<	0.0885	0.035	<	<	0.113	0.0418	0.219	0.0258	0.0199
NRA - Acenaphthylene (aq)	<0.011 µg/l		<	0.0501	0.0514	<	<	0.119	0.0184	<	0.0244	<	<	0.0132	0.0142	<	0.0212	<	<
NRA - Anthracene (aq)	<0.015 µg/l	0.1µg/l	0.114	0.0763	0.0505	0.0292	0.0783	0.431	0.0259	<	0.207	0.0248	<	0.116	0.0797	0.0262	0.0924	<	<
NRA - Benzo(a)anthracene (aq)	< 0.017 µg/l		<	<	<	<	<	<	<	<	<	<	<	0.0196	<	<	<	<	<
NRA - Benzo(a)pyrene (aq)	<0.009 µg/l	0.05µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Benzo(b)fluoranthene (aq)	<0.023 µg/l	0.03µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Benzo(g,h,i)perylene (aq)	<0.016 µg/l	0.02µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Benzo(k)fluoranthene (aq)	<0.027 µg/l	0.03µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Chrysene (aq)	<0.013 µg/l		0.0147	<	<	<	<	<	<	<	0.0222	<	<	0.048	<	<	0.0242	<	<
NRA - Dibenzo(a,h)anthracene (aq)	<0.016 µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Fluoranthene (aq)	<0.017 µg/l	0.1µg/l	0.186	0.0707	0.0916	0.127	0.134	0.202	0.0251	<	0.324	0.0841	0.0229	0.37	0.127	0.0478	0.147	0.0257	0.0422
NRA - Fluorene (aq)	<0.014 µg/l		0.166	0.423	0.169	0.0563	0.0846	0.914	0.0581	<	0.261	0.0253	<	0.0363	0.0937	0.0365	0.141	0.019	<
NRA - Indeno(1,2,3-cd)pyrene (aq)	<0.014 µg/l	0.02µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Naphthalene (aq)	<0.02 µg/l	1.2µg/l	0.141	0.25	1.18	0.129	0.172	0.907	0.26	<0.1	0.161	0.224	0.111	0.186	0.395	0.359	0.689	0.202	<0.1
NRA - Polyaromatic hydrocarbons, Total USEPA 16 (aq)	<0.02 µg/l		1.42	1.53	2.43	0.76	0.96	5.68	0.613	<0.247	2.29	0.676	<0.247	1.53	1.1	0.806	1.9	0.345	<
NRA - Phenanthrene (aq)	<0.02 µg/l		0.554	0.0913	0.34	0.263	0.27	1.87	0.146	<0.022	0.991	0.217	0.0691	0.436	0.189	0.256	0.481	0.0487	0.0905
NRA - Pyrene (aq)	<0.015 µg/l		0.126	0.0491	0.0563	0.0903	0.0816	0.143	<	<	0.21	0.0649	<	0.304	0.0885	0.0381	0.0814	0.0243	0.028
PCB's - (Solids)																			
NRA - PCB congener 101	<0.015 µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - PCB congener 118	<0.015 µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - PCB congener 138	<0.015 µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - PCB congener 153	<0.015 µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - PCB congener 180	<0.015 µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - PCB congener 28	<0.015 µg/l		0.02	<	<	<	0.02	<	<	<	<	<	<	<	<	<	<	<	<

2012 Borehole Waste Solid Samples, Laboratory Analysis Leachability

Sample Identity	LoD/Units	WQS	BH302 E28	BH303 E16	BH303 E10	BH304 E19	BH305 E16	BH306A E18	BH306B E6	BH307 E18	BH309 E22	BH310A E4	BH310B E16	BH311 E7	BH312A E14	BH312C E7	BH312C E13	BH316 E3	OP10 E2
Depth (m)			9.00-	0.20-	3.00-	5.50-6.00	4.00-4.50	7.00-	2.00-	10.00-	6.50-7.00	1.00-	5.40-	0.50-0.60	4.00-4.10	2.60-	4.50-	0.20-0.50	0.8
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			01/06/2012	09/05/2012	08/05/2012	06/06/2012	24/05/2012	04/05/2012	24/04/2012	30/05/2012	06/06/2012	24/04/2012	04/05/2012	22/05/2012	24/04/2012	10/05/2012	10/05/2012	06/06/2012	05/06/2012
Sample Received Date			06/06/2012	13/05/2012	13/05/2012	11/06/2012	28/05/2012	09/05/2012	28/04/2012	06/06/2012	11/06/2012	27/04/2012	09/05/2012	28/05/2012	28/04/2012	13/05/2012	13/05/2012	08/06/2012	05/06/2012
SDG			120606-7	120513-11	120513-11	120611-19	120528-25	120509-46	120428-54	120606-3	120611-19	120428-54	120509-46	120528-25	120428-54	120513-11	120513-11	120611-19	120606-7
NRA - PCB congener 52	<0.015 µg/l		0.02	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - PCBs, Total ICES 7 (aq)	<0.015 µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Subcontracted: Inorganics																			
NRA - Cyanide, Total (low level)*	<5 µg/l		-	-	-	<5	-	-	-	-	<5	-	-	-	-	-	-	<5	-
yellow indicates value exceeds WQS																			

2012 Borehole Waste Solid Samples, Laboratory Analysis Leachability

	LoD/Units	WQS				
	Sample Description		**flue sludge**	**slag**	**millscale**	**slag**
Sample Identity		**WQS**	**OP10 E4**	**OP10 E6**	**OP14 E3**	**OP14 E6**
Depth (m)			**2.00**	**1.10**	**1.10-1.60**	**1.7**
Sample Type			**SOLID**	**SOLID**	**SOLID**	**SOLID**
Sampled Date			**05/06/2012**	**05/06/2012**	**07/06/2012**	**07/06/2012**
Sample Received Date			**05/06/2012**	**05/06/2012**	**08/06/2012**	**08/06/2012**
SDG			**120606-7**	**120606-7**	**120611-19**	**120611-19**
Laboratory data						
NRA - Leachant Volume	ml				980	980
Carbon						
NRA - Carbon, Organic (diss.filt)	mg/l		<3	<3	4.13	<3
Inorganics						
NRA - Alkalinity, Carbonate as CaCO3	mg/l					
NRA - Alkalinity, Carbonate as CaCO3 (diss.filt)	<2 mg/l		20	30	28	39.7
NRA - Ammoniacal Nitrogen as N	<0.01 mg/l		<0.2	<0.2	<0.2	<0.2
NRA - Chloride	<0.0003 mg/l		62.8	44.7	<2	12.4
NRA - COD, unfiltered	<7 mg/l		<	<	12.3	<
NRA - Conductivity @ 20 deg.C	<0.005 mS/cm		0.855	0.442	0.15	0.549
NRA - Cyanide, Complex	<0.05 mg/l		<	<	<	<
NRA - Cyanide, Free	<0.05 mg/l		<	<	<	<
NRA - Cyanide, Total	<0.05 mg/l		<	<		
NRA - Dissolved solids, Total (gravimetric)	<10 mg/l		545	277		
NRA - Dissolved solids, Total (meter)	<10 mg/l				128	432
NRA - Fluoride	<0.5 mg/l		1.89	0.814	<	<
NRA - Nitrate as NO3	<0.3 mg/l		<	0.352	1.35	10.2
NRA - pH	pH Units	<4.5, >9	11.2	11.1	9.69	11.3
NRA - Sulphate	<2 mg/l		185	22.2	13.9	65.5
NRA - Sulphide	<0.01 mg/l		<	<	<	<
NRA - Sulphur, Free	<0.05 mg/l		<	<	<	<
NRA - Thiocyanate	<0.05 mg/l		<	<	<	<
Filtered (Dissolved) Metals						
NRA - Aluminium (diss.filt)	<2.9 µg/l	200	280	112	8.33	454
NRA - Antimony (diss.filt)	<0.16 µg/l		0.701	3.16	13.4	5.4
NRA - Arsenic (diss.filt)	<0.12 µg/l	20	0.639	1.54	8.39	0.825
NRA - Barium (diss.filt)	<0.03 µg/l		72.9	341	2.47	105
NRA - Boron (diss.filt)	<9.4 µg/l	7000	129	292	25.9	238
NRA - Cadmium (diss.filt)	<0.1 µg/l	0.2	0.26	<		
NRA - Cadmium (diss.filt) Low Level	<0.03 µg/l	0.2			<	<
NRA - Calcium (diss.filt)	< 0.012 mg/l		147	69.1	5.48	83.6
NRA - Chromium (diss.filt)	<0.22 µg/l	4.6	8.74	18.4	7.4	30.2
NRA - Chromium, Hexavalent	<0.03 mg/l	0.0006	<	<	<	0.034
NRA - Cobalt (diss.filt)	<0.06 µg/l		0.117	<	<	0.062
NRA - Copper (diss.filt)	<0.85 µg/l	5	2.4	<		
NRA - Copper Ultra low	µg/l	5			18.8	3.06
NRA - Iron (diss.filt)	<0.019 mg/l		<	<		
NRA - Lead (diss.filt)	<0.02 µg/l	7.2	255	3.53		
NRA - Lead Ultra low	µg/l	7.2			1.49	<0.1
NRA - Magnesium (diss.filt)	<0.036 mg/l		<	0.0832	22.7	
NRA - Manganese (diss.filt)	<0.04 µg/l	30	<	<		
NRA - Mercury (diss.filt)	<0.01 µg/l	0.05	0.162	<	<	<
NRA - Molybdenum (diss.filt)	<0.24 µg/l		168	10.8	12.8	8.05
NRA - Nickel (diss.filt)	<0.15 µg/l	20	1.35	0.55		
NRA - Nickel Ultra low	<0.1 µg/l	20			0.33	<
NRA - Phosphorus (diss.filt)	<6.3 µg/l		<	<	<	<
NRA - Potassium (diss.filt)	<2.335 mg/l		<2.34	<2.34	<2.34	2.39
NRA - Selenium (diss.filt)	<0.39 µg/l		9.84	1.81	1.29	1.58
NRA - Sodium (diss.filt)	0.076 mg/l		22.9	3.08	0.742	1.73
NRA - Thallium Dissolved	<0.96 µg/l		<	<	<	<
NRA - Tin (diss.filt)	<0.36 µg/l		<	<	<	<
NRA - Vanadium (diss.filt)	<0.24 µg/l		<	5.04	0.816	10
NRA - Zinc (diss.filt)	<0.41 µg/l	40	124	6.89	0.501	1.13

2012 Borehole Waste Solid Samples, Laboratory Analysis Leachability

Sample Identity	LoD/Units	WQS	OP10 E4	OP10 E6	OP14 E3	OP14 E6
Depth (m)			2.00	1.10	1.10-1.60	1.7
Sample Type			SOLID	SOLID	SOLID	SOLID
Sampled Date			05/06/2012	05/06/2012	07/06/2012	07/06/2012
Sample Received Date			05/06/2012	05/06/2012	08/06/2012	08/06/2012
SDG			120606-7	120606-7	120611-19	120611-19
Unfiltered (Total) Metals						
NRA - Chromium (tot.unfilt)	µg/l		-	-	-	-
NRA - Mercury (tot.unfilt)	µg/l		-	-	-	-
NRA - Selenium (tot.unfilt)	µg/l		-	-	-	-
NRA - Zinc (tot.unfilt)	µg/l		-	-	-	-
Phenols						
2.3.5 Trimethyl-Phenol	mg/l		-	-	-	-
2-Isopropyl Phenol	mg/l		-	-	-	-
NRA - Cresols	mg/l		-	-	-	-
NRA - Phenol	<0.002 mg/l		-	-	-	-
NRA - Phenols, Total 5 speciated	<0.025 mg/l	0.008	-	-	-	-
NRA - Phenols, Total monohydric	<0.016 mg/l		<0.016	<0.016	<0.016	<0.016
NRA - Xylenols	mg/l		-	-	-	-
Mineral Oil / Oils & Greases						
NRA - TPH / Oil & Greases	<1 mg/l		<	<	<	<
TPH Criteria Working Group (TPH CWG)						
NRA - Aliphatics >C10-C12	µg/l		-	-	<0.015	0.762
NRA - Aliphatics >C12-C16 (aq)	µg/l		-	-	<0.011	0.0401
NRA - Aliphatics >C16-C21 (aq)	µg/l		-	-	<0.015	0.0768
NRA - Aliphatics >C21-C35 (aq)	µg/l		-	-	<0.017	<0.017
NRA - Aliphatics >C5-C6	<5 µg/l		-	-	<0.009	<0.009
NRA - Aliphatics >C6-C8	<5 µg/l		-	-	<0.023	<0.023
NRA - Aliphatics >C8-C10	<5 µg/l		-	-	<0.016	<0.016
NRA - Aromatics >EC10-EC12	<10 µg/l		-	-	<0.027	<0.027
NRA - Aromatics >EC12-EC16 (aq)	<10 µg/l		-	-	<0.013	0.0205
NRA - Aromatics >EC16-EC21 (aq)	<10 µg/l		-	-	<0.016	<0.016
NRA - Aromatics >EC21-EC35 (aq)	<10 µg/l		-	-	<0.017	0.186
NRA - Aromatics >EC5-EC7	µg/l		-	-	<0.014	0.417
NRA - Aromatics >EC7-EC8	µg/l		-	-	<0.014	<0.014
NRA - Aromatics >EC8-EC10	µg/l		-	-	<0.1	0.893
NRA - Benzene	<5 µg/l		-	-	<0.247	3.03
NRA - Ethylbenzene	µg/l		-	-	0.0286	0.478
NRA - GRO >C5-C12	µg/l		-	-	<0.015	0.156
NRA - m,p-Xylene	µg/l		-	-		
NRA - Methyl tertiary butyl ether (MTBE)	µg/l		-	-		
NRA - o-Xylene	µg/l		-	-		
NRA - BTEX, Total	µg/l		-	-		
NRA - m,p,o-Xylene	µg/l		-	-		
NRA - Toluene	<5 µg/l		-	-		
NRA - Total Aliphatics & Aromatics >C5-35 (aq)	µg/l		-	-		
NRA - Total Aliphatics >C12-C35 (aq)	µg/l		-	-		
NRA - Total Aromatics >EC12-EC35 (aq)	µg/l		-	-		
Polyaromatic Hydrocarbons (PAHs)						
NRA - Acenaphthene (aq)	<0.015 µg/l		<	0.0158	<	0.762
NRA - Acenaphthylene (aq)	<0.011 µg/l		<	<	<	0.0401
NRA - Anthracene (aq)	<0.015 µg/l	0.1µg/l	0.0366	0.0207	<	0.0768
NRA - Benzo(a)anthracene (aq)	< 0.017 µg/l		0.0176	<	<	<
NRA - Benzo(a)pyrene (aq)	<0.009 µg/l	0.05µg/l	<	<	<	<
NRA - Benzo(b)fluoranthene (aq)	<0.023 µg/l	0.03µg/l	<	<	<	<
NRA - Benzo(g,h,i)perylene (aq)	<0.016 µg/l	0.02µg/l	<	<	<	<
NRA - Benzo(k)fluoranthene (aq)	<0.027 µg/l	0.03µg/l	<	<	<	<
NRA - Chrysene (aq)	<0.013 µg/l		0.125	0.0153	<	0.0205
NRA - Dibenzo(a,h)anthracene (aq)	<0.016 µg/l		<	<	<	<
NRA - Fluoranthene (aq)	<0.017 µg/l	0.1µg/l	0.562	0.0665	<	0.186
NRA - Fluorene (aq)	<0.014 µg/l		<	0.0151	<	0.417
NRA - Indeno(1,2,3-cd)pyrene (aq)	<0.014 µg/l	0.02µg/l	<	<	<	<
NRA - Naphthalene (aq)	<0.02 µg/l	1.2µg/l	0.11	0.112	<0.1	0.893
NRA - Polyaromatic hydrocarbons, Total USEPA 16 (aq)	<0.02 µg/l		1.77	0.387	<0.247	3.03
NRA - Phenanthrene (aq)	<0.02 µg/l		0.733	0.0944	0.0286	0.478
NRA - Pyrene (aq)	<0.015 µg/l		0.183	0.0474	<	0.156
PCB's - (Solids)						
NRA - PCB congener 101	<0.015 µg/l		<	<	<	<
NRA - PCB congener 118	<0.015 µg/l		<	<	<	<
NRA - PCB congener 138	<0.015 µg/l		<	<	<	<
NRA - PCB congener 153	<0.015 µg/l		<	<	<	<
NRA - PCB congener 180	<0.015 µg/l		<	<	<	<
NRA - PCB congener 28	<0.015 µg/l		<	<	<	<

2012 Borehole Waste Solid Samples, Laboratory Analysis Leachability

Sample Identity	LoD/Units	WQS	OP10 E4	OP10 E6	OP14 E3	OP14 E6
Depth (m)			2.00	1.10	1.10-1.60	1.7
Sample Type			SOLID	SOLID	SOLID	SOLID
Sampled Date			05/06/2012	05/06/2012	07/06/2012	07/06/2012
Sample Received Date			05/06/2012	05/06/2012	08/06/2012	08/06/2012
SDG			120606-7	120606-7	120611-19	120611-19
NRA - PCB congener 52	<0.015 µg/l		<	<	<	<
NRA - PCBs, Total ICES 7 (aq)	<0.015 µg/l		<	<	<	<
Subcontracted: Inorganics						
NRA - Cyanide, Total (low level)*	<5 µg/l		-	-	<5	<5
yellow indicates value exceeds WQS						

2005 Investigation Waste Solid Samples, Laboratory Analysis Leachability

Sample Identity	LoD/Units	WQS	TP121-01	TP121-02	TP123-01	TP123-02	TP125-01	TP125-04	TP125-05	TP129-01	TP129-02	TP129-03	TP129-04	TP129-05-A	TP130-01	TP130-02
Depth (m)			0.0-0.4	1.5	0.0-0.5	1.6	0.0-0.5	3.3	0.0-2.0	0.0-0.6	1.9	3.0	3.5	0.0-2.0	0.0-0.5	1.6
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Laboratory data																
Inorganics																
NRA - Alkalinity, Carbonate as CaCO3	<2 mg/l		<	57	25	25	39	<	<	56	108	<	<	15	55	<
NRA - Ammoniacal Nitrogen as N	<0.01 mg/l		<0.2		<0.2		-	<0.2	-	-	-	<0.2	-	-	<0.2	-
NRA - Chloride	<1mg/l		5	24	6	18	4	127	1	4	60	73	148	3	5	13
NRA - COD, unfiltered	<7 mg/l		<10	24	46	39	31	11	12	21	43	13	16	20	11	10
NRA - Cyanide, Free	<0.05 mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Cyanide, Total	<0.05 mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Nitrate as NO3	<0.3 mg/l		0.7	<0.3	0.3	<	0.3	0.3	<	0.5	<	1	<	<	<	0.5
NRA - pH	pH Units	<4.5, >9	7.96	8.04	8.17	7.96	7.85	7.8	7.47	7.94	11.96	8	7.75	7.94	8.04	11.82
NRA - Sulphate	<3 mg/l		55	24	21	34	21	68	5	13	6	31	47	12	8	<3
NRA - Sulphide	<0.01 mg/l		<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
NRA - Sulphur, Free	<0.05 mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<
Metals																
NRA - Arsenic (diss.filt)	<1 ug/l	20	3	1	1	2	2	2	<	<	<	<	1	<	<	<
NRA - Boron (diss.filt)	<10 ug/l	7000	194	58	133	224	228	873	28	274	<10	1338	1844	318	214	19
NRA - Cadmium (diss.filt) Low Level	<0.4 ug/l	0.2	<	<	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Calcium (diss.filt)	<5 ug/l		45540	53450	45610	47200	34680	72410	8682	54580	218600	69510	95900	28400	47200	462800
NRA - Chromium (diss.filt)	<1 ug/l	4.6	49	31	116	38	60	7	6	204	134	52	7	37	149	159
NRA - Chromium, Hexavalent	<0.03 mg/l	0.0006	0.06	0.04	0.12	0.04	0.06	<	<	0.22	0.13	0.06	<	0.05	0.16	0.18
NRA - Copper (diss.filt)	<1 ug/l	5	17	14	53	32	29	7	26	5	10	2	4	2	12	4
NRA - Lead (diss.filt)	<1 ug/l	7.2	10	8	6	<	25	15	3	1	3	<	1	2	2	28
NRA - Magnesium (diss.filt)	<5 ug/l		46	73	69	43	56	185	1955	44	37	79	82	146	44	75
MNRA - mercury	<0.05 ug/l	0.05	0.12	0.08	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Nickel (diss.filt)	<1 ug/l	20	2	7	8	5	3	3	5	3	5	3	2	2	5	6
NRA - Potassium (diss.filt)	<0.2 mg/l		0.5	10.2	4.1	3.5	1.1	3	0.2	0.3	0.6	1	2.6	1.7	5.3	2
NRA - Selenium (diss.filt)	<1 ug/l		3	2	3	4	6	6	1	2	3	<	4	2	2	3
NRA - Sodium (diss.filt)	<0.2 mg/l		1.4	13.7	2.9	4.7	1.5	46.5	1.2	1.1	9.6	11	42	5.7	6.6	4.7
NRA - Zinc (diss.filt)	<3 ug/l	40	26	20	32	23	53	27	39	20	27	25	57	24	19	25
Phenol																
Total monohydric phenol	<0.01mg/l		<0.01	<0.01	0.01	<	<	<	<	<	<	<	<	<	<	<
Polyaromatic Hydrocarbons (PAHs)																
NRA - Acenaphthene (aq)	<10ng/l		124	1277	1279	225	107	82	<	21	<	<	21	40	53	25
NRA - Acenaphthylene (aq)	<10ng/l		15	114	666	289	23	13	<	11	<	<	<	<	18	<
NRA - Anthracene (aq)	<10ng/l	100	24	468	229	90	26	79	<	<	<	<	11	<	29	<
NRA - Benzo(a)anthracene (aq)	<10ng/l		<	139	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Benzo(a)pyrene (aq)	<10ng/l	50	<	91	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Benzo(b)fluoranthene (aq)	<10ng/l	30	<	80	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Benzo(g,h,i)perylene (aq)	<10ng/l	20	<	56	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Benzo(k)fluoranthene (aq)	<10ng/l	30	<	54	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Chrysene (aq)	<10ng/l		<	135	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Dibenzo(a,h)anthracene (aq)	<10ng/l		<	11	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Fluoranthene (aq)	<10ng/l	100	139	2712	184	127	67	103	<	<	<	<	51	<10	154	41
NRA - Fluorene (aq)	<10ng/l		84	468	2628	722	81	89	<	12	<	<	12	31	110	18
NRA - Indeno(1,2,3-cd)pyrene (aq)	<10ng/l	20	<	32	<	<	<	<	<	<	<	<	<	<	<	<
NRA - Naphthalene (aq)	<10ng/l	1200	197	815	11937	94	191	84	<	132	<	<	170	160	185	109
NRA - Phenanthrene (aq)	<10ng/l		143	3703	5993	1789	353	247	<	82	<	<	59	133	418	96
NRA - Pyrene (aq)	<10ng/l		93	1482	388	237	79	56	<	<	<	<	<	<	144	52
NRA - Polyaromatic hydrocarbons, Total USEPA 16 (aq)	<1µg/l		819	11637	23304	3573	927	753	<	258	<	<	324	364	1111	341

2005 Investigation Waste Solid Samples, Laboratory Analysis Leachability

Sample Identity	LoD/Units	WQS	TP121-01	TP121-02	TP123-01	TP123-02	TP125-01	TP125-04	TP125-05	TP129-01	TP129-02	TP129-03	TP129-04	TP129-05-A	TP130-01	TP130-02
Depth (m)			0.0-0.4	1.5	0.0-0.5	1.6	0.0-0.5	3.3	0.0-2.0	0.0-0.6	1.9	3.0	3.5	0.0-2.0	0.0-0.5	1.6
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
TPH																
GRO (C4-C12) (NRA)	<10µg/l			<		<		<				<			<	
MTBE (NRA)	<10µg/l			<		<		<				<			<	
Benzene (NRA)	<10µg/l			<		<		<				<			<	
Toluene (NRA)	<10µg/l			<		<		<				<			<	
Ethyl benzene (NRA)	<10µg/l			<		<		<				<			<	
m & p Xylene (NRA)	<10µg/l			<		<		<				<			<	
o Xylene (NRA)	<10µg/l			<		<		<				<			<	
Aliphatics C5-C6 (NRA)	<10µg/l			<		<		<				<			<	
Aliphatics >C6-C8 (NRA)	<10µg/l			<		<		<				<			<	
Aliphatics >C8-C10 (NRA)	<10µg/l			<		<		<				<			<	
Aliphatics >C10-C12 (NRA)	<10µg/l			<		<		<				<			<	
Aliphatics >C12-C16 (NRA)	<10µg/l			<		<		<				<			<	
Aliphatics >C16-C21 (NRA)	<10µg/l			<		<		<				<			<	
Aliphatics >C21-C35 (NRA)	<10µg/l			<		<		<				<			<	
Total Aliphatics C5-C35 (NRA)	<10µg/l			<		<		<				<			<	
Aromatics C6-C7 (NRA)	<10µg/l			<		<		<				<			<	
Aromatics >C7-C8 (NRA)	<10µg/l			<		<		<				<			<	
Aromatics >EC8-EC10 (NRA)	<10µg/l			<		<		<				<			<	
Aromatics >EC10-EC12 (NRA)	<10µg/l			<		<		<				<			<	
Aromatics >EC12-EC16 (NRA)	<10µg/l			<		<		<				<			<	
Aromatics >EC16-EC21 (NRA)	<10µg/l			<		<		<				<			<	
Aromatics >EC21-EC35 (NRA)	<10µg/l			<		<		<				<			<	
Total Aromatics C6-C35 (NRA)	<10µg/l			<		<		<				<			<	
TPH (Aliphatics and Aromatics C5-C35) (NRA)	<10µg/l			<		<		<				<			<	
PCB's - (Solids)																
NRA - PCBs (vs Aroclor 1254)	<26µg/l			<		<		<				<			<	
yellow indicates value exceeds WQS																

2005 Investigation Waste Solid Samples, Laboratory Analysis Leachability

Sample Identity	LoD/Units	WQS	TP130-03	BH131	
Depth (m)			2.6	8.0-10.0	
Sample Type			SOLID	SOLID	
Laboratory data					
Inorganics					
NRA - Alkalinity, Carbonate as CaCO3	<2 mg/l		50		
NRA - Ammoniacal Nitrogen as N	<0.01 mg/l		-		
NRA - Chloride	<1mg/l		22		
NRA - COD, unfiltered	<7 mg/l		522		
NRA - Cyanide, Free	<0.05 mg/l		<		
NRA - Cyanide, Total	<0.05 mg/l		<		
NRA - Nitrate as NO3	<0.3 mg/l		<		
NRA - pH	pH Units	<4.5, >9	11.95		
NRA - Sulphate	<3 mg/l		<3		
NRA - Sulphide	<0.01 mg/l		<0.05		
NRA - Sulphur, Free	<0.05 mg/l		<		
Metals					
NRA - Arsenic (diss.filt)	<1 ug/l	20	<	<0.2	
NRA - Boron (diss.filt)	<10 ug/l	7000	<10		
NRA - Cadmium (diss.filt) Low Level	<0.4 ug/l	0.2	<		
NRA - Calcium (diss.filt)	<5 ug/l		576900		
NRA - Chromium (diss.filt)	<1 ug/l	4.6	88		
NRA - Chromium, Hexavalent	<0.03 mg/l	0.0006	0.13		
NRA - Copper (diss.filt)	<1 ug/l	5	266		
NRA - Lead (diss.filt)	<1 ug/l	7.2	31		
NRA - Magnesium (diss.filt)	<5 ug/l		72		
MNRA - mercury	<0.05 ug/l	0.05	<		
NRA - Nickel (diss.filt)	<1 ug/l	20	8		
NRA - Potassium (diss.filt)	<0.2 mg/l		2.7		
NRA - Selenium (diss.filt)	<1 ug/l		4		
NRA - Sodium (diss.filt)	<0.2 mg/l		5.3		
NRA - Zinc (diss.filt)	<3 ug/l	40	28		
Phenol					
Total monohydric phenol	<0.01mg/l		<		
Polyaromatic Hydrocarbons (PAHs)					
NRA - Acenaphthene (aq)	<10ng/l		<		
NRA - Acenaphthylene (aq)	<10ng/l		<		
NRA - Anthracene (aq)	<10ng/l	100	<		
NRA - Benzo(a)anthracene (aq)	<10ng/l		<		
NRA - Benzo(a)pyrene (aq)	<10ng/l	50	<		
NRA - Benzo(b)fluoranthene (aq)	<10ng/l	30	<		
NRA - Benzo(g,h,i)perylene (aq)	<10ng/l	20	<		
NRA - Benzo(k)fluoranthene (aq)	<10ng/l	30	<		
NRA - Chrysene (aq)	<10ng/l		<		
NRA - Dibenzo(a,h)anthracene (aq)	<10ng/l		<		
NRA - Fluoranthene (aq)	<10ng/l	100	<		
NRA - Fluorene (aq)	<10ng/l		<		
NRA - Indeno(1,2,3-cd)pyrene (aq)	<10ng/l	20	<		
NRA - Naphthalene (aq)	<10ng/l	1200	<		
NRA - Phenanthrene (aq)	<10ng/l		<		
NRA - Pyrene (aq)	<10ng/l		<		
NRA - Polyaromatic hydrocarbons, Total USEPA 16 (aq)	<1μg/l		<		

2005 Investigation Waste Solid Samples, Laboratory Analysis Leachability

Sample Identity	LoD/Units	WQS	TP130-03	BH131	
Depth (m)			2.6	8.0-10.0	
Sample Type			SOLID	SOLID	
TPH					
GRO (C4-C12) (NRA)	<10µg/l			<	
MTBE (NRA)	<10µg/l			<	
Benzene (NRA)	<10µg/l			<	
Toluene (NRA)	<10µg/l			<	
Ethyl benzene (NRA)	<10µg/l			<	
m & p Xylene (NRA)	<10µg/l			<	
o Xylene (NRA)	<10µg/l			<	
Aliphatics C5-C6 (NRA)	<10µg/l			<	
Aliphatics >C6-C8 (NRA)	<10µg/l			<	
Aliphatics >C8-C10 (NRA)	<10µg/l			<	
Aliphatics >C10-C12 (NRA)	<10µg/l			<	
Aliphatics >C12-C16 (NRA)	<10µg/l			<	
Aliphatics >C16-C21 (NRA)	<10µg/l			<	
Aliphatics >C21-C35 (NRA)	<10µg/l			<	
Total Aliphatics C5-C35 (NRA)	<10µg/l			<	
Aromatics C6-C7 (NRA)	<10µg/l			<	
Aromatics >C7-C8 (NRA)	<10µg/l			<	
Aromatics >EC8-EC10 (NRA)	<10µg/l			<	
Aromatics >EC10-EC12 (NRA)	<10µg/l			<	
Aromatics >EC12-EC16 (NRA)	<10µg/l			<	
Aromatics >EC16-EC21 (NRA)	<10µg/l			<	
Aromatics >EC21-EC35 (NRA)	<10µg/l			<	
Total Aromatics C6-C35 (NRA)	<10µg/l			<	
TPH (Aliphatics and Aromatics C5-C35) (NRA)	<10µg/l			<	
PCB's - (Solids)					
NRA - PCBs (vs Aroclor 1254)	<26µg/l			<	
yellow indicates value exceeds WQS					

2012 Borehole Natural Soil Samples, Laboratory Analysis Leachability

Sample Identity	LoD/Units	WQS	BH301A	BH304 E22	BH306D E9	BH309 E25	BH310B E30	BH312 B E25
Depth (m)			9.00-	6.50-7.00	16.00-	7.50-8.00	11.00-	7.50-
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			16/05/2012	06/06/2012	13/06/2012	06/06/2012	11/05/2012	01/05/2012
Sample Received Date			20/05/2012	11/06/2012	18/06/2012	11/06/2012	16/05/2012	08/05/2012
SDG			120520-1	120611-19	120618-1	120611-19	120516-77	120508-29
Laboratory data								
NRA - Leachant Volume	ml		980	980	980	980	980	980
Carbon								
NRA - Carbon, Organic (diss.filt)	mg/l		6.58	7.85	7.99	8.07	7.84	6.58
Inorganics								
NRA - Alkalinity, Carbonate as CaCO3	mg/l		10	-		-	-	-
NRA - Alkalinity, Carbonate as CaCO3 (diss.filt)	<2 mg/l		-	<	<	<		<
NRA - Ammoniacal Nitrogen as N	<0.01 mg/l		2.14	0.713	5.11	0.586	2.78	1.23
NRA - Chloride	<0.0003 mg/l		531	333	579	391	516	479
NRA - COD, unfiltered	<7 mg/l		17.2	27.4	16.8	32.2	24.1	25.4
NRA - Conductivity @ 20 deg.C	<0.005 mS/cm		1.88	1.19	1.92	1.38	1.76	1.57
NRA - Cyanide, Complex	<0.05 mg/l		<	<	<	<	<	<
NRA - Cyanide, Free	<0.05 mg/l		<	<	<	<	<	<
NRA - Cyanide, Total	<0.05 mg/l		<	<	<	<	<	<
NRA - Dissolved solids, Total (gravimetric)	<10 mg/l		1140					3690
NRA - Dissolved solids, Total (meter)	<10 mg/l			967	1540	1080	1390	
NRA - Fluoride	<0.5 mg/l		<	<	<	<	<	<
NRA - Nitrate as NO3	<0.3 mg/l		<	<	<	<	<	<
NRA - pH	pH Units	<4.5, >9	8.34	8.48	8.49	8.71	8.32	8.13
NRA - Sulphate	<2 mg/l		142	69.5	60.1	74.7	88.1	70.3
NRA - Sulphide	<0.01 mg/l		<	<	<	<	<	<
NRA - Sulphur, Free	<0.05 mg/l		<	<	<	<	<	<
NRA - Thiocyanate	<0.05 mg/l		<	<	<	<	<	<
Filtered (Dissolved) Metals								
NRA - Aluminium (diss.filt)	<2.9 µg/l	200	22.2	112	37.7	154	45.5	14.2
NRA - Antimony (diss.filt)	<0.16 µg/l		1.22	1.23	7.41	0.967	1.21	1.13
NRA - Arsenic (diss.filt)	<0.12 µg/l	20	2.8	4.25	12.4	4.39	4.7	3.84
NRA - Barium (diss.filt)	<0.03 µg/l		2.95	2.51	4.34	3.73	3.56	1.69
NRA - Boron (diss.filt)	<9.4 µg/l	7000	438	405	320	343	353	306
NRA - Cadmium (diss.filt)	<0.1 µg/l	0.2	<	<	<	<	<	<
NRA - Cadmium (diss.filt) Low Level	<0.03 µg/l	0.2						
NRA - Calcium (diss.filt)	< 0.012 mg/l		24		11.9		12.7	14.8
NRA - Chromium (diss.filt)	<0.22 µg/l	4.6	1.16	1.91	1.52	1.34	1.95	1.94
NRA - Chromium, Hexavalent	<0.03 mg/l	0.0006	<	<	<	<	<	<
NRA - Cobalt (diss.filt)	<0.06 µg/l		0.07	<	0.294	<0.06	0.064	<
NRA - Copper (diss.filt)	<0.85 µg/l	5	0.898	2.87	<	1.74	1.22	<
NRA - Copper Ultra low	µg/l							
NRA - Iron (diss.filt)	<0.019 mg/l		0.028	0.0573	<	0.0772	0.0264	0.019
NRA - Lead (diss.filt)	<0.02 µg/l	7.2	0.054	0.834	2.79	3.65	1.65	1.31
NRA - Lead Ultra low	µg/l	7.2						
NRA - Magnesium (diss.filt)	<0.036 mg/l		28.2	16.9	23.5	16	23.3	21.8
NRA - Manganese (diss.filt)	<0.04 µg/l	30	14.3	12.5	34.3	6.32	13.3	11.6
NRA - Mercury (diss.filt)	<0.01 µg/l	0.05	<	<	<	<	<	<
NRA - Molybdenum (diss.filt)	<0.24 µg/l		49.9	19	26	32.6	32.8	16.8
NRA - Nickel (diss.filt)	<0.15 µg/l	20	0.615	0.76	<1	0.551	0.714	0.597
NRA - Nickel Ultra low	<0.1 µg/l	20		<1		<1		
NRA - Phosphorus (diss.filt)	<6.3 µg/l		80.2	173	291	217	143	<
NRA - Potassium (diss.filt)	<2.335 mg/l		27	17.6	21.8	19.9	21.8	22.7
NRA - Selenium (diss.filt)	<0.39 µg/l		3.61	1.96	4.53	2.37	2.29	1.94
NRA - Sodium (diss.filt)	0.076 mg/l		355	216	362	258	296	309
NRA - Thallium Dissolved	<0.96 µg/l		<	<	<	<	10.5	7.02
NRA - Tin (diss.filt)	<0.36 µg/l		<	<	0.538	<	<	<0.36
NRA - Vanadium (diss.filt)	<0.24 µg/l		35.2	77.6	17	134	54.5	42.3
NRA - Zinc (diss.filt)	<0.41 µg/l	40	205	2.81	1.49	2.45	8.88	4.82
Unfiltered (Total) Metals								
NRA - Chromium (tot.unfilt)	µg/l		-	-	-	-	-	-
NRA - Mercury (tot.unfilt)	µg/l		-	-	-	-	-	-
NRA - Selenium (tot.unfilt)	µg/l		-	3.12	-	3.26	-	-
NRA - Zinc (tot.unfilt)	µg/l		-	-	-	-	-	-
Phenols								
2.3.5 Trimethyl-Phenol	mg/l		-	-	-	-	<0.003	<0.003
2-Isopropyl Phenol	mg/l		-	-	-	-	<0.006	<0.006
NRA - Cresols	mg/l		-	-	-	-	<0.006	<0.006
NRA - Phenol	<0.002 mg/l		-	-	-	-	<	<
NRA - Phenols, Total 5 speciated	<0.025 mg/l	0.008	-	-	-	-	<0.025	<0.025
NRA - Phenols, Total monohydric	<0.016 mg/l		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
NRA - Xylenols	mg/l		-	-	-	-	<0.008	<0.008
Mineral Oil / Oils & Greases								
NRA - TPH / Oil & Greases	<1 mg/l		<	<	<	<	<	<

2012 Borehole Natural Soil Samples, Laboratory Analysis Leachability

Sample Identity	LoD/Units	WQS	BH301A	BH304 E22	BH306D E9	BH309 E25	BH310B E30	BH312 B E25
Depth (m)			9.00-	6.50-7.00	16.00-	7.50-8.00	11.00-	7.50-
Sample Type			SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampled Date			16/05/2012	06/06/2012	13/06/2012	06/06/2012	11/05/2012	01/05/2012
Sample Received Date			20/05/2012	11/06/2012	18/06/2012	11/06/2012	16/05/2012	08/05/2012
SDG			120520-1	120611-19	120618-1	120611-19	120516-77	120508-29
TPH Criteria Working Group (TPH CWG)								
NRA - Aliphatics >C10-C12	µg/l		-	-	-	-	<10	<10
NRA - Aliphatics >C12-C16 (aq)	µg/l		-	-	-	-	<10	<10
NRA - Aliphatics >C16-C21 (aq)	µg/l		-	-	-	-	<10	<10
NRA - Aliphatics >C21-C35 (aq)	µg/l		-	-	-	-	<10	<10
NRA - Aliphatics >C5-C6	<5 µg/l		-	-	-	-	<10	<10
NRA - Aliphatics >C6-C8	<5 µg/l		-	-	-	-	<10	<10
NRA - Aliphatics >C8-C10	<5 µg/l		-	-	-	-	<10	<10
NRA - Aromatics >EC10-EC12	<10 µg/l		-	-	-	-	<10	<10
NRA - Aromatics >EC12-EC16 (aq)	<10 µg/l		-	-	-	-	<10	<10
NRA - Aromatics >EC16-EC21 (aq)	<10 µg/l		-	-	-	-	<10	<10
NRA - Aromatics >EC21-EC35 (aq)	<10 µg/l		-	-	-	-	<10	<10
NRA - Aromatics >EC5-EC7	µg/l		-	-	-	-	<10	<10
NRA - Aromatics >EC7-EC8	µg/l		-	-	-	-	<10	<10
NRA - Aromatics >EC8-EC10	µg/l		-	-	-	-	<10	<10
NRA - Benzene	<5 µg/l		-	-	-	-	<7	<7
NRA - Ethylbenzene	µg/l		-	-	-	-	<5	<5
NRA - GRO >C5-C12	µg/l		-	-	-	-	<50	<50
NRA - m,p-Xylene	µg/l		-	-	-	-	<8	<8
NRA - Methyl tertiary butyl ether (MTBE)	µg/l		-	-	-	-	<3	<3
NRA - o-Xylene	µg/l		-	-	-	-	<3	<3
NRA - BTEX, Total	µg/l		-	-	-	-	<28	<28
NRA - m,p,o-Xylene	µg/l		-	-	-	-	<11	<11
NRA - Toluene	<5 µg/l		-	-	-	-	<4	<4
NRA - Total Aliphatics & Aromatics >C5-35 (aq)	µg/l		-	-	-	-	<10	<10
NRA - Total Aliphatics >C12-C35 (aq)	µg/l		-	-	-	-	<10	<10
NRA - Total Aromatics >EC12-EC35 (aq)	µg/l		-	-	-	-	<10	<10
Polyaromatic Hydrocarbons (PAHs)								
NRA - Acenaphthene (aq)	<0.015 µg/l		<	<	0.203	<	0.0252	<
NRA - Acenaphthylene (aq)	<0.011 µg/l		<	<	<	<	<	<
NRA - Anthracene (aq)	<0.015 µg/l	0.1µg/l	<	<	<	<	<	<
NRA - Benzo(a)anthracene (aq)	< 0.017 µg/l		<	<	<	<	<	<
NRA - Benzo(a)pyrene (aq)	<0.009 µg/l	0.05µg/l	0.0102	<	<	<	<	<
NRA - Benzo(b)fluoranthene (aq)	<0.023 µg/l	0.03µg/l	<	<	<	<	<	<
NRA - Benzo(g,h,i)perylene (aq)	<0.016 µg/l	0.02µg/l	<	<	<	<	<	<
NRA - Benzo(k)fluoranthene (aq)	<0.027 µg/l	0.03µg/l	<	<	<	<	<	<
NRA - Chrysene (aq)	<0.013 µg/l		0.015	<	0.0141	<	<	<
NRA - Dibenzo(a,h)anthracene (aq)	<0.016 µg/l		<	<	<	<	<	<
NRA - Fluoranthene (aq)	<0.017 µg/l	0.1µg/l	0.0302	<	0.0542	0.0261	<	<
NRA - Fluorene (aq)	<0.014 µg/l		0.0239	<	0.0322	<	<	<
NRA - Indeno(1,2,3-cd)pyrene (aq)	<0.014 µg/l	0.02µg/l	<	<	<	<	<	<
NRA - Naphthalene (aq)	<0.02 µg/l	1.2µg/l	0.199	<0.1	0.24	<0.1	0.119	<0.1
NRA - Polyaromatic hydrocarbons, Total USEPA 16 (aq)	<0.02 µg/l		0.304	<0.247	0.626	<0.247	<0.247	<0.247
NRA - Phenanthrene (aq)	<0.02 µg/l		<0.022	<0.022	0.0355	<0.022	<0.022	<0.022
NRA - Pyrene (aq)	<0.015 µg/l		0.0262	<	0.0476	0.0294	<	<
PCB's - (Solids)								
NRA - PCB congener 101	<0.015 µg/l		<	<	<	<	<	<
NRA - PCB congener 118	<0.015 µg/l		<	<	<	<	<	<
NRA - PCB congener 138	<0.015 µg/l		<	<	<	<	<	<
NRA - PCB congener 153	<0.015 µg/l		<	<	<	<	<	<
NRA - PCB congener 180	<0.015 µg/l		<	<	<	<	<	<
NRA - PCB congener 28	<0.015 µg/l		<	<	<	<	<	<
NRA - PCB congener 52	<0.015 µg/l		<	<	<	<	<	<
NRA - PCBs, Total ICES 7 (aq)	<0.015 µg/l		<	<	<	<	<	<
Subcontracted: Inorganics								
NRA - Cyanide, Total (low level)*	<5 µg/l		-	-	-	-	-	-
yellow indicates value exceeds WQS								

Appendix L Water Analysis Results

2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	Waste and alluvium		Waste and alluvium		Waste and alluvium		Waste and alluvium		Waste and alluvium		Waste and <1m into alluvium		Waste and alluvium		Waste and alluvium		Waste		Waste	
Sample Identity			**BH116**		**BH117**		**BH118**		**BH119**		**BH120**		**BH125**		**BH126**		**BH127**		**BH128**		**BH130**	
High Water / Low Water			Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Sampled Date			19/06/2012	19/06/2012	05/06/2012	05/06/2012	25/06/2012	25/06/2012	20/06/2012	20/06/2012	20/06/2012	20/06/2012	05/06/2012	05/06/2012	20/06/2012	20/06/2012	19/06/2012	19/06/2012	25/06/2012	25/06/2012	25/06/2012	25/06/2012
Sample Ref (Alcontrol)			782115	966673	118900	221777	543939	475461	215078	74622	282822	364540	731222	585333	880167	345730	774814	355340	882654	870938	533020	345662
SDG			120621-83	120621-83	120608-53	120608-53	120627-67	120627-67	120622-50	120622-50	120622-50	120622-50	120608-53	120608-53	120622-50	120622-50	120621-83	120621-83	120627-67	120627-67	120627-67	120627-67
Carbon																						
Organic Carbon, Total	1mg/l		12.6	3.92	3.21	3.95	5.8	15.2	2.16	3.11	25.9	23.1	<	<	3.85	3.32	2.73	7.45	<	<	1.82	5.74
Inorganics																						
Ammoniacal Nitrogen as N	<0.2 mg/l	50 mg/l	1.28	1.21	<	0.223	<	<	<	0.228	18.2	9.47	0.412	0.307	1.28	0.849	<	0.242	<	<	<	<
BOD, unfiltered	<1 mg/l		89.1	61.3	<2	<2	<60	<60	2.3	<2	26.1	8.47	<2	<2	86.7	22.7	17.1	14.3	<2	<2	<2	<2
Chloride	<2 mg/l		16900	16600	12100	11700	16800	17200	16000	17000	13100	6730	17000	16800	15100	15700	17300	17600	17800	16900	17200	18100
COD, unfiltered	<7 mg/l		382	248	382	1990	270	342	251	19.3	330	184	240	158	229	95.7	253	245	280	185	260	282
Conductivity @ 20 deg.C	<0.005 mS/cm		38.6	37.7	29	27.8	38.7	39.4	36.3	37.6	29.6	16.9	39.6	40	35.1	36	40.5	39.6	40.2	39.1	39.7	40
Cyanide, Complex	<0.005mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Free	<0.005mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Total (low level)*	<0.005mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Fluoride	0.5mg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate as NO3	<0.3 mg/l		<	<	<	<	2.01	2.32	8.34	8.8	7.49	7.69	<	<	7.05	7.06	<	<	1.14	1.39	1.24	1.2
Nitrite as NO2	<0.05mg/l		<	<	-	-	<	<	<	0.053	0.078	1.45	-	-	<	<	0.075	<	<	<	<	<
pH	1 pH Units	<4.5 >9	7.09	6.83	8.76	8.49	8.65	8.41	8.34	8.8	7.49	7.69	8.92	9.24	7.05	7.06	7.61	8.09	9.24	9.25	9.04	9.04
Sulphate	<2 mg/l		1760	1700	1580	1560	2090	2150	1990	1930	59	424	2020	1990	1560	1670	2100	2140	2120	2100	2190	2240
Sulphide	<0.01 mg/l		<	<	<	<0.05	<	<	0.042	<	<	<	<	<	<	<	0.694	<	<	<	<	<
Sulphur, Free	<0.05 mg/l		0.501	<	<	<	<	<	<	<	0.0581	<	<	<	2.06	<	<	<	<	<	<	<
Total Dissolved Sulphur	µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thiocyanate	<0.05 mg/l		<	<	<	<	-**	-**	<	<	<	<	<	<	<	<	<	<	-**	-**	-**	-**
Carbonate Alkalinity as CaCO3	<5 mg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saline TON as NO3	<0.3mg/l		<	<	-	-	2.01	2.32	-	-	-	-	-	-	-	-	<	<	1.14	1.39	1.24	1.2
Metals (Dissolved)																						
Aluminium (Saline)	<29µg/l	200 µg/l	34.5	30.7	-	-	91.4	29.5	24	24	37.2	63.1	-	-	88.2	24.8	22.8	27	18.4	30.6	19.7	23.8
Aluminium (diss.filt)	<2.9 µg/l	200 µg/l	-	-	<	<	-	-	-	-	-	-	<	30.8	-	-	-	-	-	-	-	-
Antimony (Saline)	<1µg/l		<	<	-	-	<	<	<	<	<	5.97	-	-	<	<	1.49	<	<	<	<	<
Antimony (diss.filt)	<0.16µg/l		-	-	4.45	6.76	-	-	-	-	-	-	4.58	2.67	-	-	-	-	-	-	-	-
Arsenic (Saline)	<0.5µg/l	20 µg/l	2.95	2.95	-	-	<	2.02	1.92	1.96	8.8	6.49	-	-	2.05	1.33	1.13	1.51	<	0.566	<	<
Arsenic (diss.filt)	<0.12µg/l	20 µg/l	-	-	20	20.8	-	-	-	-	-	-	26.6	27.9	-	-	-	-	-	-	-	-
Barium (diss.filt)	<0.03µg/l		126	132	77	74.4	42.7	41.1	54	58.9	734	292	62.8	61.5	80.5	73.4	67.6	77.8	53.2	54.4	46.1	50.4
Beryllium (diss.filt)	<0.07µg/l		<	<	<	<	-**	-**	<	<	<	<	<	<	<	<	<	<	-**	-**	-**	-**
Boron (Saline)	<201µg/l		1870	1850	-	-	3940	2690	3760	3860	2400	1150	-	-	1450	880	2900	3700	3090	3530	3350	3150
Cadmium (Saline)	<0.15 µg/l	0.2 µg/l	<	<	-	-	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<
Cadmium (diss.filt) (low level)	<0.03µg/l	0.2 µg/l	-	-	<0.3	<0.3	-	-	-	-	-	-	<0.3	<0.3	-	-	-	-	-	-	-	-
Calcium (diss.filt)	<0.012mg/l		784	765	344	337	353	371	341	379	539	463	615	635	749	751	516	529	358	402	355	291
Chromium (diss.filt)	<0.022µg/l	4.6 µg/l	-	-	14.6	4.08	-	-	-	-	-	-	3	4.01	-	-	-	-	-	-	-	-
Cobalt (diss.filt)	<0.06 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (Saline)	<1.5µg/l	4.6 µg/l	<	<	-	-	11.1	8.67	<	<	<	<	-	-	<	<	<	<	7.72	7.94	15.6	13.9
Copper (Saline)	<1 µg/l	5 µg/l	<	<	-	-	<	1.28	<	<	<	<	-	-	1.8	<	<	<	<	<	<	<
Iron (Saline)	<4µg/l		<	<	-	-	<	<	<	<	11.9	<	-	-	<	<	<	<	<	<	<	<
Lead (Saline)	<0.2 µg/l	7.2 µg/l	<	<	-	-	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<
Magnesium (diss.filt)	<0.036µg/l		572	492	684	636	924	972	940	1020	250	36.5	737	782	553	593	840	910	961	1070	1060	1010
Manganese (Saline)	<0.3µg/l	30 µg/l	631	600	-	-	<	<	<	<	2970	350	-	-	213	198	<	75.8	<	<	<	<
Mercury (Saline)	<0.02 µg/l	0.05 µg/l	0.384	0.478	-	-	0.153	0.196	**<0.15**	**<0.15**	1.32	2.61	-	-	0.243	0.192	**<0.15**	0.273	0.165	0.213	0.22	0.251
Mercury (diss filt)	<0.01µg/l	0.05 µg/l	-	-	<	<	-	-	-	-	-	-	<	<	-	-	-	-	-	-	-	-
Molybdenum (diss.filt)	<0.24 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (saline)	<1.1µg/l	20 µg/l	<	<	-	-	3.99	2.06	<	<	12.3	39.1	-	-	<	<	<	<	3.27	2.64	3.49	3.72
Nickel (diss.filt)	<0.15µg/l	20 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium (diss.filt)	<2.335mg/l		318	307	234	227	319	320	312	345	282	159	316	327	294	305	328	336	326	360	345	330
Phosphorus (diss.filt)	6.3 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium (Saline)	<0.5µg/l		1.1	0.513	-	-	2.02	0.775	1.12	1.05	1.05	1.9	-	-	1.21	1.08	1.49	1.62	1.05	0.838	1.15	1.67
Selenium (diss.filt)	<0.39µg/l		-	-	68.4	72	-	-	-	-	-	-	95.3	101	-	-	-	-	-	-	-	-
Sodium (diss.filt)	<0.076 mg/l		8790	8530	6850	6820	9220	9040	9470	10800	7490	3830	9890	10500	8700	9190	10700	8500	9100	10100	9640	9340
Thallium (diss.filt)	0.96 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin (diss.filt)	<0.36 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (Saline)	<4µg/l		17.4	17	-	-	<	18	27.4	24.5	22	19.1	-	-	19.7	27.3	30.2	19.8	<	12.5	<4	<4
Vanadium (diss.filt)	<0.24µg/l		-	-	5	3.04	-	-	-	-	-	-	2.63	<2.4	-	-	-	-	-	-	-	-
Zinc (Saline)	<2.1µg/l	40 µg/l	<	<	-	-	<	2.78	<	<	<	<	-	-	<	<	<	<	<	<	<	<
Zinc (diss.filt)	<0.41µg/l	40 µg/l	-	-	<4.1	<4.1	-	-	-	-	-	-	<4.1	12.9	-	-	-	-	-	-	-	-
Metals Unfiltered / Total																						
Boron (tot.unfilt)	<20µg/l	7000	-	-	1980	2010	-	-	-	-	-	-	1730	1820	-	-	-	-	-	-	-	-
Chromium, Hexavalent	<0.03 mg/l	0.0006	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Chromium, Hexavalent (Low Level)	<0.1 µg/l	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (tot unfilt)	<0.5 µg/l	4.7	-	-	-	-	22.4	71.5	-	-	-	-	-	-	-	-	-	-	145	52.4	103	500
Copper Ultra low	<0.1µg/l		-	-	41	49.9	-	-	-	-	-	-	53.7	69.7	-	-	-	-	-	-	-	-
Iron Ultra low	<70µg/l		-	-	<	<	-	-	-	-	-	-	<	<	-	-	-	-	-	-	-	-
Lead Ultra Low	<0.1µg/l		-	-	1.83	1.49	-	-	-	-	-	-	1.37	1.27	-	-	-	-	-	-	-	-
Manganese Ultra low	<0.1µg/l		-	-	<	<	-	-	-	-	-	-	<	<	-	-	-	-	-	-	-	-
Molybdenum	<30µg/l		-	-	-	-	<	<	-	-	-	-	-	-	-	-	-	-	<	<	31.8	<
Nickel Ultra low	<0.1µg/l		-	-	<	<	-	-	-	-	-	-	<	<	-	-	-	-	-	-	-	-

2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	Waste and alluvium		Waste and alluvium		Waste and alluvium		Waste and alluvium		Waste and alluvium		Waste and <1m into alluvium		Waste and alluvium		Waste and alluvium		Waste		Waste	
Sample Identity			BH116		BH117		BH118		BH119		BH120		BH125		BH126		BH127		BH128		BH130	
High Water / Low Water			Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Sampled Date			19/06/2012	19/06/2012	05/06/2012	05/06/2012	25/06/2012	25/06/2012	20/06/2012	20/06/2012	20/06/2012	20/06/2012	05/06/2012	05/06/2012	20/06/2012	20/06/2012	19/06/2012	19/06/2012	25/06/2012	25/06/2012	25/06/2012	25/06/2012
Sample Ref (Alcontrol)			782115	966673	118900	221777	543939	475461	215078	74622	282822	364540	731222	585333	880167	345730	774814	355340	882654	870938	533020	345662
SDG			120621-83	120621-83	120608-53	120608-53	120627-67	120627-67	120622-50	120622-50	120622-50	120622-50	120608-53	120608-53	120622-50	120622-50	120621-83	120621-83	120627-67	120627-67	120627-67	120627-67
Phenols																						
2,3,4,6-tetrachlorophenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
2,3,5,6-tetrachlorophenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
2,4,5-trichlorophenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
2,4,6-trichlorophenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
2,4-dichlorophenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
2,4-dimethylphenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
2,4-Dinitrophenol	<2.5µg/l		<5	<5	-	-	-	-	-	-	<5	<5	-	-	-	-	<12.5	<12.5	-	-	-	-
2,6-dichlorophenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
2-chlorophenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
2-methylphenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
2-nitrophenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
3-methylphenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
4-chloro-3-methylphenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
4-Chlorophenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
4-methylphenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
4-nitrophenol	<0.5µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
Dinoseb	<4µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
DNOC	<3µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
Pentachlorophenol	<2µg/l		<	<	-	-	-	-	-	-	<	<	-	-	-	-	<	<	-	-	-	-
Phenol	0.5µg/l	8 µg/l	<3	<3	<2	<2	-	-	-	-	6.65	<3	<2	<2	-	-	<3	<3	-	-	-	-
2.3.5 Trimethyl-Phenol	3 µg/l		-	-	<	<	-	-	-	-	-	-	<	<	-	-	-	-	-	-	-	-
2-Isopropyl Phenol	6 µg/l		-	-	<	<	-	-	-	-	-	-	<	<	-	-	-	-	-	-	-	-
Cresols	8 µg/l		-	-	<	<	-	-	-	-	-	-	<	<	-	-	-	-	-	-	-	-
Phenols, Total 5 speciated	8 µg/l		-	-	<25	<25	-	-	-	-	-	-	<25	<25	-	-	-	-	-	-	-	-
Xylenols	8 µg/l		-	-	<	<	-	-	-	-	-	-	<	<	-	-	-	-	-	-	-	-
Resorcinol	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Catechol	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1-naphthol	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenols, Total Detected monohydric	16 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH Criteria Working Group (TPH CWG)																						
Aliphatics >C5-C6	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C6-C8	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C8-C10	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C10-C12	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C12-C16	<10µg/l		<	<	18	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C16-C21	<10µg/l		<	<	39	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C21-C35	<10µg/l		<	<	398	54	<	<	<	<	<	<	49	<	<	<	<	<	<	<	<	72
Aromatics >EC5-EC7	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC7-EC8	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC8-EC10	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC10-EC12	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC12-EC16	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC16-EC21	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC21-EC35	<10µg/l		<	<	14	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Total aliphatics and aromatics C5-C35	<10µg/l		<	<	471	54	<	<	<	<	<	<	49	<	<	<	<	<	<	<	<	72
MTBE	<3µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Benzene	<7µg/l	8µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<5µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
m,p-Xylene	<8µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
o-Xylene	<3µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
m,p,o-Xylene	<11µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Toluene	<4µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
BTEX, Total	<28µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Polyaromatic Hydrocarbons (PAHs)																						
Acenaphthene (aq)	0.01µg/l		0.11	0.13	<	<	< 0.03	< 0.03	< 0.03	< 0.03	0.04	0.06	0.312	0.264	0.09	0.09	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene (aq)	0.01µg/l		< 0.04	< 0.04	<	<	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	0.0185	0.0191	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Anthracene (aq)	0.01µg/l	0.1µg/l	0.05	0.08	0.0247	<	< 0.02	< 0.02	< 0.02	< 0.02	0.06	0.06	0.0474	0.0511	0.03	0.03	0.04	0.03	< 0.02	< 0.02	< 0.02	< 0.02
Benzo(a)anthracene (aq)	0.01µg/l		< 0.04	< 0.04	0.39	<	< 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
Benzo(a)pyrene (aq)	0.01µg/l	0.05µg/l	< 0.05	< 0.05	0.862	<	< 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
Benzo(b)fluoranthene (aq)	0.01µg/l	0.03µg/l	0.03	< 0.02	0.389	<	< 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
Benzo(k)fluoranthene (aq)	0.01µg/l	0.03µg/l	< 0.03	< 0.03	0.647	<	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	<	<	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene (aq)	0.01µg/l	0.02µg/l	< 0.08	< 0.08	0.478	0.0864	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	<	<	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Chrysene (aq)	0.01µg/l		< 0.03	< 0.03	0.58	<	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	<	<	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene (aq)	0.01µg/l		< 0.06	< 0.06	0.191	<	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	<	<	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Fluoranthene (aq)	0.01µg/l	0.1µg/l	< 0.07	< 0.07	0.444	0.0892	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	0.142	0.0573	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07
Fluorene (aq)	0.01µg/l		0.07	0.10	<	<	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	0.173	0.174	0.04	0.05	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Indeno(1,2,3-cd)pyrene (aq)	0.01µg/l	0.02µg/l	< 0.05	< 0.05	0.486	<	< 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
Naphthalene (aq)	0.01µg/l	1.2µg/l	0.23	0.32	<	<	< 0.06	< 0.06	< 0.06	< 0.06	0.12	0.21	0.678	0.7	0.22	0.26	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Phenanthrene (aq)	0.01µg/l		< 0.085	< 0.085	0.303	0.0701	< 0.085	< 0.085	< 0.085	< 0.085	< 0.085	< 0.085	0.312	0.261	< 0.085	0.10	< 0.085	< 0.085	< 0.085	< 0.085	< 0.085	< 0.085
Pyrene (aq)	0.01µg/l		< 0.06	< 0.06	0.523	0.142	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.0118	0.0391	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Polyaromatic hydrocarbons, Total USEPA 16 (aq)	0.2µg/l		0.82	0.83	5.366	0.388	< 0.20	< 0.20	< 0.20	< 0.20	0.25	0.50	1.8	1.57	0.54	0.52	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
PCB's																						
PCB congener 101	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.04
PCB congener 118	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.03
PCB congener 138	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.03
PCB congener 153	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.02
PCB congener 180	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
PCB congener 28	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	0.08	0.02	<	<	0.02	0.02	<	<	<	0.11
PCB congener 52	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	0.03	<	<	<	0.02	0.02	<	<	<	0.07
Sum of detected EC7 PCB's	<0.105µg/l		<	<	<	<	<	<	<	12 <	<	<	0.11	<	<	<	<	<	<	<	<	0.3

2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	Waste and alluvium		Waste and alluvium		Waste and alluvium		Waste and alluvium		Waste and alluvium		Waste and <1m into alluvium		Waste and alluvium		Waste and alluvium		Waste		Waste	
Sample Identity			BH116		BH117		BH118		BH119		BH120		BH125		BH126		BH127		BH128		BH130	
High Water / Low Water			Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Sampled Date			19/06/2012	19/06/2012	05/06/2012	05/06/2012	25/06/2012	25/06/2012	20/06/2012	20/06/2012	20/06/2012	20/06/2012	05/06/2012	05/06/2012	20/06/2012	20/06/2012	19/06/2012	19/06/2012	25/06/2012	25/06/2012	25/06/2012	25/06/2012
Sample Ref (Alcontrol)			782115	966673	118900	221777	543939	475461	215078	74622	282822	364540	731222	585333	880167	345730	774814	355340	882654	870938	533020	345662
SDG			120621-83	120621-83	120608-53	120608-53	120627-67	120627-67	120622-50	120622-50	120622-50	120622-50	120608-53	120608-53	120622-50	120622-50	120621-83	120621-83	120627-67	120627-67	120627-67	120627-67
Volatile Organic Compounds (VOCs)																						
1.1.1.2-Tetrachloroethane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.1.1-Trichloroethane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.1.2.2-Tetrachloroethane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.1.2-Trichloroethane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.1-Dichloroethane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.1-Dichloroethene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.1-Dichloropropene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.2.3-Trichlorobenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.2.3-Trichloropropane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.2.4-Trichlorobenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.2.4-Trimethylbenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.2-Dibromo-3-chloropropane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.2-Dibromoethane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.2-Dichlorobenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.2-Dichloroethane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.2-Dichloropropane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1,3,5-Trichlorobenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.3.5-Trimethylbenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.3-Dichlorobenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.3-Dichloropropane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
1.4-Dichlorobenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
2.2-Dichloropropane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
2-Chlorotoluene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
4-Chlorotoluene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
4-Isopropyltoluene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Benzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Bromobenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Bromochloromethane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Bromodichloromethane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Bromoform	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Bromomethane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Carbon disulphide	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Carbontetrachloride	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Chlorobenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Chloroethane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Chloroform	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Chloromethane	<0.1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
cis-1,2-Dichloroethene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
cis-1,3-Dichloropropene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Dibromochloromethane	µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Dibromomethane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Dichlorodifluoromethane	<0.1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Dichloromethane	<3µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Ethylbenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Hexachlorobutadiene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Isopropylbenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
m,p-Xylene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Methyl tertiary butyl ether (MTBE)	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Naphthalene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
n-Butylbenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
o-Xylene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Propylbenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
sec-Butylbenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Styrene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Total Xylenes	<2µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
tert-Amyl methyl ether (TAME)	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
tert-Butylbenzene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Tetrachloroethene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Toluene	µg/l	10µg/l	<	<	<	<	-	-	-	-	<	<	-	<	-	-	<	<	-	-	-	-
trans-1,2-Dichloroethene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
trans-1,3-Dichloropropene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Trichloroethene	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Trichlorofluoromethane	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
Vinyl Chloride	<1µg/l		<	<	<	<	-	-	-	-	<	<	<	<	-	-	<	<	-	-	-	-
VOC TIC	-		-	-	No TICs identified		-	-	-	-	-	-	No TICs identified		-	-	-	-	-	-	-	-

Notes:

* Low level Hexavalent Chromium Analysis Scheduled but not completed due to certain exceedences of chemistry parameters to waters scheduled for analysis

Two different LoD's were used for speciated PAH results from a subcontracted laboratory. Where the LoD exceeds the required level - this value has been entered into the table.

indicates value exceeds WQS

-** indicates where saline level to high for analysis
-*** Laboratory omitted Analysis in Error (not enough sample remained to test on identifying error

2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	Waste		Waste		Waste		Waste		Waste		Waste		Waste		Waste		Waste			Waste		Waste	
Sample Identity			BH301a		BH302		BH303		BH305		BH306b		BH307		BH310a		BH311		BH312a			BH314		BH315	
High Water / Low Water			Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Duplicate	Low	High	Low	High
Sampled Date			02/07/2012	02/07/2012	04/07/2012	04/07/2012	28/06/2012	28/06/2012	25/06/2012	25/06/2012	03/07/2012	03/07/2012	27/06/2012	27/06/2012	02/07/2012	02/07/2012	27/06/2012	27/06/2012	04/07/2012	04/07/2012	04/07/2012	28/06/2012	28/06/2012	25/06/2012	25/06/2012
Sample Ref (Alcontrol)			364120	775326	770734	963090	358151	293706	983837	952615	254414	438131	286405	865749	564641	221070	841212	987541	987654	261020	832111	547994	875454	654684	974589
SDG			120704-46	120704-46	120706-80	120706-80	120630-35	120630-35	120627-67	120627-67	120705-45	120705-45	120629-72	120629-72	120704-46	120704-46	120629-72	120629-72	120706-80	120706-80	Same as BH312a (High)	120630-35	120630-35	120627-67	120627-67
Carbon																									
Organic Carbon, Total	1mg/l		8.62	6.98	3.11	3.16	9.71	47.9	4.63	7.5	2.22	2.63	<	<	26.3	4.09	<	<	278	40.9	50.3	9.71	47.9	4.05	3.5
Inorganics																									
Ammoniacal Nitrogen as N	<0.2 mg/l	50 mg/l	20.8	11.4	3.28	2.99	<	<	1.64	1.73	<	<	<0.2	0.265	<	0.225	0.871	<	0.447	2.26	2.52	<	<	0.223	<
BOD, unfiltered	<1 mg/l		<6	3.93	<2	<2	<2	<5	<2	<2	<5	<3	<2	<2	<6	<3	<2	<2	18.4	17.5	17.7	<2	<2	<2	<2
Chloride	<2 mg/l		17300	15800	17200	16900	15900	16000	15700	14900	16000	16600	17800	17300	16500	17700	17000	16500	13100	13200	12600	16700	17300	15000	16700
COD, unfiltered	<7 mg/l		385	309	568	283	398	805	274	237	174	183	316	248	326	295	284	241	1220	506	466	330	325	260	254
Conductivity @ 20 deg.C	<0.005 mS/cm		37.8	36.2	41.3	37.6	37.5	37	35.3	36.1	37.6	37.9	41.2	41.5	39.5	39.8	40.1	39.7	31	30.7	30.9	39.2	40.1	35.1	38.2
Cyanide, Complex	<0.005mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Free	<0.005mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Total (low level)*	<0.005mg/l		<	<	<	<	<	<	<	<	<	<	<0.05	<0.05	<	<	<0.05	<0.05	<0.05	<0.05	<0.05	<	<	<	<
Fluoride	0.5mg/l		<	-	<	-	<	-	-	-	-	-	-	-	-	-	-	-	<	-	-	0.829	-	<	-
Nitrate as NO3	<0.3 mg/l		<	<	<	<	1.02	0.41	0.482	<	2.33	1.04	1.56	1.51	0.82	0.353	2.15	2.03	0.91	0.402	0.528	1.1	1.71	<	<
Nitrite as NO2	<0.05mg/l		<	<	<	<	<	0.114	0.094	0.495	<	<	<	<	0.359	0.133	<	<	0.464	0.232	0.248	0.155	<	0.128	0.167
pH	1 pH Units	<4.5 >9	7.45	7.48	8.6	8.56	9.57	9.37	9.01	9.14	9.56	9.52	9.45	9.11	9.47	9.73	8.78	9.04	9.68	10.4	11.4	9.06	8.51	9.17	9.14
Sulphate	<2 mg/l		1560	1780	2170	2250	1940	1900	1620	1700	2040	1990	-***	-***	2020	2250	-***	-***	1610	1300	1300	2180	2150	1650	1840
Sulphide	<0.01 mg/l		<	<	<	<	<	<0.1	<	<	<	<	<	<	<	<	<	<	<	<	<	0.025	<	0.023	0.012
Sulphur, Free	<0.05 mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Total Dissolved Sulphur	µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thiocyanate	<0.05 mg/l		<	<	<	<	<	<	-**	-**	<	<	<	<	<	<	<	<	<	<	<	<	<	-**	-**
Carbonate Alkalinity as CaCO3	<5 mg/l		-	-	-	-	29.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	-
Saline TON as NO3	<0.3mg/l		<	<	<	<	1.02	0.564	0.608	0.401	2.33	1.04	1.56	1.51	1.3	0.523	2.15	2.03	1.54	0.714	0.862	1.3	1.71	<	<
Metals (Dissolved)																									
Aluminium (Saline)	<29µg/l	200 µg/l	41.2	46.8	54.3	43.4	65.4	45.6	25.3	30.2	52.7	41.9	26.7	29.7	42.2	38.9	30.3	36.2	40.5	69.9	36.4	58.1	52.9	27.3	16.3
Aluminium (diss.filt)	<2.9 µg/l	200 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony (Saline)	<1µg/l		<	1.86	<	<	<	1.89	1.04	1.38	<	<	<	<	<	<	<	<	3.43	1.46	1.55	1.97	<	1.21	<
Antimony (diss.filt)	<0.16µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (Saline)	<0.5µg/l	20 µg/l	2.33	2.76	2.16	2.87	<	<	0.709	<	1.89	1.76	<	<	1.63	1.21	<	<	2.43	3.11	3.06	<	0.692	<	<
Arsenic (diss.filt)	<0.12µg/l	20 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium (diss.filt)	<0.03µg/l		292	71.1	106	121	74.2	111	283	302	72.3	61.9	56.5	52.9	109	430	50.9	59.6	114	170	183	116	64.2	124	92.5
Beryllium (diss.filt)	<0.07µg/l		<	<	<	<	-**	-**	-**	-**	<	<	-**	-**	<	<	-**	-**	<	<	<	-**	-**	-**	-**
Boron (Saline)	<201µg/l		1470	1900	2310	2130	2140	3070	969	584	2900	3270	3030	3080	2360	2570	2740	2630	1420	560	505	4040	4080	622	820
Cadmium (Saline)	<0.15 µg/l	0.2 µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cadmium (diss.filt) (low level)	<0.03µg/l	0.2 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium (diss.filt)	<0.012mg/l		970	635	485	551	521	614	1080	1140	452	474	368	361	717	736	411	449			1750	540	426	1210	1010
Chromium (diss.filt)	<0.022µg/l	4.6 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt (diss.filt)	<0.06 µg/l		2.48	-	1.18	-	-**	-	-	-	-	-	-	-	-	-	-	-	1.41	-	-	-**	-	-**	-
Chromium (Saline)	<1.5µg/l	4.6 µg/l	4.66	5.59	3.7	4.38	14.1	12.7	2.9	2.95	17.5	8.95	9.32	10.8	123	27.8	15.4	14.2	4.85	4.91	5.46	16.5	13.7	20.3	9.61
Copper (Saline)	<1 µg/l	5 µg/l	<	<	<	<	1.47	4.53	4.92	8.46	3.48	1.42	<	<	2.04	<	<	<	6.66	146	249	6.81	3.62	1.89	<
Iron (Saline)	<4µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Lead (Saline)	<0.2 µg/l	7.2 µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	1.23	7.79	64.2	<	2.9	<	<
Magnesium (diss.filt)	<0.036µg/l		839	760	909	934	843	698	309	246	1020	979	1040	1080	690	865	975	968	382	27.8	0.845	960	1010	232	425
Manganese (Saline)	<0.3µg/l	30 µg/l	13300	5750	727	709	<	<	<	9.2	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Mercury (Saline)	<0.02 µg/l	0.05 µg/l	**<0.15**	**<0.15**	**<0.15**	**<0.15**	0.393	0.783	0.875	0.798	<	<	0.282	0.298	**<0.15**	**<0.15**	0.305	0.395	**<0.15**	**<0.15**	**<0.15**	1.15	0.37	0.706	0.297
Mercury (diss filt)	<0.01µg/l	0.05 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum (diss.filt)	<0.24 µg/l		22.7	-	17.6	-	13.4	-	-	-	-	-	-	-	-	-	-	-	51.5	-	-	55.2	-	-	-
Nickel (saline)	<1.1µg/l	20 µg/l	11.5	11.3	5.21	5.06	4.03	6.26	7.12	10.9	5.84	6.2	4.58	3.9	5.94	4.86	4.03	4.82	7.59	41.4	50.1	10.1	11.3	5.08	4.46
Nickel (diss.filt)	<0.15µg/l	20 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium (diss.filt)	<2.335mg/l		291	293	338	354	332	326	295	296	343	346	357	363	342	377	336	346	274	305	278	386	367	304	328
Phosphorus (diss.filt)	6.3 µg/l		<	-	<63	-	<	-	-	-	-	-	-	-	-	-	-	-	<	-	-	<	-	<	-
Selenium (Saline)	<0.5µg/l		1.01	1.17	<0.5	1.22	3.25	2.6	1.45	2.74	0.848	1.29	2.62	2.81	1.92	1.05	2.63	2.81	1.26	1.15	1.54	2.69	1.98	1.97	1.81
Selenium (diss.filt)	<0.39µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium (diss.filt)	<0.076 mg/l		2260	4280	9890	9730	9640	9810	8060	8560	47.3	9730	9720	9610	10100	4670	9320	9510	7330	8270	7100	11900	12000	8120	8800
Thallium (diss.filt)	0.96 µg/l		1.83	-	<	-	-**	-	-	-	-	-	-	-	-	-	-	-	<	-	-	-**	-	-**	-
Tin (diss.filt)	<0.36 µg/l		4.45	-	9.32	-	-**	-	-	-	-	-	-	-	-	-	-	-	<	-	-	-**	-	-**	-
Vanadium (Saline)	<4µg/l		15.5	22.8	29.2	37.8	<4	<4	<4	<4	30.4	28.5	<4	<4	22.9	16.7	<4	<4	33.7	22.7	14	<4	<4	<4	<4
Vanadium (diss.filt)	<0.24µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc (Saline)	<2.1µg/l	40 µg/l	12.5	6.12	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	2.75	10.4	75.9	<	<
Zinc (diss.filt)	<0.41µg/l	40 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals Unfiltered / Total																									
Boron (tot.unfilt)	<20µg/l	7000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium, Hexavalent	<0.03 mg/l	0.0006	<	<	<	<	-	<	<	<	<	<	<	<	0.117	-	<	<	<	<	<	<	<	<	<
Chromium, Hexavalent (Low Level)	<0.1 µg/l	0.6	-	-	-	-	-	-	*	-	-	-	-	-	*	-	*	-	-	-	-	-	-	-	-
Chromium (tot unfilt)	<0.5 µg/l	4.7	-	-	-	-	-	-	24.3	53.3	-	-	-	-	-	-	-	-	-	-	-	-	-	121	131
Copper Ultra low	<0.1µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron Ultra low	<70µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Ultra Low	<0.1µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese Ultra low	<0.1µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	<30µg/l		-	-	-	-	-	-	<	<	-	-	-	-	-	-	-	-	-	-	-	-	-	<	<
Nickel Ultra low	<0.1µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	Waste		Waste		Waste		Waste		Waste		Waste		Waste		Waste		Waste			Waste		Waste	
Sample Identity			BH301a		BH302		BH303		BH305		BH306b		BH307		BH310a		BH311		BH312a			BH314		BH315	
High Water / Low Water			Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Duplicate	Low	High	Low	High
Sampled Date			02/07/2012	02/07/2012	04/07/2012	04/07/2012	28/06/2012	28/06/2012	25/06/2012	25/06/2012	03/07/2012	03/07/2012	27/06/2012	27/06/2012	02/07/2012	02/07/2012	27/06/2012	27/06/2012	04/07/2012	04/07/2012	04/07/2012	28/06/2012	28/06/2012	25/06/2012	25/06/2012
Sample Ref (Alcontrol)			364120	775326	770734	963090	358151	293706	983837	952615	254414	438131	286405	865749	564641	221070	841212	987541	987654	261020	832111	547994	875454	654684	974589
SDG			120704-46	120704-46	120706-80	120706-80	120630-35	120630-35	120627-67	120627-67	120705-45	120705-45	120629-72	120629-72	120704-46	120704-46	120629-72	120629-72	120706-80	120706-80	Same as BH312a (High)	120630-35	120630-35	120627-67	120627-67
Phenols																									
2,3,4,6-tetrachlorophenol	<0.5µg/l		<	-	<	-	-	<	<	<	<	<0.6	<	<	-	-	<	<	<	<	<	-	-	<	<
2,3,5,6-tetrachlorophenol	<0.5µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	<	<	-	-	<	<
2,4,5-trichlorophenol	<0.5µg/l		<	-	-	-	-	-	<	<	<	<	<	<	-	-	<	<	<	<	<	-	-	<	<
2,4,6-trichlorophenol	<0.5µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	<	<	-	-	<	<
2,4-dichlorophenol	<0.5µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	<	<	-	-	<	<
2,4-dimethylphenol	<0.5µg/l		<	-	-	-	-	-	<	<	<	<	<	<	-	-	<	<	<	<	1.03	-	-	<	<
2,4-Dinitrophenol	<2.5µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<5	<5	<5	-	-	<	<
2,6-dichlorophenol	<0.5µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	<	<	-	-	<	<
2-chlorophenol	<0.5µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	1.13	<	-	-	<	<
2-methylphenol	<0.5µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	1.31	1.25	-	-	<	<
2-nitrophenol	<0.5µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	<	<	-	-	<	<
3-methylphenol	<0.5µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	3.81	3.58	-	-	<	<
4-chloro-3-methylphenol	<0.5µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	<	<	-	-	<	<
4-Chlorophenol	<0.5µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	<	<	-	-	<	<
4-methylphenol	<0.5µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	6.76	3.47	-	-	<	<
4-nitrophenol	<0.5µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	<	<	-	-	<	<
Dinoseb	<4µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	<	<	-	-	<	<
DNOC	<3µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	<	<	-	-	<	<
Pentachlorophenol	<2µg/l		<	-	<	-	-	<	<	<	<	<	<	<	-	-	<	<	<	<	<	-	-	<	<
Phenol	0.5µg/l	8 µg/l	<3	-	<3	-	<2	<2.5	<2.5	<2.5	<1.3	<1.3	<3.6	<3.6	-	-	<3.6	<3.6	<2.8	9.89	9.51	<2	-	<2.5	<2.5
2.3.5 Trimethyl-Phenol	3 µg/l		-	-	-	-	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<	-	-	-
2-Isopropyl Phenol	6 µg/l		-	-	-	-	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<	-	-	-
Cresols	8 µg/l		-	-	-	-	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<6	-	-	-
Phenols, Total 5 speciated	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<25	-	-	-
Xylenols	8 µg/l		-	-	-	-	<	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<	-	-	-
Resorcinol	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Catechol	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1-naphthol	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenols, Total Detected monohydric	16 µg/l		-	-	-	-	<	<	-	-	-	-	-	-	-	-	-	-	-	-	-	<	<	-	-
TPH Criteria Working Group (TPH CWG)																									
Aliphatics >C5-C6	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C6-C8	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C8-C10	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C10-C12	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	18	22	<	<	<	<
Aliphatics >C12-C16	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	76	58	<	<	<	<
Aliphatics >C16-C21	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	27	<	<	<	<	185	181	<	<	<	<
Aliphatics >C21-C35	<10µg/l		<	<	<	<	625	467	<	<	<	<	<	<	1550	<	<	<	<	692	663	191	<	<	<
Aromatics >EC5-EC7	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC7-EC8	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC8-EC10	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC10-EC12	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	12	15	<	<	<	<
Aromatics >EC12-EC16	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	40	59	<	<	<	<
Aromatics >EC16-EC21	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	58	81	10	<	<	<
Aromatics >EC21-EC35	<10µg/l		<	<	<	<	51	22	<	<	<	<	<	<	90	<	<	<	<	100	181	56	<	<	<
Total aliphatics and aromatics C5-C35	<10µg/l		<	<	<	<	676	489	<	<	<	<	<	<	1667	<	<	<	<	1181	1260	257	<	<	<
MTBE	<3µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Benzene	<7µg/l	8µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<5µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
m,p-Xylene	<8µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
o-Xylene	<3µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
m,p,o-Xylene	<11µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Toluene	<4µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
BTEX, Total	<28µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Polyaromatic Hydrocarbons (PAHs)																									
Acenaphthene (aq)	0.01µg/l		<	<	<	<	<	<	0.09	0.07	-	<	<	<	<	<	<	<	0.30	<	0.02	<	<	< 0.03	0.15
Acenaphthylene (aq)	0.01µg/l		<	<	<	<	<	<	< 0.04	< 0.04	<	<	<	<	<	<	<	<	<	<	<	<	<	< 0.04	< 0.04
Anthracene (aq)	0.01µg/l	0.1µg/l	<	<	<	<	<	<	0.04	0.04	<	<	<	<	<	<	<	<	<	<	<	<	<	0.03	0.03
Benzo(a)anthracene (aq)	0.01µg/l		<	<	<	<	<	<	< 0.04	< 0.04	<	<	<	<	<	<	<	<	0.03	<	<	<	<	< 0.04	< 0.04
Benzo(a)pyrene (aq)	0.01µg/l	0.05µg/l	<	<	<	<	<	<	< 0.05	< 0.05	0.01	<	<	<	<	<	<	<	0.08	<	<	<	<	< 0.05	< 0.05
Benzo(b)fluoranthene (aq)	0.01µg/l	0.03µg/l	<	<	<	<	<	<	< 0.02	< 0.02	0.02	<	<	<	<	<	<	<	<	<	<	<	<	< 0.02	< 0.02
Benzo(k)fluoranthene (aq)	0.01µg/l	0.03µg/l	<	<	<	<	<	<	< 0.03	< 0.03	0.02	<	<	<	<	<	<	<	0.06	<	<	<	<	< 0.03	< 0.03
Benzo(g,h,i)perylene (aq)	0.01µg/l	0.02µg/l	<	<	<	<	<	<	< 0.08	< 0.08	0.01	<	<	<	<	<	<	<	<	<	<	<	<	< 0.08	< 0.08
Chrysene (aq)	0.01µg/l		<	<	<	<	<	<	< 0.03	< 0.03	0.01	<	<	<	<	<	<	<	<	<	<	<	<	< 0.03	< 0.03
Dibenzo(a,h)anthracene (aq)	0.01µg/l		<	<	<	<	<	<	< 0.06	< 0.06	<	<	<	<	<	<	<	<	<	<	<	<	<	< 0.06	< 0.06
Fluoranthene (aq)	0.01µg/l	0.1µg/l	<	<	<	0.02	<	<	< 0.07	< 0.07	0.04	0.02	<	0.02	0.02	<	<	0.01	0.29	0.03	0.02	0.01	<	< 0.07	< 0.07
Fluorene (aq)	0.01µg/l		<	<	<	<	<	<	< 0.04	0.04	<	<	<	<	<	<	<	<	0.05	<	<	<	<	< 0.04	0.07
Indeno(1,2,3-cd)pyrene (aq)	0.01µg/l	0.02µg/l	<	<	<	<	<	<	< 0.05	< 0.05	0.03	<	<	<	<	<	<	<	<	<	<	<	<	< 0.05	< 0.05
Naphthalene (aq)	0.01µg/l	1.2µg/l	<	0.03	<	<	<	<	0.55	0.51	<	<	<	<	<	<	<	<	<	0.08	0.08	<	<	0.13	0.25
Phenanthrene (aq)	0.01µg/l		<	<	<	<	<	<	0.12	0.13	<	<	<	<	0.01	<	<	<	0.4	0.03	0.02	<	<	< 0.085	0.12
Pyrene (aq)	0.01µg/l		<	<	0.01	0.12	<	<	< 0.06	< 0.06	0.07	0.02	<	0.02	0.02	<	1.3	0.02	0.59	0.02	0.03	0.01	<	< 0.06	< 0.06
Polyaromatic hydrocarbons, Total USEPA 16 (aq)	0.2µg/l		<	0.03	0.01	0.14	<	<	0.93	0.91	0.22	0.04	<	0.02	0.05	<	1.3	0.03	1.8	0.16	<	0.02	<	0.35	0.69
PCB's																									
PCB congener 101	<0.015µg/l		<	<	<	<	0.02	0.02	<	<	0.02	<	<	<	0.02	<	<	<	<	0.03	0.05	0.03	<	0.02	0.04
PCB congener 118	<0.015µg/l		<	<	<	<	0.02	<	<	<	<	<	<	<	0.02	<	<	<	<	0.02	0.04	0.02	<	<	0.03
PCB congener 138	<0.015µg/l		<	<	<	<	0.02	<	<	<	<	<	<	<	0.02	<	<	<	<	0.02	0.04	0.03	<	<	0.03
PCB congener 153	<0.015µg/l		<	<	<	<	0.02	<	<	<	<	<	<	<	0.02	<	<	<	<	0.02	0.03	0.02	<	<	0.02
PCB congener 180	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	0.02	<	<	<	<	<	<	<	<	<	<
PCB congener 28	<0.015µg/l		<	<	<	<	0.08	0.06	<	<	0.02	<	<	<	0.15	0.02	<	<	<	<	0.02	0.25	<	0.07	0.11
PCB congener 52	<0.015µg/l		<	<	<	<	0.04	0.03	<	<	0.02	<	<	<	0.05	<	<	<	<	0.03	0.05	0.09	<	0.04	0.06
Sum of detected EC7 PCB's	<0.105µg/l		<	<	<	<	0.2	0.11	<	<	< 12	<	<	<	0.3	<	<	<	<	0.13	0.23	0.44	<	0.13	0.29

2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	Waste		Waste		Waste		Waste		Waste		Waste		Waste		Waste		Waste			Waste		Waste	
Sample Identity			BH301a		BH302		BH303		BH305		BH306b		BH307		BH310a		BH311		BH312a			BH314		BH315	
High Water / Low Water			Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Duplicate	Low	High	Low	High
Sampled Date			02/07/2012	02/07/2012	04/07/2012	04/07/2012	28/06/2012	28/06/2012	25/06/2012	25/06/2012	03/07/2012	03/07/2012	27/06/2012	27/06/2012	02/07/2012	02/07/2012	27/06/2012	27/06/2012	04/07/2012	04/07/2012	04/07/2012	28/06/2012	28/06/2012	25/06/2012	25/06/2012
Sample Ref (Alcontrol)			364120	775326	770734	963090	358151	293706	983837	952615	254414	438131	286405	865749	564641	221070	841212	987541	987654	261020	832111	547994	875454	654684	974589
SDG			120704-46	120704-46	120706-80	120706-80	120630-35	120630-35	120627-67	120627-67	120705-45	120705-45	120629-72	120629-72	120704-46	120704-46	120629-72	120629-72	120706-80	120706-80	Same as BH312a (High)	120630-35	120630-35	120627-67	120627-67
Volatile Organic Compounds (VOCs)																									
1.1.1.2-Tetrachloroethane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.1.1-Trichloroethane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.1.2.2-Tetrachloroethane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.1.2-Trichloroethane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.1-Dichloroethane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.1-Dichloroethene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.1-Dichloropropene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.2.3-Trichlorobenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.2.3-Trichloropropane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.2.4-Trichlorobenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.2.4-Trimethylbenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.2-Dibromo-3-chloropropane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.2-Dibromoethane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.2-Dichlorobenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.2-Dichloroethane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.2-Dichloropropane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1,3,5-Trichlorobenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.3.5-Trimethylbenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.3-Dichlorobenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.3-Dichloropropane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
1.4-Dichlorobenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
2.2-Dichloropropane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
2-Chlorotoluene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
4-Chlorotoluene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
4-Isopropyltoluene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Benzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Bromobenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Bromochloromethane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Bromodichloromethane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Bromoform	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Bromomethane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Carbon disulphide	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Carbontetrachloride	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Chlorobenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Chloroethane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Chloroform	<1µg/l		-	-	-	-	<	<	<	1.39	<	1.19	<	<	-	-	<	<	<	<	<	<	<	<	<
Chloromethane	<0.1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
cis-1,2-Dichloroethene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
cis-1,3-Dichloropropene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Dibromochloromethane	µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Dibromomethane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Dichlorodifluoromethane	<0.1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Dichloromethane	<3µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Ethylbenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Hexachlorobutadiene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Isopropylbenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
m,p-Xylene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Methyl tertiary butyl ether (MTBE)	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Naphthalene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
n-Butylbenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
o-Xylene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Propylbenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
sec-Butylbenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Styrene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Total Xylenes	<2µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
tert-Amyl methyl ether (TAME)	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
tert-Butylbenzene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Tetrachloroethene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Toluene	µg/l	10µg/l	-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
trans-1,2-Dichloroethene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
trans-1,3-Dichloropropene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Trichloroethene	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Trichlorofluoromethane	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
Vinyl Chloride	<1µg/l		-	-	-	-	<	<	<	<	<	<	<	<	-	-	<	<	<	<	<	<	<	<	<
VOC TIC	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

* Low level Hexavalent Chromium Analysis Scheduled but not completed due to certain exceedences of chemistry parameters to waters scheduled for analysis

Two different LoD's were used for speciated PAH results from a subcontracted laboratory. Where the LoD exceeds the required level - this value has been entered into the table.

indicates value exceeds WQS

-** indicates where saline level to high for analysis
-*** Laboratory omitted Analysis in Error (not enough sample remained to test on identifying error

2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	alluvium		alluvium		alluvium		Alluvium		alluvium		alluvium		alluvium			Sand and Gravel		sand and gravel		sand and gravel	
Sample Identity			BH304		BH306d		BH308		BH309		BH310b		BH312b		BH316			BH313		BH117R		BH125R	
High Water / Low Water			Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	Duplicate	High	Low	High	Low	High	Low	High
Sampled Date			28/06/2012	28/06/2012	05/07/2012	05/07/2012	26/06/2012	26/06/2012	26/06/2012	26/06/2012	03/07/2012	03/07/2012	28/06/2012	28/06/2012	03/07/2012	03/07/2012	03/07/2012	03/07/2012	03/07/2012	26/06/2012	26/06/2012	02/07/2012	02/07/2012
Sample Ref (Alcontrol)			897297	542181	405311	685680	982927	292411	685990	932833	198416	435284	658920	561561	325675	923033	989321	158877	987451	225370	907491	871985	353699
SDG			120630-35	120630-35	120707-30	120707-30	120628-125	120628-125	120628-125	120628-125	120705-45	120705-45	120630-35	120630-35	120705-45	Same as BH316 (low)	120705-45	120705-45	120705-45	120628-125	120628-125	120704-46	120704-46
Carbon																							
Organic Carbon, Total	1mg/l		101	58.3	85	3.81	28.2	21.2	17.6	13.5	17.1	14	3.68	16.3	19	105	79.6	7.6	15.1	12.3	10.6	2.83	3.27
Inorganics																							
Ammoniacal Nitrogen as N	<0.2 mg/l	50 mg/l	19.3	16	3.57	1.84	8.81	12.5	2.78	3.39	28.4	37	2.84	5.85	9.64	16.1	43.6	20.6	53.1	3.13	3.3	<	3.72
BOD, unfiltered	<1 mg/l		28.3	22.4	<10	<2	3.27	<10	<10	<10	<3	<3	<2	2.08	<3	<3	9.5	3.47	<3	<2	<10	<2	<3
Chloride	<2 mg/l		12900	11500	15900	16200	2390	5340	16300	16400	17500	18200	14200	14200	17200	17600	17700	17000	18000	12800	12900	16900	16900
COD, unfiltered	<7 mg/l		3050	2070	2830	370	200	169	195	274	272	214	232	548	524	290	1600	350	1230	208	188	266	283
Conductivity @ 20 deg.C	<0.005 mS/cm		28.4	27.3	35.9	37.1	7.12	13.9	38.2	36.7	38.2	39.4	33.2	33.8	40.7	39.2	38.5	38.4	39.7	30	31	38.8	39.8
Cyanide, Complex	<0.005mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Free	<0.005mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cyanide, Total (low level)*	<0.005mg/l		<	<	<0.05	<0.05	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Fluoride	0.5mg/l		-	-	<	-	-	-	<	-	<	-	-	-	-	-	-	<	-	-	-	-	-
Nitrate as NO3	<0.3 mg/l		<	<	<	<	0.881	<	<	0.313	<	<	<	<	<	<	<	<	<	<	<	<	<
Nitrite as NO2	<0.05mg/l		<	<	0.507	0.263	0.497	0.073	<	<	0.083	0.076	0.072	<	<	<	<	<	<	<	<	<	<
pH	1 pH Units	<4.5 >9	7.42	7.63	7.92	8.09	8.2	8.15	7.95	8.75	7.66	7.72	9.06	8.07	7.57	7.66	7.65	7.87	7.72	7.92	7.9	9.03	8.4
Sulphate	<2 mg/l		814	739	2080	2100	369	621	1750	1760	1670	1440	1610	1660	1950	1920	1170	1610	664	1590	1600	2060	1990
Sulphide	<0.01 mg/l		<0.1	<0.1	<	<	<	<	<	<	0.073	<	<	<0.05	0.506	<	0.748	<	<	<	<	<	<
Sulphur, Free	<0.05 mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<0.06	<	<	<	<	<	<	<
Total Dissolved Sulphur	µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thiocyanate	<0.05 mg/l		<	<	<	<	-**	-**	-**	-**	<	<	<	<	<	<	<	0.322	<	-**	-**	<	<
Carbonate Alkalinity as CaCO3	<5 mg/l		-	-	<5	-	-	-	-	-	<5	-	-	-	-	-	-	<5	-	195	-	-	-
Saline TON as NO3	<0.3mg/l		<	<	0.749	0.637	1.55	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Metals (Dissolved)																							
Aluminium (Saline)	<29µg/l	200 µg/l	36	49.2	45.1	44.8	27.7	25.4	29.2	33	45.8	48.4	51.7	44.6	94.5	86.3	68	44.3	53.3	28.9	31.9	36.2	79.7
Aluminium (diss.filt)	<2.9 µg/l	200 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony (Saline)	<1µg/l		<	<	4.12	3.2	<	<	<	<	<	<	2.38	<	<	<	<	<	<	<	<	2.47	<
Antimony (diss.filt)	<0.16µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (Saline)	<0.5µg/l	20 µg/l	0.802	0.6	1.51	1.33	13.3	5.07	<	<	32.2	33.3	0.687	1.62	2.7	3.25	9.79	5.48	16.2	0.801	0.694	3.09	7.73
Arsenic (diss.filt)	<0.12µg/l	20 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium (diss.filt)	<0.03µg/l		596	536	171	20.3	79.4	145	195	180	126	116	141	178	194	175	228	207	280	70.6	82.6	81.9	83.3
Beryllium (diss.filt)	<0.07µg/l		-**	-**	<	<	-**	-**	-**	-**	<	<	-**	-**	<	<	<	<	<	-**	-**	<	<
Boron (Saline)	<201µg/l		3370	2680	1470	1820	250	1190	1010	964	3020	3160	2340	2530	2060	1960	3020	2600	4390	2160	2050	2610	2420
Cadmium (Saline)	<0.15 µg/l	0.2 µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Cadmium (diss.filt) (low level)	<0.03µg/l	0.2 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium (diss.filt)	<0.012mg/l		400	381	619	640	163	204	892	906	601	451	765	759	552	0.13	321	457	219	371	373	696	564
Chromium (diss.filt)	<0.022µg/l	4.6 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt (diss.filt)	<0.06 µg/l		-	-	3.01	-	-	-	-	-	2.71	-	-	-	-	-	-	2.81	4.85	-	-	-	-
Chromium (Saline)	<1.5µg/l	4.6 µg/l	4.93	4.88	3.72	3.69	3.43	3.09	3.08	2.88	6.02	6.28	4.93	5.18	6.09	8.75	5.71	5.36	6.61	2.65	3.06	5.23	7.67
Copper (Saline)	<1 µg/l	5 µg/l	<	<	1.62	2.25	10.9	13.2	<	<	2.17	4.58	<	2.83	<	21	1.04	<	<	<	<	<	12.5
Iron (Saline)	<4µg/l		<	12.5	<	<	<	<	<	<	<	<	<	<	<	<	15	<	<	<	<	<	<
Lead (Saline)	<0.2 µg/l	7.2 µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Magnesium (diss.filt)	<0.036µg/l		661	582	784	852	106	296	506	505	1020	856	420	489	941	<	1020	795	933	685	679	854	824
Manganese (Saline)	<0.3µg/l	30 µg/l	5220	5320	1180	1650	355	1750	391	316	1290	1240	66.5	225	2800	2860	1800	3260	3100	888	664	207	487
Mercury (Saline)	<0.02 µg/l	0.05 µg/l	0.209	**<0.15**	**<0.15**	**<0.15**	0.603	0.347	0.364	0.305	**<0.15**	**<0.15**	0.454	0.242	**<0.15**	**<0.15**	**<0.15**	**<0.15**	**<0.15**	0.226	0.176	**<0.15**	**<0.15**
Mercury (diss filt)	<0.01µg/l	0.05 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum (diss.filt)	<0.24 µg/l		-	-	28.1	-	-	-	17.4	-	15.4	-	-	-	-	-	-	11.3	2.61	-	-	-	-
Nickel (saline)	<1.1µg/l	20 µg/l	14.9	13.2	7.33	6.6	16.6	15.7	5.42	6.05	11.8	14.2	7.11	8.78	13.5	31.9	11	9.37	16.8	6.39	6.11	6.83	16.9
Nickel (diss.filt)	<0.15µg/l	20 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium (diss.filt)	<2.335mg/l		216	193	346	388	80.1	123	318	313	360	357	278	294	355	<	308	341	330	262	262	375	366
Phosphorus (diss.filt)	6.3 µg/l		-	-	18.4	-	-	-	19.6	-	199	-	-	-	-	-	-	<	148	-	-	-	-
Selenium (Saline)	<0.5µg/l		4.72	4.84	3.11	1.19	2.62	1.82	2.44	2.69	1.24	1.19	2.02	2.15	1.13	1.7	2.4	<0.5	1.29	2.7	2.22	1.4	0.646
Selenium (diss.filt)	<0.39µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium (diss.filt)	<0.076 mg/l		6890	6350	10400	11700	1400	3070	9970	8770	11900	9770	8080	8760	12300	0.247	9880	9310	9550	7550	7570	225	10800
Thallium (diss.filt)	0.96 µg/l		-	-	<	-	-	-	-**	-	<	-	-	-	-	-	-	<	<9.6	-	-	-	-
Tin (diss.filt)	<0.36 µg/l		-	-	<	-	-	-	-**	-	<	-	-	-	-	-	-	<	<3.6	-	-	-	-
Vanadium (Saline)	<4µg/l		<4	<4	14	18.5	<4	<4	<4	<4	29.3	31.1	<4	<4	35.5	33.9	35.2	35.5	37	<4	<4	8.6	26.6
Vanadium (diss.filt)	<0.24µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc (Saline)	<2.1µg/l	40 µg/l	<	<	<	<	<	<	<	<	<	7.51	<	10.9	17.5	167	<	<	4.91	<	<	<	22.9
Zinc (diss.filt)	<0.41µg/l	40 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals Unfiltered / Total																							
Boron (tot.unfilt)	<20µg/l	7000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium, Hexavalent	<0.03 mg/l	0.0006	<	<	-	<	<	<	<	<	<	<	<	<	<	<	<	-	<	<	<	<	<
Chromium, Hexavalent (Low Level)	<0.1 µg/l	0.6	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	*	-	-	-	-	-
Chromium (tot unfilt)	<0.5 µg/l	4.7	-	-	-	-	54.6	31.4	31	36.6	-	-	-	-	-	-	-	-	-	17.7	20.7	-	-
Copper Ultra low	<0.1µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron Ultra low	<70µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Ultra Low	<0.1µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese Ultra low	<0.1µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	<30µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel Ultra low	<0.1µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	alluvium		alluvium		alluvium		Alluvium		alluvium		alluvium		alluvium			Sand and Gravel		sand and gravel		sand and gravel	
Sample Identity			**BH304**		**BH306d**		**BH308**		**BH309**		**BH310b**		**BH312b**		**BH316**			**BH313**		**BH117R**		**BH125R**	
High Water / Low Water			Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	Duplicate	High	Low	High	Low	High	Low	High
Sampled Date			28/06/2012	28/06/2012	05/07/2012	05/07/2012	26/06/2012	26/06/2012	26/06/2012	26/06/2012	03/07/2012	03/07/2012	28/06/2012	28/06/2012	03/07/2012	03/07/2012	03/07/2012	03/07/2012	03/07/2012	26/06/2012	26/06/2012	02/07/2012	02/07/2012
Sample Ref (Alcontrol)			897297	542181	405311	685680	982927	292411	685990	932833	198416	435284	658920	561561	325675	923033	989321	158877	987451	225370	907491	871985	353699
SDG			120630-35	120630-35	120707-30	120707-30	120628-125	120628-125	120628-125	120628-125	120705-45	120705-45	120630-35	120630-35	120705-45	Same as BH316 (low)	120705-45	120705-45	120705-45	120628-125	120628-125	120704-46	120704-46
Phenols																							
2,3,4,6-tetrachlorophenol	<0.5µg/l		-	-	2.1	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
2,3,5,6-tetrachlorophenol	<0.5µg/l		-	-	<	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
2,4,5-trichlorophenol	<0.5µg/l		-	-	0.54	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
2,4,6-trichlorophenol	<0.5µg/l		-	-	0.73	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
2,4-dichlorophenol	<0.5µg/l		-	-	<	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
2,4-dimethylphenol	<0.5µg/l		-	-	<	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
2,4-Dinitrophenol	<2.5µg/l		-	-	<5	<5	-	-	<	-	<	-	-	-	-	-	-	<	-	-	-	-	-
2,6-dichlorophenol	<0.5µg/l		-	-	<	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
2-chlorophenol	<0.5µg/l		-	-	<	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
2-methylphenol	<0.5µg/l		-	-	<	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
2-nitrophenol	<0.5µg/l		-	-	<	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
3-methylphenol	<0.5µg/l		-	-	<	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
4-chloro-3-methylphenol	<0.5µg/l		-	-	<	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
4-Chlorophenol	<0.5µg/l		-	-	<	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
4-methylphenol	<0.5µg/l		-	-	<	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
4-nitrophenol	<0.5µg/l		-	-	<	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
Dinoseb	<4µg/l		-	-	<	<	-	-	<	-	<6	-	-	-	-	-	-	<6	-	-	-	-	-
DNOC	<3µg/l		-	-	<	<	-	-	<	-	<4.5	-	-	-	-	-	-	<4.5	-	-	-	-	-
Pentachlorophenol	<2µg/l		-	-	<	<	-	-	<	-	<0.75	-	-	-	-	-	-	<0.75	-	-	-	-	-
Phenol	0.5µg/l	8 µg/l	-	-	<2.8	<2.8	-**	-**	<2.5	-	<1.3	-	-	-	-**	-**	-**	<1.3	-	-	-		
2.3.5 Trimethyl-Phenol	3 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Isopropyl Phenol	6 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresols	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenols, Total 5 speciated	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenols	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Resorcinol	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Catechol	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1-naphthol	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenols, Total Detected monohydric	16 µg/l		-	-	-	-	-	-	-	-	-	-	<	<	-	-	-	-	-	-	-	-	-
TPH Criteria Working Group (TPH CWG)																							
Aliphatics >C5-C6	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C6-C8	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C8-C10	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C10-C12	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C12-C16	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C16-C21	<10µg/l		38	<	73	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C21-C35	<10µg/l		1470	279	2280	116	<	<	80	85	<	<	<	<	<	50	<	<	33	<	<	<	<
Aromatics >EC5-EC7	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC7-EC8	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC8-EC10	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC10-EC12	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC12-EC16	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC16-EC21	<10µg/l		<	<	32	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC21-EC35	<10µg/l		217	16	586	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Total aliphatics and aromatics C5-C35	<10µg/l		1725	295	2971	116	<	<	80	85	<	<	<	<	<	50	<	<	33	<	<	<	<
MTBE	<3µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Benzene	<7µg/l	8µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Ethylbenzene	<5µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
m,p-Xylene	<8µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
o-Xylene	<3µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
m,p,o-Xylene	<11µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Toluene	<4µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
BTEX, Total	<28µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Polyaromatic Hydrocarbons (PAHs)																							
Acenaphthene (aq)	0.01µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	0.02	<	<	<	<	<	<	<
Acenaphthylene (aq)	0.01µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Anthracene (aq)	0.01µg/l	0.1µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Benzo(a)anthracene (aq)	0.01µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Benzo(a)pyrene (aq)	0.01µg/l	0.05µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Benzo(b)fluoranthene (aq)	0.01µg/l	0.03µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Benzo(k)fluoranthene (aq)	0.01µg/l	0.03µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Benzo(g,h,i)perylene (aq)	0.01µg/l	0.02µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Chrysene (aq)	0.01µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Dibenzo(a,h)anthracene (aq)	0.01µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Fluoranthene (aq)	0.01µg/l	0.1µg/l	<	<	<	<	0.02	0.01	<	<	<	<	0.03	0.01	<	0.02	<	<	<	<	<	0.04	0.02
Fluorene (aq)	0.01µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Indeno(1,2,3-cd)pyrene (aq)	0.01µg/l	0.02µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Naphthalene (aq)	0.01µg/l	1.2µg/l	<	<	<	<	0.08	0.04	<	0.03	<	<	<	<	<	0.08	<	<	<	0.02	0.06	<	<
Phenanthrene (aq)	0.01µg/l		<	<	<	<	<	<	<	<	<	<	0.01	<	<	0.02	<	<	<	<	<	<	<
Pyrene (aq)	0.01µg/l		<	<	0.09	0.12	0.12	0.01	<	<	<	<	0.25	0.04	<	0.03	0.08	<	<	0.98	0.39	0.16	0.03
Polyaromatic hydrocarbons, Total USEPA 16 (aq)	0.2µg/l		<	<	0.09	0.12	0.22	0.06	<	0.03	<	<	0.29	0.05	<	0.17	0.08	<	<	1	0.45	0.2	0.05
PCB's																							
PCB congener 101	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
PCB congener 118	<0.015µg/l		<	<	0.02	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
PCB congener 138	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
PCB congener 153	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
PCB congener 180	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
PCB congener 28	<0.015µg/l		<	<	0.02	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
PCB congener 52	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Sum of detected EC7 PCB's	<0.105µg/l		<	<	<	<	<	<	<	< 12	<	<	<	<	<	<	<	<	<	<	<	<	<

2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	alluvium		alluvium		alluvium		Alluvium		alluvium		alluvium		alluvium			Sand and Gravel		sand and gravel		sand and gravel	
Sample Identity			**BH304**		**BH306d**		**BH308**		**BH309**		**BH310b**		**BH312b**		**BH316**			**BH313**		**BH117R**		**BH125R**	
High Water / Low Water			Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	Duplicate	High	Low	High	Low	High	Low	High
Sampled Date			28/06/2012	28/06/2012	05/07/2012	05/07/2012	26/06/2012	26/06/2012	26/06/2012	26/06/2012	03/07/2012	03/07/2012	28/06/2012	28/06/2012	03/07/2012	03/07/2012	03/07/2012	03/07/2012	03/07/2012	26/06/2012	26/06/2012	02/07/2012	02/07/2012
Sample Ref (Alcontrol)			897297	542181	405311	685680	982927	292411	685990	932833	198416	435284	658920	561561	325675	923033	989321	158877	987451	225370	907491	871985	353699
SDG			120630-35	120630-35	120707-30	120707-30	120628-125	120628-125	120628-125	120628-125	120705-45	120705-45	120630-35	120630-35	120705-45	Same as BH316 (low)	120705-45	120705-45	120705-45	120628-125	120628-125	120704-46	120704-46
Volatile Organic Compounds (VOCs)																							
1.1.1.2-Tetrachloroethane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.1.1-Trichloroethane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.1.2.2-Tetrachloroethane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.1.2-Trichloroethane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.1-Dichloroethane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.1-Dichloroethene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.1-Dichloropropene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.2.3-Trichlorobenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.2.3-Trichloropropane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.2.4-Trichlorobenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.2.4-Trimethylbenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.2-Dibromo-3-chloropropane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.2-Dibromoethane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.2-Dichlorobenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.2-Dichloroethane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.2-Dichloropropane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1,3,5-Trichlorobenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.3.5-Trimethylbenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.3-Dichlorobenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.3-Dichloropropane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
1.4-Dichlorobenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
2.2-Dichloropropane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
2-Chlorotoluene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
4-Chlorotoluene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
4-Isopropyltoluene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Benzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Bromobenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Bromochloromethane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Bromodichloromethane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Bromoform	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Bromomethane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Carbon disulphide	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	1.5	<	-	-	-	-	-	-
Carbontetrachloride	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Chlorobenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Chloroethane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Chloroform	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Chloromethane	<0.1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
cis-1,2-Dichloroethene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
cis-1,3-Dichloropropene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Dibromochloromethane	µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Dibromomethane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Dichlorodifluoromethane	<0.1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Dichloromethane	<3µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Ethylbenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Hexachlorobutadiene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Isopropylbenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
m,p-Xylene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Methyl tertiary butyl ether (MTBE)	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Naphthalene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
n-Butylbenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
o-Xylene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Propylbenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
sec-Butylbenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Styrene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Total Xylenes	<2µg/l				<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
tert-Amyl methyl ether (TAME)	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
tert-Butylbenzene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Tetrachloroethene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Toluene	µg/l	10µg/l	-	-	<	<	<	<	-	-	-	-	93.3	97.7	<	<	<	-	-	-	-	-	-
trans-1,2-Dichloroethene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
trans-1,3-Dichloropropene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Trichloroethene	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Trichlorofluoromethane	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
Vinyl Chloride	<1µg/l		-	-	<	<	<	<	-	-	-	-	<	<	<	<	<	-	-	-	-	-	-
VOC TIC	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

* Low level Hexavalent Chromium Analysis Scheduled but not completed due to certain exceedences of chemistry parameters to waters scheduled for analysis

Two different LoD's were used for speciated PAH results from a subcontracted laboratory. Where the LoD exceeds the required level - this value has been entered into the table.

indicates value exceeds WQS

-** indicates where saline level to high for analysis

-*** Laboratory omitted Analysis in Error (not enough sample remained to test on identifying error

2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	Limestone		base 5m of sand and gravel, then weathered limestone		Limestone		0.7m gravel then limestone		SurfaceWater Samples					Harbour Water Samples							
Sample Identity			BH122		BH306c		BH310c		BH312c		SW1	SW2	SP1	SP2	SP3	HW-01	HW-02	HW-03	HW-04	HW-04	HW-05	HW-06	Trip Sample
High Water / Low Water			Low	High	Low	High	Low	High	Low	High	Low	Low	Low	Low	Low	Low	Low	Low	Low	Duplicate #3	Low	Low	-
Sampled Date			20/06/2012	20/06/2012	04/07/2012	04/07/2012	04/07/2012	04/07/2012	05/07/2012	05/07/2012	25/06/2012	25/06/2012	21/06/2012	21/06/2012	26/06/2012	19/06/2012	19/06/2012	19/06/2012	19/06/2012	Same as HW-04 (WYG scheduled this analysis from a separate laboratory)	19/06/2012	19/06/2012	02/07/2012
Sample Ref (Alcontrol)			733743	419835	966135	534284	798741	266498	984114	457113	237415	637220	515251	256404	221455	HW1	HW2	HW3	HW4		HW5	HW6	637895
SDG			120622-50	120622-50	120706-80	120706-80	120706-80	120706-80	120707-30	120707-30	120627-67	120627-67	120623-38	120623-38	120628-125	120621-83	120621-83	120621-83	120621-83		120621-83	120621-83	120704-46
											Lagoon #1	Lagoon #2	Seepage #1	Seepage #2	Seepage #3								
Carbon																							
Organic Carbon, Total	1mg/l		<	1.41	<	<	<	<	4.49	1.71	1.06	1.27	1.27	<	3.04	3.94	3.15	3.35	3.63	8	2.34	2.27	<
Inorganics																							
Ammoniacal Nitrogen as N	<0.2 mg/l	50 mg/l	<	<	<	<	3.06	2	<	0.308	<	<	<	<	<	0.222	0.225	0.214	<0.2	0.47	<	<	2.59
BOD, unfiltered	<1 mg/l		<2	<2	<2	<2	<2	<5	<2	<2	<60	<2	<2	<2	<2	<2	<2	<2	<2	19	<2	<2	<2
Chloride	<2 mg/l		17800	18900	17600	17500	18000	17800	17200	17200	17100	18300	16400	17000	18000	10500	11900	13900	17000		17700	18100	<
COD, unfiltered	<7 mg/l		264	212	624	386	355	464	426	<280	<280	308	338	336	184	194	243	256	267	1807	274	247	<
Conductivity @ 20 deg.C	<0.005 mS/cm		42.7	43.2	38.3	41.9	42.5	42.6	40.1	40.8	39.6	40.8	38.5	39.2	39.8	24.8	28.8	31.5	37.9	43.535	39.2	40.7	<0.005
Cyanide, Complex	<0.005mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<0.01	<	<	<
Cyanide, Free	<0.005mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<0.01	<	<	<
Cyanide, Total (low level)*	<0.005mg/l		<	<	<	<	<0.05	<0.05	<0.05	<0.05	<	<	<	<	<	<	<	<	<	<0.01	<	<	<
Fluoride	0.5mg/l		-	-	-	-	-	-	0.695	-	-	-	<	-	0.836	0.582	-	-	0.759	<0.3	-	-	<
Nitrate as NO3	<0.3 mg/l		8.11	8.09	<	<	<	<	1.93	1.53	<	<	1.87	2.2	2.26	5.1	4.53	3.66	2.05	<0.2	1.61	1.33	<
Nitrite as NO2	<0.05mg/l		<	<	<	<	1.5	1.1	0.103	0.081	<	<	<	<	<	0.057	<	<	<	-	<	<	-
pH	1 pH Units	<4.5 >9	8.11	8.09	7.71	7.54	7.82	8.02	7.88	7.85	9	9.08	8.48	8.24	7.89	7.89	7.99	8.09	8.13	7.92	8.05	8.06	6.57
Sulphate	<2 mg/l		2310	2340	2150	2190	2320	2350	2310	2280	2120	2170	2110	2190	2260	1340	1500	1730	2100	2015.35	2200	2320	<
Sulphide	<0.01 mg/l		<	<	<	<	<	0.014	<	<	<	<	<	<	<	<	<	<	<	<0.3	<	<	<
Sulphur, Free	<0.05 mg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	-	<	<	<
Total Dissolved Sulphur	µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	658800	-	-	-
Thiocyanate	<0.05 mg/l		<	<	<	<	<	<	<	<	-**	-**	<	<	<	<	<	<	<	<0.02	<	<	<
Carbonate Alkalinity as CaCO3	<5 mg/l		-	-	-	-	<	-	<	-	-	-	-	-	-	<5	-	-	<5	<1	-	-	<
Saline TON as NO3	<0.3mg/l		-	-	<	<	2.11	1.39	-	-	<	<	1.87	2.2	2.26	5.2	4.53	3.66	2.05	-	1.61	1.33	-
Metals (Dissolved)																							
Aluminium (Saline)	<29µg/l	200 µg/l	29.7	163	50.3	44.7	139	60.7	44.2	48.9	23.1	24.9	77.2	62.3	57.1	52.2	37.2	44.4	28.6	25.4	28.2	24.2	-
Aluminium (diss.filt)	<2.9 µg/l	200 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.58
Antimony (Saline)	<1µg/l		<	5.53	<	<	<	<	15.2	3.24	<	<	<	<	<	<	1.65	<	<	<2	<	<	-
Antimony (diss.filt)	<0.16µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<
Arsenic (Saline)	<0.5µg/l	20 µg/l	4.76	9.48	2.07	2.47	2.44	1.51	2.04	2.07	<	<	3.34	3.95	<	2.08	2	2.24	2.5	<0.9	2.18	2.37	-
Arsenic (diss.filt)	<0.12µg/l	20 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<
Barium (diss.filt)	<0.03µg/l		37.8	35.9	12.7	3.12	23.1	54.9	3.09	3.12	73.8	60.7	29	25.3	22.7	11	9.09	10	7.98	10	7	6.76	0.236
Beryllium (diss.filt)	<0.07µg/l		<	<	<	<	<	1.86	<	<	-**	-**	<	<	-**	<	<	<	<	<0.5	<	<	<
Boron (Saline)	<201µg/l		4180	4230	2140	2150	3100	2740	3860	3650	2560	2110	4810	4190	2920	2550	2780	3270	3920	2497	3270	3700	-
Cadmium (Saline)	<0.15 µg/l	0.2 µg/l	4.05	12	0.636	0.904	1.42	<	3.52	3.63	<	<	<	<	<	<	<	<	<	<0.03	<	<	-
Cadmium (diss.filt) (low level)	<0.03µg/l	0.2 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<
Calcium (diss.filt)	<0.012mg/l		378	383	622	485	425	445	355	333	491	423	336	307	350	201	229	259	311	-	324	338	<
Chromium (diss.filt)	<0.022µg/l	4.6 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.411
Cobalt (diss.filt)	<0.06 µg/l		-	-	-	-	-	-	<0.6	-	-	-	0.469	-	-**	0.399	-	-	0.391	<0.1	-	-	<
Chromium (Saline)	<1.5µg/l	4.6 µg/l	<	<	4.59	6	3.87	4.32	5.91	5.62	12.1	7.74	<	<	9.2	<	<	<	<	<0.2	<	<	-
Copper (Saline)	<1 µg/l	5 µg/l	<	7.08	<	<	1.65	1.45	1.4	1.39	6.75	2.38	<	<	1.09	<	<	<	<	<3	<	<	-
Iron (Saline)	<4µg/l		<	11.3	<	<	<	<	<	<	<	<	29.4	8.25	<	4.6	24.2	<	<	21.6	<	<	-
Lead (Saline)	<0.2 µg/l	7.2 µg/l	5.59	4.81	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<0.4	<	<	-
Magnesium (diss.filt)	<0.036µg/l		1080	1100	1280	992	1070	1030	1330	1150	859	885	942	964	1060	649	712	857	1050	-	1030	1080	0.0615
Manganese (Saline)	<0.3µg/l	30 µg/l	1.89	25.1	128	59.7	850	1370	123	240	<	<	<	<	<	12.6	9.12	6.62	1.12	5.3	<	<	-
Mercury (Saline)	<0.02 µg/l	0.05 µg/l	**<0.15**	0.918	**<0.15**	**<0.15**	**<0.15**	**<0.15**	**<0.15**	**<0.15**	0.399	0.293	0.298	0.219	**<0.15**	**<0.15**	**<0.15**	**<0.15**	**<0.15**	-	**<0.15**	**<0.15**	-
Mercury (diss filt)	<0.01µg/l	0.05 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	<
Molybdenum (diss.filt)	<0.24 µg/l		-	-	-	-	-	-	<2.4	-	-	-	8.75	-	10.2	5.64	-	-	7.57	5.1	-	-	<
Nickel (saline)	<1.1µg/l	20 µg/l	2.24	9.27	6.69	5.29	24.1	18.5	7.21	7.43	4.9	4.4	<	1.78	4.83	<	<	<	<	<0.2	<	<	<
Nickel (diss.filt)	<0.15µg/l	20 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<
Potassium (diss.filt)	<2.335mg/l		351	361	384	299	360	362	446	414	363	322	310	314	337	193	225	255	312	-	328	343	<
Phosphorus (diss.filt)	6.3 µg/l		-	-	-	-	-	-	<63	-	-	-	<	6.59	18.7	<	-	-	<	23.2	-	-	<
Selenium (Saline)	<0.5µg/l		1.49	2.84	<0.5	0.548	<0.5	0.516	2.07	2.08	1.5	2.19	1.22	0.881	2.19	1.18	0.893	0.901	0.767	<1.2	1.06	0.816	-
Selenium (diss.filt)	<0.39µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<
Sodium (diss.filt)	<0.076 mg/l		11000	11200	13600	9300	9840	10300	15600	12100	9390	9490	9470	8840	10900	5110	6730	6770	7770	-	10800	11400	1.67
Thallium (diss.filt)	0.96 µg/l		-	-	-	-	-	-	<	-	-	-	<	-	-**	<	-	-	<	<0.9	-	-	<
Tin (diss.filt)	<0.36 µg/l		-	-	-	-	-	-	<3.6	-	-	-	<	-	-**	<	-	-	<	<5	-	-	<
Vanadium (Saline)	<4µg/l		26	28	36.1	39.6	37.2	26.1	11	14.9	<4	<4	21.9	22.2	<4	23.8	41.2	25.6	24.5	<	39.1	39	-
Vanadium (diss.filt)	<0.24µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<
Zinc (Saline)	<2.1µg/l	40 µg/l	10.4	58.6	13.4	14.1	<	<	<	<	<	<	<	<	<	<	<	<	<	1.8	<	<	-
Zinc (diss.filt)	<0.41µg/l	40 µg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<
Metals Unfiltered / Total																							
Boron (tot.unfilt)	<20µg/l	7000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	361
Chromium, Hexavalent	<0.03 mg/l	0.0006	<	<	<	<	<	<	-	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Chromium, Hexavalent (Low Level)	<0.1 µg/l	0.6	-	-	-	-	-	-	*	-	*	*	-	-	-	-	-	-	-	-	-	-	-
Chromium (tot unfilt)	<0.5 µg/l	4.7	-	-	-	-	-	-	-	-	9.6	4.2	-	-	12.1	-	-	-	-	-	-	-	-
Copper Ultra low	<0.1µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1
Iron Ultra low	<70µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27.1	-	-	<700
Lead Ultra Low	<0.1µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1
Manganese Ultra low	<0.1µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1
Molybdenum	<30µg/l		-	-	-	-	-	-	-	-	<	<	-	-	-	-	-	-	-	-	-	-	-
Nickel Ultra low	<0.1µg/l		-	-	-	-	-	-	-	-	-	-	<	1.78	-	-	-	-	-	-	-	-	-

2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	Limestone		base 5m of sand and gravel, then weathered limestone		Limestone		0.7m gravel then limestone		SurfaceWater Samples					Harbour Water Samples							
Sample Identity			**BH122**		**BH306c**		**BH310c**		**BH312c**		**SW1**	**SW2**	**SP1**	**SP2**	**SP3**	**HW-01**	**HW-02**	**HW-03**	**HW-04**	**HW-04**	**HW-05**	**HW-06**	Trip Sample
High Water / Low Water			Low	High	Low	High	Low	High	Low	High	Low	Low	Low	Low	Low	Low	Low	Low	Low	Duplicate #3	Low	Low	-
Sampled Date			20/06/2012	20/06/2012	04/07/2012	04/07/2012	04/07/2012	04/07/2012	05/07/2012	05/07/2012	25/06/2012	25/06/2012	21/06/2012	21/06/2012	26/06/2012	19/06/2012	19/06/2012	19/06/2012	19/06/2012	Same as HW-04 (WYG scheduled this analysis from a separate laboratory)	19/06/2012	19/06/2012	02/07/2012
Sample Ref (Alcontrol)			733743	419835	966135	534284	798741	266498	984114	457113	237415	637220	515251	256404	221455	HW1	HW2	HW3	HW4		HW5	HW6	637895
SDG			120622-50	120622-50	120706-80	120706-80	120706-80	120706-80	120707-30	120707-30	120627-67	120627-67	120623-38	120623-38	120628-125	120621-83	120621-83	120621-83	120621-83		120621-83	120621-83	120704-46
											Lagoon #1	Lagoon #2	Seepage #1	Seepage #2	Seepage #3								
Phenols																							
2,3,4,6-tetrachlorophenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
2,3,5,6-tetrachlorophenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
2,4,5-trichlorophenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
2,4,6-trichlorophenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
2,4-dichlorophenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
2,4-dimethylphenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
2,4-Dinitrophenol	<2.5µg/l		-	-	<5	<5	-	-	<5	<5	<	<	<5	-	<	<5	-	-	<5	-	-	-	<5
2,6-dichlorophenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
2-chlorophenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
2-methylphenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
2-nitrophenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
3-methylphenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
4-chloro-3-methylphenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
4-Chlorophenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
4-methylphenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
4-nitrophenol	<0.5µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
Dinoseb	<4µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
DNOC	<3µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
Pentachlorophenol	<2µg/l		-	-	<	<	-	-	<	<	<	<	<	-	<	<	-	-	<	-	-	-	<
Phenol	0.5µg/l	8 µg/l	-	-	<2.8	<2.8	-	-	<2.8	<2.8	<2.5	<2.5	<1.5	-	<2.5	<3	-	-	<1.5	<	-	-	<3
2.3.5 Trimethyl-Phenol	3 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-
2-Isopropyl Phenol	6 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-
Cresols	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-
Phenols, Total 5 speciated	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-
Xylenols	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-
Resorcinol	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-
Catechol	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-
1-naphthol	8 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-	-
Phenols, Total Detected monohydric	16 µg/l		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH Criteria Working Group (TPH CWG)																							
Aliphatics >C5-C6	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<5	<	<	<
Aliphatics >C6-C8	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<5	<	<	<
Aliphatics >C8-C10	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<5	<	<	<
Aliphatics >C10-C12	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<5	<	<	<
Aliphatics >C12-C16	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C16-C21	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aliphatics >C21-C35	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC5-EC7	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<5	<	<	<
Aromatics >EC7-EC8	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<5	<	<	<
Aromatics >EC8-EC10	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<5	<	<	<
Aromatics >EC10-EC12	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<5	<	<	<
Aromatics >EC12-EC16	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC16-EC21	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Aromatics >EC21-EC35	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Total aliphatics and aromatics C5-C35	<10µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
MTBE	<3µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	-	<	<	<
Benzene	<7µg/l	8µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	-	<	<	<
Ethylbenzene	<5µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	-	<	<	<
m,p-Xylene	<8µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	-	<	<	<
o-Xylene	<3µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	-	<	<	<
m,p,o-Xylene	<11µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	-	<	<	<
Toluene	<4µg/l	10µg/l	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	-	<	<	<
BTEX, Total	<28µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	-	<	<	<
Polyaromatic Hydrocarbons (PAHs)																							
Acenaphthene (aq)	0.01µg/l		< 0.03	< 0.03	<	<	<	<	<	<	< 0.03	< 0.03	< 0.03	< 0.03	<	< 0.03	< 0.03	< 0.03	< 0.03	<	< 0.03	< 0.03	-
Acenaphthylene (aq)	0.01µg/l		< 0.04	< 0.04	<	<	<	<	<	<	< 0.04	< 0.04	< 0.04	< 0.04	<	< 0.04	< 0.04	< 0.04	< 0.04	<	< 0.04	< 0.04	-
Anthracene (aq)	0.01µg/l	0.1µg/l	< 0.02	< 0.02	<	<	<	<	<	<	< 0.02	< 0.02	< 0.02	< 0.02	<	< 0.02	< 0.02	< 0.02	< 0.02	<	< 0.02	< 0.02	-
Benzo(a)anthracene (aq)	0.01µg/l		< 0.04	< 0.04	<	<	<	<	<	<	< 0.04	< 0.04	< 0.04	< 0.04	0.02	< 0.04	< 0.04	< 0.04	< 0.04	<	< 0.04	< 0.04	-
Benzo(a)pyrene (aq)	0.01µg/l	0.05µg/l	< 0.05	< 0.05	<	<	<	<	<	<	< 0.05	< 0.05	< 0.05	< 0.05	<	< 0.05	< 0.05	< 0.05	< 0.05	<	< 0.05	< 0.05	-
Benzo(b)fluoranthene (aq)	0.01µg/l	0.03µg/l	< 0.02	< 0.02	<	<	<	<	<	<	< 0.02	< 0.02	0.03	0.03	<	< 0.02	< 0.02	< 0.02	< 0.02	<	< 0.02	< 0.02	-
Benzo(k)fluoranthene (aq)	0.01µg/l	0.03µg/l	< 0.03	< 0.03	<	<	<	<	<	<	< 0.03	< 0.03	0.04	< 0.03	<	< 0.03	< 0.03	< 0.03	< 0.03	<	< 0.03	< 0.03	-
Benzo(g,h,i)perylene (aq)	0.01µg/l	0.02µg/l	< 0.08	< 0.08	<	<	<	<	<	<	< 0.08	< 0.08	< 0.08	< 0.08	<	< 0.08	< 0.08	< 0.08	< 0.08	<	< 0.08	< 0.08	-
Chrysene (aq)	0.01µg/l		< 0.03	< 0.03	<	<	<	<	<	<	< 0.03	< 0.03	< 0.03	< 0.03	<	< 0.03	< 0.03	< 0.03	< 0.03	<	< 0.03	< 0.03	-
Dibenzo(a,h)anthracene (aq)	0.01µg/l		< 0.06	< 0.06	<	<	<	<	<	<	< 0.06	< 0.06	< 0.06	< 0.06	<	< 0.06	< 0.06	< 0.06	< 0.06	<	< 0.06	< 0.06	-
Fluoranthene (aq)	0.01µg/l	0.1µg/l	< 0.07	< 0.07	<	0.01	<	<	<	<	< 0.07	< 0.07	< 0.07	< 0.07	<	< 0.07	< 0.07	< 0.07	< 0.07	<	< 0.07	< 0.07	-
Fluorene (aq)	0.01µg/l		< 0.04	< 0.04	<	<	<	<	<	<	< 0.04	< 0.04	< 0.04	< 0.04	<	< 0.04	< 0.04	< 0.04	< 0.04	<	< 0.04	< 0.04	-
Indeno(1,2,3-cd)pyrene (aq)	0.01µg/l	0.02µg/l	< 0.05	< 0.05	<	<	<	<	<	<	< 0.05	< 0.05	< 0.05	< 0.05	<	< 0.05	< 0.05	< 0.05	< 0.05	<	< 0.05	< 0.05	-
Naphthalene (aq)	0.01µg/l	1.2µg/l	< 0.06	< 0.06	<	<	<	<	<	<	< 0.06	< 0.06	< 0.06	< 0.06	<	< 0.06	< 0.06	< 0.06	< 0.06	0.03	< 0.06	< 0.06	-
Phenanthrene (aq)	0.01µg/l		< 0.085	< 0.085	<	0.01	<	<	<	<	< 0.085	< 0.085	< 0.085	< 0.085	<	< 0.085	< 0.085	< 0.085	< 0.085	0.01	< 0.085	< 0.085	-
Pyrene (aq)	0.01µg/l		< 0.06	< 0.06	<	<	<	<	0.12	<	< 0.06	< 0.06	< 0.06	< 0.06	<	< 0.06	< 0.06	< 0.06	< 0.06	<	< 0.06	< 0.06	-
Polyaromatic hydrocarbons, Total USEPA 16 (aq)	0.2µg/l		< 0.20	< 0.20	<	0.02	<	<	0.12	<	< 0.20	< 0.20	0.28	< 0.20	0.02	< 0.20	< 0.20	< 0.20	< 0.20	0.04	< 0.20	< 0.20	-
PCB's																							
PCB congener 101	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
PCB congener 118	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
PCB congener 138	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
PCB congener 153	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
PCB congener 180	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
PCB congener 28	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
PCB congener 52	<0.015µg/l		<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
Sum of detected EC7 PCB's	<0.105µg/l		<	<	<	<	<	<	<	<	12 <	<	<	<	<	<	<	<	<	<	<	<	<

2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	Limestone		base 5m of sand and gravel, then weathered limestone		Limestone		0.7m gravel then limestone		SurfaceWater Samples					Harbour Water Samples							
Sample Identity			BH122		BH306c		BH310c		BH312c		SW1	SW2	SP1	SP2	SP3	HW-01	HW-02	HW-03	HW-04	HW-04	HW-05	HW-06	Trip Sample
High Water / Low Water			Low	High	Low	High	Low	High	Low	High	Low	Low	Low	Low	Low	Low	Low	Low	Low	Duplicate #3	Low	Low	-
Sampled Date			20/06/2012	20/06/2012	04/07/2012	04/07/2012	04/07/2012	04/07/2012	05/07/2012	05/07/2012	25/06/2012	25/06/2012	21/06/2012	21/06/2012	26/06/2012	19/06/2012	19/06/2012	19/06/2012	19/06/2012	Same as HW-04 (WYG scheduled this analysis from a separate laboratory)	19/06/2012	19/06/2012	02/07/2012
Sample Ref (Alcontrol)			733743	419835	966135	534284	798741	266498	984114	457113	237415	637220	515251	256404	221455	HW1	HW2	HW3	HW4		HW5	HW6	637895
SDG			120622-50	120622-50	120706-80	120706-80	120706-80	120706-80	120707-30	120707-30	120627-67	120627-67	120623-38	120623-38	120628-125	120621-83	120621-83	120621-83	120621-83		120621-83	120621-83	120704-46
											Lagoon #1	Lagoon #2	Seepage #1	Seepage #2	Seepage #3								
Volatile Organic Compounds (VOCs)																							
1.1.1.2-Tetrachloroethane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.1.1-Trichloroethane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.1.2.2-Tetrachloroethane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.1.2-Trichloroethane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.1-Dichloroethane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.1-Dichloroethene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.1-Dichloropropene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.2.3-Trichlorobenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.2.3-Trichloropropane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.2.4-Trichlorobenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.2.4-Trimethylbenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.2-Dibromo-3-chloropropane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.2-Dibromoethane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.2-Dichlorobenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.2-Dichloroethane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.2-Dichloropropane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1,3,5-Trichlorobenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.3.5-Trimethylbenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.3-Dichlorobenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.3-Dichloropropane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
1.4-Dichlorobenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
2.2-Dichloropropane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
2-Chlorotoluene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
4-Chlorotoluene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
4-Isopropyltoluene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Benzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Bromobenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Bromochloromethane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Bromodichloromethane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Bromoform	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Bromomethane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Carbon disulphide	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Carbontetrachloride	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Chlorobenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Chloroethane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Chloroform	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Chloromethane	<0.1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
cis-1,2-Dichloroethene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
cis-1,3-Dichloropropene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Dibromochloromethane	µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Dibromomethane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Dichlorodifluoromethane	<0.1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Dichloromethane	<3µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Ethylbenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Hexachlorobutadiene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Isopropylbenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
m,p-Xylene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Methyl tertiary butyl ether (MTBE)	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Naphthalene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
n-Butylbenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
o-Xylene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Propylbenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
sec-Butylbenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Styrene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Total Xylenes	<2µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
tert-Amyl methyl ether (TAME)	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
tert-Butylbenzene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Tetrachloroethene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Toluene	µg/l	10µg/l	-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
trans-1,2-Dichloroethene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
trans-1,3-Dichloropropene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Trichloroethene	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Trichlorofluoromethane	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
Vinyl Chloride	<1µg/l		-	-	<	<	-	-	<	<	-	-	<	<	<	-	-	-	-	-	-	-	<
VOC TIC	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No TICs identified

Notes:

* Low level Hexavalent Chromium Analysis Scheduled but not completed due to certain exceedences of chemistry parameters to waters scheduled for analysis

Two different LoD's were used for speciated PAH results from a subcontracted laboratory. Where the LoD exceeds the required level - this value has been entered into the table.

indicates value exceeds WQS

-** indicates where saline level to high for analysis

-*** Laboratory omitted Analysis in Error (not enough sample remained to test on identifying error

Nov 2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	Waste and alluvium	Waste and alluvium	Waste and alluvium	Waste and alluvium	Waste and alluvium		Waste and alluvium	Waste	Waste
Sample Identity			**BH116**	**BH118**	**BH119**	**BH120**	**BH126**		**BH127**	**BH128**	**BH130**
High Water / Low Water			Low	Low	Low	Low	Low	High	Low	Low	Low
Sampled Date			28/11/2012	27/11/2012	28/11/2012	28/11/2012	08/11/2012	08/11/2012	28/11/2012	29/11/2012	29/11/2012
Metals (Dissolved)	**µg/l**	**µg/l**									
Arsenic (diss.filt)	<0.9	20 µg/l	<0.9	<0.9	1.6	3.0	<0.9	<0.9	<0.9	<0.9	<0.9
Cadmium (diss.filt)	<0.03	0.2 µg/l	<0.03	<0.03	<0.03	<0.03	0.12	<0.03	0.05	<0.03	0.05
Chromium (diss.filt)	<0.2	4.6 µg/l	<0.2	4.3	1.5	0.5	<0.2	<0.2	**16.6**	1.5	**5.0**
Copper (diss.filt)	<3	5 µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
Lead (diss.filt)	<0.4	7.2 µg/l	<0.4	2.2	0.8	1.1	<0.4	<0.4	0.5	0.7	0.7
Manganese (diss.filt)	<1.5	30 µg/l	**325.5**	<1.5	11.9	**1909.0**	**79.1**	**103.5**	<1.5	<1.5	<1.5
Nickel (diss.filt)	<0.2	20 µg/l	<0.2	<0.2	<0.2	1.4	0.5	0.2	<0.2	<0.2	<0.2
Zinc (diss.filt)	<1.5	40 µg/l	12.0	15.8	14.5	10.6	6.3	11.5	10.4	9.8	7.2
Mercury (CV-AF)	<0.01	0.05 µg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hexavalent Chromium	2	0.6	<2	<2	<2	<2	<2	**2**	<2	<2	<2
Mercury (PS analytical)*	<0.0005	0.05					<0.0005	<0.0005			

Notes:

indicates value exceeds WQS

* indicates analysis completed by PS Analytical (specialists in mercury analysis)

Analysis completed using ICP-OES with exception of mercury

Nov 2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	Waste	Waste	Waste	Waste	Waste	Waste	Waste		Waste	Waste		Waste		Waste
Sample Identity			**BH301a**	**BH302**	**BH303**	**BH305**	**BH306b**	**BH307**	**BH310a**		**BH311**	**BH312a**		**BH314**		**BH315**
High Water / Low Water			Low	Low	Low	Low	Low	Low	Low	High	Low	Low	High	Low	High	Low
Sampled Date			16/11/2012	16/11/2012	28/11/2012	28/11/2012	30/11/2012	16/11/2012	07/11/2012	07/11/2012	27/11/2012	06/11/2012	06/11/2012	08/11/2012	08/11/2012	27/11/2012
Metals (Dissolved)	**µg/l**	**µg/l**														
Arsenic (diss.filt)	<0.9	20 µg/l	<0.9	<0.9	<0.9	<0.9	1.4	3.2	<0.9	1.2	1.4	1.2	<0.9	1.6	<0.9	1.3
Cadmium (diss.filt)	<0.03	0.2 µg/l	0.11	0.05	0.06	<0.03	<0.03	<0.03	0.13	<0.03	<0.03	<0.03	0.08	**0.28**	**0.30**	<0.03
Chromium (diss.filt)	<0.2	4.6 µg/l	<0.2	<0.2	0.8	<0.2	**5.2**	2.8	**31.8**	**18.3**	**8.0**	<0.2	<0.2	1.5	0.4	**8.3**
Copper (diss.filt)	<3	5 µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3	**21**	**19**	<3	<3	<3
Lead (diss.filt)	<0.4	7.2 µg/l	1.7	1.8	0.5	<0.4	<0.4	<0.4	0.7	1.1	<0.4	6.9	4.5	<0.4	0.8	<0.4
Manganese (diss.filt)	<1.5	30 µg/l	**1784.0**	**576.7**	5.6	**140.7**	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	1.8
Nickel (diss.filt)	<0.2	20 µg/l	1.4	1.6	<0.2	1.3	<0.2	0.5	<0.2	<0.2	<0.2	9.9	10.1	1.4	1.4	0.7
Zinc (diss.filt)	<1.5	40 µg/l	9.6	12.3	13.3	19.7	34.8	30.1	6.1	5.2	13.0	1.8	3.8	18.2	**45.4**	22.3
Mercury (CV-AF)	<0.01	0.05 µg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hexavalent Chromium	2	0.6	<2	<2	<2	<2	<2	<2	**33**	**20**	**4**	<2	<2	<2	<2	**2**
Mercury (PS analytical)*	<0.0005	0.05							0.0032	0.143		**0.0543**	**0.0596**	0.028	**0.2274**	

Notes:

indicates value exceeds WQS

* indicates analysis completed by PS Analytical (specialists in mercury analysis)

Analysis completed using ICP-OES with exception of mercury

Nov 2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	alluvium		alluvium	alluvium	Alluvium	alluvium	alluvium	alluvium		Sand and Gravel	sand and gravel	sand and gravel
Sample Identity			**BH304**		**BH306d**	**BH308**	**BH309**	**BH310b**	**BH312b**	**BH316**		**BH313**	**BH117R**	**BH125R**
High Water / Low Water			Low	High	Low	Low	Low	Low	Low	Low	High	Low	Low	Low
Sampled Date			08/11/2012	08/11/2012	16/11/2012	15/11/2012	16/11/2012	16/11/2012	15/11/2012	07/11/2012	07/11/2012	15/11/2012	27/11/2012	16/11/2012
Metals (Dissolved)	**µg/l**	**µg/l**												
Arsenic (diss.filt)	<0.9	20 µg/l	4.8	1.4	<0.9	8.0	<0.9	**31.1**	2.8	<0.9	1.3	**25.0**	3.4	3.8
Cadmium (diss.filt)	<0.03	0.2 µg/l	0.07	0.09	<0.03	<0.03	<0.03	**0.36**	<0.03	0.14	<0.03	**0.65**	**0.32**	<0.03
Chromium (diss.filt)	<0.2	4.6 µg/l	<0.2	<0.2	<0.2	<0.2	<0.2	0.9	<0.2	<0.2	<0.2	0.7	<0.2	<0.2
Copper (diss.filt)	<3	5 µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Lead (diss.filt)	<0.4	7.2 µg/l	1.4	2.0	<0.4	<0.4	<0.4	1.1	<0.4	0.8	<0.4	1.8	<0.4	<0.4
Manganese (diss.filt)	<1.5	30 µg/l	**4122.0**	**4908.0**	**1497.0**	**565.8**	**394.7**	**3397.0**	**75.9**	**295.5**	**359.8**	**2126.0**	**587.5**	**76.2**
Nickel (diss.filt)	<0.2	20 µg/l	2.4	1.2	1.1	5.8	0.4	3.2	0.8	0.8	<0.2	2.3	0.9	0.5
Zinc (diss.filt)	<1.5	40 µg/l	<1.5	<1.5	9.8	19.3	9.2	27.5	18.2	4.9	4.0	18.3	18.9	12.9
Mercury (CV-AF)	<0.01	0.05 µg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hexavalent Chromium	2	0.6	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Mercury (PS analytical)*	<0.0005	0.05	0.0017	<0.0005						0.0443	0.0099			

Notes:

indicates value exceeds WQS

* indicates analysis completed by PS Analytical (specialists in mercury analysis)

Analysis completed using ICP-OES with exception of mercury

Nov 2012, East Tip, Water Analysis Results

Sample Location	LoD/Units	WQS	Limestone	base 5m of sand and gravel, then weathered limestone	Limestone	0.7m gravel then limestone	Seepages			Harbour Water Samples					
Sample Identity			**BH122**	**BH306c**	**BH310c**	**BH312c**	**SP1**	**SP2**	**SP3**	**HW-01**	**HW-02**	**HW-03**	**HW-04**	**HW-05**	**HW-06**
High Water / Low Water			Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Sampled Date			29/11/2012	30/11/2012	30/11/2012	29/11/2012	28/11/2012	28/11/2012	28/11/2012	13/11/2012	13/11/2012	13/11/2012	13/11/2012	13/11/2012	13/11/2012
Metals (Dissolved)	**µg/l**	**µg/l**													
Arsenic (diss.filt)	<0.9	20 µg/l	2.2	<0.9	2.7	2.0	2.1	2.3	2.1	1.7	1.2	1.9	<0.9	1.6	<0.9
Cadmium (diss.filt)	<0.03	0.2 µg/l	**1.78**	**0.49**	**0.37**	**1.35**	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	0.04	0.05	0.19
Chromium (diss.filt)	<0.2	4.6 µg/l	<0.2	0.3	1.0	<0.2	1.2	2.7	1.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Copper (diss.filt)	<3	5 µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Lead (diss.filt)	<0.4	7.2 µg/l	0.4	0.6	<0.4	<0.4	<0.4	<0.4	<0.4	1.0	<0.4	<0.4	<0.4	<0.4	<0.4
Manganese (diss.filt)	<1.5	30 µg/l	7.0	**74.2**	**790.5**	7.0	<1.5	<1.5	<1.5	3.5	2.5	2.8	4.1	1.9	<1.5
Nickel (diss.filt)	<0.2	20 µg/l	0.3	1.8	2.2	<0.2	<0.2	<0.2	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Zinc (diss.filt)	<1.5	40 µg/l	16.7	39.7	**95.0**	37.4	12.7	11.9	11.0	2.0	2.2	5.6	9.1	4.8	6.9
Mercury (CV-AF)	<0.01	0.05 µg/l	<0.01	**0.07**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hexavalent Chromium	2	0.6	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Mercury (PS analytical)*	<0.0005	0.05								0.0265	0.0128	0.0159	0.0276	0.0158	0.0108

Notes:

indicates value exceeds WQS

* indicates analysis completed by PS Analytical (specialists in mercury analysis)

Analysis completed using ICP-OES with exception of mercury

Appendix M Asbestos Results

Asbestos Analysis Results

In total 94 No. numbers samples were analysed by Alcontrol to identify asbestos fibres. The results are presented at the end of this Appendix. The samples were analysed for asbestos using the UKAS accredited methods which included:

Stage 1 - Initial bulk analysis.

This involved the whole sample being spread out in a tray and examined for the presence of asbestos. Following initial examination, a sub sample was taken (for analysis following HSG 248) to either confirm the identity of any materials suspected of containing asbestos or to perform a more detailed examination for samples in which no asbestos was detected visually.

Stage 2 - Hand picking and Weighing of Asbestos Containing Materials

If any asbestos containing materials (ACM's) are visible when the sample is spread out in the tray they are picked out, dried and weighed. A percentage asbestos is assigned to each ACM with reference to 'HSG264 Asbestos: The Survey Guide' and the calculated weight of asbestos present in these materials is expressed as a percentage of the total weight of the soil sample (dry weight).

Stage 3 - Fibre Counting and Sizing by Phase Contrast Optical Microscopy (PCOM)

If asbestos is identified as being present during stage 1 analysis but is not in a form that is suitable for analysis by stage 2 (normally if the asbestos is present as free fibre) then quantification is carried out using PCOM. A representative sub sample of the soil is made up in solution from which filters are prepared and analysed by PCOM. The limit of detection for this analysis is 0.0001%. The limit of quantification for this technique is 0.001%.

Out of the 94 No. analysed 56 No. tested positive for the presence of asbestos. Typically these comprised of loose chrysotile fibres, however asbestos cement material (ACM) was also observed in 7 No. samples (BH302 8mbgl, BH306B 6.5mbgl, BH312A 2-2.1mbgl and 3.6-3.8mbgl, BH314 0-0.5mbgl, BH315 3mbgl and BH315 6mbgl.) Amosite asbestos was identified in 6 No. samples and crocidolite in 2 No. samples. A sample from BH312A 3.6-2.8mbgl contained all three forms of asbestos. With the exception of 5 No. samples, asbestos was mainly identified in samples comprising of slag and to a lesser extent sludge, millscale and construction and demolition type waste material as summarised below.

5 No. samples from natural underlying soils have been identified as containing asbestos including:

- BH301A 7.5mbgl with chrysotile loose fibres in silt (0.4m beneath base of waste material);
- BH309 13.5-14mbgl with chrysotile loose fibres in silt (6.1m beneath base of waste material);

- BH312A 6-6.1mbgl with trace chrysotile loose fibres in silt (0.2m beneath base of waste material);
- BH312B 5mbgl chrysotile loose fibres in silt (at the interface between waste and silt); and
- BH312B 5.5mbgl trace chrysotile loose fibres in silt (0.5m beneath base of waste material)

With the exception of BH309, all positive asbestos identifications were within natural soils immediately underlying the waste material and as a result it is considered likely that the sample has been cross contaminated by the overlying waste.

It should be noted that the analysed samples were obtained from waste material in situ rather than any above ground stockpiles. The observed waste is heterogeneous and mixed and as a result the samples generally comprised of a mixture of different waste types as opposed to "pure wastes."

A second phase of asbestos analysis was completed in August 2012 by Alcontrol laboratories to provide further confidence on asbestos identified at the East Tip. Alcontrol were instructed to take a further subsample for analysis from the original samples that had tested positive for asbestos. Generally this confirmed the original analysis results. Out of the 56 No. that previously tested positive for asbestos, 51 No. tested positive for asbestos. 6 No. samples previously not identified as containing asbestos, were analysed a second time and all 6 No. samples tested negative for asbestos.

As outlined above, during the first phase of testing, a sample obtained from BH309 13.5-14mbgl, 6.1m below the base of the waste material was identified as containing chrysotile loose fibres. The analysis of the second subsample did not identify asbestos and additionally asbestos has not been identified in samples taken from the overlying silt (7.5-8mbgl) and waste (5.5-6mbgl and 7.5-8mbgl) which would indicate that cross contamination could have occurred during the site investigation. Furthermore, analysis of a duplicate sample from this location by IOM laboratories (see below) also did not identify asbestos. As a result it is considered likely that the original identification of asbestos in this sample is an error.

8 No. samples identified as containing asbestos were scheduled to quantify the amount of asbestos present. 5 No. did not identify asbestos within the sample and therefore returned quantification results of less than 0.001%. Very low quantities of asbestos were identified in the other 3 No. samples with percentages ranging from 0.0011% to 0.0028%.

IOM Analysis

Upon receiving the first phase of asbestos analysis results, duplicate samples were retrieved from stored bulk bags and sent to IOM laboratories for asbestos identification and quantification. IOM were selected as a preferred laboratory due to their expertise in the field of asbestos analysis and given that their consultancy department has been appointed to develop UK Asbestos Risk Assessment Guidance and Best Practice document on behalf of CLAIRE.

The samples that were selected were generally those that had been previously identified by Alcontrol laboratories as containing asbestos. In total 73 No. samples were submitted to IOM for asbestos analysis with 24 No. testing positive for asbestos. The method of analysis was the same UKAS accredited method as outlined above in respect to Alcontrol's analysis. This equates to 33% compared to the 61% previously identified by Alcontrol as containing asbestos. Typically the samples were identified as containing chrysotile with the exception of 3 No. samples which contained amosite. Predominantly asbestos was present as free fibres with the exception of 2 No. samples. 1 No. sample contained asbestos that was bound in insulation and 1 No. sample with asbestos bound in bitumen. IOM completed quantification analysis on all samples which tested positive for asbestos with percentage quantities ranging from 0.003% to 0.056%. Typically the results returned concentrations of 0.003% to 0.006%. Very low quantities of asbestos are considered to be present. The IOM analysis results are presented at the end of this Appendix.

Potential Asbestos Source

As the asbestos has been identified as free fibres, generally not bound in asbestos containing material (ACM) it is difficult to determine an exact source. IOM have confirmed that the identified asbestos has not undergone any heat treatment and therefore did not pass through the steelworks process. On this basis it can be concluded that the slag waste (or other steelworks waste which would have been subject to high temperatures) were not the primary source of the contamination Construction and demolition type waste is the most likely to be the source and it is assumed that during deposition of this waste, cross contamination to other waste types such as the slag waste occurred. Two refractory bricks and a piece of green cement with wire re-enforcing were submitted to IOM laboratories to examine for asbestos content. The refractory bricks did not contain asbestos however the green cement with re-enforcing wire contained amosite. Additionally it is considered that the asbestos observed in natural soils may be due to cross contamination.

Conclusion

Asbestos has been identified in a number of samples analysed from the waste material at the East Tip. However quantification analysis has shown this to be in very low quantities typically in the 0.003%-0.006% range. Typically the lower risk chrysotile has been identified, as loose fibres which will have the potential to become airborne where they are at the surface and could cause risks to the users of the site through inhalation of asbestos fibres. The most likely source of the asbestos is considered to be Construction and Demolition Type waste as opposed to steelworks waste as it has been shown that the asbestos has not been subjected to heat. As a result this is considered to be a pollutant linkage and further assessment works are recommended to more accurately characterise the risks.

Soil Analysis - Primary Contaminants

Borehole Number		BH301a						BH302					BH303			
Sample REF		E3	E6	E17				E8		E27	E30	E32	E3	E9	E19	E21
Sample Depth		0.2-0.3	0.6-1	4	7.5	14	16.5	2	5	8.0	11.0	14.0	1	3	8	10
Date Sampled		15-May	15-May	15-May	15-May	15-May	18-May	17-May	17-May	25-May	05-Jun	05-Jun	08/05/2012	08/05/2012	14/05/2012	19/05/2012
Material		Slag occ RB	Mill Scale	Slag occ RB	SILT	SILT	CLAY	CLAY / C&D	SLAG	SLAG	SILT	SILT	SLAG	SLAG & RB 5%	SILT	SILT
Lab Schedule #		Schedule #6				Schedule #7		Schedule #6		Schedule #7	Schedule #9		Schedule #4			Schedule #6
Lab Schedule date		23-May				01-Jun		23-May		01-Jun	08-Jun		14-May			23-May
Asbestos - Screen All Samples	I1.24			Chrysotile LFS	Chrysotile LFS			Chrysotile LFS	Chrysotile LFS	Chrysotile ACM			Chrysotile LFS	Chrysotile LFS		
Asbestos - Screen All Samples - August		Chrysotile		Chrysotile	Chrysotile			Chrysotile	Chrysotile	Chrysotile			Chrysotile	Chrysotile		
AlControl Quantitative Result - Asbestos		0.0011%												<0.001		
IOM Results (Quantitative where positive)																
IOM Schedule 270812										Bound Chrysotile 0.012%						

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Soil Analysis - Primary Contaminants

Borehole Number		BH304					BH305			BH306a				BH306b			BH306d	
Sample REF		E3	E9	E15	E22	E45	E3	E15		E6	E15	E17	E20	E3	E12	E22	E8	E10
Sample Depth		0.3	2.0	4.2	6.5 - 7	16.5 - 17	0.3	4 - 4.5	7.5-8	2	5	7	9	1	4	6.5	14.0	18.0
Date Sampled		25-May	25-May	25-May	06-Jun	07-Jun	24-May	24-May	31-May	01/05/2012	01/05/2012	01/05/2012	08/05/2012	24/04/2012	24/04/2012	26/04/2012	11-Jun	13-Jun
Material		Topsoil	SLAG	SLAG	SILT	CLAY	Topsoil	SLAG + RB 20%	SILT	SLAG	SLAG	SLAG	SLAG	SLAG	SLAG	SLAG	SILT	SILT
Lab Schedule #		Schedule #7			Schedule #9		Schedule #7			Schedule #1 / #2		Schedule #3	Schedule #4	Schedule #1/#2			Schedule #12	
Lab Schedule date		01-Jun			08-Jun		01-Jun			02-May		09-May	14-May	02-May			15-Jun	
Asbestos - Screen All Samples	I1.24		Crocidolite LFS	Amosite LFS				Chrysotile LFS		Chrysotile Trace LFS	Chrysotile LFS	Chrysotile LFS	Chrysotile LFS	Chrysotile Trace LFS	Chrysotile LFS	Chrysotile LFS & ACM		
Asbestos - Screen All Samples 2nd Time				Amosite				Chrysotile		Trace Chrysotile	Chrysotile	Chrysotile	Chrysotile	Chrysotile	Chrysotile	Chrysotile		
AlControl Quantitative Result - Asbestos															<0.001			
IOM Results (Quantitative where positive)																		
IOM Schedule 270812								Chrysotile loose insulation 0.008%				Chrysotile 0.003%	Chrysotile loose Insulation 0.004%			Bitumen - Chrysotile 0.004%		

Soil Analysis - Primary Contaminants

Borehole Number		BH307				BH308					BH309						BH310a			
Sample REF		E3	E9	E15	E19	E3	E7	E17	E25	E37	E19	E25	E40	Dup #3 (15.5-16)	E45	E52	E3	E10	E19	E23
Sample Depth		0.6	2.5-3	7.0	12.0	0.3	0.7 - 0.9	3.5 - 4	7 - 7.5	11.5 - 12	5.5 - 6	7.5 - 8	13.5 - 14		15.5 - 16	19.5	1	3	6	9
Date Sampled		21/05/2012	21/05/2012	29-May	30-May	25-May	25-May	25-May	29-May	29-May	06-Jun	06-Jun	07-Jun		07-Jun	08-Jun	26/04/2012	26/04/2012	26/04/2012	01/05/2012
Material		SLAG	SLAG & RB 10%	SLAG	SILT	Topsoil	SLAG	CLAY	SILT	SILT	SLAG	SILT	SILT	SILT	SILT	CLAY	SLAG	SLAG	SLAG	SLAG
Lab Schedule #		Schedule #6		Schedule #7		Schedule #7					Schedule #9			Schedule #11	Schedule #12	Schedule #11	Schedule #1 / #2			
Lab Schedule date		23-May		01-Jun		01-Jun					08-Jun			12-Jun	15-Jun		02-May			
Asbestos - Screen All Samples	I1.24			Chrysotile LFS			amosite						Chrysotile LFS				Chrysotile LFS	Chrysotile Trace LFS	Chrysotile LFS	Chrysotile LFS
Asbestos - Screen All Samples 2nd Time				Chrysotile													Chrysotile		Chrysotile	Chrysotile
AlControl Quantitative Result - Asbestos																				0.0014%
IOM Results (Quantitative where positive)																				
IOM Schedule 270812				Free Chrysotile fibres 0.003%																Not Available

Soil Analysis - Primary Contaminants

Borehole Number		BH310b				BH310c		BH311			BH312a				BH312b					
Sample REF		E6	E15	E25	E29	E3	E12	E6	Duplicate	E13	E1	E7	E11	E20	E3	E9	E14	E17	E20	E36
Sample Depth		2	5	8	11	0.6-0.8	4.0	0.5-0.6	0.5-0.6	3.5	0.5 - 0.6	2 - 2.1	3.6 - 3.8	6 - 6.1	1	2.5	4.5	5	5.5	11.5
Date Sampled		04/05/2012	04/05/2012	10/05/2012	11/05/2012	21/05/2012	22/05/2012	23/05/2012	23/05/2012	23/05/2012	25/04/2012	25/04/2012	25/04/2012	25/04/2012	30/04/2012	30/04/2012	30/04/2012	30/04/2012	01/05/2012	01/05/2012
Material		SLAG	SLAG	SLAG	SILT	SLAG	SLAG	SLAG	SLAG	SLAG	SLUDGE	C&D	SLUDGE	SILT	Mill Scale	Millscale	TAR	SILT	SILT	SILT
Lab Schedule #		Schedule #3		Schedule #4		Schedule #6	Schedule #7	Schedule #7			Schedule #1 / #2				Schedule #1 / #2				Schedule #3	
Lab Schedule date		09-May		14-May		23-May	01-Jun	01-Jun			02-May				02-May				09-May	
Asbestos - Screen All Samples	I1.24	Chrysotile LFS	Chrysotile Trace LFS	Chrysotile LFS			Chrysotile LFS	Chrysotile LFS	amosite	Chrysotile LFS		Chrysotile ACM	Chrysotile, amosite and crocidolite LFS & ACM	Chrysotile Trace LFS	Chrysotile	Chrysotile & Amosite LFS		Chrysotile LFS	Chrysotile Trace LFS	
Asbestos - Screen All Samples 2nd Time		Chrysotile	Chrysotile	Chrysotile				Trace Chrysotile	Chrysotile	Chrysotile		Chrysotile	Chrysotile**	Chrysotile	Chrysotile	Chrysotile		Chrysotile	Chrysotile	
AlControl Quantitative Result - Asbestos																			0.0028%	
IOM Results (Quantitative where positive)												0.006%						0.005%	0.056%	
IOM Schedule 270812		Free Chrysotile Fibres 0.003%					Free Chrysotile fibres 0.003%	Free Amosite fibres 0.004%						Free Chrysotile fibres 0.003%	Free Chrysotile Fibres 0.003%	Free Amosite fibres 0.003%				

Soil Analysis - Primary Contaminants

Borehole Number		BH312c			BH313			BH314					BH315			BH316				
Sample REF		E3	E6	E10	E6	E14	E18	E3	E10	E14	E15	E22	E3	E9	E19	E3	E10	E15	E17	E29
Sample Depth		1	2.3	3.5	2	5	8	0-0.5	2.2	3.2	3.2	5.3	1	3	6.0	0.2 - 0.5	4.0	5 - 5.5	6.5 - 7	10.5 - 11
Date Sampled		10/05/2012	10/05/2012	10/05/2012	16/05/2012	17/05/2012	18/05/2012	26/04/2012	26/04/2012	27/04/2012	27/04/2012	27/04/2012	16/05/2012	16/05/2012	22/05/2012	06-Jun	06-Jun	11-Jun	12-Jun	12-Jun
Material		SLAG	SLAG	SLAG	SLAG	SLAG	SILT	SLAG	SLAG	SLAG	Duplicate	C&D	SLAG	SLAG	SLAG	SLAG	SLAG / waste	SLAG	SILT	SILT
Lab Schedule #		Schedule #4			Schedule #6			Schedule #1 / #2					Schedule #6		Schedule #7	Schedule #9		Schedule #11	Schedule #12	
Lab Schedule date		14-May			23-May			02-May					23-May		01-Jun	08-Jun		12-Jun	15-Jun	
Asbestos - Screen All Samples	I1.24		Chrysotile LFS	Chrysotile LFS	Chrysotile LFS	Chrysotile LFS		Chrysotile ACM	Chrysotile LFS	Chrysotile LFS	Chrysotile LFS	Chrysotile LFS	Chrysotile LFS	Chrysotile LFS & ACM	Chrysotile LFS & ACM	amosite	Chrysotile LFS	Chrysotile LFS		
Asbestos - Screen All Samples 2nd Time			Chrysotile	Chrysotile	Chrysotile	Chrysotile		Chrysotile	Chrysotile	Trace Chrysotile	Chrysotile	Chrysotile	Chrysotile	Chrysotile	Chrysotile	Trace Amosite	Chrysotile	Chrysotile		
AlControl Quantitative Result - Asbestos						<0.001		<0.001					<0.001							
IOM Results (Quantitative where positive)			0.006%		0.006%			0.006%						0.006%		0.006%				
IOM Schedule 270812				Free Amosite fibres 0.004%				Loose Crysotile insulation 0.038%			Not Available		Free Chrysotile fibres 0.003%		Loose Chrysotile insulation 0.023%					

Soil Analysis - Primary Contaminants

Borehole Number		OP10			OP14	
Sample REF		E1	E3	E5	E3	E5
Sample Depth		0.8	2.0	1.1	1.1 - 1.6	1.7
Date Sampled		05-Jun	05-Jun	05-Jun	07-Jun	07-Jun
Material		SLAG/Millscale	Flue Dust	SLAG	Millscale	SLAG
Lab Schedule #		Schedule #9			Schedule #9	
Lab Schedule date		08-Jun			08-Jun	
Asbestos - Screen All Samples	I1.24					
Asbestos - Screen All Samples 2nd Time					Chrysotile	Chrysotile
AlControl Quantitative Result - Asbestos						
IOM Sample reference						
IOM Results (Quantitative where positive)						
IOM Schedule 270812					Not Available	Not Available

IOM Sample Ref	Misc Items	location	result
S17140	Green cement with wire re-inforcing	BH306b @ 6.5m	Amosite
S17141	Yellow Refractory Brick	BH305 @ 4-4.5m	
S17142	Yellow Refractory Brick	BH310b - SP	

** The screening of the sample from BH312a (3.6-3.8m) also detected amosite & crocidolite

(red)	Sample screened positive for Asbestos like fibres / minerals
(green)	Sample screened negative for Asbestos like fibres / minerals
ACM	asbestos containing material
LFS	Loose fibres

Appendix N Ground Gas Assessment Methodology

Ground Gas Assessment Methodology

The methodology used to assess ground gas monitoring results have been taken from CIRIA Document, C665 (CIRIA, 2007). This provides guidance on the collection of relevant and valid data to allow the gassing regime to be adequately characterised. The assessment methodology of the risks posed by soil gas to be undertaken utilises, both gas concentrations and boreholes flow rates to define a “Characteristic Situation” based on limiting borehole gas volume flow for methane and carbon dioxide, called the Gas Screening Value (GSV). The GSV (litre of gas per hour (l/hr)) = borehole flow rate (l/h) x gas concentration. This calculation is carried out for both carbon dioxide and methane, and the worst-case value adopted. One of two assessment methods can be utilized depending on the floor construction of the properties being considered. In this instance the Wilson and Card method has been utilised in preference to the NHBC Traffic Light system. The Traffic light system is for residential properties which have a clear 150mm underfloor void. As the foundation construction of the one site buildings and potential future buildings on site is not known, the Wilson and Card method is considered to be more appropriate as it is relevant for all foundation/floor types. The Wilson and Card method is shown in Table N1 below.

Table N1 – Wilson & Card method for classifying gassing sites

Characteristic Situation	Gas Screening Value (CH_4 or CO_2) (l/hr)[1]	Additional limiting factors	Typical source of generation
1	<0.07	Typically methane ≤ 1% and or carbon dioxide =/ >5% otherwise consider increasing to situation 2.	Natural soils with low organic content
2	<0.7	Borehole air flow rate not to exceed 70l/hr otherwise increase to characteristic situation3	Natural soil, high peat/organic content
3	<3.5		Old landfill, inert waste, mine working flooded
4	<15	Quantitative risk assessment required to evaluate scope of protection measures	Mine working – susceptible to flooding, completed landfill, inert waste (WMP 26B criteria)
5	<70		Mine working unflooded inactive
6	>70		Recent landfill site

Notes:
Gas screening value: litres of gas/hour is calculated by multiplying the gas concentration (%) by the measured borehole flow rate (l/h)
Site characteristics should be based on gas monitoring of gas concentrations and borehole flow rates for specified minimum periods in table 5.5 of the CIRIA guidance
Source of gas and generation potential/performance must be identified
Soil gas investigation to be in accordance with guidance provided in chapters 4-6 of CIRIA guidance.
If there is not a detectable flow use the limit of detection of the instrument.
The boundaries between the Partners in Technology classification do not fit exactly with the boundaries for the CIRIA classification.

Appendix O Ground Gas Assessment

O1 Ground Gas Assessment

This gas assessment includes consideration of gas concentrations (methane and carbon dioxie) and flow rates monitored after completion of the borehole drilling and installation works in accordance with current best practice guidance highlighted in Appendix N. All monitoring works were completed by appropriately experienced engineers using calibrated monitoring equipment. In total 5 No. monitoring rounds were completed at all existing and newly constructed boreholes from the 30th July 2012 to 28th August 2012 comprising of:

- 23 No. boreholes screened solely within the waste horizon of the East Tip,
- 8 No. boreholes from the 2005 investigation screened into the waste and underlying alluvial sediments,
- 7 No. boreholes screened into alluvial strata,
- 3 No. boreholes screened into sands and gravels, and
- 4 No. boreholes screened into limestone.

The assessment completed below also includes the results of previous gas monitoring completed at the site (WYG 2005 and 2008). Including:

- Sampling and analysis of gases from BH116-BH120, BH125-BH128, BH130, BH122 (28/9/2005);
- One round of gas monitoring using a portable gas analyser (18/10/2005); and
- Twelve rounds of gas monitoring using a portable gas analyser (2/3/06-28/6/06).

O1.1 Meteorological Conditions

Over the monitoring periods in 2012, atmospheric pressure was high (>1000mb) which is reflective of the time of the year (summer time). Atmospheric pressure varied from 1002mb to 1003mb, with falling pressure observed on one occasion, 13th August 2012, where pressure fell from 1024 on the 10th to 1003mb on the day of monitoring. However atmospheric pressure rose slightly to 1006mb the following day. Weather conditions varied between wet, breezy and overcast conditions to calmer, drier conditions, typically with temperatures in the late teens.

Metrological conditions have an influence on the generation and migration of soil gases. Atmospheric pressure will increase emission rates during low and falling atmospheric pressures. The solubility of gases also increases with pressure, lowering concentrations within the ground as more gas will be dissolved in the groundwater. Whilst monitoring was completed under falling pressure conditions, low pressure was not recorded during the monitoring, largely due to monitoring being completed during summer months when high pressure weather systems normally predominate.

High rainfall and also tidal fluctuations may cause shallow groundwater levels to rise, reducing the available pore space in which gases can exist, increasing the concentration of gas and therefore the release of gas to the atmosphere. Monitoring was completed during periods of rainfall. Monitoring was completed under variable tidal conditions. On the 30th July generally the tide was rising during most of the monitoring, on the 8th August generally falling, 13th August it was rising, 2oth August the low tide was at approximately 2.20pm as a result the morning monitoring was during a falling tide and the afternoon during a rising tide and generally the monitoring completed on the 28th August was during a rising tide.

O1.2 Site Gas Concentrations

Methane (CH_4) and carbon dioxide (CO_2) were detected at concentrations above recommended threshold values, 1% for CH_4 and 5% for CO_2 (CIRIA C665), at BH02, BH03 and BH04 during a number of the monitoring rounds. More significant concentrations were detected at BH04 during all monitoring rounds. Maximum detected concentrations are presented in Table O1 for each monitoring location across all visits.

Table O1 – Summary of 2012 Monitored Gas Concentrations and Flows

Location	CH_4 (%) (max conc. range)	CO_2 (%) (max conc. range)	O_2 (%) Min Conc. range	H_2S (ppm) (range)	Flow (l/hr) (range)	GSV (l/hr)	CS
Waste							
BH301A (GAS)	0.0-0.4	0	13.1-20.6	0	-0.2-+0.9	0.004	1
BH302 (GAS)	0	0	15.4-17.4	0	-0.3-+1.2	0	1
BH303	0	0	17.8-20.9	0	-0.2-+1.2	0	1
BH304 (GAS)	0-0.1	0.0-0.3	4.6-10.8	0	-0.2-+0.8	0.002	1
BH305 (GW)	0-0.1	0	18.2-20.7	0	-4.6-+0.9	0.005	1
BH305 (GAS)	0-0.1	0-0.2	12.2-18.7	0	-0.1-+0.9	0.001	1
BH306B	0-0.1	0	20.6-20.9	0	-0.1-+1.2	0.001	1
BH307 (GAS)	0	0	20.4-20.6	0	-0.1-+1.1	0	1

BH307	0	0	20.4-20.8	0	-7.3-+1.2	0	1
BH308 (GAS)	0-0.1	0	3.8-15.3	0	0.0-0.8	0.001	1
BH309 (GAS)	0-0.1	0	19.9-20.9	0	-0.1-+0.8	0.001	1
BH310A	0-0.1	0	20.4-20.6	0	-0.5-+0.9	0.001	1
BH310B (GAS)	0-0.1	0	20.1-20.8	0	-0.1-+1.0	0.001	1
BH311	0	0	19.8-20.3	0	-0.1-+7.0	0	1
BH312A	0	0	19.3-20.3	0	-0.4-+0.7	0	1
BH313 (GAS)	0	0	19.3-20.5	0	-3.2-+1	0	1
BH314	0	0	19.3-20.8	0	-0.1-+1	0	1
BH315	0	0	19.7-20.5	0	-0.2-+0.7	0	1
Location	**CH_4 (%) (max conc. range)**	**CO_2 (%) (max conc. range)**	**O_2 (%) Min Conc. range**	**H_2S (ppm) (range)**	**Flow (l/hr) (range)**	**GSV (l/hr)**	**CS**
BH316 (GAS)	0.3-10.4	0	17-20	0	-1.0-+0.9	**0.1**	**2**
BH130	0	0	20.3-20.6	0	-0.1-+0.9	0	1
Waste and alluvium							
BH116	11.1-30.5	0.2-0.6	10.2-13.4	0	-0.1-+0.9	**0.27**	**2**
BH118	0	0	19.1-20.2	0	-0.2-+2.3	0	1
BH119	0-0.1	0	18.0-19.5	0	-0.4-+0.9	0.001	1
BH120	0-0.1	0	6.7-15	0	-0.5-+0.8	0.001	1
BH126	78.0-88.6	0	0.7-2.5	0	-0.1--11.2	**9.9**	**4**
BH127	0-0.1	0	19.8-20.3	0	-0.1-+0.9	0.001	1
BH128	0	0	20.2-20.6	0	0.1-+1.2	0	1

Alluvium							
BH301	0-0.1	0	19.9-21	0	-0.1-+0.9	0.001	1
BH302	0.2-1.0	0	18.3-19.6	0	-0.3-+1.1	0.01	1
BH304	3.2-7.8	0.1-0.3	10.3-17.4	0	0-0.8	0.06	1
BH306D	13.0-34.0	0.1-0.3	12.-17.2	0	-0.3-+1.2	**0.41**	**2**
BH308	0-0.3	0	19.4-20.5	0	0-0.8	0.002	1
BH309	0-0.1	0	20.4-20.8	0	-0.3-+0.8	0.001	1
BH310B	0.1-0.3	0	20.3-20.7	0	-3.7-+1.2	0.004	1
BH312B	0	0	18.5-19.8	0	-0.4-+0.7	0	1
BH316	79.4-93.4	0-0.2	0.2-2.3	0	3-27.7	**25.87**	**5**
Location	**CH_4 (%) (max conc. range)**	**CO_2 (%) (max conc. range)**	**O_2 (%) Min Conc. range**	**H_2S (ppm) (range)**	**Flow (l/hr) (range)**	**GSV (l/hr)**	**CS**
Sand and Gravel							
BH313	0	0	20.4-20.7	0	-6.6-+0.8	0	1
BH117R	0-0.1	0	20.5-20.8	0	-0.2-+0.8	0.001	1
BH125R	0	0	20.4-20.9	0	-2.3-+2.5	0	1
Limestone							
BH122B	0	0	19.8-20.6	0	-3.5-+19.7	0	1
BH306C	0-0.1	0	20.3-20.9	0	-1.0-+1.5	0.002	1

Note: (GAS) indicates gas monitoring results presented of shallow borehole (typically less <5mbgl) at this location
Note 2: gas concentrations presented above are peak readings

<u>Waste</u>

With the exception of BH316, elevated concentrations of landfill gas, methane (CH_4), carbon dioxide (CO_2) and hydrogen sulphide were not measured in significant concentrations, i.e. above respective concentrations of 1% and 5%. Typically low flows were also measured at these monitored locations. Gas screening values (GSV) calculated in accordance with CIRIA guidance (CIRIA, 2007), resulted in GSVs ranging from 0-0.005l/hr which is classified as characteristic situation 1. Gas protection measures would not normally be required to protect current or future users of the East Tip.

However a maximum methane concentration of 10.4% was recorded in the shallow installation at BH316. This was recorded as a peak concentration with concentrations generally dropping over the monitoring time period. Carbon dioxide and hydrogen sulphide concentrations were not observed. Gas flow ranged from -1l/hr to 0.1l/hr which when combined results in a GSV of 0.1l/hr, classifying this location as characteristic situation 2. Gas protection measures would normally be required to be installed into buildings in the area BH316. However the observed gas regime at this location is also discussed further in the alluvium section below.

Waste and Alluvium

The existing boreholes which are mainly installed into the waste material but also into the top of the alluvium were monitored as part of the 2012 investigation works. Elevated methane concentrations were recorded at BH116 and BH126 with maximum concentrations ranging from 30.5% to 88.6% respectively. The maximum methane concentrations recorded at BH126 were peak concentrations recorded at the start of the monitoring which them typically fell by 50% after 3-6 minutes of monitoring. The observed concentrations of methane at BH116 appeared to be steady concentrations with lower decreases observed during the monitoring. Significant concentrations of carbon dioxide and hydrogen sulphide were not recorded at these locations. Gas flows at these two locations ranged from -0.1l/hr-0.9l/hr with calculated GSVs of 0.27l/hr and 9.9l/hr respectively, resulting in BH116 being classified as characteristic situation 2 and BH126 being classified as characteristic situation 4. Further gas monitoring, assessment and or gas protection measures will be needed should buildings be proposed in the area of these locations.

The response zone for BH116 is installed mainly into the waste material but also 3m into the top of alluvium which is organic in nature and therefore could be causing the elevated gas concentrations observed. The response zone for BH126 is 8m into the top of the alluvium in addition to 3m of the overlying waste material and as a result it is also likely that the alluvium is at this location is generating the elevated concentrations. This is supported by the fact that typically elevated methane and carbon dioxide concentrations were not recorded in boreholes installed exclusively into the waste material.

Alluvium

Elevated ground gas concentrations, methane were recorded at 3 No. out of the 9 No. alluvial boreholes monitored. Methane concentrations were recorded at BH316 and BH306D on all monitoring occasions with respective maximum concentrations of 93% methane and 34% methane. The maximum flow of 27.7l/hr was also observed at BH316 which when combined with the maximum methane concentration resulted in a GSV of 25.9lhr classified as characteristic situation 5. BH306D was classified as characteristic situation 2 based on a calculated GSV of 0.41l/hr. Further gas monitoring, assessment and or gas protection measures will be necessary should buildings be proposed in the area of these locations. As noted above in the waste section elevated methane was also recorded in the shallow borehole monitored at BH316. This is considered to be due to upward migration of the elevated methane concentration from underlying alluvium as monitored at this location and also due to a lack of identified organic material as shown in the investigation log for waste at this location.

Slightly elevated methane concentrations were also recorded at two other locations, BH302 with a maximum concentration of 1% and BH304 with a maximum concentration of 7.8%. However as low gas flows were observed at these locations, the maximum GSV has been calculated as 0.06l/hr which would classify these locations as characteristic situation 1, not requiring gas protection measures.

Sand and Gravels

Significant concentrations of methane and carbon dioxide were not recorded at boreholes installed into sands and gravels underlying alluvium. As a result the gassing regime of this horizon is considered to be low and characteristic situation 1 has been assigned to BH313, BH117R and BH125R.

Limestone

Two of the four limestone monitoring wells were monitored for concentrations of methane, carbon dioxide and hydrogen sulphide. Concentrations typically were not encountered above the equipment detection limits and as a result a gassing regime requiring gas protection measures has not been identified.

Table O2 – Summary Ground Gas Monitoring Prior to 2012

Location	CH_4 (%) (max conc. range)	CO_2 (%) (max conc. range)	O_2 (%) Min Conc. range	Flow (l/hr) (range)	GSV (l/hr)	CS
BH116	8-22.1*	0-0.3*	13.8*-17.1	-1.9- 0.6	**0.4**	**2**
BH117	0-<0.05*	0-0.04*	19.8-19.6*	-0.7-1.2	0.001	1
BH118	0-<0.05*	0-<0.05	19.7-19.0*	-0.1-0.5	0.0003	1
BH119	0.3-0.05*	0-<0.05*	13.8*-18.2	-0.9-1.6	0.005	1
BH120	0.2-0.07*	0-<0.05*	3.18-3.5*	0-0.2	0.0004	1
BH125	0-0.05*	0.1-<0.05*	17.0*-18.3	-0.7-29	0.03	1
BH126	12-80.6*	0-<0.05*	3.3*-16.8	-0.2-1.8	**1.45**	**3**
BH127	0.3-0.4*	0-<0.05*	19.5*-19.9	-1.1-1.1	0.004	1
BH128	0-0.05*	0-<0.05*	19.7-21.0*	-0.6-1.3	0.0007	1
BH130	0-0.08*	0-<0.05*	20.4-20.9*	-1.9- 0.6	0.002	1

Note 1: Table above includes results of laboratory analysis gas samples (2005) in addition to monitoring of ground gas at boreholes using a portable gas analyser. This was completed on 18th Oct 2005 during low and falling atmospheric pressure (998mb fell to 992mb on the 20th Oct).
Note 2: * Values recorded by laboratory analysis of collected gas sample.
Note 3: typically the above boreholes were screened into the waste material and also into the top of the alluvium.

Table O2 summarises monitoring and laboratory analysis data relating to ground gases, methane (CH_4), carbon dioxide (CO_2), oxygen (O_2) and gas flows, prior to the 2012 investigation. Elevated methane concentrations were measured at BH116 and BH126 with respective maximum concentrations of 22% and 80.6%. This combined with maximum flows has resulted in GSVs of 0.4l/hr and 1.45l/hr respectively and respective CIRIA characteristic Situations of 2 and 3 respectively.

In conclusion, ground gas monitoring has been completed on 18 occasions under varying tidal and atmospheric conditions such that it is likely that monitoring has been completed under “worst case conditions” when ground gas concentrations and flows are likely to be at their highest. There is now a good understanding and characterisation of the ground gas regime at the East Tip.

The results of the gas monitoring and assessment have identified that the waste in the East Tip is not considered to be a significant source for the generation of ground gas with significant organic material not identified and recorded in the site investigations logs and an absence of significant ground gas concentrations observed in boreholes screened exclusively into the waste. Consequently, the waste material has been characterised as characteristic situation 1 in accordance with CIRIA guidance.

However the underlying alluvium in parts of the site, is generating elevated ground gases particularly in the area of BH316 with a maximum methane concentration of 93% which when combined with the flow results in a classification of characteristic situation 5 in accordance with CIRIA guidance. This is considered to be due decomposing natural organic material in the alluvium. Currently these elevated ground gas concentrations vent to air and can not build up in confined spaces (such as buildings) to cause risks to the current users of the site. However further consideration of the ground gas regime through further monitoring, risk assessment and or potentially installation of gas protection measures will be required for any future buildings to be constructed on site.

Appendix P Waste Type Generic Assessment

P1 Solid Waste Assessment - Human Health

The results of the analysis of the samples collected from waste horizons within the East Tip were assessed against GACs for Park and Commercial Land Uses in order to determine if the site could deemed as 'fit for use' under either of these scenarios. In undertaking this assessment data for samples collected from investigations in 2005, 2008 and 2012 were compared to the park land use GAC as presented in Tables P1, P2 and P3. Attempts to assess contamination characteristics of known waste streams present have also been completed as included in Section P2, however this is limited due to the heterogeneity of the waste material and the fact that the different waste types are mixed together, consequently only limited samples of "pure" waste types were collected.

Table P1 - Summary Analysis Results from Solid Samples in 2012 – Park Land Use

Contaminant	Number of Samples	Maximum Conc. (mg/kg)	Park Land Use Human Health GAC (mg/kg)	Number of Samples Exceeding	Location and Depth (mbgl)
Arsenic	93	119	41.4	17	BH301A (0.6-1), BH306A (5), BH312A (3.6-3.8), BH312B (1), BH312B (2.5), BH312B (5), BH312C (1), BH312C (2.3), BH312C (3.5), BH314 (2.2), BH314 (3.2), BH314 (5.3), BH315 (6), BH316 (0.2-0.5), OP10 (0.8), OP10 (2), OP14 (1.1-1.6).
Cadmium	93	553	83.6	2	BH312B (1), OP10 (2)
Lead	93	41700	477	24	BH301A (0.2-0.3), BH301A (4), BH302 (2), BH302 (5), BH303 (1), BH304 (2), BH304 (4.2), BH306a (9), BH308 (0.7-0.9), BH310A (1), BH312A (0.5-0.6), BH312A (2-2.1), BH312A (3.6-3.8), BH312B (1), BH312B (2.5), BH312B (5), BH312C (3.5), BH313 (2), BH314 (2.2), BH314 (5.3), BH315 (1), BH316 (0.2-0.5), OP10 (0.8), OP10 (2)
Nickel	93	2860	922	1	BH314 (2.2)
Vanadium	93	581	422	12	BH304 (4.2), BH306A (2), BH306B (6.5), BH307 (0.6), BH309 (5.5-6), BH310A (3), BH310A (9), BH310B (5), BH310B (8), BH313 (5), BH315 (1), OP10 (1.1)
Zinc	93	189000	54800	1	OP10 (2)

Table P1 summarises all solid chemical analysis results obtained from waste in the East Tip during the 2012 investigation. This includes samples obtained from slag waste, processed and unprocessed slag waste with inclusions of timber, concrete, metal, demolition waste, plastic, domestic waste, refractory waste, flue dust and sludge. Further detailed consideration is given to the different waste types in respect of contamination as in Section P2 of this appendix. Laboratory analysis results compared to relevant GACs are presented in Appendix D.

Heavy Metals

Measured concentrations of arsenic, cadmium, lead, nickel, vanadium and zinc concentrations exceeded the respective Atrisk GACs for a park land use (Appendix D).

Measured concentrations of arsenic exceeded the GAC in 17 No. out of 93 No. samples, with a maximum concentration of 119mg/kg measured in a sample from BH314 at 3.2mbgl comprised of slag with 50% demolition waste (plastic, textile, red brick, concrete and refractory bricks).

Cadmium concentrations exceeded the park land use GAC in 2 No. samples analysed, BH312 at 1mbgl which mainly comprised millscale and OP10 at 2mbgl described in the site investigation logs as “flue dust.” The later measured the maximum concentration of 553mg/kg compared to the GAC of 83.6mbgl.

Lead concentrations exceeded the relevant GAC in 24 No. out 93 No. samples analysed, with a maximum concentration of 41,700mg/kg observed in a sample obtained from OP10 at 2mbgl described in the site investigation logs as “flue dust”. However, this concentration is not typical of the other concentrations which exceed the GAC, with the next highest concentration of lead being 5770mg/kg.

1 No. sample from BH314 at 2.2mbgl from slag material with pockets of black material and metal wire exceeded the nickel GAC of 922mg/kg with a concentration of 2860mg/kg.

Vanadium concentrations exceeded the park land use GAC of 422mg/kg in 12 No. out of 93 No. samples analysed with a maximum concentration of 581mg/kg measured in a sample from BH309 at 5.5-6.0mbgl comprising of slag material.

Only 1 No. zinc concentration exceeded the GAC of 54,800mg/kg with a concentration of 189,000mg/kg observed in a sample obtained from “flue dust” encountered at OP10 at 2mbgl.

Concentrations of metals in waste samples are worthy of note in the area of BH312 (A, B & C) where a number of samples obtained from this area measured multiple metal contaminant concentrations in excess of the GAC. Lead concentrations exceed the park land use GAC in samples analysed from a variety of depths at BH312A including 0.5-0.6mbgl, 2-2.1mbgl and 3.6-3.8mbgl, BH312B at 1mbgl, 2.5mbgl and 5mbgl and from

BH312C and 3.5mbgl. The most significant concentration was observed at BH312B 1mbgl which comprised of millscale with some scrap metal, refractory waste and a minute amount of refuse waste. At this location elevated arsenic 81mg/kg and cadmium 896mg/kg were measured above the park land use GAC of 41.4mg/kg. Measured arsenic concentrations were in excess of the GAC in other samples obtained from this location including at BH312A at 3.6-3.8mbgl, BH312B at 1mbgl, 2.5mbgl and 5mbgl, BH312C at 1mbgl, 2.3mbgl and 3.5mbgl with concentrations ranging from 47.7mg/kg to 95.6mg/kg.

Samples obtained from BH314 also contained multiple metal concentrations, arsenic, lead and nickel, in excess of the park land use GAC. Arsenic concentrations were in excess of the GAC 41.4mg/kg in 3 No. out of 4 No. samples obtained from this location with a maximum concentration of 91mg/kg. Lead exceeded the park land use GAC 477mg/kg in 2 No. out of 4 No. samples with a maximum concentration of 2130mg/kg. A nickel concentration of 2860mg/kg observed at BH314 at 2.2mbgl exceeded the park land use GAC of 922mg/kg.

Organics

Concentrations of phenols in all 64 No. samples analysed were less than the park land use GACs with most concentrations less than laboratory detection limits.

Measured concentrations of speciated TPH did not exceed park land use GACs in all 17 No samples analysed. The analysis was generally targeted to samples with field based evidence of hydrocarbon contamination which is typically reflected in the analysis results in that concentrations of total TPH range from 60.6mg/kg-3230mg/kg with a maximum concentration measured in a sample from BH316 at 0.2-0.5mbgl in a sample comprised of slag material.

Typically concentrations of BTEX in samples analysed were less than laboratory detection limits and where concentrations were encountered they were measured they were significantly less than the park land use GAC.

Total concentrations of PAHs were also typically less than laboratory detection limits. Out of the 64 No. samples analysed concentrations ranged from 11.7mg/kg to 70mg/kg in the 5 No. samples with concentrations above laboratory detection limits.

Typically measured concentrations of VOCs and SVOCs were less than laboratory detection limits. Concentrations of PAHs compounds were measured above laboratory detection limits in 6 No. out of 17 No. analysed, however they were not measured in excess of park land use GACs and are therefore not of concern. Other SVOC concentrations were measured above laboratory detection limits, including 2methylnaphthalene in 1 No. sample with a concentration of 1.89mg/kg at BH312A at 5-5.1mbgl; Bis(2ethylhexyl)phthalate 1.92mg/kg at BH301A 4mbgl, 5.38mg/kg at BH304 at 4.2mbgl, 1.26mg/kg at BH312A at 3.6-3.8mbgl, 0.294mg/kg at BH312B 5mbgl, 0.452mg/kg at BH312C at 3.5mbgl, 0.274mg/kg at OP10 2mbgl and 0.241mg/kg at OP14 1.7mbgl. No park end use GAC is available for this contaminant however the concentrations do not exceed the CIEH residential end use GAC of 280mg/kg (CIEH, 2009). Measured carbazole concentrations were 0.247mg/kg at BH312A 3.6-3.8mbgl; dibenzofuran 0.2mg/kg and 0.156mg/kg at BH312A at respective depths of 3.6-3.8mbgl and 5-5.1mbgl. Commercially available GACs are not available for this contaminant. Ndibutyl phthalate was measured at concentrations of 0.25mg/kg at BH301A 4mbgl, 0.115mg/kg at BH304 4.2mbgl and 2.29mg/kg at BH312B 5mbgl, nDioctyl phthalate at BH312C 3.5mbgl. A park end use GAC is not available for this contaminant, however concentrations do not exceed the CIEH residential GAC of 13mg/kg (CIEH, 2009). These contaminants are therefore not of concern with respect to human health.

With the exception of samples obtained from BH312A at 3.6-3.8mbgl and 5-5.1mbgl and minor carbon disulphide concentrations, concentrations of VOCs were less than laboratory detection limits. Where concentrations were measured they were not in excess of available GACs. Samples obtained from BH312A are discussed further in Section P2 of this appendix.

Dioxins, furans and PCBs

Concentrations of dioxins and furans were measured above laboratory detection limits in all 5 No. samples analysed. Mostly concentrations were close to or within an order of magnitude of the laboratory detection limits. This is with the exception of a sample from OP10 at 2mbgl, which is detailed in Section P2.

Concentrations of PCBs were measured above laboratory detection limits in 6 No. samples out of 9 No. analysed. Total concentrations ranged from less than detection limits to 114µg/l measured in a sample obtained from BH301A at 0.2-0.3mbgl comprising of slag with occasional bricks and metal.

Table P2 - Summary Analysis Results from Solid Samples in 2012 – Commercial Land Use

Contaminant	Number of Samples	Maximum Conc. (mg/kg)	Commercial Land Use Human Health GAC (mg/kg)	Number of Samples Exceeding	Location and Depth (mbgl)
Cadmium	93	553	230	1	OP10 (2)
Lead	93	41700	4640	3	BH312B (1), BH312C (3.5), OP10 (2)
Nickel	93	2860	1800	1	BH314 (2.2)

Table P2 shows a low number of samples measuring concentrations of cadmium, lead and nickel in excess of the commercial land use GACs. This is considered to be significantly different when compared to assessment through comparison with park land use GACs which is a more sensitive land use. The samples with concentrations that exceed the commercial land use GAC are from samples which comprise either slag mixed with other waste material such as sludge or demolition waste and will therefore be discussed in further detail in Section P2 in this appendix.

In order to provide a more comprehensive assessment and fully consider all relevant data for the East Tip, laboratory analysis results obtained during the 2005 investigation (WYG, 2005) and 2008 investigations (WYG, 2008) are included within this assessment section as summarised in Table P3.

Table P3 - Summary Analysis Results from Waste Samples in 2005 and 2008

Contaminant	Number of Samples	Maximum Conc. (mg/kg)	Park Land Use Human Health GAC (mg/kg)	Number of Samples Exceeding	Location and Depth (mbgl)
Arsenic	45	126	41.4	12	BH125 (2.5), TP123 (1.6), TP125 (0.3), TP125A (0-2), TP126 (3-4.2), TP127 (0-0.5), TP131 (1.8), TP132 (2.5-3.5), TP132 (4.2), DIS101(0), DIS102(0), DIS104(0).
Lead	45	3043	477	10	BH125 (2.5), TP121 (0-0.4), TP123 (0-0.5), TP123 (1.6), TP125 (0.3), TP125 (3.3), TP126 (0-01), TP127 (0-0.5), TP128 (0-0.5), DIS103(0)
Benzo(a)pyrene	45	2.88	1.2	1	BH119 (7.2)

Note: GAC not available for total chromium, therefore chromium III GAC has been utilised and is considered appropriate given that prevalent form in the environment is chromium III due to its stability

The summarised laboratory analysis results from solid waste shown in Table P3 identifies that concentrations of arsenic, lead and benzo(a)pyrene exceeded the respective GACs for a park land use. However laboratory analysis results for other heavy metals including antimony, barium, boron, cadmium, chromium, hexavalent chromium, copper, mercury, nickel, selenium, vanadium and zinc did not exceed park land use GACs.

Measured arsenic concentrations in 9 No. samples exceeded the park land use GAC 41.4mg/kg with a maximum concentration of 126mg/kg measured at BH125 at 2.5mg/kg. Lead was also in excess of the GAC, 477mg/kg, at this location with a concentration of 798mg/kg.

Lead concentrations exceeded the park land use GAC, 477mg/kg, in 9 No. samples out of 41 No. samples analysed with a maximum concentration of 3043mg/kg measured at TP126 at 0-1mbgl.

Only 1 No. benzo(a)pyrene concentration exceeded the park land use GAC of 1.2mg/kg with a concentration of 2.88mg/kg measured in a sample obtained from BH119 at 7.3mg/kg. All other 40 No. samples analysed measured concentrations of speciated PAHs below the park land use GACs and in most instances were also less than laboratory detection limits.

Concentrations of other organics, such as phenol, speciated TPH and VOCs were not in excess of park land use GACs where available. Phenol concentrations were typically less than laboratory detection limits with a measured maximum concentration of 1.11mg/kg compared to the park land use GAC of 868mg/kg.

Dioxins and furans and PCBs

Speciated concentrations of dioxins and furans were encountered above laboratory detection limits for all 6 No. samples analysed, with maximum concentrations of the individual species ranging from less than laboratory detection limits for 1,2,3,4,7,8HxCDD and 1,2,3,7, PeCDD in all samples and 4 No. samples respectively, with a maximum of 1100ng/kg OCDD at TP131 1.8mbgl.

Total PCB concentrations were less than laboratory detection limits in 26 No. out of 44 No. samples analysed with a maximum concentration of 1544µg/kg observed at TP125 at 0.3mbgl.

In summary, it is considered that the measured contaminants fits with the conceptual understanding of the likely contaminant profile in that the predominant contaminants of concern include metals, with localised organic contamination associated with the deposition of sludge and other waste types.

P2 Waste Types

The waste material at the East Tip predominantly comprised of slag waste, however from the logs it is known that this is mixed with other waste types from the steel works including refractory, millscale, sludge, flue dust and construction and demolition type wastes. Domestic type waste has not been encountered in significant quantities. The waste is therefore heterogeneous and as a result there were difficulties in obtaining samples that were representative of each of the waste types as “pure” samples. Plans showing the locations of the different waste types encountered during the 2012 investigation in the East Tip are provided at the end of this Appendix and are summarised below:

- Refractory Waste – typically encountered at most locations at varying quantities mixed with slag. Quantities were typically low at most locations varying from occasional to approximately 10%. The presence of abundant refractory bricks was noted at BH308 0.7-0.9mbgl, 50% refractory at BH309 1.2-5mbgl and BH311 0.4-0.8mbgl;

- Millscale Waste – only encountered at four locations, however with greater quantities than compared to refractory waste. BH301A 0.7-1mbgl comprised of 100% millscale, although this was noted to be possibly flue dust, TP01 0.5-1.2mbgl comprised of 60% millscale with 5% metal and slag and TP02 comprised of millscale from 0.9-2mbgl.

- Sludge waste – predominantly noted at two locations BH306B 0-0.5mbgl comprised of slag with possible weathered sludge and BH312A sludge extending from 0.5 – 5.8mbgl
- Flue Dust – identified at one location only OP10 at 2mbgl, noted in the site investigation logs as "flue dust" and confirmed by the measured contaminants concentrations observed at this location.
- Construction and demolition type waste – observed at a number of locations, however typically low quantities were mixed with slag waste. The most significant quantities were observed at BH306C 0-1mbgl comprised of demolition rubble (concrete and bricks) with slag, BH312A 0.6-5.8mbgl varying from 25% to 50% construction and demolition waste (steel wire, concrete, redbrick and fabric) and BH314 4-6mbgl comprising of wood, glass, concrete, re-bar and glass.

P2.1 Slag Waste only

Table P4 includes a summary of laboratory analysis results for 100% slag material which from the site investigation logs appear to not include other waste inclusions such as refractory, demolition, metal, sludge, timber and concrete. Any samples containing any other waste material apart from slag were removed from the dataset, consequently the results presented below are of samples comprising of 100% slag. The aim was to purely consider the contaminative potential of slag waste only. The laboratory analysis as compared to GACs is included in Appendix D.

Table P4 - Summary Analysis Results from 100% Slag Samples in 2012

Contaminant	Number of Samples	Maximum Conc. (mg/kg)	Park Land Use Human Health GAC (mg/kg)	Number of Samples Exceeding	Location and Depth (mbgl)
Arsenic	22	80	41.4	1	BH316 (0.2-0.5)
Lead	22	1010	477	3	BH301A (4), BH303 (1), BH316 (0.2-0.5)
Vanadium	22	581	422	7	BH309 (5.5-6), BH310A (3), BH310A (9), BH310B (5), BH310B (8), BH313 (5), OP10 (1.1)

The results summarised in Table P4 show that the majority of metal and organic contaminant concentrations, as analysed from slag material only, do not exceed relevant park land use or commercial land use GACs. This is with the exception of arsenic, lead and vanadium.

In total 1 No. out of 22 No. samples analysed measured an arsenic concentration in excess of the park land use GAC, 41.4mg/kg, with a maximum concentration of 80mg/kg measured in a sample obtained from BH316 0.2-0.5mbgl. 3 No. samples measured lead concentrations in excess of the park land use GAC, 477mg/kg, with a maximum concentration of 1010mg/kg measured at BH303 at 1mbgl. 7 No. samples measured vanadium marginally in excess of the park land use GAC with a maximum concentration of 581mg/kg measured at BH309 at 5.5-6mbgl.

With the exception of phthalates and speciated PAH compounds, concentrations of SVOCs were less than laboratory detection limits and therefore park and commercial land use GACs. Concentrations of speciated PAHs were measured above laboratory detection limits in 2 No. out of 6 No. slag samples analysed, however concentrations were not in excess of park and commercial land use GACs and are not of concern in respect to human health. Concentrations of bis(2Ethylhexyl)phthalate were measured above laboratory detection limits in 2 No. out of 6 No samples analysed and nDibutyl phthalate in 1 No. sample out of 6 No. samples analysed. Bis(2Ethylhexyl) phthalate concentrations are not in excess of the relevant GACs and are therefore not of concern in respect to human health.

Concentrations of VOCs were less than laboratory detection limits for all 6 No. samples analysed and were also below relevant GACs where available. They are not of concern with respect to human health.

Dioxin and furan analysis results for 1 No. sample analysed typically measured concentrations that were slightly greater than laboratory detection limits.

Minor concentrations of PCBs were measured in 2 No. out of 3 No. samples analysed with a total PCB concentration of 62.3mg/kg measured in a sample from OP14 at 1.7mbgl.

A sample of slag was analysed from BH301A at 4mbgl which was noted on the borehole log to have a “hydrocarbon odour”. Consequently speciated TPH analysis was targeted to this sample and measured concentrations above laboratory detection limits for TPH aliphatic and aromatic carbon fractions in the C6-C44 carbon fraction range, with the greatest concentrations measured for the heavier fractions. These concentrations were not in excess of park land use or commercial land use GACs and are therefore not of concern with respect to human health. The maximum total TPH concentration, 3230mgkg, from 6 No. samples analysed, was measured in a sample obtained from BH316 at 0.2-0.5mbgl. In this sample with the exception of C5-C8 aromatic carbon fractions, concentrations of the aliphatic and aromatic carbon fractions were measured above laboratory detection limits with the greatest concentrations measured in the heavier fractions, e.g. 1220mg/kg C21-C35 aliphatic TPH compared to 0.099mg/kg C5-C6 aliphatic TPH. Again none of the speciated TPH concentrations exceeded park or commercial land use GACs. Concentrations of benzene, toluene, ethylbenzene and xylene (BTEX), were less than laboratory detection limits in all 6 No. samples analysed. These contaminants are therefore not of concern with respect to human health.

Typically the analysed samples being assessed in this section comprised of unprocessed slag, however during the investigation processed slag was encountered in the east of the East Tip mainly at BH310A, BH310B and BH310C which are located in the same area and then to a lesser extent at BH313 (1m thickness) and BH314 (0.5m thick) which are located in the south of the East Tip. 3 No. samples of processed slag were selected for laboratory analysis. The sample from BH310A at 3mbgl, contained a vanadium concentration 438mg/kg, which is marginally in excess of the park land use GAC of 422mg/kg. However samples obtained from BH310C at 0.6-0.8mbgl and BH314 0-0.5mbgl did not measure heavy metal concentrations in excess of park land use or commercial land use GACs.

P2.2 Refractory Waste

Table P5 includes a summary of laboratory analysis results for samples that contained varying proportions of refractory waste. The laboratory analysis results compared to GACs are included in Appendix E. Generally where refractory waste was observed it was found to be mixed with varying quantities of slag material and other waste types. The sample obtained from BH311 at 0.5-0.6mbgl contained the greatest proportion of refractory waste comprising of slag with 50% refractory brick. It is possible that the sample obtained from BH308 also contains a high proportion of refractory waste as the logs describe this sample as “slag with abundant refractory brick”, however this suggests that the main waste component of this sample is slag. Other samples contained varying amounts of refractory waste from occasional up to 20%. It should also be noted that often refractory waste was mixed with other waste types aside from slag, for example demolition material (BH306B, BH312B and BH314) and waste steel and scrap metal (BH312A, BH312B and BH312C).

Table P5 - Summary Analysis Results from Solid Samples in 2012 – Refractory Waste

Contaminant	Number of Samples	Maximum Conc. (mg/kg)	Park Land Use Human Health GAC (mg/kg)	Number of Samples Exceeding	Location and Depth (mbgl)
Arsenic	12	119	41.4	3	BH312B (5), BH312C (2.3), BH314 (3.2)
Lead	12	1270	477	7	BH304 (2), BH304 (4.2), BH308 (0.7-0.9), BH311 (0.5-0.6), BH312A (5), BH312B (5), BH313 (2)
Vanadium	12	498	422	1	BH304 (4.2)

The results summarised in Table P5, show that the majority of contaminant concentrations did not exceed applicable GACs. This is with the exception of arsenic, lead and vanadium. In total 3 No. out of 12 No. samples contained arsenic concentrations above the park land use GAC with a maximum concentration of 119mg/kg was measured in a sample from BH314 3.2mbgl, comprising of slag with 50% demolition waste; 7 No. samples contained lead and 1 No. sample contained vanadium above the applicable GAC. This appears to similar to that observed for slag waste in Table P4 and is most likely due to the fact that commonly most of the samples mainly comprised of slag with up to 20% refractory.

The sample with the greatest volume of refractory waste was BH311 at 0.5-0.5mbgl which was noted as slag with 50% refractory brick. Contaminant concentrations measured in this sample did not exceed applicable GACs, this includes heavy metals, speciated phenols and PAHs. The later measured contaminant concentrations less than laboratory detection limits.

Speciated TPH and BTEX analysis was completed on 4 No. samples and concentrations were measured above laboratory detection limits, however concentrations were not in excess of park land use or commercial GACs and are not of concern in respect to human health. A maximum total TPH concentration of 1100mg/kg was measured at BH312B 5mbgl which was the location where steel barrels with tar waste were observed and as a result the measured concentrations are considered to be associated with this waste type as opposed to refractory waste.

SVOC and VOC analysis was completed on 4 No. samples with most VOC/SVOC compounds found at concentrations were measured at less than laboratory detection limits. Concentrations of speciated PAHs, bis(2Ethylhexyl) and nDibutyl phthalate were measured in 2 No. samples however they did not exceed relevant GACs where available and are not of concern in respect to human health as a result.

P2.3 Millscale

Table P6 includes a summary of laboratory analysis results for samples containing millscale waste. The laboratory analysis compared to GACs are included in Appendix F. 2 No. out of 7 No. samples analysed were comprised of 100% millscale (BH312B at 2.5mbgl and OP14 at 1.1-1.6mbgl). The sample obtained from BH301A at 0.6-1mbgl was described as millscale possible flue dust and BH312B at 1mbgl as millscale with some scrap metal/occasional amounts of refractory brick and minute amount of refuse waste on the driller borehole logs. The other 3 No. samples were described as clay with slag and possible millscale and 5% timber, 2% refractory, 1% construction and 2% plastic refuse waste (BH302 at 2mbgl), slag with possible millscale (BH302 at 5mbgl) and slag with 20% millscale (OP10 at 0.8mbgl).

Table P6 - Summary Analysis Results from Waste Samples with Millscale in 2012

Contaminant	Number of Samples	Maximum Conc. (mg/kg)	Park Land Use Human Health GAC (mg/kg)	Number of Samples Exceeding	Location and Depth (mbgl)
Arsenic	7	115	41.4	5	BH301A (0.6-1), BH312B (1), BH312B (2.5), OP10 (0.8), OP14 (1.1-1.6)
Cadmium	7	95.9	83.6	1	BH312B (1)
Lead	7	5480	477	5	BH302 (2), BH302 (5), BH312B (1), BH312C (2.5), OP10 (1.1-1.6)

The results summarised in Table P6, show that the majority of contaminant concentrations, as measured in samples containing millscale, did not exceed applicable GACs. This is with the exception of arsenic, cadmium and lead. In total 5 No. out of 7 No. samples measured arsenic concentrations above the park land use GAC with a maximum concentration of 115mg/kg measured in a 100% millscale sample obtained from BH312B at 2.5mbgl. With the exception of a sample obtained from OP10 at 0.8mbgl, comprising of slag with 20% millscale. The other samples with concentrations in excess of park land use GACs were also from material comprising 100% millscale.

1 No. sample obtained from BH312B at 1mbgl measured a cadmium concentration of 96mg/kg which is marginally in excess of the GAC 83.6mg/kg.

5 No. samples out of 7 No. measured lead concentrations in excess of the park land use GAC. The maximum lead concentration was measured at BH312B at 1mbgl, which also measured elevated arsenic and cadmium above park land use GACs as noted above. This concentration, 5480mg/kg, also exceeds the commercial land use GAC of 4640mg/kg.

The sample obtained from BH312B at 2.5mbgl noted in the investigations logs as millscale, exhibited the maximum arsenic concentration of 115mg/kg. The maximum lead concentration was measured in a sample obtained from BH312B which comprised of millscale mixed with scrap metal, occasional refractory and a minute amount of refuse type waste. Generally a higher percentage of samples exceeding GACs was observed for millscale waste when compared to the slag waste dataset (Table P4).

As part of the 2008 investigation, one sample was also obtained from millscale (DIS-104). This measured arsenic at a concentration of 47mg/kg which marginally exceeds the park land use GAC, 41.4mg/kg.

All other contaminant concentrations as analysed did not exceed park land use and commercial land use GACs and are not of concern in respect to human health as a result. This includes heavy metals antimony, barium, beryllium, boron, chromium, hexavalent chromium, copper, mercury, nickel, selenium and zinc.

In regard to organics, concentrations were less than available park land use and commercial land use GACs. Concentrations of speciated phenols were all less than laboratory detection limits in all 7 No. samples analysed and are therefore not of concern. Speciated TPH and BTEX analysis was completed on 2 No. samples with concentrations of lighter carbons fractions (<C12 aliphatic and <C16 aromatic) measured as less than laboratory detection limits. Total TPH concentrations for the two samples analysed were 71.3mg/kg and 277mg/kg and their respective fractions did not exceed applicable GACs. Consequently they are not of concern with respect to human health.

Analysis for SVOC and VOCs in samples obtained from OP10 at 0.8mbgl (slag with 20% millscale) and OP14 at 1.1-1.6mbgl (100% millscale), did not measure concentrations above laboratory detection limits and therefore they were not in excess of available park land use and commercial land use GACs. They are not of concern as a result.

3 No. samples were selected for PCB analysis, BH301A 0.6-1mbgl (100% millscale), OP10 0.8mbgl (slag with 20% millscale) and OP14 1.1-1.6mbgl (100% millscale) with concentrations measured as less than laboratory detection limits. PCB concentrations are therefore not of concern.

Low concentrations of dioxins and furans were measured in the 2 No. samples analysed with concentrations measured as close to the laboratory detection limits and for a number of the fractions, concentrations were less than laboratory detection limits. The maximum concentration was 14ng/kg OCDD which was measured in the sample obtained from OP10 at 0.8mbgl, comprising of slag with 20% millscale.

P2.4 Sludge

Table P7 includes a summary of laboratory analysis results for sludge waste as compared to park and commercial land use GACs. The analysis results compared to GACs are included in Appendix G. In total 4 No. samples were selected for chemical laboratory analysis. The quantity of sludge in the samples varied from 100% sludge observed in the sample obtained from BH312A at 0.5-0.5mbgl to slag with pockets of black material (assumed to be sludge) in the sample obtained from BH314 at 2.2mbgl.

Table P7 - Summary Analysis Results from Solid Samples in 2012 – Sludge

Contaminant	Number of Samples	Maximum Conc. (mg/kg)	Park Land Use Human Health GAC (mg/kg)	Number of Samples Exceeding	Location and Depth (mbgl)
Arsenic	3	95.6	41.4	2	BH312A (3.6-3.8), BH314 (2.2)
Lead	3	3090	477	3	BH312A (0.5-0.6), BH312A (3.6-3.8), BH314 (2.2)
Nickel	3	2860	922	1	BH314 (2.2)

Table P7 identifies that for sludge waste elevated concentrations of arsenic, lead and nickel were measured above the park land use GACs. Arsenic concentrations exceeded the park land use GAC, 41.4mg/kg, in 2 No. out of 3 No. samples analysed with a maximum concentration of 96mg/kg measured at BH312A at 3.6mbgl noted in the logs as comprising of sludge surrounded by an old barrel, all 3 No. samples measured lead concentrations in excess of the park land use GAC with a maximum concentration of 3090mg/kg and 1 No. nickel concentration was measured in excess of the park land use GAC with a concentration of 2860mg/kg.

Hydrocarbons are considered to be contaminants of concern in respect of sludge. The laboratory analysis results for 3 No. samples analysed measured concentrations of hydrocarbons, (TPH, BTEX and PAHs) above laboratory detection limits, however they were not in excess of applicable GACs and as a result are not of concern in respect to human health.

The investigation completed in 2008 (WYG, 2008) included collecting two discrete samples specifically from sludge surface materials (DIS101 and DIS102), from an area referred to as the “contractor excavations”. The analysis results measured elevated concentrations of arsenic in excess of the park land use GAC 41.4mg/kg with respective concentrations of 60mg/kg and 93mg/kg. These concentrations do not exceed the commercial land use GAC. All other concentrations of heavy metals were less than park land use and commercial land use GACs where available. Low concentrations of speciated TPHs comprising of the heavier aliphatic fractions (>C12) were measured, however they were not in excess of both park and commercial land use GACs and are not of concern in respect to human health as a result. Concentrations of PAHs and PCBs were less than detection limits (<1mg/kg) in both samples analysed and as a result are also not of concern.

P2.5 Construction and Demolition Waste

Table P8 includes a summary of laboratory analysis results in relation to construction and demolition type waste as encountered, sampled and analysed from the East Tip. The laboratory results compared to relevant GACs are included in Appendix H. From the site investigation logs generally low volumes of demolition waste were encountered observed as occasional construction and demolition type waste mixed with slag. The results summarised below are from samples comprising of varying quantities of demolition mixed with slag material, with 9 No. out 12 No. samples comprising of less than 25% demolition waste. The remaining 3 No. samples were described in the borehole logs as concrete, red brick and fabric, 50% cream ash with possible refractory, in a clayey sandy gravel (BH312A 2-2.1mbgl), slag with 50% demolition waste (plastic, textile, red brick, concrete and refractory (BH314 3.2mbgl) and demolition waste: wood, glass, concrete, glass bottles, red brick, oil filters (BH314 5.3mbgl).

Table P8 - Summary Analysis Results from Solid Samples in 2012 – Construction and Demolition Type Waste and Slag with Demolition Waste

Contaminant	Number of Samples	Maximum Conc. (mg/kg) & Location	Park Land Use Human Health GAC (mg/kg)	Number of Samples Exceeding	Location and Depth (mbgl)
Arsenic	10	119	41.4	5	BH312B (5), BH312C (1), BH312C (3.5), BH314 (3.2), BH314 (5.3)
Lead	10	5770	477	5	BH302 (2), BH312A (2-2.1), BH312B (5), BH312C (3.5), BH314 (5.3)
Vanadium	10	470	422	1	BH306B (6.5))

Table P8 identifies that for demolition type waste including that mixed with slag, concentrations of arsenic, and lead exceeded the park land use GAC in approximately half the samples analysed and vanadium in 10% of samples analysed. Analysis for other heavy metals did not measure concentrations in excess of relevant GACs.

Arsenic concentrations exceeded the park land use in 5 No. samples out of 10 No. samples analysed, with a maximum concentration of 119mg/kg measured in a sample obtained from BH314 3.2mbgl comprising of slag with 50% demolition waste (plastic, textile, red brick, concrete and refractory). This concentration does not exceed the commercial land use GAC, 64mg/kg. Concentrations of other metals were not in excess of applicable GACs in this sample.

5 No. lead concentrations exceeded the park land use GAC 477mg/kg and 1 No. exceeded the commercial GAC 4640mg/kg with a maximum concentration of 5770mg/kg measured in a sample obtained from BH312C 36.5mbgl comprising of slag with 20% waste steel and 5% demolition.

1 No. vanadium concentration 470mg/kg marginally exceeded the park land use GAC of 422mg/kg in a sample obtained from BH306B at 6.5mbgl described as slag with green rubble concrete. Vanadium concentrations did not exceed the commercial land use GAC, 3160mg/kg, in all 10 No. samples analysed.

In regard to samples containing the greatest proportions of demolition material such as BH312A 2-2.1mbgl comprising of concrete, red brick and fabric with 50% cream ash with possible refractory in a clayey sandy gravel and BH314 5.3mbgl comprising of demolition waste: wood, glass, concrete, glass bottles, red brick, oil filters, concentrations of lead and arsenic exceeded the park land use GAC but were less than commercial land use GACs. Both lead concentrations, 1250mg/kg and 2130mg/kg respectively exceeded the GAC of 477mg/kg and one arsenic concentration, 48.5mg/kg, (BH314 5.3mbgl) exceeded the park land use GAC, 41.4mg/kg.

In regard to organics, concentrations were less than relevant park land use and commercial land use GACs. Concentrations of speciated phenols were all less than laboratory detection limits in all 10 No. samples analysed with the exception of a minor phenol concentration of 0.011mg/kg just above the laboratory detection limit of 0.01mg/kg. Phenol concentrations are therefore not of concern.

Speciated TPH and BTEX analysis was completed on 5 No. samples with concentrations of most hydrocarbon fractions measured above laboratory detection limits. Total TPH concentrations ranged from 286mg/kg to 3170mg/kg at BH312A 5-5.1mbgl which comprised of 50% sludge, 25% steel wire concrete, red brick and fabric, 25% cream ash possible refractory. The measured concentrations could therefore be due to the observed sludge at this location.

P2.6 Flue Dust

Table P7 includes the analysis results for 1 No. flue dust sample analysed. Flue dust was only observed at one location during the site investigation works. The laboratory analysis results have been compared to park and commercial land use GACs. The analysis results compared to GACs are included in Appendix G. The analysis measured concentrations of arsenic, cadmium, lead and zinc above the park land use GACs. The cadmium concentration of 553mg/kg also exceeded the commercial land use GAC of 230mg/kg and the lead concentration of 41,700mg/kg exceeded the commercial land use GACs. The zinc concentration of 189,000mg/kg exceeded the park land use GACs but was below the commercial land use GAC of 665,000mg/kg. The lead and zinc concentrations are the maximum concentrations measured across all solid samples analysed during the 2012 investigation and as a result this location is considered to be a potential hotspot of contamination.

P3 Waste Type Leachability Analysis

NRA Leachability test results from the 2012 investigation were considered for each of the identified waste types as below. The aim was to consider which of the waste types would contribute the most contaminant concentrations through the solid leaching to groundwater pathway.

It should also be noted that the use of NRA leachability test results in generic assessments adds conservatism as the laboratory grinds down the sample providing a larger surface from contaminants to leach from where in reality most of the measured concentrations are locked within the matrix of the material and are not exposed.

P3.1 Leachability Analysis – Slag only

Generally, samples obtained from waste material which comprised only of slag did not contain leachable metal contaminant concentrations that exceeded applicable WQS. This included samples obtained from BH304 at 5.5-6mbgl, BH309 at 6.5-7mbgl and BH310B at 5.4mbgl although this sample also contained 10% metal. This is with the exception of BH306A at 7mbgl which had an elevated leachable chromium VI at a concentration of 0.034mg/l compared to the WQS of 0.0006mg/l and OP10 at 1.1mbgl where a chromium concentration of 18.4µg/l exceeded the WQS 4.6µg/l.

Leachable PAHs compound concentrations for anthracene and fluoranthene, 0.4µg/l and 0.2µg/l respectively, also marginally exceeded the WQS of 0.1µg/l at BH312A at 7mbgl. Elevated pH concentrations above the WQS of 9 pH were measured in most samples obtained exclusively from slag material (BH304 5.5-6mbgl, BH309 6.5-7mbgl, BH316 0.2-0.5mbgl and OP10 1.1mbgl) with pHs ranging from 10.3-11.1.

P3.2 Leachability Analysis – Sludge

The sample obtained from sludge, BH312A at 4-4.1mbgl, did not contain leachable metal concentrations in excess of applicable WQSs. A marginally elevated concentration of a PAH compound, fluoranthene, was measured 0.127µg/l, which marginally exceeded the WQS of 0.1µg/l.

P3.3 Leachability Analysis - Refractory Waste

The sample obtained from BH311 at 0.5-0.6mbgl which comprised of slag with 50% refractory waste, contained leachable metal concentrations above applicable WQSs for the following:

- Aluminium - 665µg/l compared to WQS of 200µg/l;
- Chromium - 192µg/l compared to WQS of 4.6µg/l
- Chromium VI – 221µg/l compared to WQS of 0.6µg/l

- Copper – 9.81µg/l compared to WQS of 5µg/l; and
- Lead – 15.6 µg/l compared to WQS of 7.2 µg/l

Leachable PAH compounds were measured as marginally in excess of WQSs, with an anthracene concentration 0.116 µg/l compared to the WQS of 0.1 µg/l and fluoranthene 0.37 µg/l compared to the WQS of 0.1 µg/l. Other PAH compound concentrations did not exceed available WQSs and in a number of instances were less than laboratory detection limits.

Slag with 20% refractory waste was observed at BH305 at 4-4.5mbgl and measured the maximum aluminium concentration of 6840µg/l compared to the WQS of 200µg/l. No other leachable metal concentrations were measured in excess of the WQS in this sample. A PAH compound, fluoranthene 0.134µg/l, marginally exceeded the WQS of 0.1µg/l in this sample.

5% refractory waste in slag was observed at BH303 at 3mbgl and measured:

- Aluminium 1190µg/l compared to the WQS of 200µg/l;
- Chromium 418µg/l compared to the WQS of 4.6µg/l; and
- Chromium VI 422µg/l compared to the WQS of 0.6µg/l.

10% waste steel was also observed in this sample.

BH312C at 2.6mbgl contained 2.5% refractory in slag, 5% steel and 0.5% waste plastic and measured leachable metal concentrations in excess of WQS as follows:

- Aluminium 1050µg/l compared to the WQS of 200µg/l;
- Chromium 37µg/l compared to the WQS of 4.6µg/l;
- Chromium VI 44µg/l compared to the WQS of 0.6µg/l; and
- Copper 20µg/l compared to WQS of 5µg/l.

P3.4 Leachability Analysis - Millscale

Samples were obtained from encountered millscale at OP10 at 0.8mbgl and measured leachable metal contaminant concentrations as follows:

- Aluminium - 494µg/l compared to WQS of 200µg/l;
- Chromium - 38µg/l compared to WQS of 4.6µg/l;
- Chromium VI – 39µg/l compared to WQS of 0.6µg/l; and
- Copper – 5.02µg/l marginally in excess of WQS of 5µg/l.

OP14 at 1.1-1.6mbgl also was comprised of 100% millscale with leachable metal concentrations in excess of relevant WQSs as follows:

- Chromium – 7.4µg/l compared to WQS of 4.6µg/l; and
- Copper – 18.8µg/l marginally in excess of WQS of 5µg/l.

P3.5 Leachability Analysis – Flue Dust

Flue dust was encountered at one location OP10 at 2mbgl with leachable metal contaminant concentrations in excess of WQS as follows;

- Aluminium - 280µg/l compared to WQS of 200µg/l;
- Cadmium – 0.26µg/l compared to WQS of 0.2µg/l;
- Chromium – 8.74µg/l compared to WQS of 4.6µg/l;
- Lead – 255µg/l compared to WQS of 7.2 µg/l;
- Mercury -0.162µg/l compared to WQS of 0.05µg/l; and
- Zinc - 124µg/l compared to WQS of 40µg/l.

P3.6 Leachability Analysis – Construction and Demolition Type Waste

Leachability analysis conducted on samples containing construction and demolition type waste measured elevated leachable metal concentrations in excess of WQSs. Although it should be noted that the strata where samples were obtained from contained low proportions of construction and demolition type waste (=/<10%) and mainly comprised slag material. Locations with leachable concentrations that exceeded WQSs are as follows:

BH303 at 0.2mbgl and 3mbgl (slag with 5%-10% waste steel in construction form):

- Aluminium (3mbgl only) - 1190 µg/l compared to WQS of 200 µg/l;
- Chromium – 15.9µg/l and 418 µg/l compared to WQS of 4.6µg/l;
- Chromium VI (3mbgl only) – 422µg/l compared to WQS of 0.6µg/l;
- Copper (0.2mbgl only) -10.9µg/l compared to WQS of 5µg/l.

However a sample analysed from BH306B at 2mbgl from slag with occasional demolition waste did not measure leachable metal concentrations in excess of applicable WQSs.

P3.7 Conclusions

Whilst a review of data as presented in the above sections to assess the contaminant status of each of the different waste streams in the East Tip has been completed it should be noted that this is limited by the heterogeneity of the material and the fact that the different waste streams are mixed together. Only limited analysis of pure waste stream samples could be completed as a result. None the less it appears from the analysis results of samples of each of the different waste types that flue dust as expected contains the highest metal contaminant concentrations as totals and leachable concentrations. However it is worth noting that flue dust was observed at only 1 location OP10 and is therefore not present is large volumes in the East Tip. Slag waste which appears to be the predominant waste stream type, appears to contain the lowest contaminant concentrations of total and leachable metals with approximately 5-22% of metal concentrations exceeding the park land use GAC. This compares to 14-71% of millscale samples analysed containing metal concentrations in excess of the park land use GAC and 5-50% in regard to construction and demolition type waste.

Construction and Demolition Waste

Location	Depth (m)	Description
BH302	1-3.2	Dark borwn, slightly sandy CLAY with unprocessed Slag and possible millscale, approx.5% timber, 2% refractory brick, **1% construction waste** and 2% household plastic waste

Location	Depth (m)	Description
BH301	2-3	Dark brown/ black, unprocessed SLAG in granular form with approx. **10% concrete, broken bricks, rubble and 1% plastic**

Location	Depth (m)	Description
BH303	0-1	Dark brown, slightly sandy gravelly unprocessed SLAG with 1% waste plastic and **5% waste steel in construction form** and occasional broken red brick

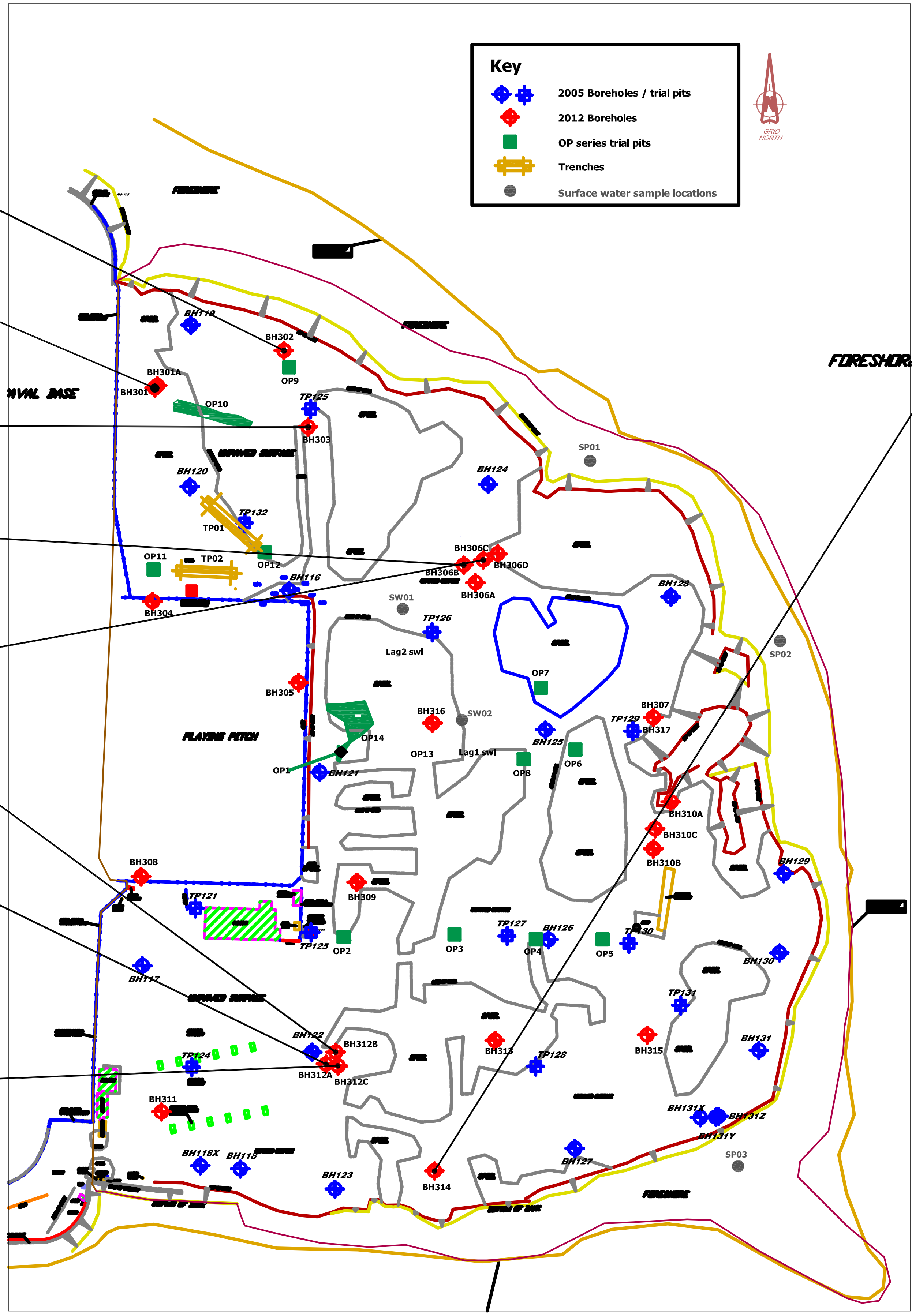
Location	Depth (m)	Description
BH306B	2.5-3	Grey, unprocessed SLAG with approx. 10% steel waste, **occasional pieces of demolition material** and occasional refractory bricks. Slag is present in slightly sandy slightly gravelly granular form with cobble sized pockmark pieces

Location	Depth (m)	Description
BH306C	0-1	**Demolition rubble (concrete and bricks)** with slag

Location	Depth (m)	Description
BH312B	3.6-5	Scrap metal with refractory bricks, sands, gravels and some **black demolition waste.** Hydrocarbon odour and iridescent 3.6-4m. Steel barrels containing tar at 4.5m

Location	Depth (m)	Description
BH312A	0-0.5	Made ground: Dark brown, slightly clayey sandy GRAVEL with **steel wire, concrete, red brick and fabric - possible demolition material**
BH312A	0.6-4.8	**50% demolition material (steel wire, concrete, red brick & fabric)** with 50% cream ash like material with yellow bricks (possibly refractory waste)
BH312A	4.8-5.8	Sludge (50%), **possible demolition material (25%)** (steel wire, concrete, red brick & fabric) cream ash like material with refractory bricks (25%) becoming oily in appearance from 4.8-5.8m

Location	Depth (m)	Description
BH312C	0.8-2.2	Dark brown/ grey unprocessed SLAG in granular and cobble sized form with some cream/ white SLAG, waste steel (approx.15%), **demolition waste - glazed tiles (approx.5%)** and plastic (approx.1%)
BH312C	2.8-5	Dark brown/ grey unprocessed SLAG in granular and cobble to boulder size, pockmarked form with waste steel (approx.20%) and **demolition waste (approx.5%)**



Location	Depth (m)	Description
BH314	0.5-1.5	Unprocessed, grey SLAG ranging from sand to cobble sized with approx. **30% demolition waste** consisting of metal, brick, timber, plastic and glass
BH314	2.6-3	Unprocessed SLAG. Oxidised red in colour with pockets of black materail. Predominantly fine grained with many pieces of wire, metaland metal shavings (approx. 15%) with approx. 25% cobble sized, highly weathered and oxidised pieces and **15% demolition waste** consisting of metal, brick, plastic and glass
BH314	3-4	Unprocessed SLAG. Oxidised red in colour with pockets of black material. Predominantly fine grained with **50% demolition waste: plastic textile, red brick, concrete** and rear yellow refractory brick
BH314	4-4.5	**Demolition waste - wood, glass, concrete, re-bar, glass bottles, red brick,** oil filters and plastic sheeting (4-4.5 includes 20% sand and gravel and 10% raw steel) 4-6m water is slightly iridescent, occasional black slick in water: run off from spoil heap
BH314	4.5-6	**Demolition waste: Wood, glass, mass concrete, re-bar,** glass bottles, red brick, oil filters and plastic sheeting (NB depth not proven)

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Project:
East Tip, Haulbowline

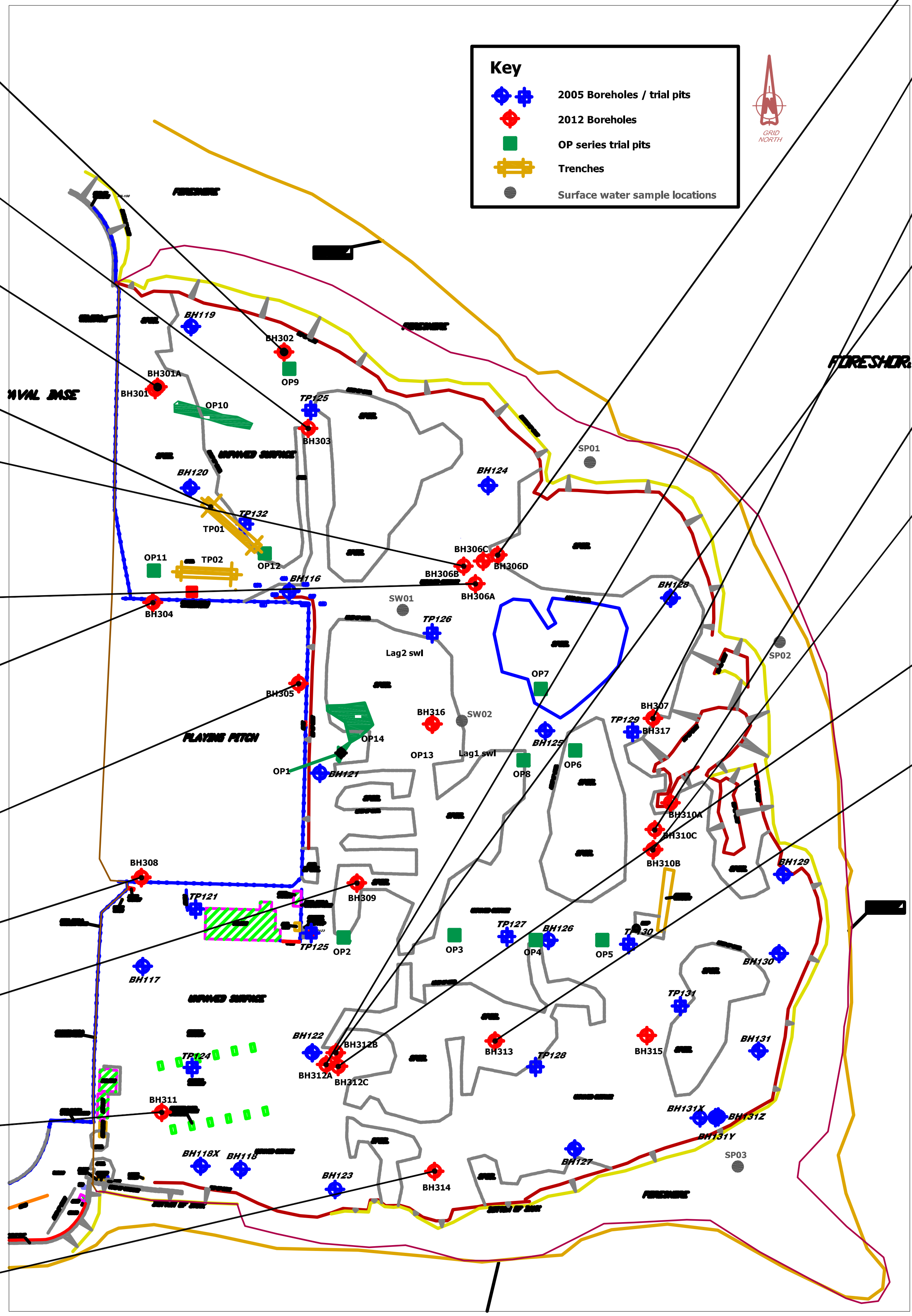
Drawing Title:
Construction and Demolition Waste

Scale @ A3	Drawn	Date	Checked	Date	Approved	Date
NTS	SG	03/13	YB	03/13	YB	03/13

Project No.	Office	Type	Drawing No.	Revision
A075294	4616	581		

DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS

Refractory Waste



Location	Depth (m)	Description
BH302	1-3.2	Dark borwn, slightly sandyCLAY with unprocessed Slag and possible mill scale, approx. 5% timber, **2% refractory** brick, 1% construction waste and 2% household plastic waste
BH302	7.5-8.8	Light to dark grey, unprocessed SLAG with bricks, steel and some plastics

Location	Depth (m)	Description
BH303	3-4.5	Light to dark grey, slightly sandygravelly unprocessed SLAG with 15% cobble sized, pockmarked pieces, 10% waste steel and **5% refractory brick**

Location	Depth (m)	Description
BH301A	1.3-2.4	Unprocessed, furnaced, postmarked **SLAG with refractory brick**, approximately 1% timber and 1% metal
BH301A	3.4-5	Unprocessed, furnace SLAG with approximately 2% plastic, 1% metal, **refractory bricks** and cobbles (10%)

Location	Depth (m)	Description
TP01	1.2-3.5	Slag with 10% metal waste, **2% refractories** 1No. IBC bag <1% car parts

Location	Depth (m)	Description
BH306B	0.5-2.5	Grey, unprocessed SLAG with occassional pieces of demolition material and **occasional refractory bricks.** Slag is present in slightly sandy slightly gravelly granualr form with cobble sized pockmarked pieces
BH306B	2.5-3	Grey, unprocessed SLAG with approximately 10% steel waste, occassional pieces of demolition material and **occasional refractory bricks.** Slag is present in slightly sandy slightly gravelly granular form with cobble sized, pockmarked pieces

Location	Depth (m)	Description
BH306A	2-3	Light grey/ dark grey, gravel and cobble sized, unprocessed SLAG with scrap metal (10%) and **occasional refractory bricks**

Location	Depth (m)	Description
BH304	1.2-3	Grey/ black unprocessed SLAG with approx. 2% plastic, **10% refractory bricks** and 1% metal
BH304	3-4.5	Grey/ black, unprocessed SLAG with small pieces of metal, molten and pockmarked pieces and **2% pieces of refarctory bricks.** 3.0-4.5m : Hydrocarbon sheen on water surface

Location	Depth (m)	Description
BH305	3.1-4.7	Unprocessed SLAG in gravel and pockmarked cobbles sazes approx. **20% refractory bricks**

Location	Depth (m)	Description
BH308	0.7-0.9	Fill: Grey unprocessed SLAG with **abundant yellow refractory bricks**

Location	Depth (m)	Description
BH309	0.7-1.2	Light grey, unprocessed SLAG in granular and cobble form with **broken refractory bricks (approx. <1%)**
BH309	1.2-5	Unprocessed SLAG with approx. **50% refractories** and approx. 30% molten, pockmarked cobbles. 1.4m: Oxidised red/ brown, unprocessed SLAG

Location	Depth (m)	Description
BH311	0.4-0.8	Light brown/ grey, unprocessed SLAG with approx. **50% refractory bricks**
BH311	0.8-2	Unprocessed SLAG in granular form with light brown/ dark **grey refractory bricks (approx.<1%)** and small, pockmarked pieces of slag
BH311	2.1-4.1	Dark brown/ grey unprocessed SLAG in granular and cobble form with **refractroy brick (approx.<1%)**
BH311	4.1-4.5	Unprocessed SLAG with pockmarked pieces and fragments of **refractory bricks (approx.5%)**

Location	Depth (m)	Description
BH314	3-4	Unprocessed SLAG. Oxidized red in colour with pockets of black materail. Predominantly fine grained with 50% demolition waste: plastic, textile, red brick, concrete and **yellow refractory bricks**

Location	Depth (m)	Description
BH306D	0.08-3	Light grey, unprocessed SLAG in granular and pockmarked cobble form with occasional pieces of metal (approx. 2%) and **refrectory bricks (<1%)**

Location	Depth (m)	Description
BH312A	0.6-4.8	50% demolition material (steel wire, concrete, red brick & fabric) with 50%cream ash like material with **yellow bricks (possibly refractory waste)**
BH312A	4.8-5.8	Sludge (50%), possibly demolition material (25%) (steel wire, concrete, red brick & fabric) cream ash like material with **refractory bricks (25%)** becoming oily in appearance from 4.8-5.8

Location	Depth (m)	Description
BH307	0.6-1.5	Loose dark grey/ black, unprocessed SLAG in pockmarked gravel and cobble sizes with white lime weathering and approx. **<1% refractory bricks**

Location	Depth (m)	Description
BH312B	0-1	Millscale with some scrap metal and **occasional refractory brick**
BH312B	1-2.8	Millscale with **occasional refractory brick** and scrapmetal. (minute household waste including textiles from 1-2m)
BH312B	3-3.6	Unprocessed SLAG with some scrap metal and **occasional refractory bricks**
BH312B	3.6-5	Scrap metal with **refractory bricks,** sands, gravels and some black demolition waste. Hydrocarbon odours and irridescence 3.6-4m. Steel barrels containing tar at 4.5m

Location	Depth (m)	Description
BH310C	2.2-3	Grey/ oxidised brown granular processed SLAG with **refractory bricks (<1%)** and pockmarked cobbles
BH310C	3-5.2	Granular SLAG with a lime coating, with pockmarked cobbles and **refractory bricks (<1%)**

Location	Depth (m)	Description
BH310B	0-1	Light to dark grey, processed SLAG in sandy gravelly form with large, consolidated pieces (approx.300mm x 400mm) and 1% scrap metal and **refractory brick.** 0-1m: Rock breaker used to break up consolidated slag
BH310B	1-2	Light to dark grey, processed SLAG in sandy gravelly form with 1% scrap metal and **refractory brick**
BH310B	2-3	Light to dark grey processed SLAG in sandy gravelly form with some pockmarked, boulder sized pieces, scrap metal; rebar (approx.3%) and **occasional refractory bricks**

Location	Depth (m)	Description
BH312C	2.2-2.8	Dark brown/ grey, unprocessed SLAG in granular and cobble ot boulder sized pieces with waste steel (approx. 5%), **refractories (approx.2.5%)** and waste sheet plastic (approx.0.5%)

Location	Depth (m)	Description
BH313	1-2	Unprocessed SLAG with **refractories (approx.2%)**
BH313	2-3.5	Unprocessed SLAG with **refractories (approx.1%)**
BH313	4.6-5.5	Light to dark grey, unprocessed SLAG in granular and cobble form with occasional pieces of **refractory**

REV	DESCRIPTION	BY	CHK	APP	DATE

CLIENT
Cork County Council

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Project:
East Tip, Haulbowline

Drawing Title:
Refractory Waste

Scale @ A3	Drawn	Date	Checked	Date	Approved	Date
NTS	SG	03/13	YB	03/13	YB	03/13

Project No.	Office	Type	Drawing No.	Revision
A075294	4616	581		

FILENAME : G:\PROJECTS\A075\A075294\P-03 EXECUTION\11 EP\04 FIGURES\COPY OF HOUBOWLINE FIGS.DWG | PLOTTED BY : SHANE.GREER | PLOTTED DATE : 27 March 2013 12:42:25

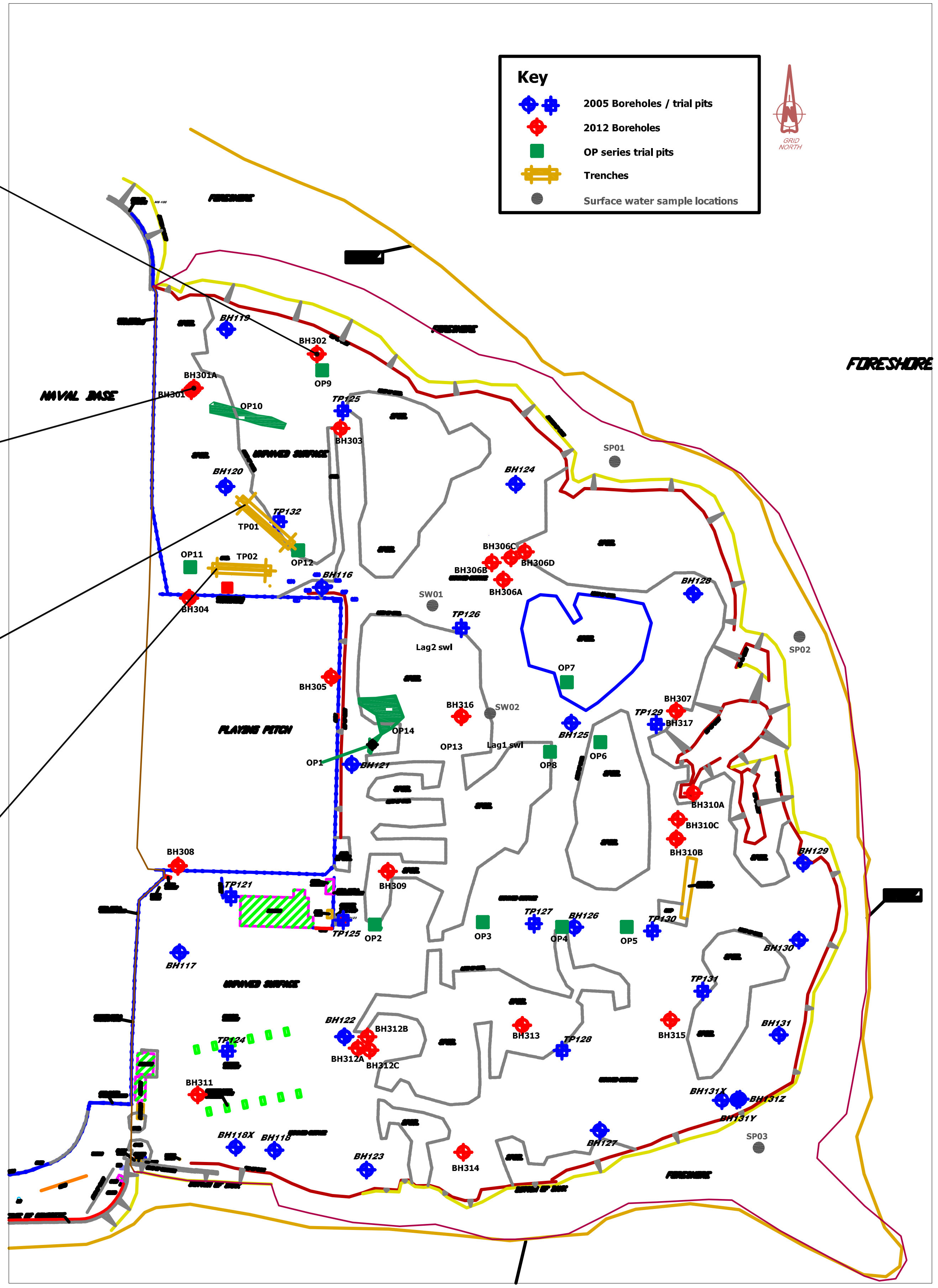
Millscale Waste

Location	Depth (m)	Description
BH302	1-3.2	Dark brown, slightly sandy CLAY with unprocessed slag, possible **millscale,** approx. 5% timber, 2% refractory brick, 1% construction waste and 2% household plastic waste
BH302	3.2-5	Unprocessed SLAG withpossible **millscale**

Location	Depth (m)	Description
BH301A	0.7-1	**Millscale/ possible flue dust**
BH301A	1-1.3	**Millscale** with slag

Location	Depth (m)	Description
TP01	0-0.5	Topsoil mixed with **millscale**
TP01	0.5-1.2	**60% millscale,** 5% metal and slag

Location	Depth (m)	Description
TP02	0.9-2	**Millscale**



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Project:
East Tip, Haulbowline

Drawing Title:
Millscale Waste

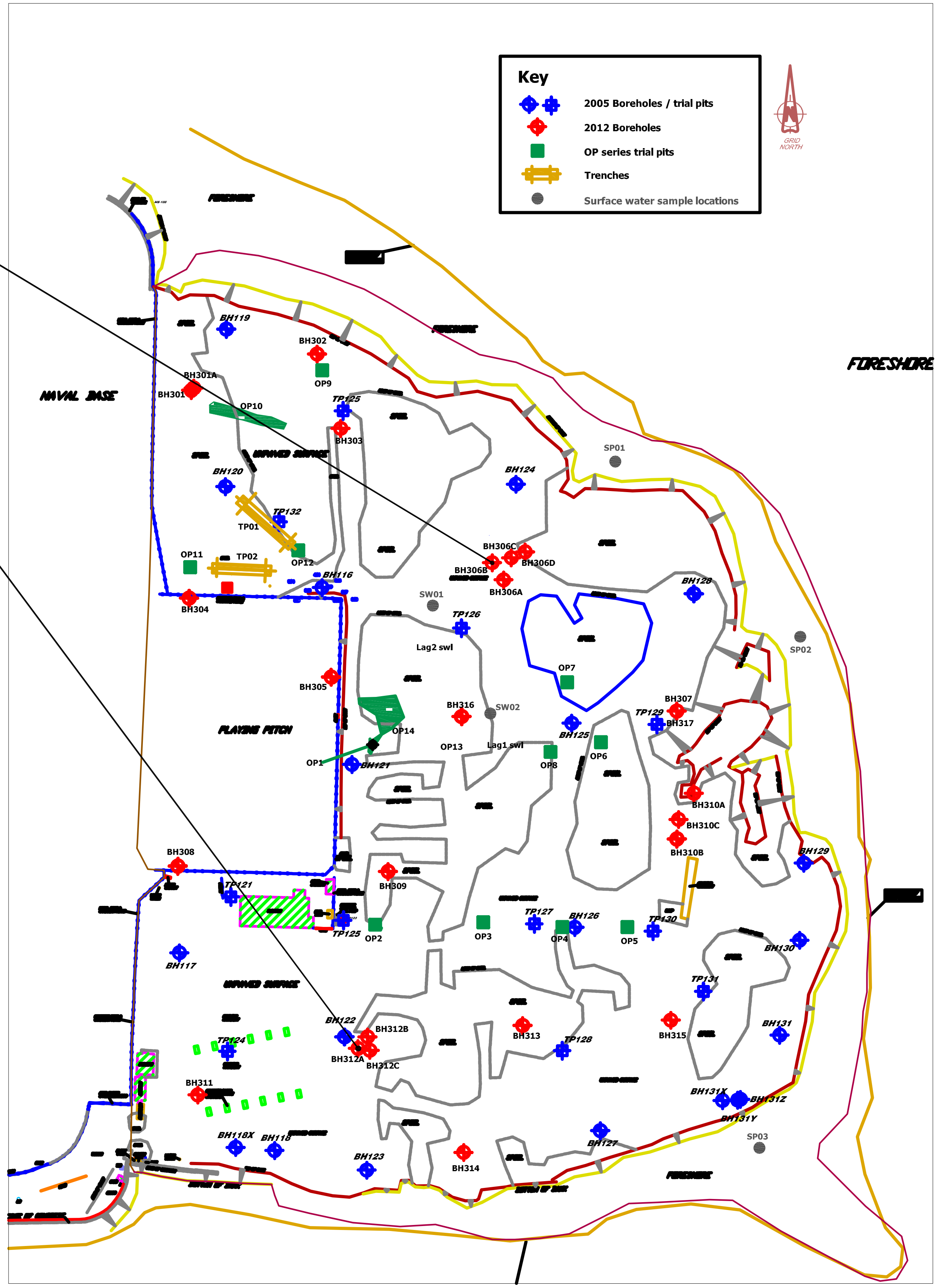
Scale @ A3	Drawn	Date	Checked	Date	Approved	Date
NTS	SG	03/13	YB	03/13	YB	03/13

Project No.	Office	Type	Drawing No.	Revision
A075294	4616	581		

Sludge Waste

Location	Depth (m)	Description
BH306B	0-0.5	Slag with possible **weathered sludge**

Location	Depth (m)	Description
BH312A	0.5-0.6	**Black sludge** with 20% glass, gravels or fine sand
BH312A	3.6	**Black iridescent sludge** surrounded by metal (possible old barrel)
BH312A	4.8-5.8	**Sludge (50%),** possible demolition material (25%) (steel wire, concrete, red brick & fabric) cream ash like material with refractory bricks (25%) becoming oily in appearance from 4.8-5.8



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Project:
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Drawing Title:
Sludge Waste

Scale @ A3	Drawn	Date	Checked	Date	Approved	Date
NTS	SG	03/13	YB	03/13	YB	03/13

Project No.	Office	Type	Drawing No.	Revision
A075294	4616	581		

Appendix Q Summary Statistical Analysis Sheets

Client/client ref:
Project ref:
Site ref:
Data description:
Contaminant(s):
Test scenario: Planning
Date: 0 January 1900
User details:

	arsenic	Cadmium	Lead	Vanadium						
Critical concentration, C_c	**41.4**	**83.6**	**477**	**422**						
Notes										
Sample size, n	34	34	34	34	0	0	0	0	0	0
Sample mean, $\bar{x}$	26.6594118	11.3251471	751.223529	217.975588	No Data	No Data	No Data	No Data	No Data	No Data
Standard deviation, s	24.7887128	19.8153752	1097.12398	154.247064						
Number of non-detects	**5**	**7**	0	0						
Set non-detect values to:	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit
Outliers?	No	No	No	No						
Distribution	Non-normal	Non-normal	Non-normal	Non-normal						
Statistical approach	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto	Auto	Auto	Auto	Auto	Auto

Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?				**Evidence level required:**	**95%**	Use Log-Normal distribution to test for outliers			
t statistic, t_0 (or k_0)	-3.467370873	-21.26788847	1.457432552	-7.712668871						
Upper confidence limit (on true mean concentration, μ)	45.1900901	26.1380318	1571.37308	333.28221						
Evidence level	**92%**	**100%**	**0%**	**98%**						
Base decision on:	evidence level	evidence level	evidence level	evidence level						
Result	**μ ≈≥ Cc**	**μ < Cc**	**μ ≥ Cc**	**μ < Cc**						
Select dataset	◉ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y	○ Y

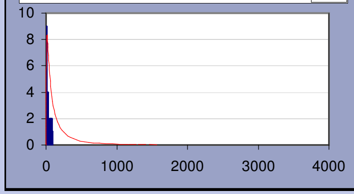
Back to data | **Go to outlier test** | **Go to normality test** | **Show individual summary**

Test Results

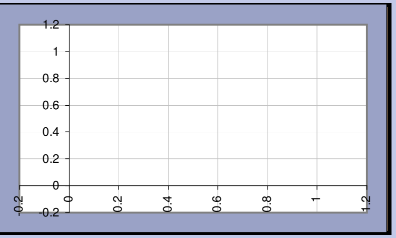
Client/client ref:
Project ref:
Site ref:
Data description:
Date: 00-Jan-1900
User details:

Dataset:	arsenic
Sample mean, $\overline{x}$	26.659
Sample standard deviation, s	24.789
Sample size, n	34
Critical concentration, Cc	41.4

Use Log-Normal distribution to te

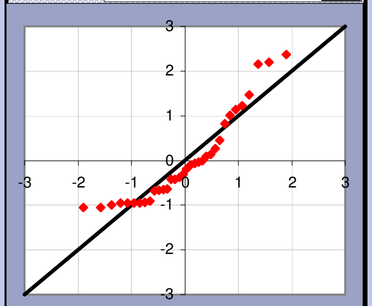


Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	5

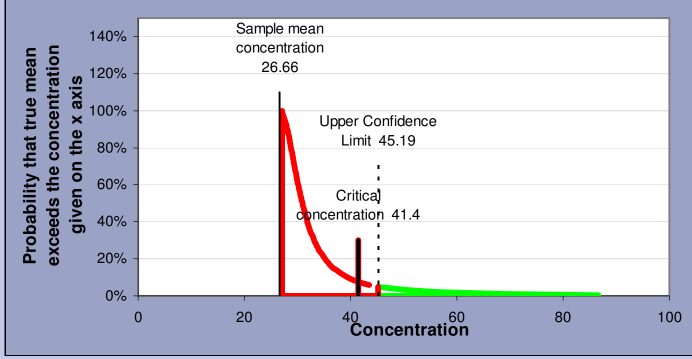


Normality test

Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc



Evidence against Null hypothesis:	**92%**
Base decision on:	evidence level
Evidence level required:	**95%**
Balance of probability?	N/A
Reject Null Hypothesis?	No

Not enough evidence

Back to data | **Back to summary** | **Go to outlier test** | **Go to normality test**

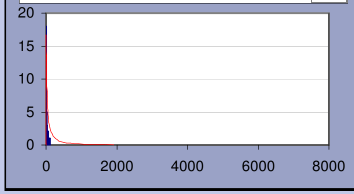
Test Results

Client/client ref: | Site ref: | Date: 00-Jan-1900

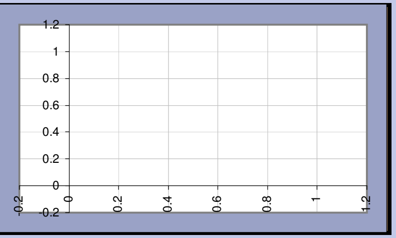
Project ref: | Data description: | User details:

Dataset:	Cadmium
Sample mean, $\overline{x}$	11.325
Sample standard deviation, s	19.815
Sample size, n	34
Critical concentration, Cc	83.6

Use Log-Normal distribution to te

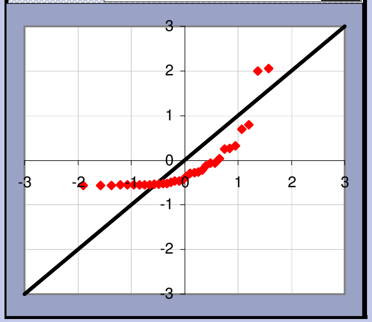


Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	7

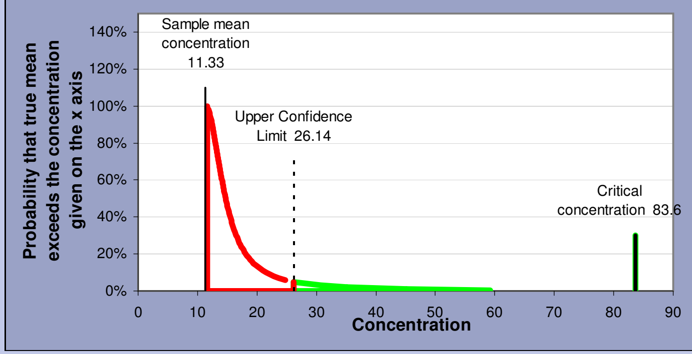


Normality test

Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc



Evidence against Null hypothesis:	100%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

μ < Cc (re this dataset)

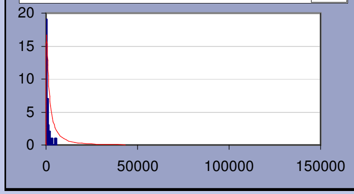
Back to data | **Back to summary** | **Go to outlier test** | **Go to normality test**

Test Results

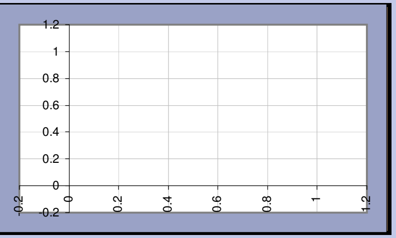
Client/client ref: Project ref: | Site ref: Data description: | Date: 00-Jan-1900 User details:

Dataset:	Lead
Sample mean, $\overline{x}$	751.22
Sample standard deviation, s	1097.1
Sample size, n	34
Critical concentration, Cc	477

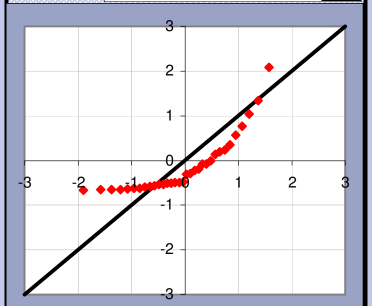
Use Log-Normal distribution to te



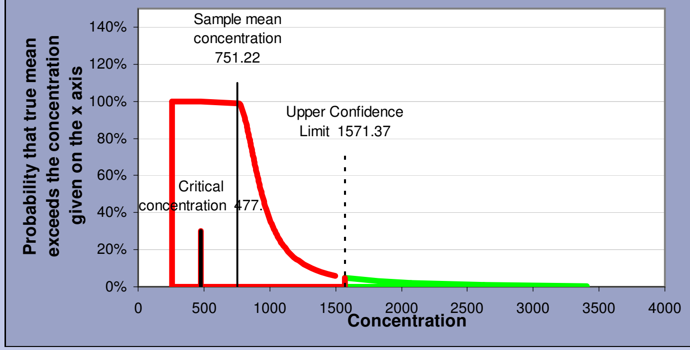
Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	0



Normality test	
Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc



Evidence against Null hypothesis:	0%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	N/A
Reject Null Hypothesis?	No

μ ≥ Cc

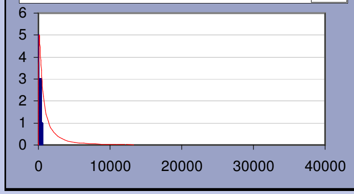
Back to data | Back to summary | Go to outlier test | Go to normality test

Test Results

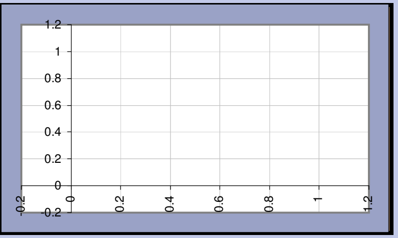
Client/client ref:
Project ref:
Site ref:
Data description:
Date: 00-Jan-1900
User details:

Dataset:	Vanadium
Sample mean, $\overline{x}$	217.98
Sample standard deviation, s	154.25
Sample size, n	34
Critical concentration, Cc	422

Use Log-Normal distribution to te

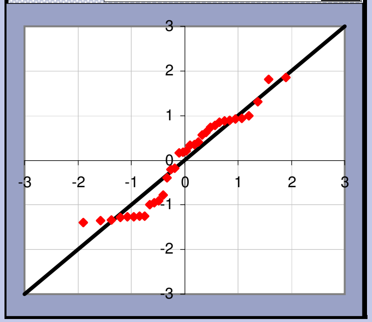


Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	0

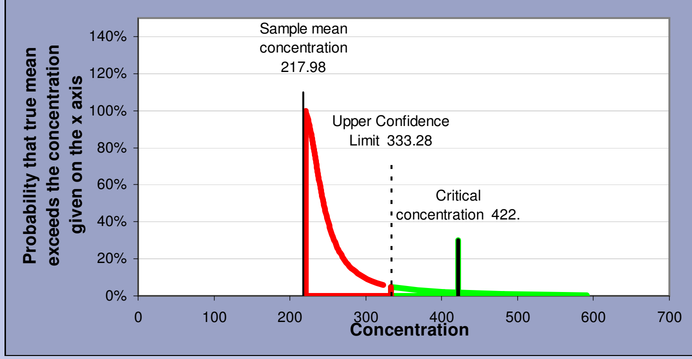


Normality test

Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc



Evidence against Null hypothesis:	**98%**
Base decision on:	evidence level
Evidence level required:	**95%**
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

μ < Cc (re this dataset)

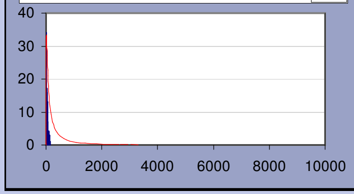
Back to data | **Back to summary** | **Go to outlier test** | **Go to normality test**

Test Results

Client/client ref: Cork County Co Site ref: Date: 00-Jan-1900
Project ref: East Tip Haulbowline Data description: Statistical analaysis - all waste da User details:

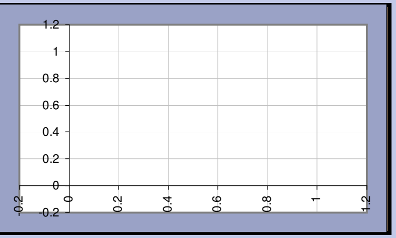
Dataset:	arsenic
Sample mean, $\overline{x}$	30.359
Sample standard deviation, s	30.585
Sample size, n	108
Critical concentration, Cc	41.4

Use Log-Normal distribution to te



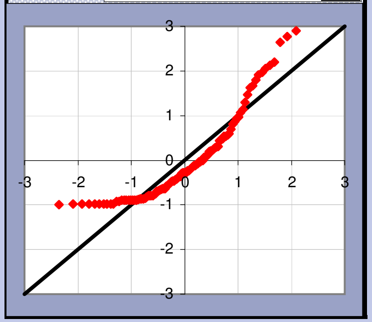
Outliers & non-detects

Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	17



Normality test

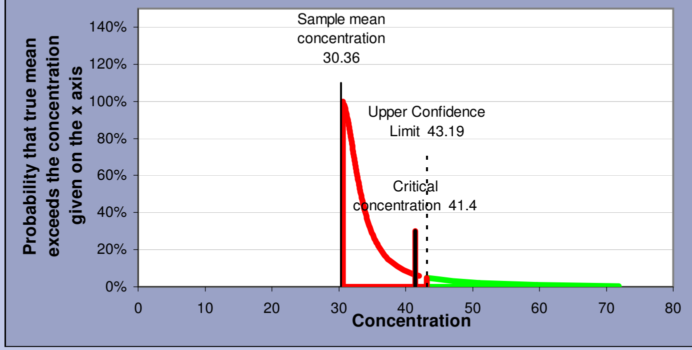
Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:

Planning: is true mean lower than critical concentration (μ < Cc)?

Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc

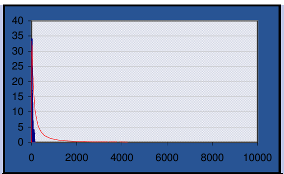


Evidence against Null hypothesis:	**93%**
Base decision on:	evidence level
Evidence level required:	**95%**
Balance of probability?	N/A
Reject Null Hypothesis?	No

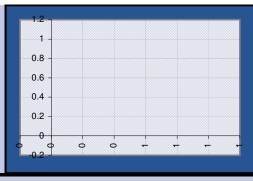
Not enough evidence

Back to data | **Back to summary** | **Go to outlier test** | **Go to normality test**

Sample ID	Include?	arsenic	Outliers
BH301A	☑ Y	25.6	
BH301A	☑ Y	85.5	
BH301A	☑ Y	37	
BH302	☑ Y	39.4	
BH302	☑ Y	13.1	
BH302	☑ Y	7.09	
BH303	☑ Y		
BH303	☑ Y	29.1	
BH303	☑ Y	26.8	
BH304	☑ Y	16.2	
BH304	☑ Y	36.9	
BH304	☑ Y	21.3	
BH305	☑ Y	16.2	
BH305	☑ Y	0.3	
BH306a	☑ Y	12.7	
BH306a	☑ Y	43.5	
BH306a	☑ Y	38.8	
BH306a	☑ Y	32.2	
BH306b	☑ Y	3	
BH306b	☑ Y		
BH306b	☑ Y	3	
BH306b	☑ Y	3	
BH307	☑ Y	3	
BH307	☑ Y	3	
BH307	☑ Y	27.8	
BH308	☑ Y	17.3	
BH308	☑ Y	33.4	
BH309	☑ Y	21.6	
BH310a	☑ Y	19.2	
BH310a	☑ Y	6.06	
BH310a	☑ Y		
BH310a	☑ Y	18.1	
BH310a	☑ Y	27.6	
BH310b	☑ Y		
BH310b	☑ Y	39.9	
BH310b	☑ Y	29.2	
BH310b	☑ Y	32.9	
BH310c	☑ Y	3	
BH310c	☑ Y	15.9	
BH311	☑ Y	3.47	
BH311	☑ Y	21.8	
BH312a	☑ Y	26.5	
BH312a	☑ Y	16.8	
BH312a	☑ Y	95.6	
BH312a	☑ Y		
BH312b	☑ Y	81.2	
BH312b	☑ Y	115	
BH312b	☑ Y		
BH312b	☑ Y	47.7	
BH312c	☑ Y	51.6	
BH312c	☑ Y	70.2	
BH312c	☑ Y	97.7	
BH313	☑ Y	36.1	
BH313	☑ Y	6.23	
BH314	☑ Y	9.65	
BH314	☑ Y	90.5	
BH314	☑ Y	119	
BH314	☑ Y	48.5	
BH315	☑ Y	10.6	
BH315	☑ Y	11	
BH315	☑ Y	0.03	
BH316	☑ Y	80	
BH316	☑ Y	7.5	
BH316	☑ Y	23	
OP10	☑ Y	62.9	
OP10	☑ Y	13.8	
OP10	☑ Y	75.2	
OP14	☑ Y	45.2	
OP14	☑ Y	4.38	



Outliers?
NO
(None selected)



Sample mean, $\bar{x}$
14.066

Standard deviation, s
Factor of 4.94

Sample size, n
108

Maxiumum
126.000

Test Applicability
Applicable

Level of Significance, α
5%

Tn = 1.372
Tcrit = 3.236

Dataset: arsenic

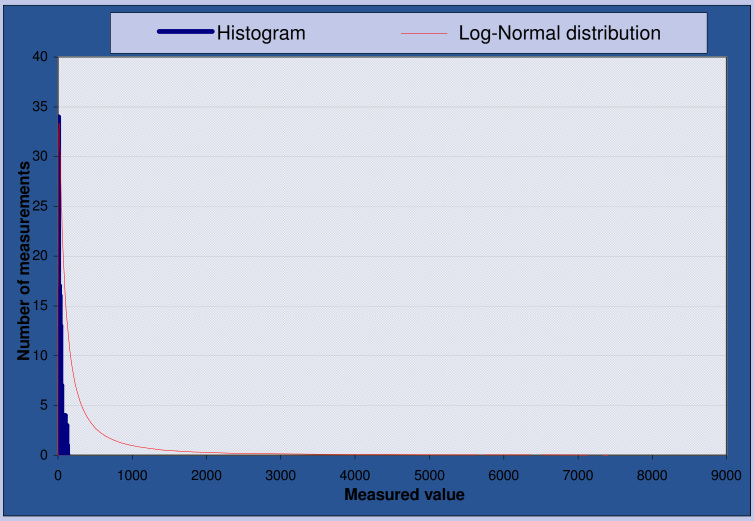
Us Log-Normal distribution to test for outliers

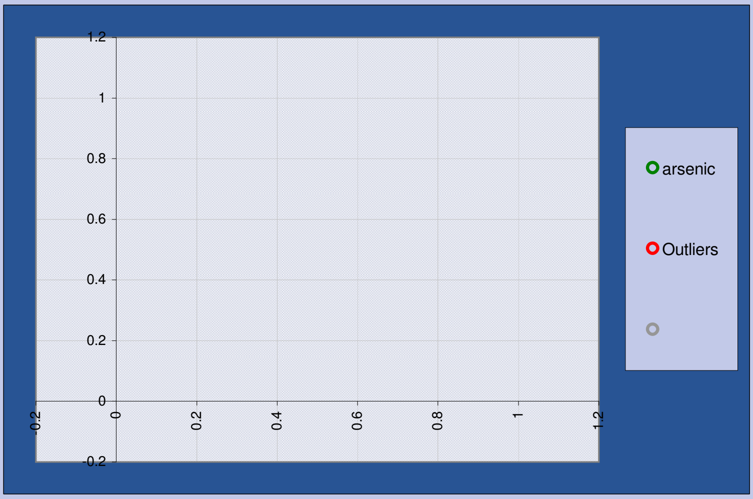
Exclude identified outliers

Show individual summary

Back to summary

Back to data





BH117	☑ Y			
BH117	☑ Y			
BH117	☑ Y	6		
BH117	☑ Y			
BH117	☑ Y	4		
BH118/A	☑ Y	30		
BH118/A	☑ Y	4		
BH119	☑ Y	3		
BH120	☑ Y			
BH122/B	☑ Y	0.5		
BH125	☑ Y	126		
BH125	☑ Y	6		
BH127	☑ Y	2		
BH128	☑ Y	5		
BH131	☑ Y	19		
DIS 101	☑ Y	60		
DIS 102	☑ Y	93		
DIS 103	☑ Y	22		
DIS 104	☑ Y	47		
TP121	☑ Y	30		
TP121	☑ Y	15		
TP123	☑ Y	38		
TP123	☑ Y	59		
TP124	☑ Y	10		
TP124	☑ Y	34		
TP125	☑ Y	47		
TP125	☑ Y	3		
TP125a	☑ Y	57		
TP126	☑ Y	22		
TP126	☑ Y	111		
TP127	☑ Y	55		
TP127	☑ Y	23		
TP128	☑ Y	0.5		
TP128	☑ Y	25		
TP128	☑ Y	11		
TP129A	☑ Y	0.5		
TP129	☑ Y	4		
TP129	☑ Y	0.5		
TP129	☑ Y	0.5		
TP129	☑ Y	0.5		
TP130	☑ Y	11		
TP130	☑ Y	0.5		
TP130	☑ Y	0.5		
TP131	☑ Y	2		
TP131	☑ Y	44		
TP131	☑ Y	9		
TP132	☑ Y	24		
TP132	☑ Y	65		
TP132	☑ Y	89		

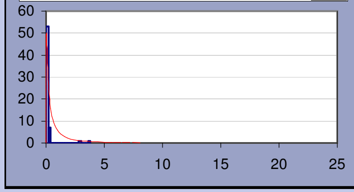
☑ Y

Test Results

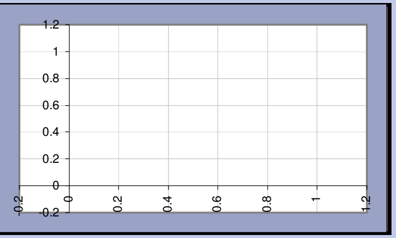
Client/client ref: Cork County Co Site ref:
Date: 00-Jan-1900
Project ref: East Tip Haulbowline Data description: Statistical analaysis - all waste da User details:

Dataset:	BaP
Sample mean, $\overline{x}$	0.1665
Sample standard deviation, s	0.5816
Sample size, n	62
Critical concentration, Cc	1.2

Use Log-Normal distribution to te

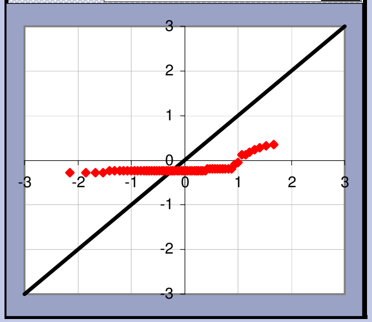


Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	51

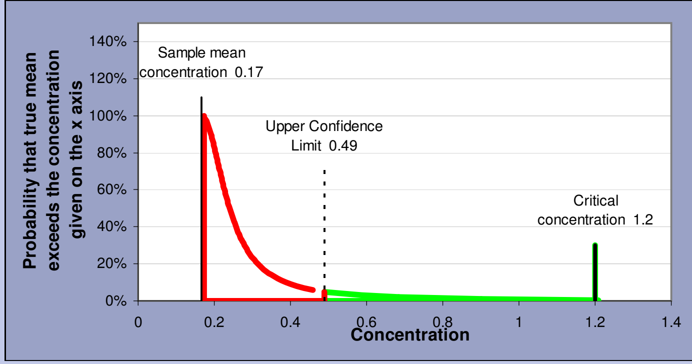


Normality test

Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc

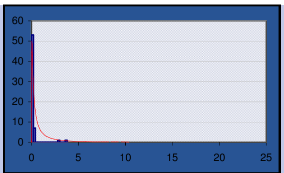


Evidence against Null hypothesis:	99%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

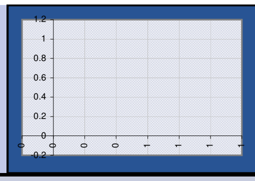
μ < Cc (re this dataset)

Back to data | **Back to summary** | **Go to outlier test** | **Go to normality test**

Sample ID	Include?	BaP	Outliers
BH301A	Y		
BH301A	Y		
BH301A	Y	0.137	
BH302	Y		
BH302	Y		
BH302	Y		
BH303	Y		
BH303	Y		
BH303	Y		
BH304	Y		
BH304	Y		
BH304	Y	0.356	
BH305	Y		
BH305	Y		
BH306a	Y		
BH306a	Y		
BH306a	Y		
BH306a	Y		
BH306b	Y		
BH306b	Y		
BH306b	Y		
BH306b	Y		
BH307	Y		
BH307	Y		
BH307	Y		
BH308	Y		
BH308	Y		
BH309	Y		
BH310a	Y		
BH310a	Y		
BH310a	Y	0.05	
BH310a	Y		
BH310a	Y		
BH310b	Y		
BH310b	Y		
BH310b	Y		
BH310b	Y		
BH310c	Y		
BH310c	Y		
BH311	Y		
BH311	Y		
BH312a	Y		
BH312a	Y		
BH312a	Y	3.65	
BH312a	Y	0.306	
BH312b	Y		
BH312b	Y		
BH312b	Y		
BH312b	Y	0.368	
BH312c	Y		
BH312c	Y	0.05	
BH312c	Y	0.05	
BH313	Y		
BH313	Y		
BH314	Y		
BH314	Y		
BH314	Y	0.05	
BH314	Y	0.274	
BH315	Y		
BH315	Y	0.05	
BH315	Y		
BH316	Y	0.05	
BH316	Y		
BH316	Y		
OP10	Y	0.05	
OP10	Y	0.05	
OP10	Y	0.05	
OP14	Y	0.05	
OP14	Y	0.116	



Outliers?
NO
(None selected)



Sample mean, $\overline{x}$
0.035

Standard deviation, s
Factor of 4.91

Sample size, n
62

Maxiumum
3.650

Test Applicability
Applicable

Level of Significance, α
5%

Tn = 2.915
Tcrit = 3.039

Dataset: BaP

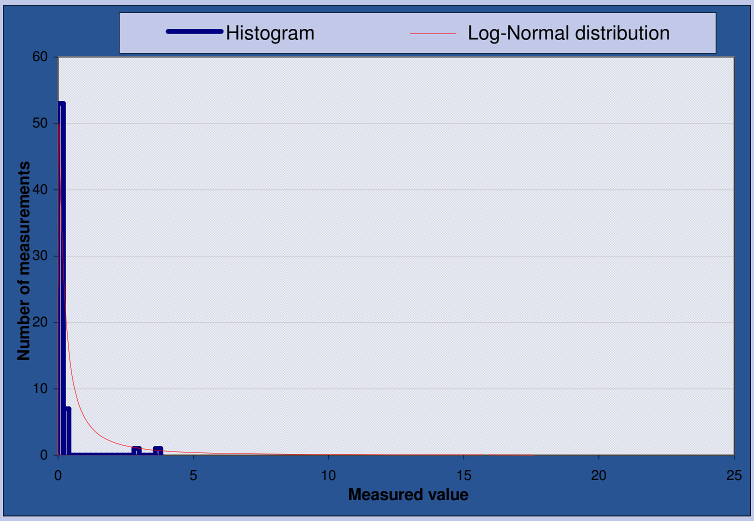
Use Log-Normal distribution to test for outliers

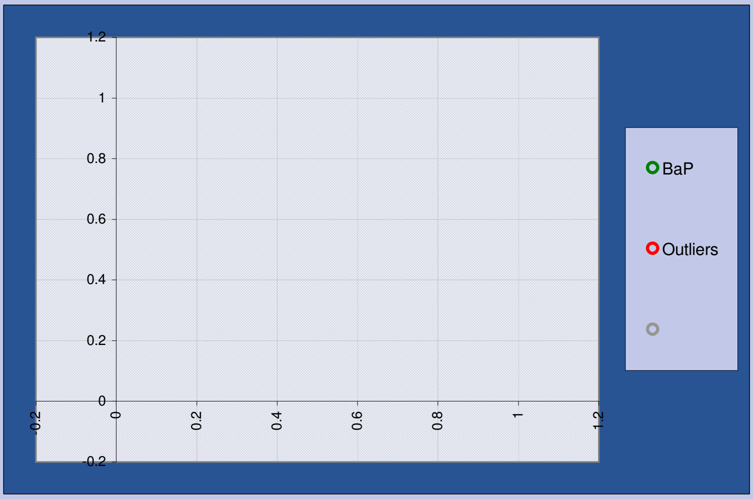
Exclude identified outliers

Show individual summary

Back to summary

Back to data





BH117	☑ Y			
BH117	☑ Y			
BH117	☑ Y	0.025		
BH117	☑ Y			
BH117	☑ Y	0.025		
BH118/A	☑ Y	0.025		
BH118/A	☑ Y	0.24		
BH119	☑ Y	2.88		
BH120	☑ Y			
BH122/B	☑ Y	0.025		
BH125	☑ Y	0.025		
BH125	☑ Y	0.025		
BH127	☑ Y	0.025		
BH128	☑ Y	0.025		
BH131	☑ Y	0.025		
DIS 101	☑ Y	0.0005		
DIS 102	☑ Y	0.0005		
DIS 103	☑ Y	0.0005		
DIS 104	☑ Y	0.0005		
TP121	☑ Y	0.025		
TP121	☑ Y	0.24		
TP123	☑ Y	0.025		
TP123	☑ Y	0.025		
TP124	☑ Y	0.025		
TP124	☑ Y	0.33		
TP125	☑ Y	0.025		
TP125	☑ Y	0.025		
TP125a	☑ Y	0.025		
TP126	☑ Y	0.025		
TP126	☑ Y	0.025		
TP127	☑ Y	0.025		
TP127	☑ Y	0.025		
TP128	☑ Y	0.025		
TP128	☑ Y	0.025		
TP128	☑ Y	0.025		
TP129A	☑ Y	0.025		
TP129	☑ Y	0.025		
TP129	☑ Y	0.025		
TP129	☑ Y	0.025		
TP129	☑ Y	0.025		
TP130	☑ Y	0.025		
TP130	☑ Y	0.025		
TP130	☑ Y	0.025		
TP131	☑ Y	0.025		
TP131	☑ Y	0.025		
TP131	☑ Y	0.025		
TP132	☑ Y	0.025		
TP132	☑ Y	0.025		
TP132	☑ Y	0.025		

☑ Y

Test Results

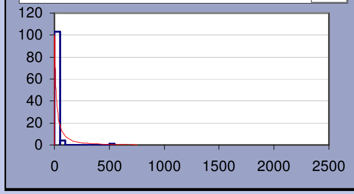
Client/client ref: Cork County Co Site ref:

Date: 00-Jan-1900

Project ref: East Tip Haulbowline Data description: Statistical analaysis - all waste dε User details:

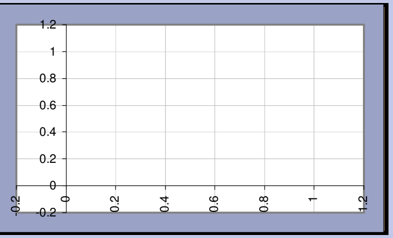
Dataset:	Cadmium
Sample mean, $\bar{x}$	11.589
Sample standard deviation, s	52.458
Sample size, n	108
Critical concentration, Cc	83.6

Use Log-Normal distribution to te



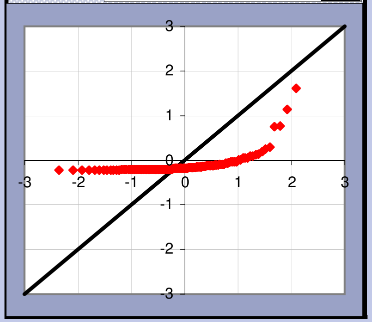
Outliers & non-detects

Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	30

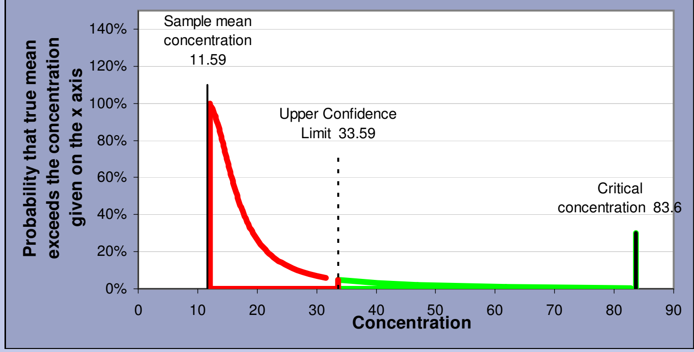


Normality test

Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc



Evidence against Null hypothesis:	**100%**
Base decision on:	evidence level
Evidence level required:	**95%**
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

μ < Cc (re this dataset)

Back to data | **Back to summary** | **Go to outlier test** | **Go to normality test**

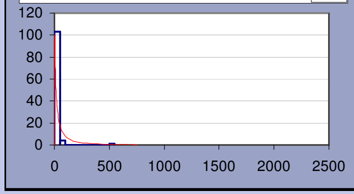
Test Results

Client/client ref: Cork County Co Site ref: Date: 00-Jan-1900

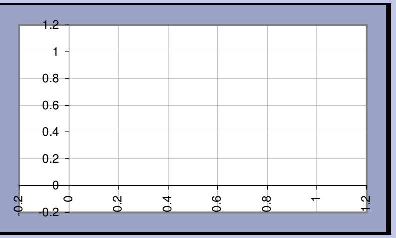
Project ref: East Tip Haulbowline Data description: Statistical analaysis - all waste da User details:

Dataset:	Cadmium
Sample mean, $\overline{x}$	11.589
Sample standard deviation, s	52.458
Sample size, n	108
Critical concentration, Cc	230

Use Log-Normal distribution to te

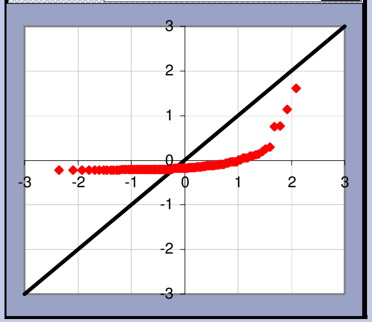


Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	30

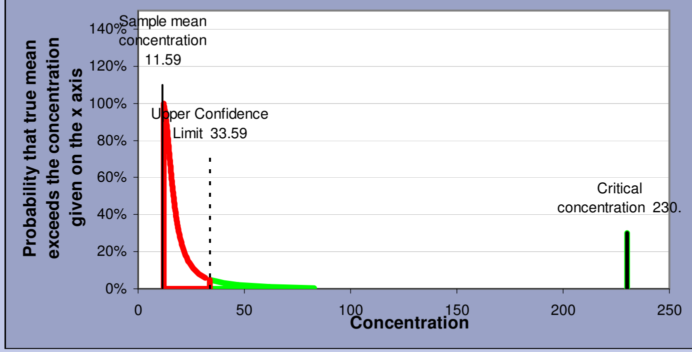


Normality test

Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc

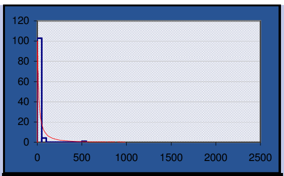


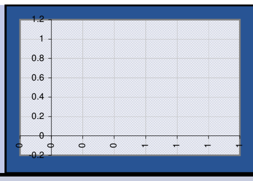
Evidence against Null hypothesis:	100%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

μ < Cc (re this dataset)

Back to data | Back to summary | Go to outlier test | Go to normality test

Sample ID	Include?	Cadmium	Outliers
BH301A	☑ Y	5.58	
BH301A	☑ Y	0.1	
BH301A	☑ Y	6.64	
BH302	☑ Y	4.84	
BH302	☑ Y	4.59	
BH302	☑ Y	2.31	
BH303	☑ Y		
BH303	☑ Y	16.5	
BH303	☑ Y	6.8	
BH304	☑ Y	0.301	
BH304	☑ Y	14.2	
BH304	☑ Y	8.12	
BH305	☑ Y	0.377	
BH305	☑ Y	0.301	
BH306a	☑ Y	2.37	
BH306a	☑ Y	4.04	
BH306a	☑ Y	5.06	
BH306a	☑ Y	5.47	
BH306b	☑ Y	0.1	
BH306b	☑ Y		
BH306b	☑ Y	0.1	
BH306b	☑ Y	0.1	
BH307	☑ Y	0.1	
BH307	☑ Y	0.1	
BH307	☑ Y	0.357	
BH308	☑ Y	0.627	
BH308	☑ Y	4.1	
BH309	☑ Y	4.38	
BH310a	☑ Y	1.51	
BH310a	☑ Y	2.08	
BH310a	☑ Y		
BH310a	☑ Y	0.1	
BH310a	☑ Y	2.28	
BH310b	☑ Y		
BH310b	☑ Y	3.75	
BH310b	☑ Y	2.85	
BH310b	☑ Y	4.88	
BH310c	☑ Y	0.854	
BH310c	☑ Y	3.19	
BH311	☑ Y	0.636	
BH311	☑ Y	2.41	
BH312a	☑ Y	5.75	
BH312a	☑ Y	5.39	
BH312a	☑ Y	21.6	
BH312a	☑ Y		
BH312b	☑ Y	95.9	
BH312b	☑ Y	12.1	
BH312b	☑ Y		
BH312b	☑ Y	2.2	
BH312c	☑ Y	7	
BH312c	☑ Y	9.53	
BH312c	☑ Y	71.6	
BH313	☑ Y	8.42	
BH313	☑ Y	0.731	
BH314	☑ Y	2.68	
BH314	☑ Y	5	
BH314	☑ Y	0.1	
BH314	☑ Y	14.3	
BH315	☑ Y	16.3	
BH315	☑ Y	2.25	
BH315	☑ Y	0.114	
BH316	☑ Y	8.94	
BH316	☑ Y	0.25	
BH316	☑ Y	4	
OP10	☑ Y	17.7	
OP10	☑ Y	2.75	
OP10	☑ Y	533	
OP14	☑ Y	0.811	
OP14	☑ Y	0.544	





Outliers?
NO
(None selected)

Sample mean, $\bar{x}$
2.086

Standard deviation, s
Factor of 5.60

Sample size, n
108

Maxiumum
533.000

Test Applicability
Applicable

Level of Significance, α
5%

Tn = 3.217
Tcrit = 3.236

Dataset: Cadmium

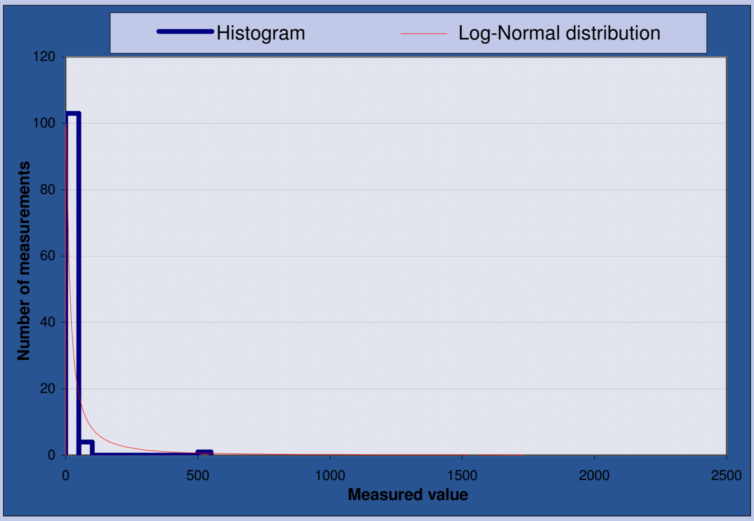
Us Log-Normal distribution to test for outliers

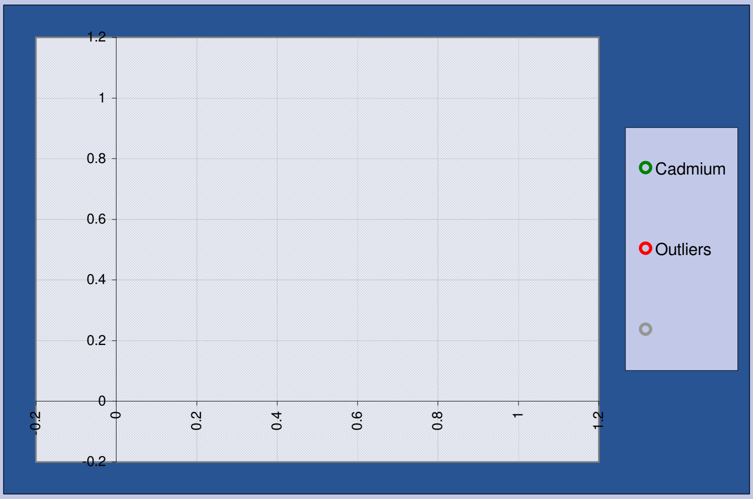
Exclude identified outliers

Show individual summary

Back to summary

Back to data





BH117	☑ Y			
BH117	☑ Y			
BH117	☑ Y	0.5		
BH117	☑ Y			
BH117	☑ Y	0.5		
BH118/A	☑ Y	4		
BH118/A	☑ Y	2		
BH119	☑ Y	0.5		
BH120	☑ Y			
BH122/B	☑ Y	2		
BH125	☑ Y	19		
BH125	☑ Y	0.5		
BH127	☑ Y	0.5		
BH128	☑ Y	0.5		
BH131	☑ Y	0.5		
DIS 101	☑ Y	0.5		
DIS 102	☑ Y	0.5		
DIS 103	☑ Y	14		
DIS 104	☑ Y	0.5		
TP121	☑ Y	52		
TP121	☑ Y	4		
TP123	☑ Y	12		
TP123	☑ Y	10		
TP124	☑ Y	6		
TP124	☑ Y	3		
TP125	☑ Y	10		
TP125	☑ Y	51		
TP125a	☑ Y	0.5		
TP126	☑ Y	27		
TP126	☑ Y	1		
TP127	☑ Y	25		
TP127	☑ Y	7		
TP128	☑ Y	0.5		
TP128	☑ Y	10		
TP128	☑ Y	1		
TP129A	☑ Y	0.5		
TP129	☑ Y	1		
TP129	☑ Y	0.5		
TP129	☑ Y	2		
TP129	☑ Y	0.5		
TP130	☑ Y	0.5		
TP130	☑ Y	0.5		
TP130	☑ Y	0.5		
TP131	☑ Y	2		
TP131	☑ Y	3		
TP131	☑ Y	0.5		
TP132	☑ Y	2		
TP132	☑ Y	0.5		
TP132	☑ Y	0.5		

☑ Y

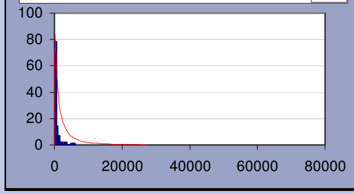
Test Results

Client/client ref: Cork County Co Site ref: Date: 00-Jan-1900

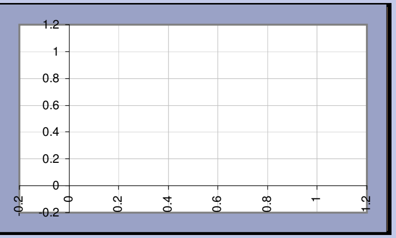
Project ref: East Tip Haulbowline Data description: Statistical analaysis - all waste dε User details:

Dataset:	Lead
Sample mean, $\overline{x}$	522.14
Sample standard deviation, s	916.54
Sample size, n	107
Critical concentration, Cc	477

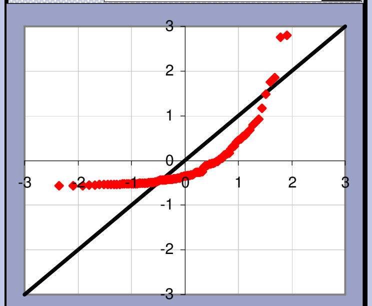
Use Log-Normal distribution to te



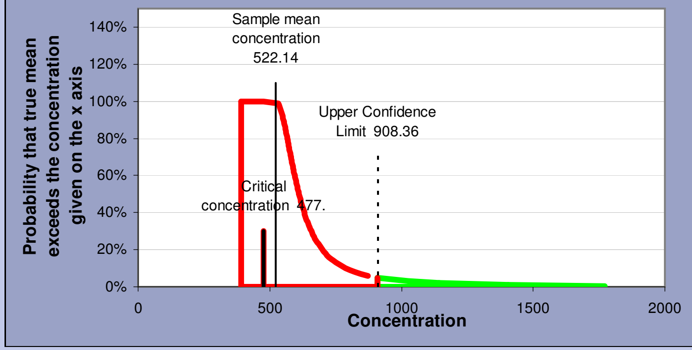
Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	1
Non-detects	0



Normality test	
Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc



Evidence against Null hypothesis:	0%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	N/A
Reject Null Hypothesis?	No

μ ≥ Cc

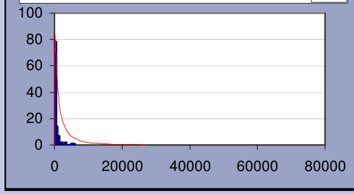
Back to data | **Back to summary** | **Go to outlier test** | **Go to normality test**

Test Results

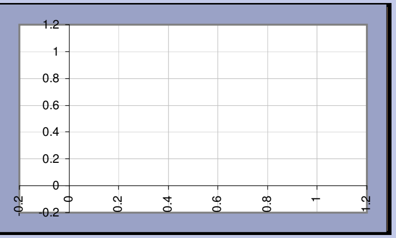
Client/client ref: Cork County Co Site ref: Date: 00-Jan-1900
Project ref: East Tip Haulbowline Data description: Statistical analaysis - all waste da User details:

Dataset:	Lead
Sample mean, $\bar{x}$	522.14
Sample standard deviation, s	916.54
Sample size, n	107
Critical concentration, Cc	4640

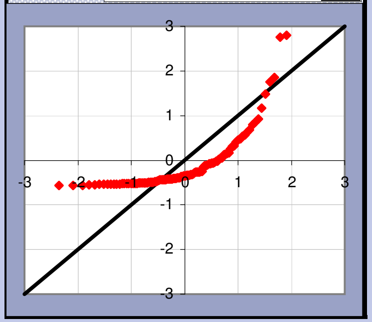
Use Log-Normal distribution to te



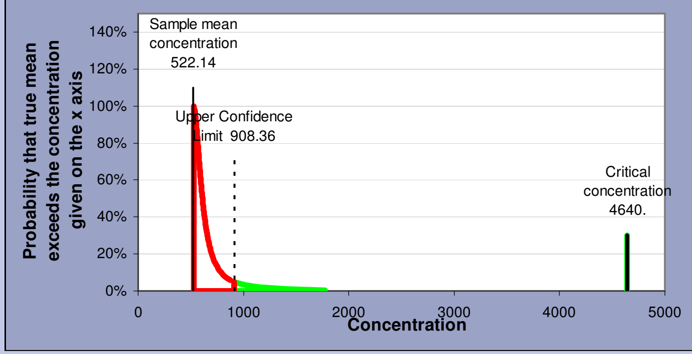
Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	1
Non-detects	0



Normality test	
Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc

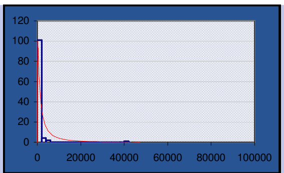


Evidence against Null hypothesis:	100%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

μ < Cc (re this dataset)

Back to data | **Back to summary** | **Go to outlier test** | **Go to normality test**

Sample ID	Include?	Lead		Outliers
BH301A	Y	660		
BH301A	Y	24.2		
BH301A	Y	814		
BH302	Y	568		
BH302	Y	469		
BH302	Y	212		
BH303	Y			
BH303	Y	1010		
BH303	Y	228		
BH304	Y	127		
BH304	Y	1090		
BH304	Y	645		
BH305	Y	36.7		
BH305	Y	28.4		
BH306a	Y	82.2		
BH306a	Y	281		
BH306a	Y	239		
BH306a	Y	565		
BH306b	Y	98.7		
BH306b	Y			
BH306b	Y	53.6		
BH306b	Y	72.1		
BH307	Y	34.2		
BH307	Y	38.8		
BH307	Y	20.8		
BH308	Y	66.8		
BH308	Y	542		
BH309	Y	264		
BH310a	Y	504		
BH310a	Y	42.7		
BH310a	Y			
BH310a	Y	277		
BH310a	Y	54		
BH310b	Y			
BH310b	Y	138		
BH310b	Y	152		
BH310b	Y	78.2		
BH310c	Y	220		
BH310c	Y	282		
BH311	Y	108		
BH311	Y	292		
BH312a	Y	1140		
BH312a	Y	1250		
BH312a	Y	3090		
BH312a	Y			
BH312b	Y	5480		
BH312b	Y	1300		
BH312b	Y			
BH312b	Y	478		
BH312c	Y	217		
BH312c	Y	378		
BH312c	Y	5770		
BH313	Y	941		
BH313	Y	136		
BH314	Y	188		
BH314	Y	497		
BH314	Y	184		
BH314	Y	2130		
BH315	Y	1590		
BH315	Y	127		
BH315	Y	29.3		
BH316	Y	425		
BH316	Y	37.3		
BH316	Y	289		
OP10	Y	966		
OP10	Y	165		
OP10	Y	41700	Outlier	
OP14	Y	39.4		
OP14	Y	38.5		



Sample mean, $\bar{x}$
210.475

Standard deviation, s
Factor of 4.55

Sample size, n
108

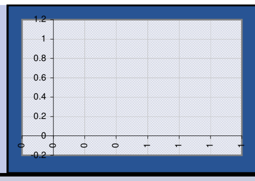
Maxiumum
41700.000

Test Applicability
Applicable

Level of Significance, α
5%

Tn = 3.490
Tcrit = 3.236

Outliers?
YES
(None selected)



Dataset: Lead

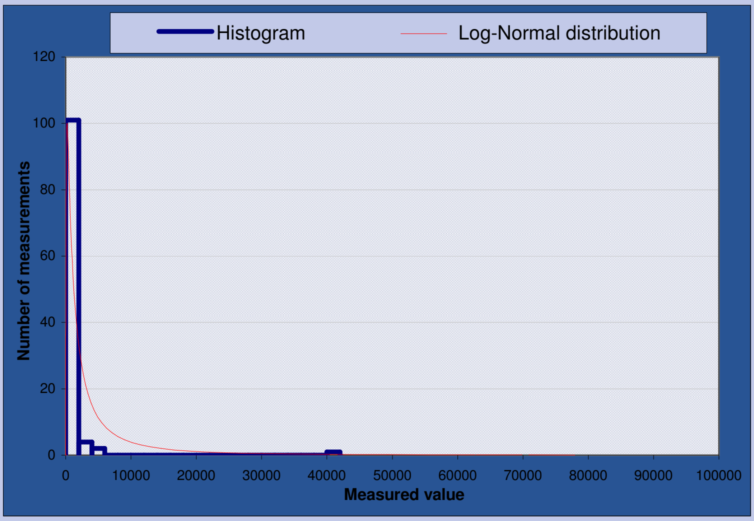
Us Log-Normal distribution to test for outliers

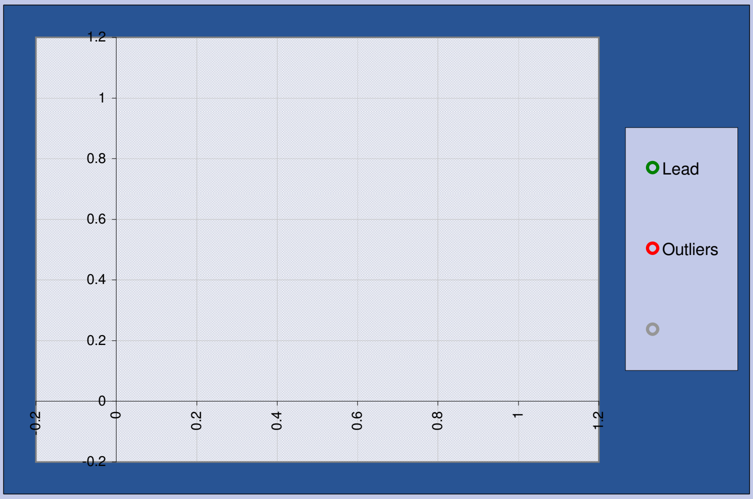
Exclude identified outliers

Show individual summary

Back to summary

Back to data





BH117	☑ Y			
BH117	☑ Y			
BH117	☑ Y	26		
BH117	☑ Y			
BH117	☑ Y	7		
BH118/A	☑ Y	454		
BH118/A	☑ Y	134		
BH119	☑ Y	17		
BH120	☑ Y			
BH122/B	☑ Y	143		
BH125	☑ Y	798		
BH125	☑ Y	36		
BH127	☑ Y	9		
BH128	☑ Y	8		
BH131	☑ Y	200		
DIS 101	☑ Y	60		
DIS 102	☑ Y	116		
DIS 103	☑ Y	1035		
DIS 104	☑ Y	131		
TP121	☑ Y	1885		
TP121	☑ Y	469		
TP123	☑ Y	668		
TP123	☑ Y	638		
TP124	☑ Y	406		
TP124	☑ Y	416		
TP125	☑ Y	1365		
TP125	☑ Y	2228		
TP125a	☑ Y	30		
TP126	☑ Y	3043		
TP126	☑ Y	282		
TP127	☑ Y	898		
TP127	☑ Y	227		
TP128	☑ Y	65		
TP128	☑ Y	749		
TP128	☑ Y	127		
TP129A	☑ Y	46		
TP129	☑ Y	161		
TP129	☑ Y	41		
TP129	☑ Y	126		
TP129	☑ Y	73		
TP130	☑ Y	205		
TP130	☑ Y	58		
TP130	☑ Y	56		
TP131	☑ Y	159		
TP131	☑ Y	445		
TP131	☑ Y	54		
TP132	☑ Y	196		
TP132	☑ Y	142		
TP132	☑ Y	133		

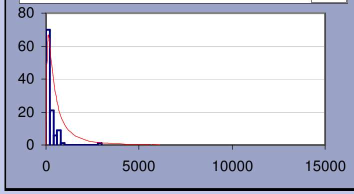
Test Results

Client/client ref: Cork County Co Site ref: Date: 00-Jan-1900

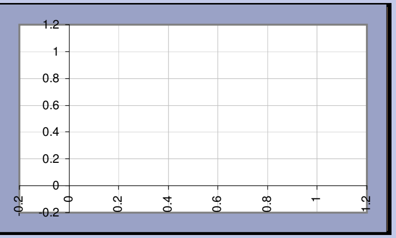
Project ref: East Tip Haulbowline Data description: Statistical analaysis - all waste da User details:

Dataset:	Nickel
Sample mean, $\overline{x}$	227.22
Sample standard deviation, s	327.73
Sample size, n	108
Critical concentration, Cc	922

Use Log-Normal distribution to te

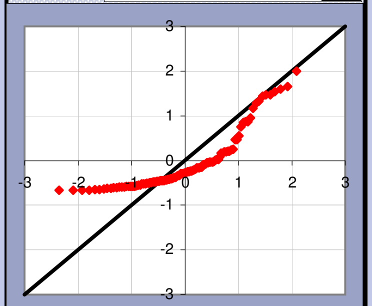


Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	0

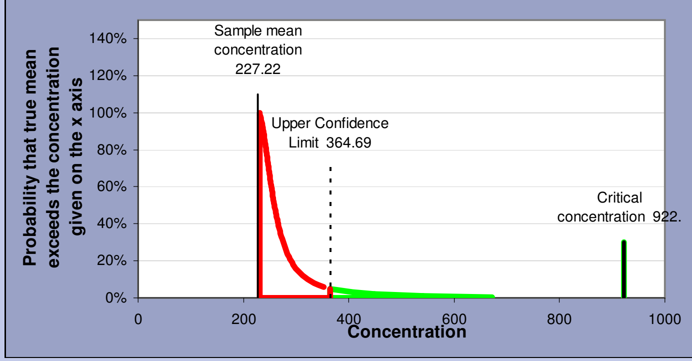


Normality test

Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc



Evidence against Null hypothesis:	100%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

μ < Cc (re this dataset)

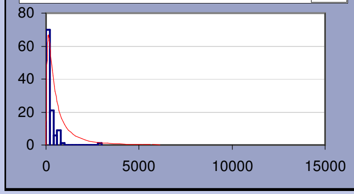
Back to data | Back to summary | Go to outlier test | Go to normality test

Test Results

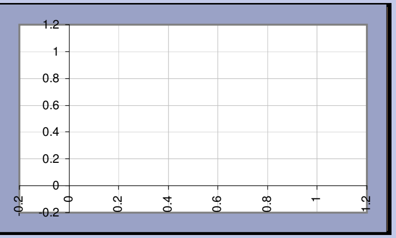
Client/client ref: Cork County Co Site ref:
Project ref: East Tip Haulbowline Data description: Statistical analaysis - all waste da User details:
Date: 00-Jan-1900

Dataset:	Nickel
Sample mean, $\overline{x}$	227.22
Sample standard deviation, s	327.73
Sample size, n	108
Critical concentration, Cc	1800

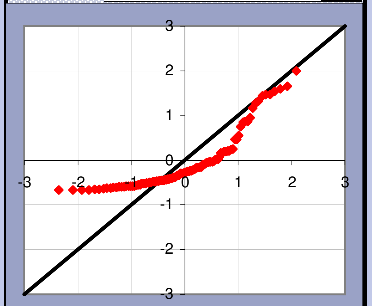
Use Log-Normal distribution to te



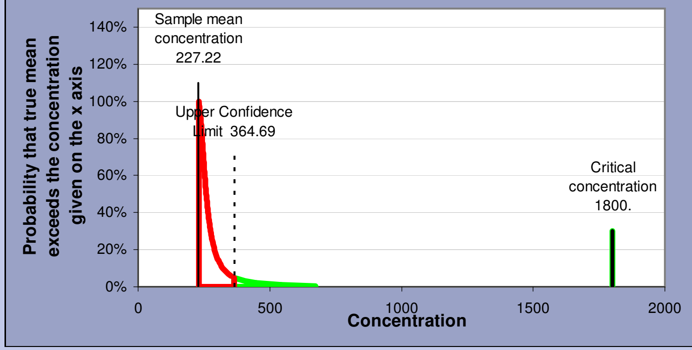
Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	0



Normality test	
Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc

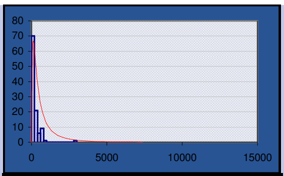


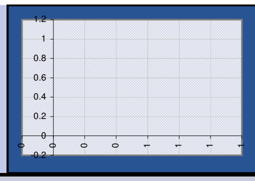
Evidence against Null hypothesis:	100%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

μ < Cc (re this dataset)

Back to data | Back to summary | Go to outlier test | Go to normality test

Sample ID	Include?	Nickel	Outliers
BH301A	☑ Y	232	
BH301A	☑ Y	707	
BH301A	☑ Y	280	
BH302	☑ Y	381	
BH302	☑ Y	198	
BH302	☑ Y	69.4	
BH303	☑ Y		
BH303	☑ Y	200	
BH303	☑ Y	156	
BH304	☑ Y	21.4	
BH304	☑ Y	179	
BH304	☑ Y	78.8	
BH305	☑ Y	25.8	
BH305	☑ Y	10.4	
BH306a	☑ Y	83.1	
BH306a	☑ Y	218	
BH306a	☑ Y	307	
BH306a	☑ Y	251	
BH306b	☑ Y	74.7	
BH306b	☑ Y		
BH306b	☑ Y	81.1	
BH306b	☑ Y	65.9	
BH307	☑ Y	32.2	
BH307	☑ Y	37	
BH307	☑ Y	211	
BH308	☑ Y	37.5	
BH308	☑ Y	131	
BH309	☑ Y	91.1	
BH310a	☑ Y	217	
BH310a	☑ Y	56.3	
BH310a	☑ Y		
BH310a	☑ Y	146	
BH310a	☑ Y	173	
BH310b	☑ Y		
BH310b	☑ Y	294	
BH310b	☑ Y	174	
BH310b	☑ Y	215	
BH310c	☑ Y	118	
BH310c	☑ Y	102	
BH311	☑ Y	10.3	
BH311	☑ Y	56.8	
BH312a	☑ Y	199	
BH312a	☑ Y	131	
BH312a	☑ Y	211	
BH312a	☑ Y		
BH312b	☑ Y	472	
BH312b	☑ Y	701	
BH312b	☑ Y		
BH312b	☑ Y	290	
BH312c	☑ Y	308	
BH312c	☑ Y	410	
BH312c	☑ Y	513	
BH313	☑ Y	150	
BH313	☑ Y	76.5	
BH314	☑ Y	91.2	
BH314	☑ Y	2860	
BH314	☑ Y	750	
BH314	☑ Y	293	
BH315	☑ Y	162	
BH315	☑ Y	64.7	
BH315	☑ Y	8.09	
BH316	☑ Y	379	
BH316	☑ Y	37	
BH316	☑ Y	103	
OP10	☑ Y	505	
OP10	☑ Y	72.2	
OP10	☑ Y	236	
OP14	☑ Y	537	
OP14	☑ Y	20.8	





Outliers?
NO
(None selected)

Sample mean, $\bar{x}$
124.167

Standard deviation, s
Factor of 3.12

Sample size, n
108

Maxiumum
2860.000

Test Applicability
Applicable

Level of Significance, α
5%

Tn = 2.754
Tcrit = 3.236

Dataset: Nickel

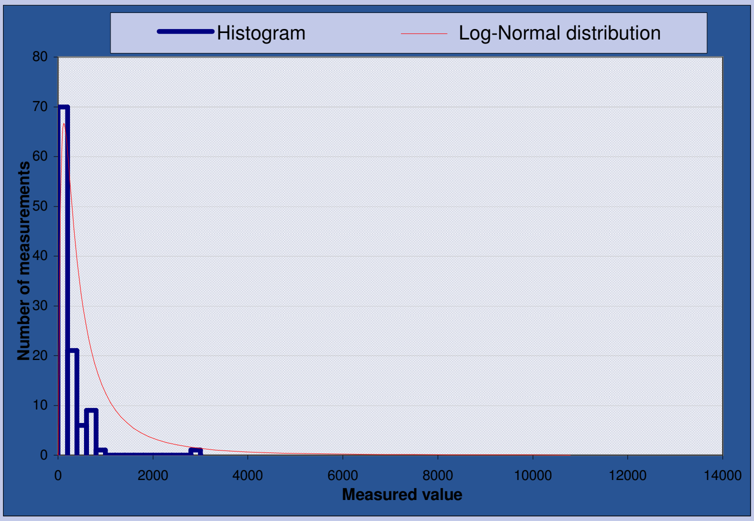
Us Log-Normal distribution to test for outliers

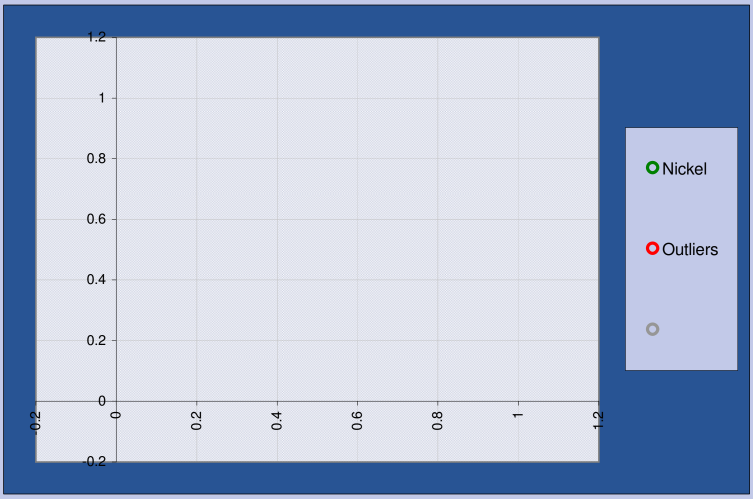
Exclude identified outliers

Show individual summary

Back to summary

Back to data





BH117	☑ Y			
BH117	☑ Y			
BH117	☑ Y	26		
BH117	☑ Y			
BH117	☑ Y	14		
BH118/A	☑ Y	84		
BH118/A	☑ Y	45		
BH119	☑ Y	12		
BH120	☑ Y			
BH122/B	☑ Y	34		
BH125	☑ Y	734		
BH125	☑ Y	72		
BH127	☑ Y	19		
BH128	☑ Y	11		
BH131	☑ Y	134		
DIS 101	☑ Y	883		
DIS 102	☑ Y	610		
DIS 103	☑ Y	230		
DIS 104	☑ Y	662		
TP121	☑ Y	174		
TP121	☑ Y	55		
TP123	☑ Y	158		
TP123	☑ Y	178		
TP124	☑ Y	131		
TP124	☑ Y	87		
TP125	☑ Y	217		
TP125	☑ Y	114		
TP125a	☑ Y	707		
TP126	☑ Y	291		
TP126	☑ Y	770		
TP127	☑ Y	137		
TP127	☑ Y	79		
TP128	☑ Y	32		
TP128	☑ Y	140		
TP128	☑ Y	150		
TP129A	☑ Y	143		
TP129	☑ Y	94		
TP129	☑ Y	48		
TP129	☑ Y	59		
TP129	☑ Y	36		
TP130	☑ Y	78		
TP130	☑ Y	37		
TP130	☑ Y	40		
TP131	☑ Y	99		
TP131	☑ Y	282		
TP131	☑ Y	115		
TP132	☑ Y	59		
TP132	☑ Y	509		
TP132	☑ Y	649		

☑ Y

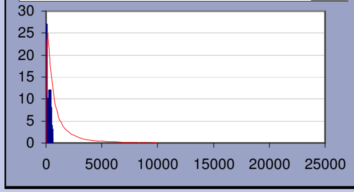
Test Results

Client/client ref: Cork County Co Site ref: Date: 00-Jan-1900

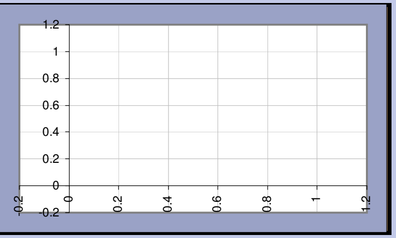
Project ref: East Tip Haulbowline Data description: Statistical analaysis - all waste da User details:

Dataset:	Vanadium
Sample mean, $\overline{x}$	220.92
Sample standard deviation, s	160.2
Sample size, n	108
Critical concentration, Cc	422

Use Log-Normal distribution to te

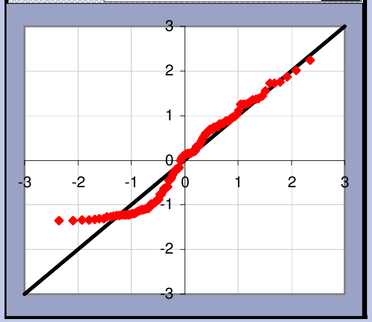


Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	0

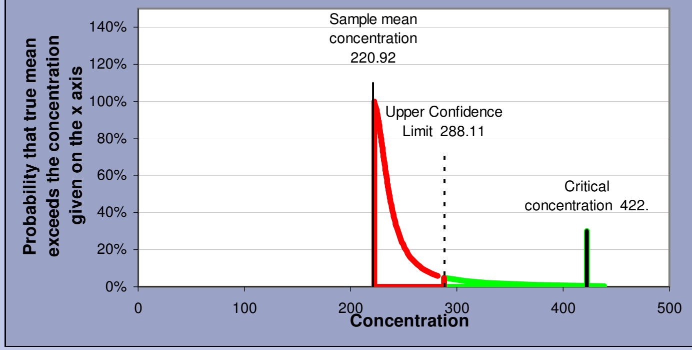


Normality test

Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc

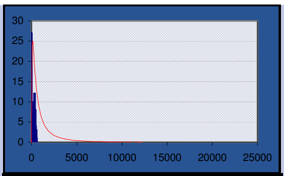


Evidence against Null hypothesis:	**99%**
Base decision on:	evidence level
Evidence level required:	**95%**
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

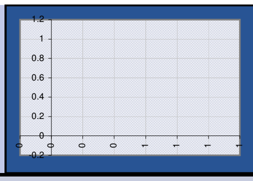
μ < Cc (re this dataset)

Back to data | **Back to summary** | **Go to outlier test** | **Go to normality test**

Sample ID	Include?	Vanadium	Outliers
BH301A	Y	315	
BH301A	Y	3.07	
BH301A	Y	108	
BH302	Y	24.4	
BH302	Y	316	
BH302	Y	351	
BH303	Y		
BH303	Y	338	
BH303	Y	421	
BH304	Y	22.4	
BH304	Y	151	
BH304	Y	498	
BH305	Y	20.5	
BH305	Y	38.4	
BH306a	Y	440	
BH306a	Y	321	
BH306a	Y	253	
BH306a	Y	375	
BH306b	Y	350	
BH306b	Y		
BH306b	Y	385	
BH306b	Y	470	
BH307	Y	503	
BH307	Y	442	
BH307	Y	332	
BH308	Y	24.1	
BH308	Y	251	
BH309	Y	581	
BH310a	Y	244	
BH310a	Y	438	
BH310a	Y		
BH310a	Y	332	
BH310a	Y	521	
BH310b	Y		
BH310b	Y	300	
BH310b	Y	543	
BH310b	Y	431	
BH310c	Y	361	
BH310c	Y	342	
BH311	Y	21.6	
BH311	Y	243	
BH312a	Y	70.6	
BH312a	Y	118	
BH312a	Y	46.6	
BH312a	Y		
BH312b	Y	63.9	
BH312b	Y	42.9	
BH312b	Y		
BH312b	Y	195	
BH312c	Y	97.9	
BH312c	Y	126	
BH312c	Y	55.5	
BH313	Y	189	
BH313	Y	451	
BH314	Y	356	
BH314	Y	121	
BH314	Y	25.3	
BH314	Y	97.7	
BH315	Y	498	
BH315	Y	421	
BH315	Y	28.7	
BH316	Y	77.3	
BH316	Y	48.8	
BH316	Y	169	
OP10	Y	11.8	
OP10	Y	423	
OP10	Y	123	
OP14	Y	26.2	
OP14	Y	62.8	



Outliers?
NO
(None selected)



Sample mean, $\bar{x}$
132.802

Standard deviation, s
Factor of 3.54

Sample size, n
108

Maxiumum
581.000

Test Applicability
Applicable

Level of Significance, α
5%

Tn = 1.167
Tcrit = 3.236

Dataset: Vanadium

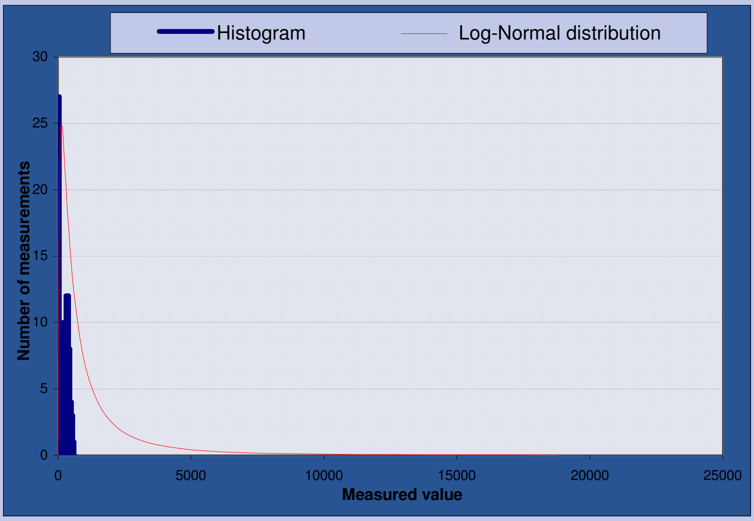
Use Log-Normal distribution to test for outliers

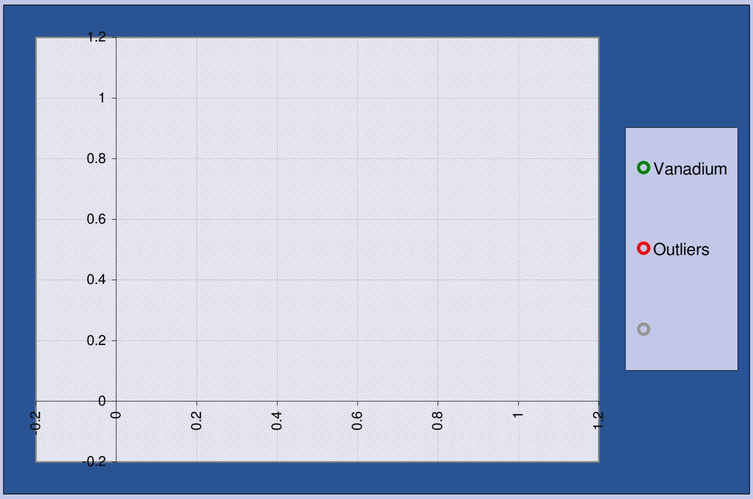
Exclude identified outliers

Show individual summary

Back to summary

Back to data





BH117	☑ Y			
BH117	☑ Y			
BH117	☑ Y	18		
BH117	☑ Y			
BH117	☑ Y	46		
BH118/A	☑ Y	272		
BH118/A	☑ Y	149		
BH119	☑ Y	18		
BH120	☑ Y			
BH122/B	☑ Y	80		
BH125	☑ Y	30		
BH125	☑ Y	40		
BH127	☑ Y	34		
BH128	☑ Y	179		
BH131	☑ Y	220		
DIS 101	☑ Y	6		
DIS 102	☑ Y	6		
DIS 103	☑ Y	290		
DIS 104	☑ Y	11		
TP121	☑ Y	245		
TP121	☑ Y	362		
TP123	☑ Y	353		
TP123	☑ Y	245		
TP124	☑ Y	281		
TP124	☑ Y	341		
TP125	☑ Y	158		
TP125	☑ Y	270		
TP125a	☑ Y	9		
TP126	☑ Y	191		
TP126	☑ Y	4		
TP127	☑ Y	186		
TP127	☑ Y	228		
TP128	☑ Y	306		
TP128	☑ Y	363		
TP128	☑ Y	338		
TP129A	☑ Y	421		
TP129	☑ Y	331		
TP129	☑ Y	254		
TP129	☑ Y	399		
TP129	☑ Y	378		
TP130	☑ Y	271		
TP130	☑ Y	236		
TP130	☑ Y	237		
TP131	☑ Y	372		
TP131	☑ Y	241		
TP131	☑ Y	247		
TP132	☑ Y	25		
TP132	☑ Y	44		
TP132	☑ Y	68		

☑ Y

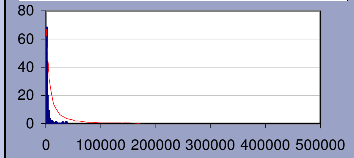
Test Results

Client/client ref: Cork County Co Site ref: Date: 00-Jan-1900

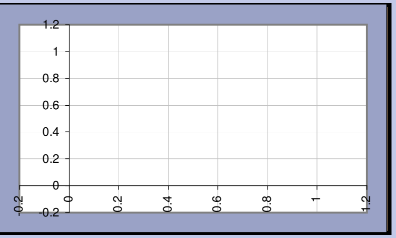
Project ref: East Tip Haulbowline Data description: Statistical analaysis - all waste da User details:

Dataset:	Zinc
Sample mean, $\overline{x}$	2815.2
Sample standard deviation, s	5309.9
Sample size, n	108
Critical concentration, Cc	54800

Use Log-Normal distribution to te



Outliers & non-detects	
Outliers present?	NO
Significance level	5%
Outliers removed?	0
Non-detects	0

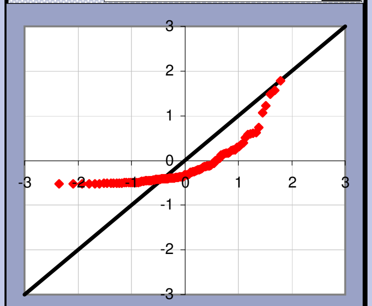


Normality test

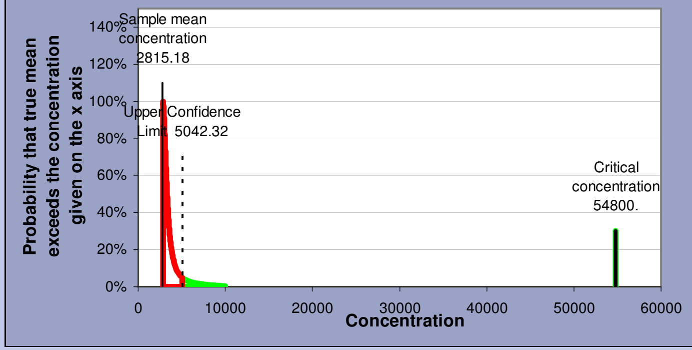
Significance level: 5%

Non-normal distribution

Use: Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc

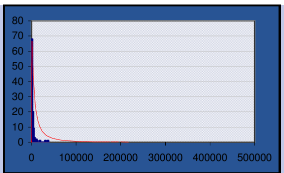


Evidence against Null hypothesis:	100%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

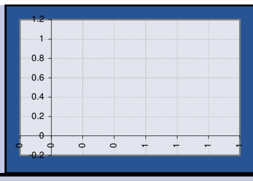
μ < Cc (re this dataset)

Back to data | Back to summary | Go to outlier test | Go to normality test

Sample ID	Include?	Zinc	Outliers
BH301A	Y	2470	
BH301A	Y	96.3	
BH301A	Y	3610	
BH302	Y	2150	
BH302	Y	2080	
BH302	Y	847	
BH303	Y		
BH303	Y	5480	
BH303	Y	1500	
BH304	Y	162	
BH304	Y	5970	
BH304	Y	3700	
BH305	Y	99.6	
BH305	Y	592	
BH306a	Y	718	
BH306a	Y	2830	
BH306a	Y	1070	
BH306a	Y	639	
BH306b	Y	468	
BH306b	Y		
BH306b	Y	395	
BH306b	Y	779	
BH307	Y	143	
BH307	Y	226	
BH307	Y	374	
BH308	Y	213	
BH308	Y	2020	
BH309	Y	1440	
BH310a	Y	2160	
BH310a	Y	204	
BH310a	Y		
BH310a	Y	784	
BH310a	Y	295	
BH310b	Y		
BH310b	Y	651	
BH310b	Y	591	
BH310b	Y	169	
BH310c	Y	631	
BH310c	Y	418	
BH311	Y	1070	
BH311	Y	731	
BH312a	Y	4670	
BH312a	Y	2770	
BH312a	Y	12300	
BH312a	Y		
BH312b	Y	31200	
BH312b	Y	6730	
BH312b	Y		
BH312b	Y	2200	
BH312c	Y	1580	
BH312c	Y	2250	
BH312c	Y	37900	
BH313	Y	3030	
BH313	Y	742	
BH314	Y	1500	
BH314	Y	879	
BH314	Y	801	
BH314	Y	9310	
BH315	Y	5910	
BH315	Y	709	
BH315	Y	95.2	
BH316	Y	2460	
BH316	Y	140	
BH316	Y	1740	
OP10	Y	4410	
OP10	Y	1090	
OP10	Y	18900	
OP14	Y	562	
OP14	Y	215	



Outliers?
NO
(None selected)



Sample mean, $\bar{x}$
1036.009

Standard deviation, s
Factor of 4.46

Sample size, n
108

Maxiumum
37900.000

Test Applicability
Applicable

Level of Significance, α
5%

Tn = 2.407
Tcrit = 3.236

Dataset: Zinc

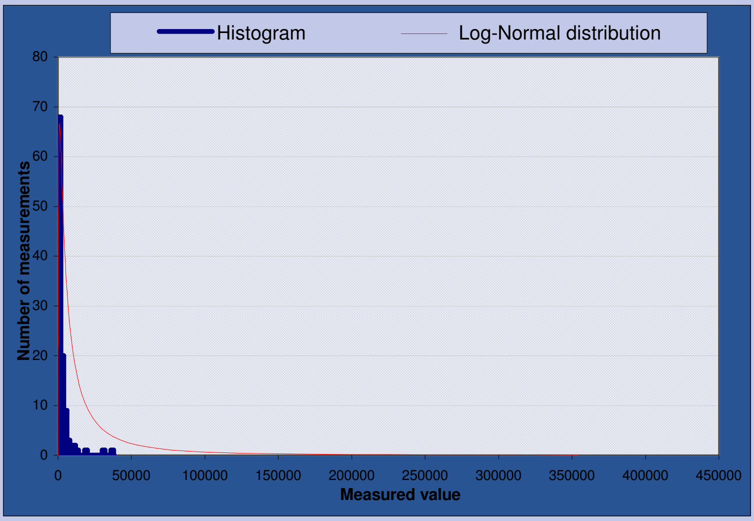
Us Log-Normal distribution to test for outliers

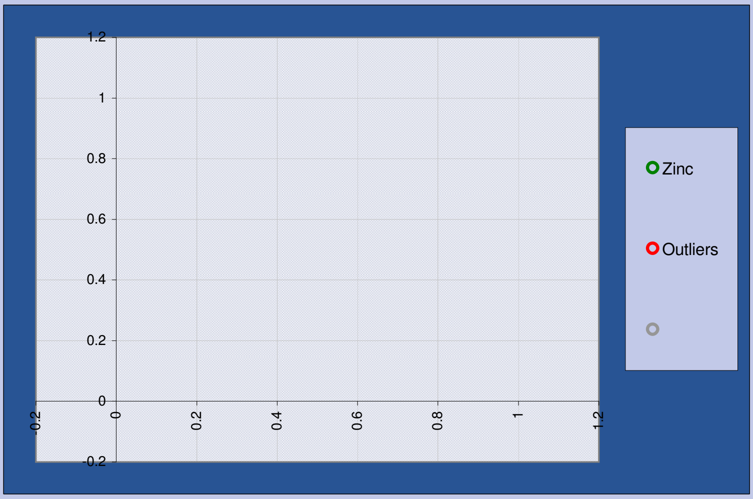
Exclude identified outliers

Show individual summary

Back to summary

Back to data





BH117	☑ Y			
BH117	☑ Y			
BH117	☑ Y	95		
BH117	☑ Y			
BH117	☑ Y	67		
BH118/A	☑ Y	1893		
BH118/A	☑ Y	6055		
BH119	☑ Y	53		
BH120	☑ Y			
BH122/B	☑ Y	628		
BH125	☑ Y	6095		
BH125	☑ Y	221		
BH127	☑ Y	69		
BH128	☑ Y	103		
BH131	☑ Y	1728		
DIS 101	☑ Y	3750		
DIS 102	☑ Y	4045		
DIS 103	☑ Y	4086		
DIS 104	☑ Y	718		
TP121	☑ Y	8492		
TP121	☑ Y	1169		
TP123	☑ Y	3523		
TP123	☑ Y	3082		
TP124	☑ Y	4482		
TP124	☑ Y	1615		
TP125	☑ Y	3992		
TP125	☑ Y	10670		
TP125a	☑ Y	192		
TP126	☑ Y	11160		
TP126	☑ Y	3477		
TP127	☑ Y	4912		
TP127	☑ Y	2063		
TP128	☑ Y	480		
TP128	☑ Y	3700		
TP128	☑ Y	843		
TP129A	☑ Y	390		
TP129	☑ Y	1413		
TP129	☑ Y	370		
TP129	☑ Y	1078		
TP129	☑ Y	638		
TP130	☑ Y	661		
TP130	☑ Y	535		
TP130	☑ Y	454		
TP131	☑ Y	889		
TP131	☑ Y	1758		
TP131	☑ Y	389		
TP132	☑ Y	25		
TP132	☑ Y	44		
TP132	☑ Y	68		

☑ Y

Appendix R Football Pitch Analysis Results

East Tip Football Pitch Solid Samples, Laboratory Analysis
2012 and 2008 data

Sample Identity	LODs & Units	Commercial / Industrial Land Use GAC (mg/kg)	Park Human Health GAC (mg/kg)	BH304	BH304	BH304	BH305	BH305	BH308	BH308
Depth (m)				0.3	2	4.2	0.3	4 4.5	0.3	0.7 0.9
Sample Description										
Colour				Dark Brown	Dark Brown	Dark Brown	Light Brown	Dark Brown	Light Brown	Dark Brown
Description				Silt Loam	Sand	Sand	Loamy Sand	Sand	Sandy Loam	Sand
Grain Size				0.063 0.1 mm	0.1 2 mm	0.1 2 mm	0.063 0.1 mm	0.1 2 mm	0.1 2 mm	0.1 2 mm
Inclusion 1)				Stones	Crushed Brick	Stones	Stones	Stones	Stones	Stones
Inclusion 2)				None	Stones	None	N/A	N/A	None	None
Moisture content ratio	%			9.2	6.2	0.88	13	2.9	12	13
Laboratory data										
2Butanone	<100 µg/kg					<100				
Acetone	< 50 µg/kg					<50				
Chloride (soluble)	<5mg/kg			<5	115	1740	36.5	1210	57.7	64.1
Water Soluble Sulphate as SO4 2:1 Extract	<0.008 g/l			<0.008	0.164	0.454	0.0123	<0.008	0.0168	0.232
Carbon										
Fraction Organic Carbon (FOC)				0.00859	<0.1	<0.1	0.00414	<0.1	0.00931	<0.1
Inorganics										
Ammoniacal Nitrogen as N	mg/kg			<15	<15	<15	<15	<15	<15	<15
Cyanide, Complex	mg/kg			<1	<1	<1	<1	<1	<1	<1
Cyanide, Free	mg/kg	36	34	<1	<1	<1	<1	<1	<1	<1
Cyanide, Total	mg/kg			<1	<1	<1	<1	<1	<1	<1
pH	1 pH Units			6.54	10.4	9.57	7.75	10.6	7.29	11.9
Sulphate, Total	<0.008 mg/kg			285	2850	6000	221	2460	244	3750
Sulphate, Total	%									
Sulphide, Easily liberated	mg/kg			<15	<15	29.2	<15	<15	<15	<15
Sulphur, Total	%			<0.02			0.026		0.0298	
Sulphur, Total	%			0.00949	0.0948	0.2	0.00736	0.082	0.00813	0.125
Thiocyanate	mg/kg			<1	<1	<1	<1	<1	<1	<1
Metals										
Aluminium	<11 mg/kg			10300	16200	16000	11100	1920	12600	8310
Antimony	<0.6 mg/kg		831	4.09	27.3	30.9	1.52	6.89	2.32	19.2
Arsenic	mg/kg	640	41.4	16.2	36.9	21.3	16.2	<0.6	17.3	33.4
Barium	mg/kg		1570	116	663	543	28.9	68.4	42.5	383
Beryllium	mg/kg	420	277000	0.393	0.261	0.0686	0.473	<0.01	0.44	0.127
Boron, water soluble	mg/kg	192000		<1	3.64	5.59	<1	4.26	<1	4.44
Cadmium	mg/kg	230	83.6	0.301	14.2	8.12	0.377	0.301	0.627	4.1
Calcium	<21mg/kg			2890	136000	176000	1640	161000	2610	101000
Chromium	mg/kg	30400	22500	23.4	1520	2230	25.5	302	41.3	801
Chromium, Hexavalent	mg/kg	35	239	<0.6	1.06	<0.6	<0.6	<0.6	<0.6	0.929
Copper	mg/kg	71700	12200	20.6	652	305	13.9	28.9	75.8	431
Lead	mg/kg	4640	477	127	**1090**	**645**	36.7	28.4	66.8	**542**
Magnesium	<8mg/kg			2280	22100	53300	2780	74000	3130	99900
Manganese	<0.13 mg/kg			1170	16600	29400	1310	11400	1320	18000
Mercury	<0.14 mg/kg	3640	303	0.305	<0.7	<0.7	<0.14	<0.14	<0.14	<0.7
Nickel	mg/kg	1800	922	21.4	179	78.8	25.8	10.4	37.5	131
Selenium	mg/kg	13000	696	1.27	9.9	17.5	1.59	1.14	<1	8.42
Vanadium	mg/kg	3160	422	22.4	151	**498**	20.5	38.4	24.1	251
Zinc	mg/kg	665000	54800	162	5970	3700	99.6	592	213	2020
Phenols										
2,3,5 TrimethylPhenol	<0.01 mg/kg			<	<	<	<	<	<	<
2Isopropyl Phenol	<0.015 mg/kg			<	<	<	<	<	<	<
Cresols	<0.01 mg/kg		9910	<	<	<	<	<	<	<
Phenol	<0.01 mg/kg	482	686	<	<	<	<	<	<	<
Phenols, Total 5 speciated	<0.06 mg/kg		686	<	<	<	<	<	<	<
Phenols, Total monohydric	<0.035 mg/kg		686	<	<	<	<	<	<	<
Xylenols	<0.015 mg/kg			<	<	<	<	<	<	<
TPH Criteria Working Group (TPH CWG)										
Aliphatics >C5C6	<10µg/kg	3400000	324000000			<				
Aliphatics >C6C8	<10µg/kg	8300000	326000000			<				
Aliphatics >C8C10	<10µg/kg	2100000	6420000			<				
Aliphatics >C10C12	<10µg/kg	10000000	6520000			<				
Aliphatics >C12C16	<100µg/kg	61000000	6520000			2230				
Aliphatics >C16C21	<100µg/kg	1000000000	177000000			18500				
Aliphatics >C21C35	<100µg/kg	1000000000	177000000			88300				
Aliphatics >C35C44	<100µg/kg					20400				
Aromatics >EC5EC7	<10µg/kg	28000	14200			<				
Aromatics >EC7EC8	<10µg/kg	59000000	23500000			<				
Aromatics >EC8EC10	<10µg/kg	3700000	1940000			<				
Aromatics >EC10EC12	<10µg/kg	17000000	2490000			<				
Aromatics >EC12EC16	<100µg/kg	36000000	2590000			1890				
Aromatics >EC16EC21	<100µg/kg	28000000	1610000			11900				
Aromatics >EC21EC35	<100µg/kg	28000000	1610000			54600				
Aromatics >EC35EC44	<100µg/kg					22900				
Aromatics >EC40EC44	<100µg/kg					8330				
Total Aliphatics >C535	<100µg/kg					109000				
Total Aromatics >C535	<100µg/kg					68400				
Total Aliphatics & Aromatics >C5C44	<100µg/kg					221000				
Methyl tertiary butyl ether (MTBE)	<5µg/kg		15600000			<				
Benzene	<10µg/kg	28000	14200			<				
Ethylbenzene	<3µg/kg	518000	10100000			<				
m,p,oXylene	<9 µg/kg		14500000			<				
m,pXylene	<6µg/kg	312000	14500000			<				
oXylene	<3µg/kg		15700000			<				
Toluene	<2µg/kg	869000	23500000			<				
BTEX, Total	<24µg/kg					<				
TPH Screen										
TPH by GC (>C6-C10)	mg/kg									
TPH by GC (>C10 - C20)	mg/kg									
TPH by GC (>C20-C40)	mg/kg									
TPH by GC (>C6 - C40)	mg/kg									
Rapid PAH Screen										
Polyaromatic hydrocarbons, Total 17	<10mg/kg			<	11.7	<	<	<	<	<
POLYCYCLIC AROMATIC HYDROCARBONS										
Naphthalene	mg/kg	200.0	1010.0							
Acenaphthylene	mg/kg	84000								
Acenaphthene	mg/kg	85000	5570							
Fluorene	mg/kg	64000	3810							
Phenanthrene	mg/kg	22000								
Anthracene	mg/kg	530000	29100							
Fluoranthene	mg/kg	23000	3890							
Pyrene	mg/kg	54000	2920							
Benzo(a)anthracene	mg/kg	90.0	9.5							
Chrysene	mg/kg	140.0	993.0							
Benzo(b)fluoranthene	mg/kg	100.0	11.5							
Benzo(k)fluoranthene	mg/kg	140.0	123.0							
Benzo(a)pyrene	mg/kg	14.0	1.2							
Dibenzo(ah)anthracene	mg/kg	13.0	1.3							
Benzo(ghi)perylene	mg/kg	650.0	143.0							
Indeno(123cd)pyrene	mg/kg	60.0	11.2							
PAH (Total - SUM EPA16)	mg/kg									
SemiVolatile Organic Compounds (SVOCs)										
1,2,4Trichlorobenzene	<100µg/kg					<				
1,2Dichlorobenzene	<100µg/kg					<				
1,3Dichlorobenzene	<100µg/kg					<				
1,4Dichlorobenzene	<100µg/kg					<				
2,4,5Trichlorophenol	<100µg/kg					<				
2,4,6Trichlorophenol (S)	<100µg/kg					<				
2,4Dichlorophenol (S)	<100µg/kg					<				
2,4Dimethylphenol (S)	<100µg/kg		1920000			<				
2,4Dinitrotoluene (S)	<100µg/kg		200000			<				
2,6Dinitrotoluene	<100µg/kg		101000			<				
2Chloronaphthalene	<100µg/kg		2450000			<				
2Chlorophenol (S)	<100µg/kg					<				
2Methylnaphthalene	<100µg/kg					<				
2Methylphenol	<100µg/kg		9910000			<				
2Nitroaniline (S)	<100µg/kg					<				
2Nitrophenol (S)	<100µg/kg					<				
3Nitroaniline	<100µg/kg					<				
4Bromophenylphenylether	<100µg/kg					<				
4Chloro3methylphenol (S)	<100µg/kg					<				
4Chloroaniline	<100µg/kg					<				
4Chlorophenylphenylether	<100µg/kg					<				
4Methylphenol (S)	<100µg/kg		9910000			<				
4Nitroaniline	<100µg/kg					<				
4Nitrophenol (S)	<100µg/kg					<				
Acenaphthene	<100µg/kg	85000000	5570000			<				

Sample Identity	HP01	HP02	HP02	HP03	HP04	HP04	HP05	HP05	HP06	HP07	HP08	HP09	HP09	HP10	HP11	HP12	HP13	HP13
Depth (m)	0.00m - 0.05m	0.00m - 0.01m	0.01m - 0.05m	0.00m - 0.05m	0.00m - 0.01m	0.01m - 0.05m	0.00m - 0.05m	0.01m - 0.05m	0.00m - 0.05m	0.00m - 0.05m	0.00m - 0.05m	0.00m - 0.01m	0.01m - 0.05m	0.00m - 0.05m	0.00m - 0.05m	0.00m - 0.05m	0.00m - 0.01m	0.01m - 0.05m
Carbon																		
Fraction Organic Carbon (FOC)	0.04	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	0.036	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Inorganics																		
Cyanide, Free	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cyanide, Total	<2.5	<2.5	<2.5	<2.5	4.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
pH	6.4	7.1	6.9	6.2	6.3	6.4	7.7	8	6.5	6.8	6.3	6.1	6	7.2	6.9	6.2	6.9	6.2
Sulphate, Total (%)	0.032	<0.024	<0.024	0.035	<0.024	<0.024	<0.024	0.026	0.026	0.029	0.034	0.026	0.028	0.038	0.037	<0.024	0.037	0.026
Sulphide, Easily liberated	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	110	<7.5
Sulphur, Total (%)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Thiocyanate	0.29	<0.20	<0.20	0.35	<0.20	<0.20	<0.20	0.22	<0.20	<0.20	0.23	<0.20	0.55	0.23	<0.20	0.6	0.79	<0.20
Metals																		
Arsenic	10	12	12	11	10	11	11	9.7	11	12	8.7	11	11	11	11	9.8	9.7	11
Barium	58	40	38	42	34	35	40	38	36	49	37	34	35	120	56	43	39	39
Beryllium	0.44	0.35	0.37	0.36	0.33	0.36	0.38	0.33	0.35	0.37	<0.30	0.34	0.33	0.32	0.35	0.32	0.3	0.32
Boron, water soluble	1.6	1.5	1.1	1.3	1.4	1.3	1.3	0.71	1.2	1.1	1.6	1.3	1.2	1.6	1.8	1	1.5	0.94
Cadmium	0.72	1.6	1.4	0.58	0.52	0.53	0.59	0.55	0.55	1.3	0.52	0.6	0.67	0.98	1.3	0.89	0.97	0.89
Chromium	42	66	66	39	37	39	41	38	37	68	39	41	41	46	68	47	53	49
Chromium, Hexavalent	0.51	1	1	0.41	0.63	0.41	0.47	0.5	0.3	1	0.31	0.35	0.34	0.43	3.7	0.57	0.46	0.42
Copper	44	50	46	31	28	29	32	33	27	47	31	29	29	66	53	37	43	40
Lead	110	150	130	78	67	71	83	82	66	130	71	78	81	270	180	110	110	99
Mercury	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	0.32	<0.25	<0.25	0.77	<0.25	<0.25	<0.25	<0.25
Nickel	23	32	32	20	20	20	23	22	18	29	17	21	20	25	30	21	25	24
Selenium	0.44	0.39	0.41	0.53	0.41	0.36	0.38	0.35	<0.30	0.39	<0.30	0.33	0.35	0.35	0.43	<0.30	<0.30	0.31
Vanadium	23	22	22	24	22	23	24	22	23	28	22	24	23	23	23	23	23	23
Zinc	370	540	490	220	190	190	240	230	190	430	180	220	220	380	410	330	310	290
TPH Screen																		
TPH by GC (>C6-C10)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TPH by GC (>C10 - C20)	<50	<50	<50	<50	<50	<50	310	140	<50	<50	<50	<50	<50	<50	100	<50	<50	<50
TPH by GC (>C20-C40)	160	60	59	83	62	55	460	280	130	75	60	62	57	87	300	66	<50	<50
TPH by GC (>C6 - C40)	160	60	59	83	62	55	770	420	130	75	60	62	57	87	410	66	<50	<50
POLYCYCLIC AROMATIC HYDROCARBONS																		
Naphthalene	<0.10	<0.10	<0.10	<0.10	0.14	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	0.15	0.15	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	0.2	<0.10	<0.10	<0.10	<0.10
Anthracene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.33	<0.10	<0.10	<0.10	<0.10
Pyrene	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.34	<0.10	<0.10	<0.10	<0.10
Benzo(a)anthracene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.2	<0.10	<0.10	<0.10	<0.10
Chrysene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.22	<0.10	<0.10	<0.10	<0.10
Benzo(b)fluoranthene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.17	<0.10	<0.10	<0.10	<0.10
Benzo(k)fluoranthene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10
Benzo(a)pyrene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.18	<0.10	<0.10	<0.10	<0.10
Dibenzo(ah)anthracene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(ghi)perylene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.15	<0.10	<0.10	<0.10	<0.10
Indeno(123cd)pyrene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10
PAH (Total - SUM EPA16)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.2	<1.0	<1.0	<1.0	<1.0

East Tip Football Pitch Solid Samples, Laboratory Analysis
2012 and 2008 data

Sample Identity	LODs & Units	Commercial / Industrial Land Use GAC (mg/kg)	Park Human Health GAC (mg/kg)	BH304	BH304	BH304	BH305	BH305	BH308	BH308
Depth (m)				0.3	2	4.2	0.3	4 4.5	0.3	0.7 0.9
Acenaphthylene	<100µg/kg	84000000				<				
Anthracene	<100µg/kg	530000000	29100000			150				
Azobenzene	<100µg/kg					<				
Benzo(a)anthracene	<100µg/kg	90000	9520			381				
Benzo(a)pyrene	<100µg/kg	14000	1200			356				
Benzo(b)fluoranthene	<100µg/kg	100000	11500			318				
Benzo(g,h,i)perylene	<100µg/kg	650000	143000			254				
Benzo(k)fluoranthene	<100µg/kg	140000	123000			310				
Bis(2chloroethoxy)methane	<100µg/kg					<				
bis(2Chloroethyl)ether	<100µg/kg					<				
bis(2Ethylhexyl) phthalate	<100µg/kg		3420000			5380				
Butylbenzyl phthalate	<100µg/kg					<				
Carbazole	<100µg/kg					<				
Chrysene	<100µg/kg	140000	993000			411				
Dibenzo(a,h)anthracene	<100µg/kg	13000	1270			<				
Dibenzofuran	<100µg/kg					<				
Diethyl phthalate	<100µg/kg		21000000			<				
Dimethyl phthalate	<100µg/kg					<				
Fluoranthene	<100µg/kg	23000000	3890000			904				
Fluorene	<100µg/kg	64000000	3810000			<				
Hexachlorobenzene	<100µg/kg					<				
Hexachlorobutadiene	<100µg/kg					<				
Hexachlorocyclopentadiene	<100µg/kg					<				
Hexachloroethane	<100µg/kg		51400			<				
Indeno(1,2,3cd)pyrene	<100µg/kg	60000	11200			201				
Isophorone	<100µg/kg					<				
Naphthalene	<100µg/kg	200000	1010000			165				
nDibutyl phthalate	<100µg/kg					115				
nDioctyl phthalate	<100µg/kg					<				
Nitrobenzene	<100µg/kg					<				
nNitrosodipropylamine	<100µg/kg					<				
Pentachlorophenol	<100µg/kg					<				
Phenanthrene	<100µg/kg	22000000				678				
Phenol	<100µg/kg	482				<				
Pyrene	<100µg/kg	54000000	2920000			703				
Tic Report						No TICs identified				
Volatile Organic Compounds (VOCs) (Solids)										
1.1.1.2Tetrachloroethane	<10µg/kg	120000	223000			<				
1.1.1Trichloroethane	<7µg/kg	700000	54500000			<				
1.1.2.2Tetrachloroethane	<10µg/kg	290000	292000			<				
1.1.2Trichloroethane	<10µg/kg		171000			<				
1.1Dichloroethane	<8µg/kg		9730000			<				
1.1Dichloroethene	<10µg/kg		453000			<				
1.1Dichloropropene	<10µg/kg					<11				
1.2.3Trichlorobenzene	<6µg/kg					<				
1.2.3Trichloropropane	<17µg/kg					<				
1.2.4Trichlorobenzene	<6µg/kg					<				
1.2.4Trimethylbenzene	<9µg/kg		49700			<				
1.2Dibromo3chloropropane	<14µg/kg					<				
1.2Dibromoethane	<12µg/kg					<				
1.2Dichlorobenzene	<12µg/kg					<				
1.2Dichloroethane	<5µg/kg	710	2800			<				
1.2Dichloropropane	<12µg/kg		18600			<				
1,3,5-trichlorobenzene										
1.3.5Trimethylbenzene	<8µg/kg					<				
1.3Dichlorobenzene	<6µg/kg					<				
1.3Dichloropropane	<7µg/kg					<				
1.4Dichlorobenzene	<5µg/kg					<				
2.2Dichloropropane	<12µg/kg					<				
2Chlorotoluene	<9µg/kg					<				
4Chlorotoluene	<12µg/kg					<				
4Isopropyltoluene	<11µg/kg					<				
Benzene	<9µg/kg	28000	14200			<				
Bromobenzene	<10µg/kg		228000			<				
Bromochloromethane	<14µg/kg					<				
Bromodichloromethane	<7µg/kg		7710			<				
Bromoform	<10µg/kg		644000			<				
Bromomethane	<13µg/kg					<				
Carbon Disulphide	<7µg/kg		303			14.7				
Carbontetrachloride	<14µg/kg	3000	22400			<				
Chlorobenzene	<5µg/kg		4920000			<				
Chloroethane	<14µg/kg		272000000			<				
Chloroform	<8µg/kg	110000	457000			<				
Chloromethane	<7µg/kg		17200			<				
cis12Dichloroethene	<5µg/kg		89500			<				
cis13Dichloropropene	<7µg/kg					<14				
Dibromochloromethane	<13µg/kg		45000			<				
Dibromomethane	<9µg/kg					<				
Dichlorodifluoromethane	<6µg/kg					<				
Dichloromethane	<10µg/kg		297000			<				
Ethylbenzene	<3µg/kg	518000	10100000			<4				
Hexachlorobutadiene	<12µg/kg					<				
Isopropylbenzene	<5µg/kg		10000000			<				
Methyl Tertiary Butyl Ether	<11µg/kg					<				
Naphthalene	<13µg/kg		1010000			<				
nButylbenzene	<10µg/kg					<				
n-propylbenzene										
oXylene	<3µg/kg					<10				
p/mXylene	<14µg/kg	312000	14500000			<				
p-isopropyltoluene										
Propylbenzene	<11µg/kg		10400000			<				
secButylbenzene	<10µg/kg					<				
Styrene	<10µg/kg					<				
Tertamyl methyl ether	<15µg/kg					<				
tertButylbenzene	<12µg/kg					<				
Tetrachloroethene	<5µg/kg	130000	982000			<				
Toluene	<2µg/kg	869000	23500000			<5				
trans12Dichloroethene	<11µg/kg		212000			<				
trans13Dichloropropene	<14µg/kg					<				
Trichloroethene	<9µg/kg	12000	88200			<				
Trichlorofluoromethane	<6µg/kg					<				
Vinyl Chloride	<10µg/kg	63	804			<				
VOC TIC						No TICs identified				
PCB's (Solids)										
PCB28	< 3 µg/kg									
PCB52	< 3 µg/kg									
PCB101	< 3 µg/kg									
PCB118	< 3 µg/kg									
PCB138	< 3 µg/kg									
PCB153	< 3 µg/kg									
PCB180	< 3 µg/kg									
sum of 6 PCB's	< 21 µg/kg									
Sum of 7 PCBS										

Sample Identity	HP01	HP02	HP02	HP03	HP04	HP04	HP05	HP05	HP06	HP07	HP08	HP09	HP09	HP10	HP11	HP12	HP13	HP13
Depth (m)	0.00m - 0.05m	0.00m - 0.01m	0.01m - 0.05m	0.00m - 0.05m	0.00m - 0.01m	0.01m - 0.05m	0.00m - 0.05m	0.01m - 0.05m	0.00m - 0.05m	0.00m - 0.05m	0.00m - 0.05m	0.00m - 0.01m	0.01m - 0.05m	0.00m - 0.05m	0.00m - 0.05m	0.00m - 0.05m	0.00m - 0.01m	0.01m - 0.05m
Volatile Organic Compounds (VOCs) (Solids)																		
1.1.1.2Tetrachloroethane					<130	<120	<130	<120				<0.14	<130				<0.16	<0.13
1.1.1Trichloroethane					<130	<120	<130	<120				<0.14	<130				<0.16	<0.13
1.1.2.2Tetrachloroethane					<130	<120	<130	<120				<140	<130				<160	<130
1.1.2Trichloroethane					<130	<120	<130	<120				<140	<130				<160	<130
1.1Dichloroethane					<130	<120	<130	<120				<140	<130				<160	<130
1.1Dichloroethene					<130	<120	<130	<120				<140	<130				<160	<130
1.1Dichloropropene					<130	<120	<130	<120				<140	<130				<160	<130
1.2.3Trichlorobenzene					<130	<120	<130	<120				<140	<130				<160	<130
1.2.3Trichloropropane					<130	<120	<130	<120				<140	<130				<160	<130
1.2.4Trichlorobenzene					<130	<120	<130	<120				<140	<130				<160	<130
1.2.4Trimethylbenzene					<130	<120	<130	<120				<140	<130				<160	<130
1.2Dibromo3chloropropane					<130	<120	<130	<120				<140	<130				<160	<130
1.2Dibromoethane					<130	<120	<130	<120				<140	<130				<160	<130
1.2Dichlorobenzene					<130	<120	<130	<120				<140	<130				<160	<130
1.2Dichloroethane					<130	<120	<130	<120				<140	<130				<160	<130
1.2Dichloropropane					<130	<120	<130	<120				<140	<130				<160	<130
1,3,5-trichlorobenzene					<130	<120	<130	<120				<140	<130				<160	<130
1.3.5Trimethylbenzene					<130	<120	<130	<120				<140	<130				<160	<130
1.3Dichlorobenzene					<130	<120	<130	<120				<140	<130				<160	<130
1.3Dichloropropane					<130	<120	<130	<120				<140	<130				<160	<130
1.4Dichlorobenzene					<130	<120	<130	<120				<140	<130				<160	<130
2.2Dichloropropane					<130	<120	<130	<120				<140	<130				<160	<130
2Chlorotoluene					<130	<120	<130	<120				<140	<130				<160	<130
4Chlorotoluene					<130	<120	<130	<120				<140	<130				<160	<130
4Isopropyltoluene												<140					<160	<130
Benzene					<130	<120	<130	<120				<140	<130				<160	<130
Bromobenzene					<130	<120	<130	<120				<140	<130				<160	<130
Bromochloromethane					<130	<120	<130	<120				<140	<130				<160	<130
Bromodichloromethane					<130	<120	<130	<120				<140	<130				<160	<130
Bromoform					<130	<120	<130	<120				<140	<130				<160	<130
Bromomethane																		
Carbon Disulphide																		
Carbontetrachloride					<130	<120	<130	<120				<140	<130				<160	<130
Chlorobenzene					<130	<120	<130	<120				<140	<130				<160	<130
Chloroethane												<140					<160	<130
Chloroform					<130	<120	<130	<120				<140	<130				<160	<130
Chloromethane												<140					<160	<130
cis12Dichloroethene					<130	<120	<130	<120				<140	<130				<160	<130
cis13Dichloropropene					<130	<120	<130	<120				<140	<130				<160	<130
Dibromochloromethane					<130	<120	<130	<120				<140	<130				<160	<130
Dibromomethane					<130	<120	<130	<120				<140	<130				<160	<130
Dichlorodifluoromethane																		
Dichloromethane					<130	<120	<130	<120				<140	<130				<160	<130
Ethylbenzene					<130	<120	<130	<120				<140	<130				<160	<130
Hexachlorobutadiene					<130	<120	<130	<120				<140	<130				<160	<130
Isopropylbenzene					<130	<120	<130	<120				<140	<130				<160	<130
Methyl Tertiary Butyl Ether																		
Naphthalene																		
nButylbenzene					<130	<120	<130	<120				<140	<130				<160	<130
n-propylbenzene					<130	<120	<130	<120				<140	<130				<160	<130
oXylene					<130	<120	<130	<120				<140	<130				<160	<130
p/mXylene					<130	<240	<250	<240				<270	<260				<320	<270
p-isopropyltoluene					<130	<120	<130	<120				<140	<130				<160	<130
Propylbenzene																		
secButylbenzene					<130	<120	<130	<120				<140	<130				<160	<130
Styrene					<130	<120	<130	<120				<140	<130				<160	<130
Tertamyl methyl ether																		
tertButylbenzene					<130	<120	<130	<120				<140	<130				<160	<130
Tetrachloroethene					<130	<120	<130	<120				<140	<130				<160	<130
Toluene					<130	<120	<130	<120				<140	<130				<160	<130
trans12Dichloroethene					<130	<120	<130	<120				<140	<130				<160	<130
trans13Dichloropropene					<130	<120	<130	<120				<140	<130				<160	<130
Trichloroethene					<130	<120	<130	<120				<140	<130				<160	<130
Trichlorofluoromethane																		
Vinyl Chloride					<130	<120	<130	<120				<140	<130				<160	<130
VOC TIC																		
PCB's (Solids)																		
PCB28	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.9	<1.0	<1.0	<1.0	<1.0
PCB52	<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	1.5	<1.0	<1.0	<1.0	<1.0
PCB101	<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	1.8	<1.0	<1.0	<1.0	<1.0
PCB118	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.6	<1.0	<1.0	<1.0	<1.0
PCB138	<1.0	<1.0	1.9	<1.0	<1.0	<1.0	<1.0	<1.0	1.6	<1.0	<1.0	1.3	<1.0	2.3	1.3	2.7	1.6	<1.0
PCB153	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	2.2	<1.0	<1.0	1.5	2.8
PCB180	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1	<1.0	<1.0	<1.0	1.6
sum of 6 PCB's	6	6	6	6	6	6	6	6	6.8	6	6	6.3	6	11.7	6.3	7.7	7.1	8.4
Sum of 7 PCBS	7	7	7	7	7	7	7	7	7.8	7	7	7.3	7	14.3	7.3	8.7	8.1	9.4

BOLD and yellow indicates value exceeding Atrisk Park Human Health GAC

turquoise indicates value exceeds commercial GAC

Screen Unformatted Data

Screen Formatted Data

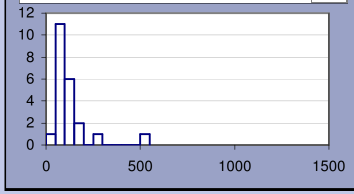
Appendix S Football Pitch Statistical Analysis Results

Test Results

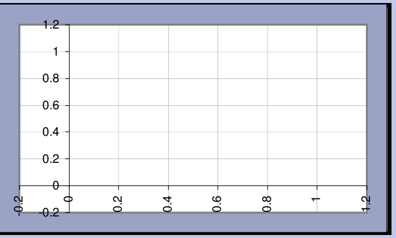
Client/client ref: | Site ref: | Date: 00-Jan-1900
Project ref: | Data description: | User details:

Dataset:	Lead
Sample mean, $\overline{x}$	124.48
Sample standard deviation, s	105.51
Sample size, n	22
Critical concentration, Cc	477

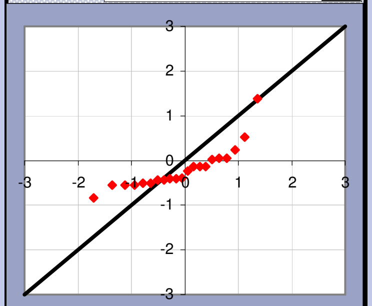
Use Log-Normal distribution to te



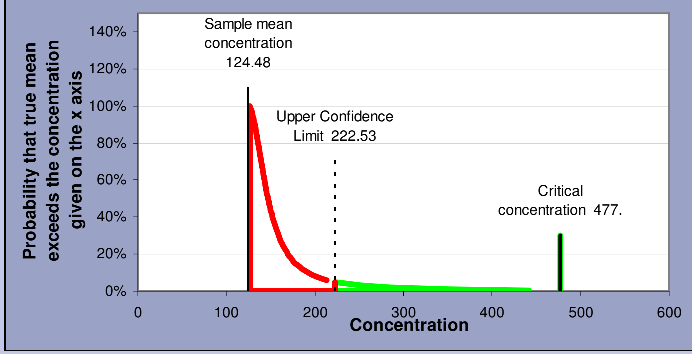
Outliers & non-detects	
Outliers present?	YES
Significance level	5%
Outliers removed?	0
Non-detects	0



Normality test	
Significance level:	5%
Non-normal distribution	
Use:	Auto: Chebychev



Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?
Null hypothesis:	The true mean concentration is equal to or greater than the critical concentration: μ ≥ Cc
Alternative hypothesis:	The true mean concentration is less than the critical concentration: μ < Cc



Evidence against Null hypothesis:	100%
Base decision on:	evidence level
Evidence level required:	95%
Balance of probability?	N/A
Reject Null Hypothesis?	Yes

μ < Cc (re this dataset)

Back to data | Back to summary | Go to outlier test | Go to normality test

Sample ID	Include?	Lead		Outliers
BH304	☑ Y	127		
BH304	☑ Y			
BH304	☑ Y			
BH305	☑ Y	36.7		
BH305	☑ Y			
BH308	☑ Y	66.8		
BH308	☑ Y	542	Outlier	
HP01	☑ Y	110		
HP02	☑ Y	150		
HP02	☑ Y	130		
HP03	☑ Y	78		
HP04	☑ Y	67		
HP04	☑ Y	71		
HP05	☑ Y	83		
HP05	☑ Y	82		
HP06	☑ Y	66		
HP07	☑ Y	130		
HP08	☑ Y	71		
HP09	☑ Y	78		
HP09	☑ Y	81		
HP10	☑ Y	270		
HP11	☑ Y	180		
HP12	☑ Y	110		
HP13	☑ Y	110		
HP13	☑ Y	99		
	☑ Y			
	☑ Y			
	☑ Y			
	☑ Y			
	☑ Y			
	☑ Y			
	☑ Y			
	☑ Y			
	☑ Y			
	☑ Y			
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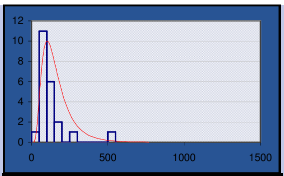
	☑ Y			
	☑ Y			

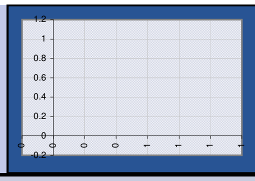
☑ Y



Outliers?

YES

(None selected)



Sample mean, $\bar{x}$

103.313

Standard deviation, s

Factor of 1.75

Sample size, n

22

Maxiumum

542.000

Test Applicability

Applicable

Level of Significance, α

5%

Tn = 2.973
Tcrit = 2.603

Dataset: Lead

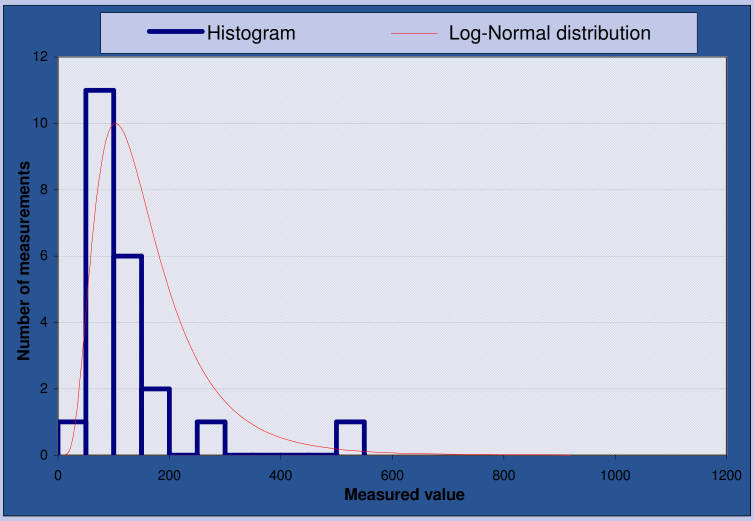
Us[e] Log-Normal distribution to test for outliers

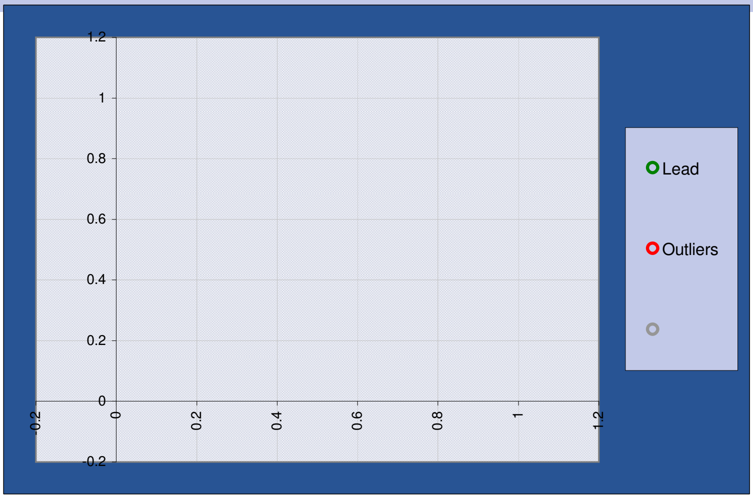
Exclude identified outliers

Show individual summary

Back to summary

Back to data





Appendix T Laboratory Certificates for November 2012 Sampling

Jones Environmental Laboratory

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

WYG
1 Locksley Business Park
Montgomery Park
Belfast
Northern Ireland
BT6 9UP

No.4225

Attention :	Yvonne Buchanan
Date :	22nd November, 2012
Your reference :	A075294
Our reference :	Test Report 12/8989 Batch 1
Location :	EAST TIP
Date samples received :	16th November, 2012
Status :	Final report
Issue :	1

Twenty one samples were received for analysis on 16th November, 2012. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Bruce Leslie
Project Co-ordinator

Bob Millward B.Sc
Principal Chemist

Jones Environmental Laboratory

Client Name: WYG
Reference: A075294
Location: EAST TIP
Contact: Yvonne Buchanan
JE Job No.: 12/8989

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1	2	3	4	5	6	7	8	9	10			
Sample ID	BH312A-HW	BH312A-LW	BH316-HW	BH316-LW	BH310A-LW	BH310A-HW	BH314-HW	BH314-LW	BH304-LW	BH126-HW			
Depth													
COC No / misc													
Containers	HN	HN	HN	HN	HN	HN	HN	HN	HN	HN			
Sample Date	06/11/2012	06/11/2012	07/11/2012	07/11/2012	07/11/2012	07/11/2012	08/11/2012	08/11/2012	08/11/2012	08/11/2012			
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water			
Batch Number	1	1	1	1	1	1	1	1	1	1	**LOD**	**Units**	**Method No.**
Date of Receipt	16/11/2012	16/11/2012	16/11/2012	16/11/2012	16/11/2012	16/11/2012	16/11/2012	16/11/2012	16/11/2012	16/11/2012			
Dissolved Arsenic #	<0.9	1.2	1.3	<0.9	<0.9	1.2	<0.9	1.6	4.8	<0.9	<0.9	ug/l	TM30/PM14
Dissolved Cadmium #	0.08	<0.03	<0.03	0.14	0.13	<0.03	0.30	0.28	0.07	<0.03	<0.03	ug/l	TM30/PM14
Total Dissolved Chromium #	<0.2	<0.2	<0.2	<0.2	31.8	18.3	0.4	1.5	<0.2	<0.2	<0.2	ug/l	TM30/PM14
Dissolved Copper #	19	21	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM30/PM14
Dissolved Lead #	4.5	6.9	<0.4	0.8	0.7	1.1	0.8	<0.4	1.4	<0.4	<0.4	ug/l	TM30/PM14
Dissolved Manganese #	<1.5	<1.5	359.8	295.5	<1.5	<1.5	<1.5	<1.5	4122.0	103.5	<1.5	ug/l	TM30/PM14
Dissolved Nickel #	10.1	9.9	<0.2	0.8	<0.2	<0.2	1.4	1.4	2.4	0.2	<0.2	ug/l	TM30/PM14
Dissolved Zinc #	3.8	1.8	4.0	4.9	6.1	5.2	45.4	18.2	<1.5	11.5	<1.5	ug/l	TM30/PM14
Mercury Dissolved by CVAF #	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ug/l	TM61/PM38
Hexavalent Chromium	<0.002	<0.002	<0.002	<0.002	0.033	0.020	<0.002	<0.002	<0.002	0.002	<0.002	mg/l	TM38/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Jones Environmental Laboratory

Client Name: WYG

Reference: A075294

Location: EAST TIP

Contact: Yvonne Buchanan

JE Job No.: 12/8989

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HNO_3$

Please see attached notes for all abbreviations and acronyms

J E Sample No.	11	12	13	14	15	16	17	18	19	20			
Sample ID	BH126-LW	DUPLICATE 1	HW1	HW2	HW3	HW4	HW5	HW6	DUPLICATE 2	BLANK TRIP			
Depth													
COC No / misc													
Containers	HN	HN	HN	HN	HN	HN	HN	HN	HN	P			
Sample Date	08/11/2012	08/11/2012	13/11/2012	13/11/2012	13/11/2012	13/11/2012	13/11/2012	13/11/2012	13/11/2012	<>			
Sample Type	Ground Water	Ground Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Trip Blank			
Batch Number	1	1	1	1	1	1	1	1	1	1	**LOD**	**Units**	**Method No.**
Date of Receipt	16/11/2012	16/11/2012	16/11/2012	16/11/2012	16/11/2012	16/11/2012	16/11/2012	16/11/2012	16/11/2012	16/11/2012			
Dissolved Arsenic #	<0.9	<0.9	1.7	1.2	1.9	<0.9	1.6	<0.9	<0.9	<0.9	<0.9	ug/l	TM30/PM14
Dissolved Cadmium #	0.12	0.06	<0.03	0.03	<0.03	0.04	0.05	0.19	0.07	<0.03	<0.03	ug/l	TM30/PM14
Total Dissolved Chromium #	<0.2	34.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	ug/l	TM30/PM14
Dissolved Copper #	<3	5	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM30/PM14
Dissolved Lead #	<0.4	0.6	1.0	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	ug/l	TM30/PM14
Dissolved Manganese #	79.1	<1.5	3.5	2.5	2.8	4.1	1.9	<1.5	2.6	<1.5	<1.5	ug/l	TM30/PM14
Dissolved Nickel #	0.5	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	ug/l	TM30/PM14
Dissolved Zinc #	6.3	<1.5	2.0	2.2	5.6	9.1	4.8	6.9	8.9	<1.5	<1.5	ug/l	TM30/PM14
Mercury Dissolved by CVAF #	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ug/l	TM61/PM38
Hexavalent Chromium	<0.002	0.070	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM38/PM0

Jones Environmental Laboratory

Client Name: WYG

Reference: A075294

Location: EAST TIP

Contact: Yvonne Buchanan

JE Job No.: 12/8989

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

Please see attached notes for all abbreviations and acronyms

J E Sample No.	21										**LOD**	**Units**	**Method No.**
Sample ID	BH304-HW												
Depth													
COC No / misc													
Containers	HN												
Sample Date	08/11/2012												
Sample Type	Ground Water												
Batch Number	1												
Date of Receipt	16/11/2012												
Dissolved Arsenic #	1.4										<0.9	ug/l	TM30/PM14
Dissolved Cadmium #	0.09										<0.03	ug/l	TM30/PM14
Total Dissolved Chromium #	<0.2										<0.2	ug/l	TM30/PM14
Dissolved Copper #	<3										<3	ug/l	TM30/PM14
Dissolved Lead #	2.0										<0.4	ug/l	TM30/PM14
Dissolved Manganese #	4908.0										<1.5	ug/l	TM30/PM14
Dissolved Nickel #	1.2										<0.2	ug/l	TM30/PM14
Dissolved Zinc #	<1.5										<1.5	ug/l	TM30/PM14
Mercury Dissolved by CVAF #	<0.01										<0.01	ug/l	TM61/PM38
Hexavalent Chromium	<0.002										<0.002	mg/l	TM38/PM0

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 12/8989

SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of £1 (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory . It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

NOTE

Data is only accredited when all the requirements of our Quality System have been met. In certain circumstances where the requirements have not been met, the laboratory may issue the data in an interim report but will remove the accreditation, in this instance results should be considered indicative only. Where possible samples will be re-extracted and a final report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

ABBREVIATIONS and ACRONYMS USED

#	UKAS accredited.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
NFD	No Fibres Detected

JE Job No 12/8989

Test Method No.	Description	Prep Method No. (if appropriate)	Description	UKAS	MCERTS (soils only)	Analysis done on As Received (AR) or Air Dried (AD)	Solid Results expressed on Dry/Wet basis
TM30	Metals by ICP-OES	PM14	Metals by ICP (Waters)	Yes			
TM38	SO4,Cl,NO3,NO2,F,PO4, Amm N2,ThioCN, Hex Cr by Aquakem	PM0	No Preparation				
TM61	Mercury - low level CVAF	PM38	Mercury CVAF	Yes			

P S ANALYTICAL

LABORATORY REPORT

To:	Yvonne Buchanan, WYG Environmental & Planning
C/c:	Lab, RC
From:	Dr Bin Chen
Subject:	Hg in Effluent Samples
PSA Reference:	12/238 – 12/258
PO number:	A075294-4616-016
Date:	27 November 2012

The measurement of total mercury concentrations in 21 water samples were carried out using Millennium Merlin System after BrCl digestion. Samples were acidified upon collection and well mixed before digestion. Aliquot of bromide/bromate solution (1 ml, 0.1N) was accurately transferred using a pipette directly into the sample bottle. The sample was capped tightly for at least 30 min to achieve a complete oxidation. Right before the analysis, the sample was decolourised by the addition of 20 µl hydroxylamine solution (10%, m/v). A reference material (Elevated mercury in river water, ORMS-3) was used for quality control. The results of the samples are listed in table 1.

Table 1 Mercury concentrations found in WYG water samples

Sample ID	Sample Date	PSA ID	Hg Conc, ng l^{-1}	SD
BH312A-HW	06/11/2012	12/238	59.6	1.2
BH312A-LW	06/11/2012	12/239	54.3	0.0
BH316-HW	07/11/2012	12/240	9.9	0.1
BH316-LW	07/11/2012	12/241	44.3	0.1
BH310A-LW	07/11/2012	12/242	3.2	0.4
BH310A-HW	07/11/2012	12/243	143.9	5.4
BH314-HW	08/11/2012	12/244	227.4	4.5
BH314-LW	08/11/2012	12/245	28.0	0.8
BH304-HW	08/11/2012	12/246	< 0.5	N/A
BH304-LW	08/11/2012	12/247	1.7	0.7
BH126-HW	08/11/2012	12/248	< 0.5	N/A
BH126-LW	08/11/2012	12/249	< 0.5	N/A
HW1	13/11/2012	12/250	26.5	1.5
HW2	13/11/2012	12/251	12.8	0.1
HW3	13/11/2012	12/252	15.9	1.4
HW4	13/11/2012	12/253	27.6	0.7
HW5	13/11/2012	12/254	15.8	0.1
HW6	13/11/2012	12/255	10.8	0.3
DUPLICATE 1	<>	12/256	10.5	0.2
DUPLICATE 2	<>	12/257	20.4	0.7
BLANK TRIP	<>	12/258	3.4	0.2
ORMS-3 Certified Value 12.6 ± 1.1 ng l^{-1}			11.9	0.1

PSA

P S ANALYTICAL LTD
Registered Office: Arthur House, Crayfields Industrial Estate,
Main Road, Orpington, Kent, BR5 3HP, England.
Telephone: +44 (0)1689 891211 Facsimile: +44 (0)1689 896009
E-mail: psa@psanalytical.com Website: www.psanalytical.com
Directors: Dr P.B. Stockwell M.A.Stockwell Reg No. 1600004 VAT No: GB 367 6490 13

Jones Environmental Laboratory

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WYG
1 Locksley Business Park
Montgomery Park
Belfast
Northern Ireland
BT6 9UP

No.4225

Attention :	Yvonne Buchanan
Date :	11th December, 2012
Your reference :	A075294
Our reference :	Test Report 12/9463 Batch 1
Location :	EAST TIP
Date samples received :	3rd December, 2012
Status :	Final report
Issue :	1

Thirty samples were received for analysis on 3rd December, 2012. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Phil Sommerton B.Sc
Project Manager

Bob Millward B.Sc
Principal Chemist

Jones Environmental Laboratory

Client Name: WYG

Reference: A075294

Location: EAST TIP

Contact: Yvonne Buchanan

JE Job No.: 12/9463

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1	2	3	4	5	6	7	8	9	10			
Sample ID	BH116-LW	BH118-LW	BH119-LW	BH120-LW	BH122-LW	BH127-LW	BH128-LW	BH130-LW	BH301A-LW	BH302-LW			
Depth													
COC No / misc													
Containers	HN	HN	HN	HN	HN	HN	HN	HN	HN	HN			
Sample Date	28/11/2012	27/11/2012	28/11/2012	28/11/2012	29/11/2012	28/11/2012	29/11/2012	29/11/2012	16/11/2012	16/11/2012			
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water			
Batch Number	1	1	1	1	1	1	1	1	1	1	**LOD**	**Units**	**Method No.**
Date of Receipt	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012			
Dissolved Arsenic #	<0.9	<0.9	1.6	3.0	2.2	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	ug/l	TM30/PM14
Dissolved Cadmium #	<0.03	<0.03	<0.03	<0.03	1.78	0.05	<0.03	0.05	0.11	0.05	<0.03	ug/l	TM30/PM14
Total Dissolved Chromium #	<0.2	4.3	1.5	0.5	<0.2	16.6	1.5	5.0	<0.2	<0.2	<0.2	ug/l	TM30/PM14
Dissolved Copper #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM30/PM14
Dissolved Lead #	<0.4	2.2	0.8	1.1	0.4	0.5	0.7	0.7	1.7	1.8	<0.4	ug/l	TM30/PM14
Dissolved Manganese #	325.5	<1.5	11.9	1909.0	7.0	<1.5	<1.5	<1.5	1784.0	576.7	<1.5	ug/l	TM30/PM14
Dissolved Nickel #	<0.2	<0.2	<0.2	1.4	0.3	<0.2	<0.2	<0.2	1.4	1.6	<0.2	ug/l	TM30/PM14
Dissolved Zinc #	12.0	15.8	14.5	10.6	16.7	10.4	9.8	7.2	9.6	12.3	<1.5	ug/l	TM30/PM14
Mercury Dissolved by CVAF #	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ug/l	TM61/PM38
Hexavalent Chromium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM38/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Jones Environmental Laboratory

Client Name: WYG

Report : Liquid

Reference: A075294

Location: EAST TIP

Contact: Yvonne Buchanan

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle

JE Job No.: 12/9463

$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

Please see attached notes for all abbreviations and acronyms

J E Sample No.	11	12	13	14	15	16	17	18	19	20			
Sample ID	BH303-LW	BH305-LW	BH306B-LW	BH306C-LW	BH306D-LW	BH307-LW	BH308-LW	BH309-LW	BH310B-LW	BH310-LW			
Depth													
COC No / misc													
Containers	HN	HN	HN	HN	HN	HN	HN	HN	HN	HN			
Sample Date	28/11/2012	28/11/2012	30/11/2012	30/11/2012	16/11/2012	16/11/2012	15/11/2012	16/11/2012	16/11/2012	30/11/2012			
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water			
Batch Number	1	1	1	1	1	1	1	1	1	1	**LOD**	**Units**	**Method No.**
Date of Receipt	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012			
Dissolved Arsenic #	<0.9	<0.9	1.4	<0.9	<0.9	3.2	8.0	<0.9	31.1	2.7	<0.9	ug/l	TM30/PM14
Dissolved Cadmium #	0.06	<0.03	<0.03	0.49	<0.03	<0.03	<0.03	<0.03	0.36	0.37	<0.03	ug/l	TM30/PM14
Total Dissolved Chromium #	0.8	<0.2	5.2	0.3	<0.2	2.8	<0.2	<0.2	0.9	1.0	<0.2	ug/l	TM30/PM14
Dissolved Copper #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM30/PM14
Dissolved Lead #	0.5	<0.4	<0.4	0.6	<0.4	<0.4	<0.4	<0.4	1.1	<0.4	<0.4	ug/l	TM30/PM14
Dissolved Manganese #	5.6	140.7	<1.5	74.2	1497.0	<1.5	565.8	394.7	3397.0	790.5	<1.5	ug/l	TM30/PM14
Dissolved Nickel #	<0.2	1.3	<0.2	1.8	1.1	0.5	5.8	0.4	3.2	2.2	<0.2	ug/l	TM30/PM14
Dissolved Zinc #	13.3	19.7	34.8	39.7	9.8	30.1	19.3	9.2	27.5	95.0	<1.5	ug/l	TM30/PM14
Mercury Dissolved by CVAF #	<0.01	<0.01	<0.01	0.07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ug/l	TM61/PM38
Hexavalent Chromium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM38/PM0

Jones Environmental Laboratory

Client Name: WYG

Reference: A075294

Location: EAST TIP

Contact: Yvonne Buchanan

JE Job No.: 12/9463

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle

H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

Please see attached notes for all abbreviations and acronyms

J E Sample No.	21	22	23	24	25	26	27	28	29	30			
Sample ID	BH311-LW	BH312B-LW	BH312C-LW	BH313-LW	BH315-LW	BH117R-LW	BH125R-LW	SP01	SP02	SP03			
Depth													
COC No / misc													
Containers	HN	HN	HN	HN	HN	HN	HN	HN	HN	HN			
Sample Date	27/11/2012	15/11/2012	29/11/2012	15/11/2012	27/11/2012	27/11/2012	16/11/2012	28/11/2012	28/11/2012	28/11/2012			
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Surface Water	Surface Water	Surface Water			
Batch Number	1	1	1	1	1	1	1	1	1	1	**LOD**	**Units**	**Method No.**
Date of Receipt	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012	03/12/2012			
Dissolved Arsenic #	1.4	2.8	2.0	25.0	1.3	3.4	3.8	2.1	2.3	2.1	<0.9	ug/l	TM30/PM14
Dissolved Cadmium #	<0.03	<0.03	1.35	0.65	<0.03	0.32	<0.03	<0.03	<0.03	<0.03	<0.03	ug/l	TM30/PM14
Total Dissolved Chromium #	8.0	<0.2	<0.2	0.7	8.3	<0.2	<0.2	1.2	2.7	1.1	<0.2	ug/l	TM30/PM14
Dissolved Copper #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM30/PM14
Dissolved Lead #	<0.4	<0.4	<0.4	1.8	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	ug/l	TM30/PM14
Dissolved Manganese #	<1.5	75.9	7.0	2126.0	1.8	587.5	76.2	<1.5	<1.5	<1.5	<1.5	ug/l	TM30/PM14
Dissolved Nickel #	<0.2	0.8	<0.2	2.3	0.7	0.9	0.5	<0.2	<0.2	0.5	<0.2	ug/l	TM30/PM14
Dissolved Zinc #	13.0	18.2	37.4	18.3	22.3	18.9	12.9	12.7	11.9	11.0	<1.5	ug/l	TM30/PM14
Mercury Dissolved by CVAF #	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ug/l	TM61/PM38
Hexavalent Chromium	0.004	<0.002	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM38/PM0

Please include all sections of this report if it is reproduced

All solid results are expressed on a dry weight basis unless stated otherwise.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 12/9463

SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of £1 (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory . It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

NOTE

Data is only accredited when all the requirements of our Quality System have been met. In certain circumstances where the requirements have not been met, the laboratory may issue the data in an interim report but will remove the accreditation, in this instance results should be considered indicative only. Where possible samples will be re-extracted and a final report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

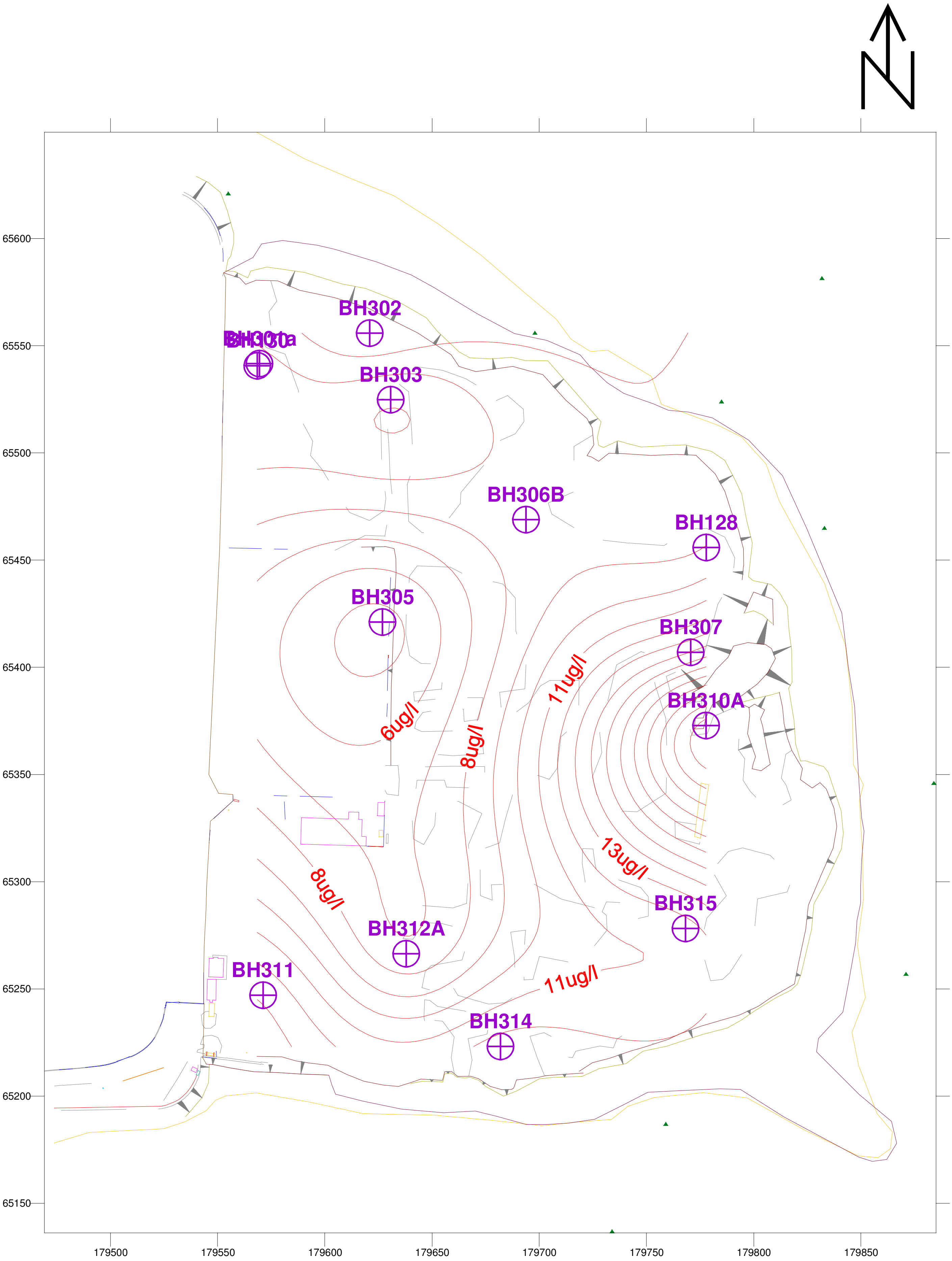
ABBREVIATIONS and ACRONYMS USED

#	UKAS accredited.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
CO	Suspected carry over
NFD	No Fibres Detected

JE Job No 12/9463

Test Method No.	Description	Prep Method No. (if appropriate)	Description	UKAS	MCERTS (soils only)	Analysis done on As Received (AR) or Air Dried (AD)	Solid Results expressed on Dry/Wet basis
TM30	Metals by ICP-OES	PM14	Metals by ICP (Waters)	Yes			
TM38	SO4,Cl,NO3,NO2,F,PO4, Amm N2,ThioCN, Hex Cr by Aquakem	PM0	No Preparation				
TM61	Mercury - low level CVAF	PM38	Mercury CVAF	Yes			

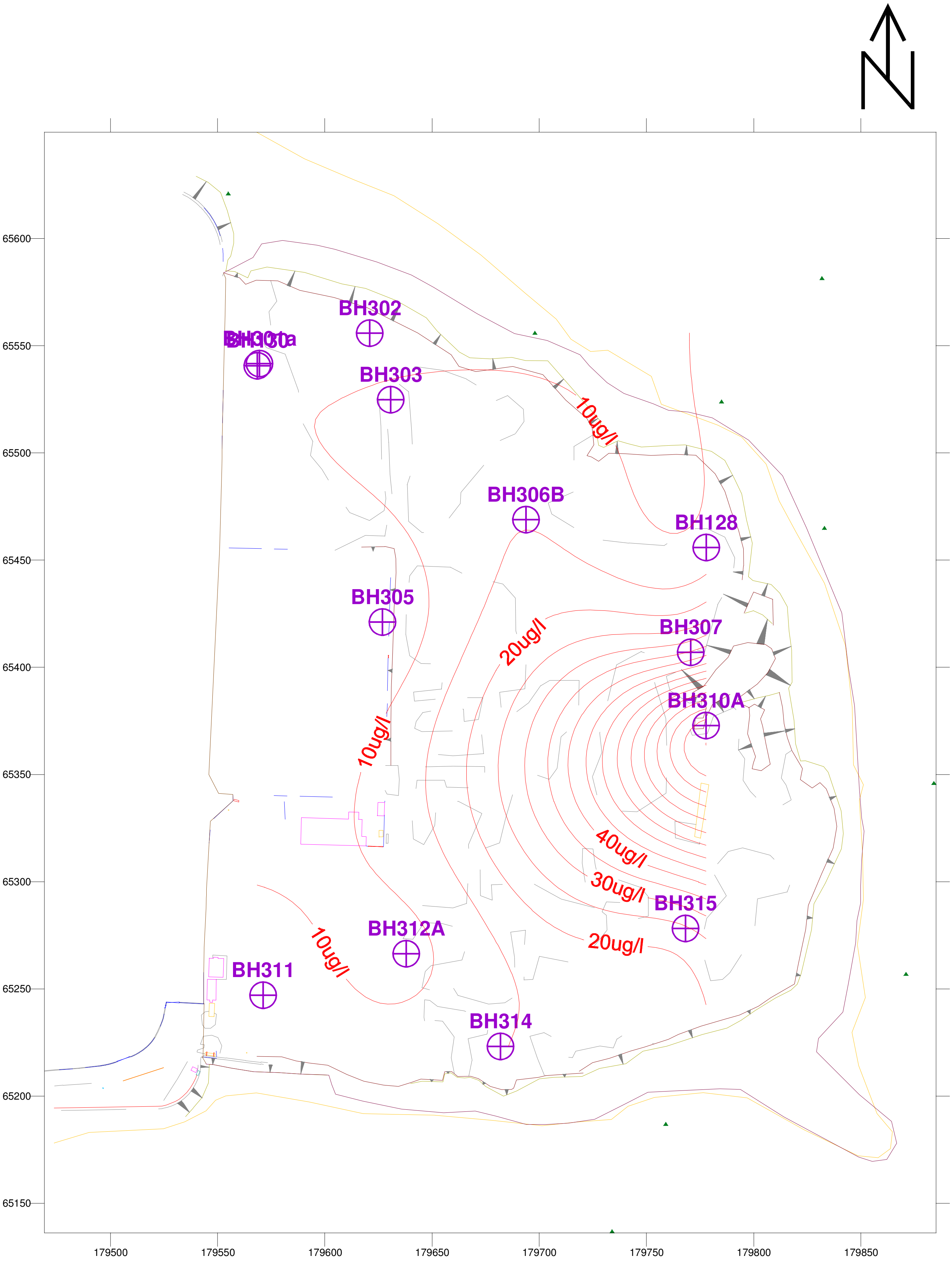
Appendix U Groundwater Contaminant Concentration Plots for Waste



Chromium Concentrations within Slag at High Tide

WQS - 4.6ug/l

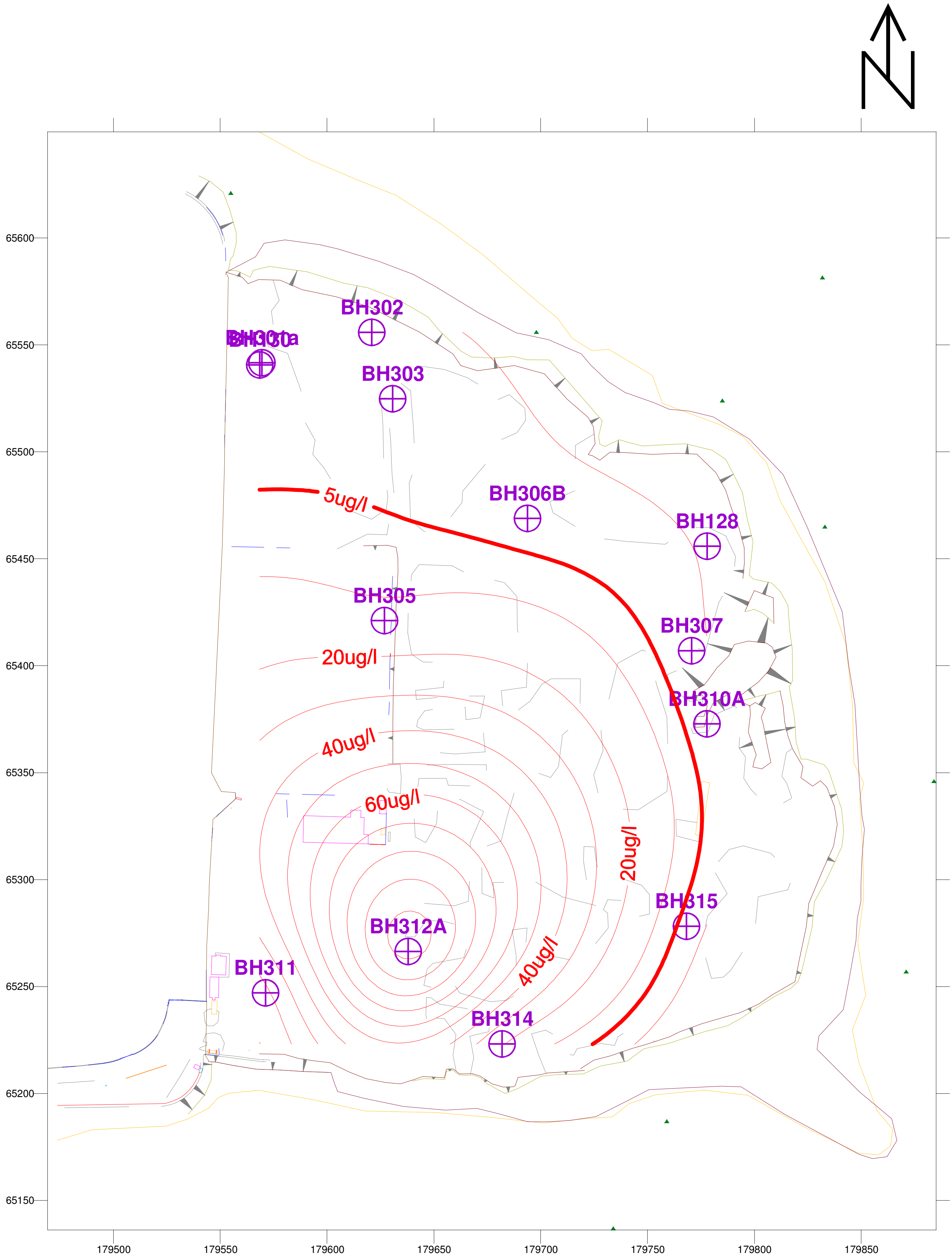
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142 /DWG/ENV/Surfer



Chromium Concentrations within Slag at Low Tide

WQS - 4.6ug/l

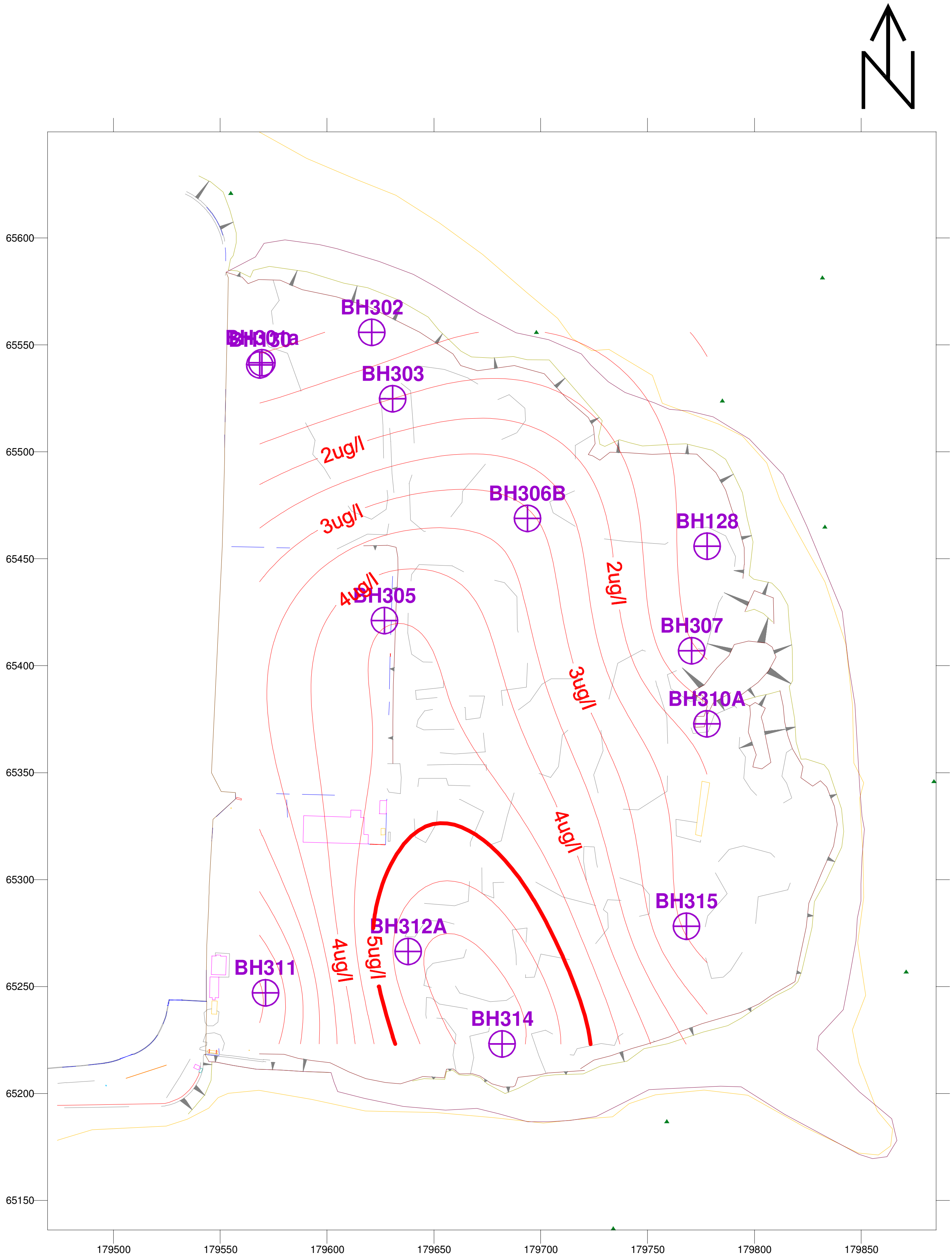
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142 /DWG/ENV/Surfer



Copper Concentrations within Slag at High Tide

WQS - 5ug/l

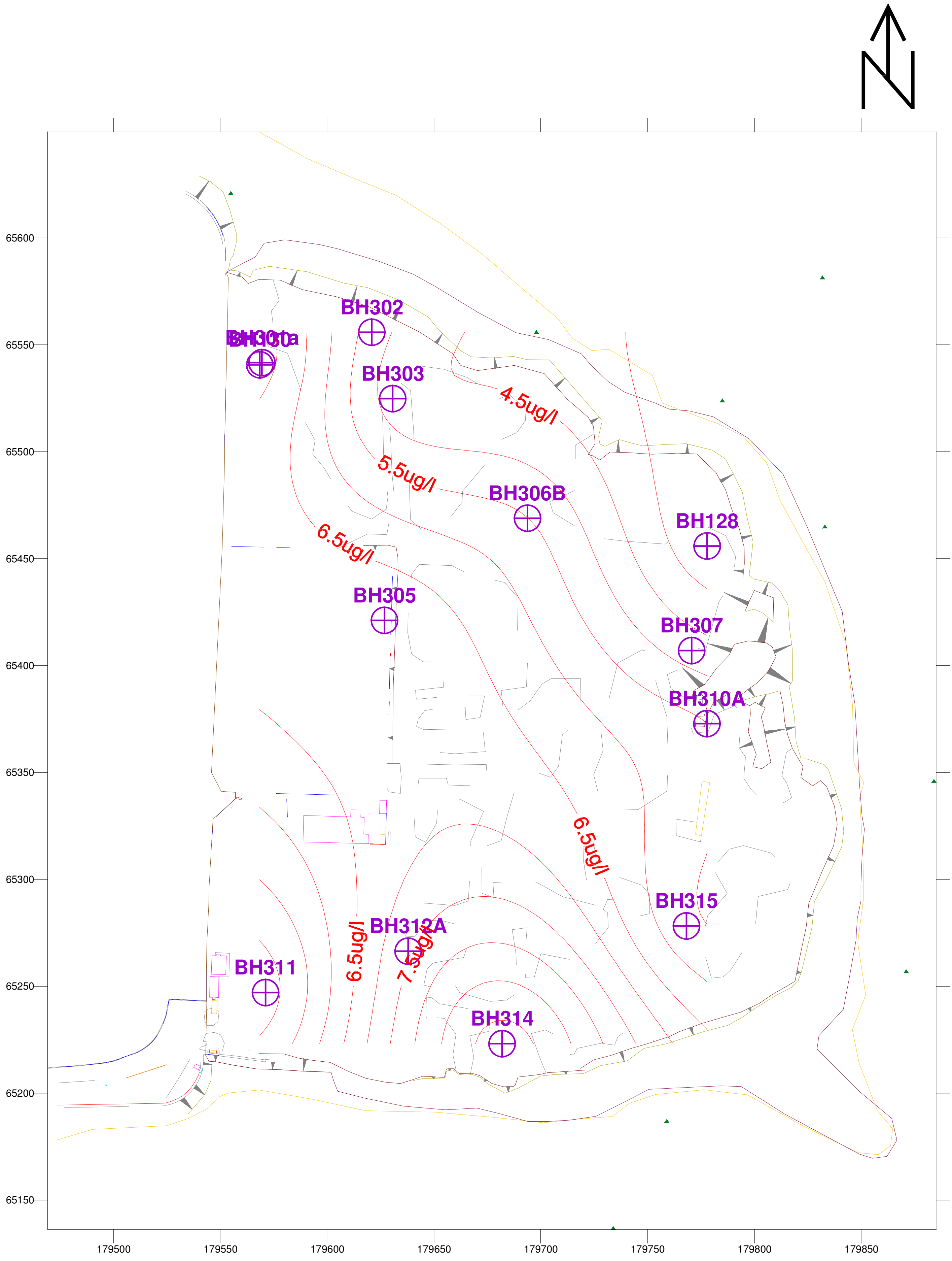
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer



Copper Concentrations within Slag at Low Tide

WQS - 5ug/l

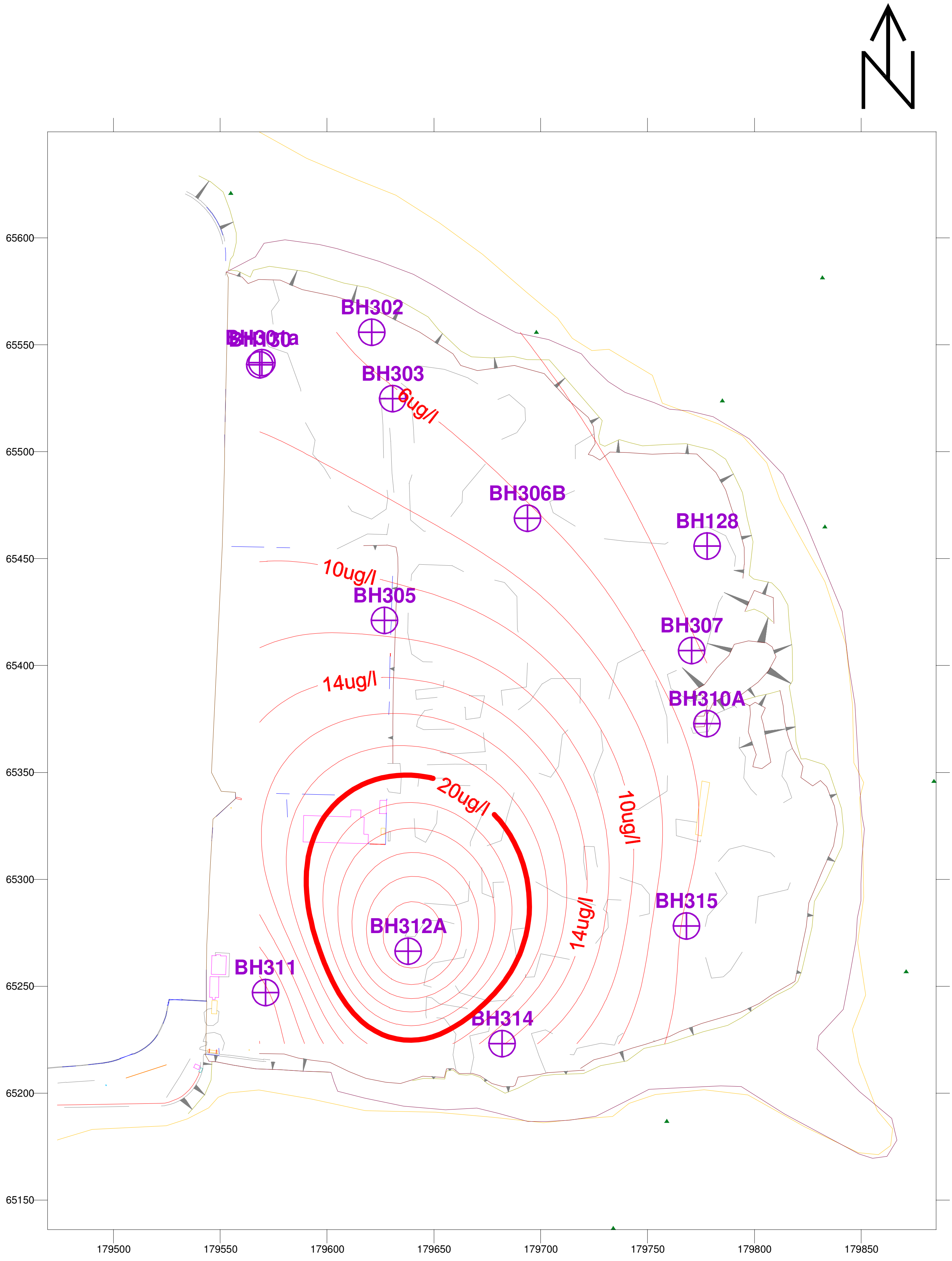
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer



Nickel Concentrations within Slag at Low Tide

WQS - 20ug/l

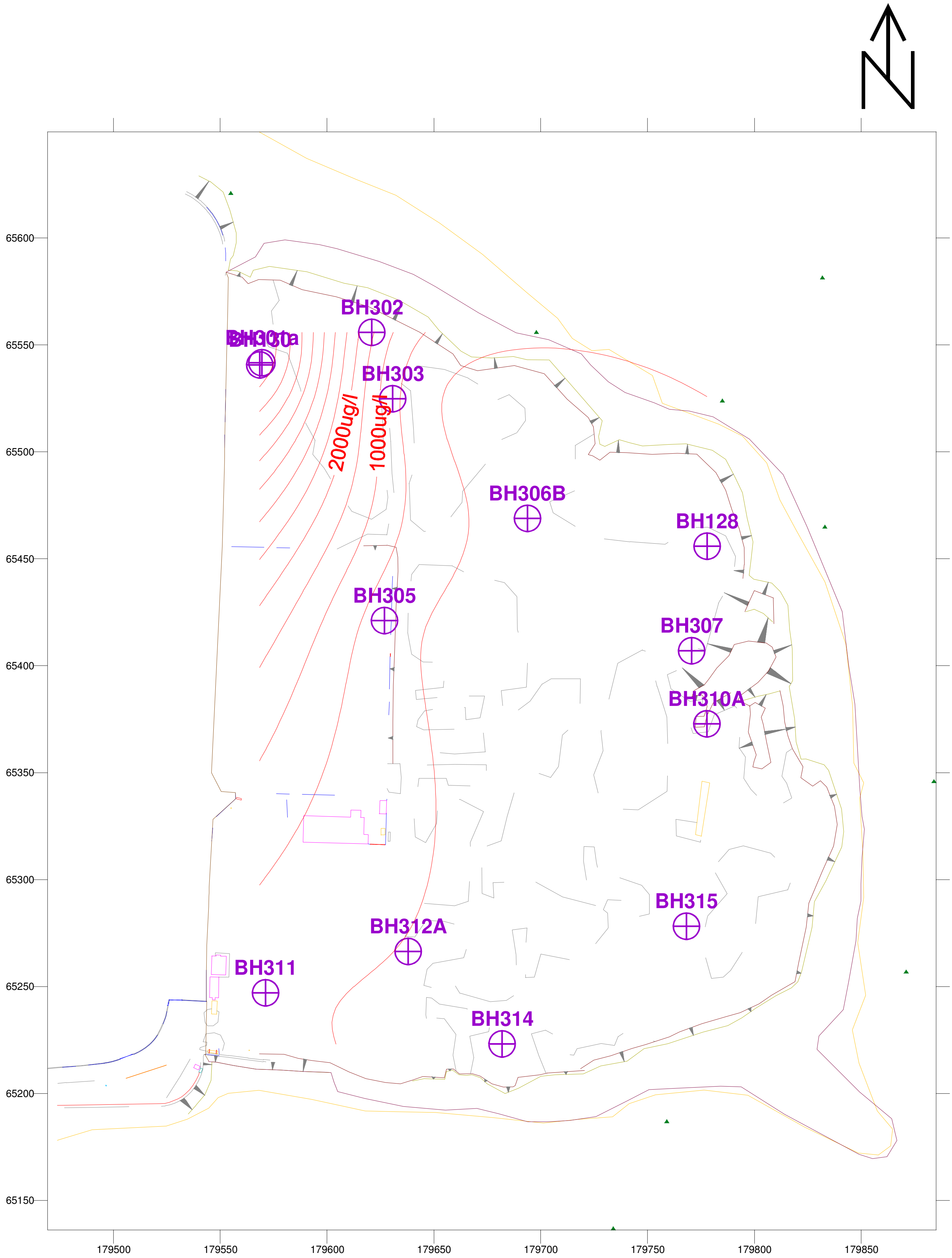
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142 /DWG/ENV/Surfer



Nickel Concentrations within Slag at High Tide

WQS - 20ug/l

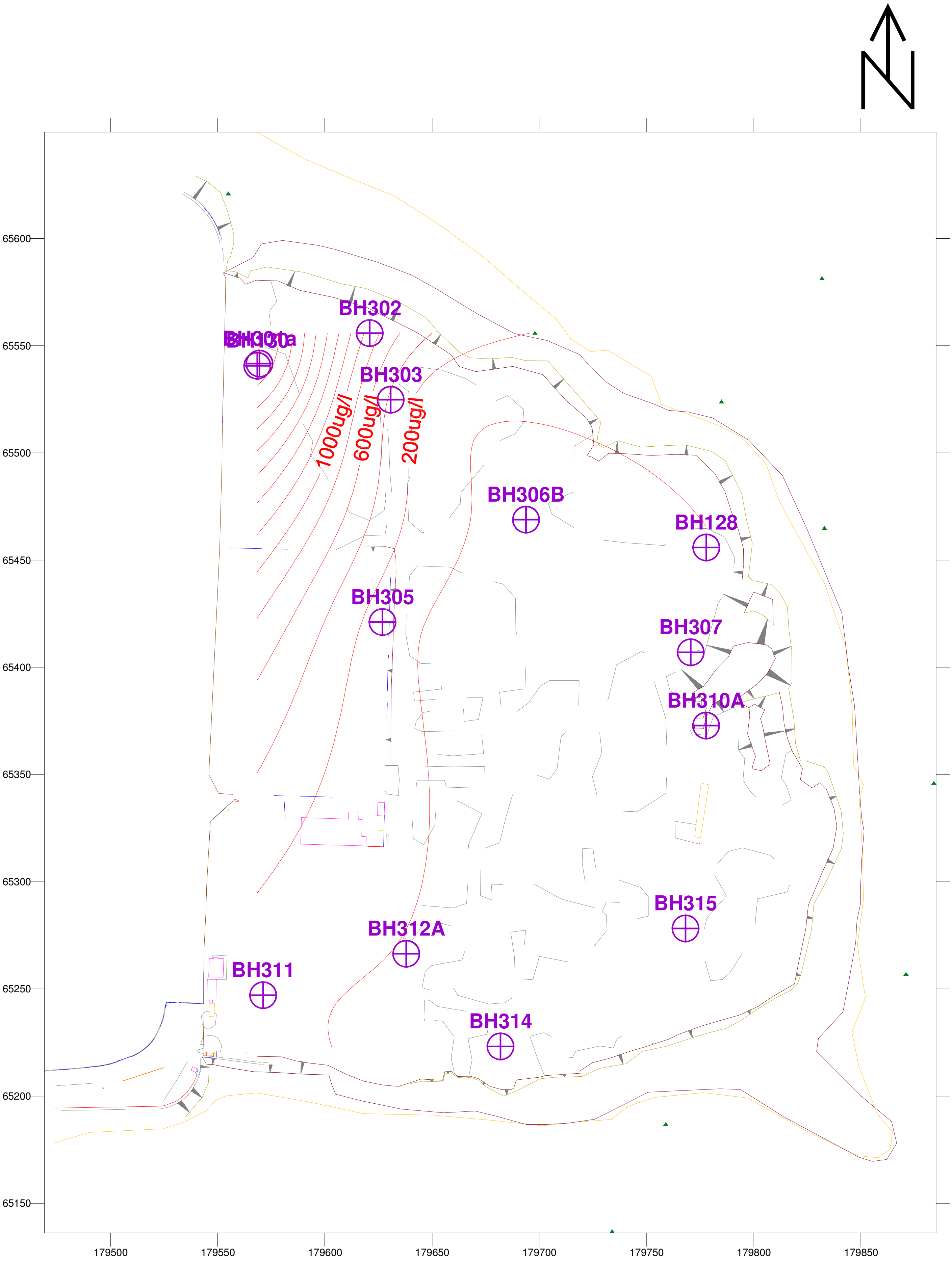
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer



Managense Concentrations within Slag at Low Tide

WQS - 30ug/l

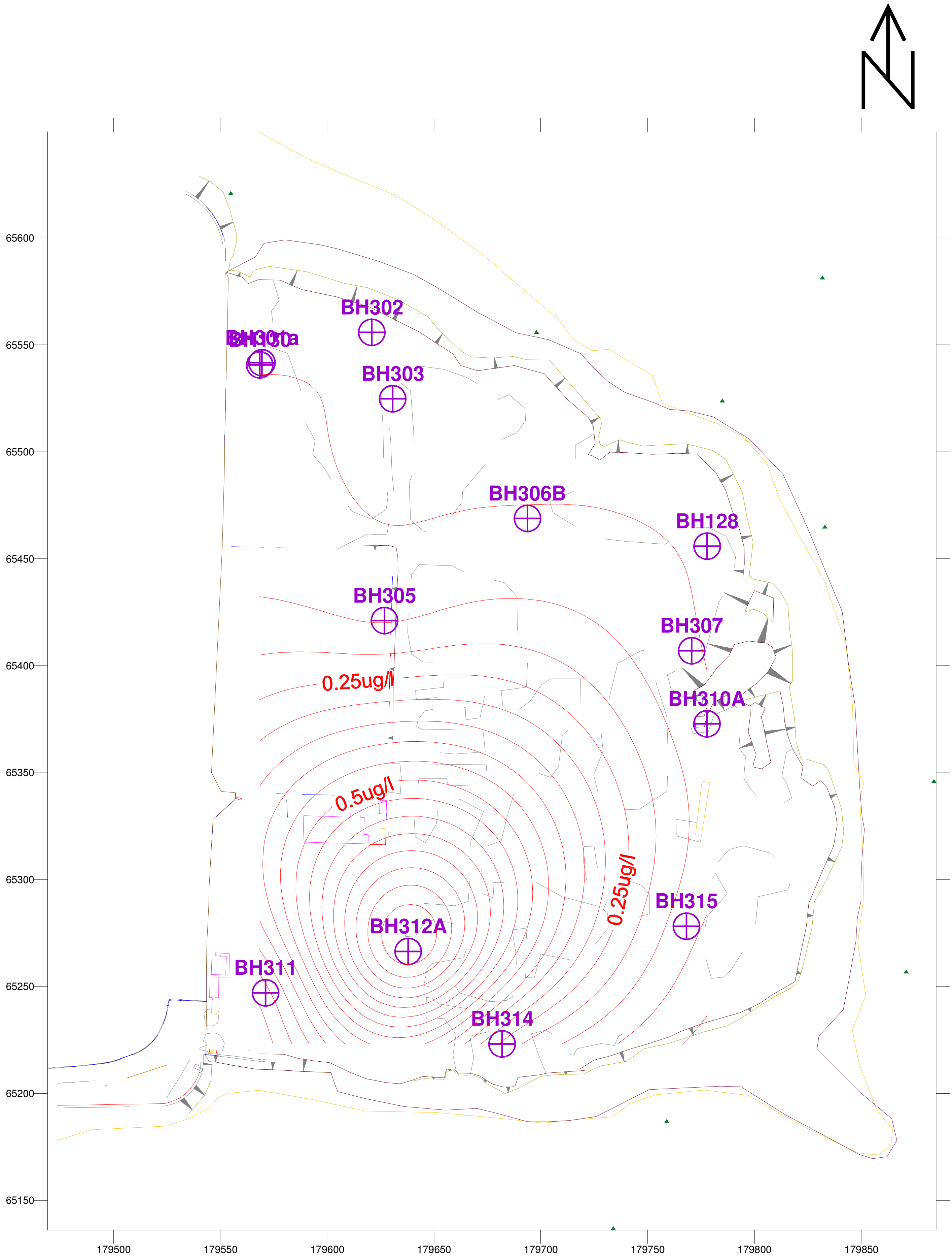
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142 /DWG/ENV/Surfer



Managense Concentrations within Slag at High Tide

WQS - 30ug/l

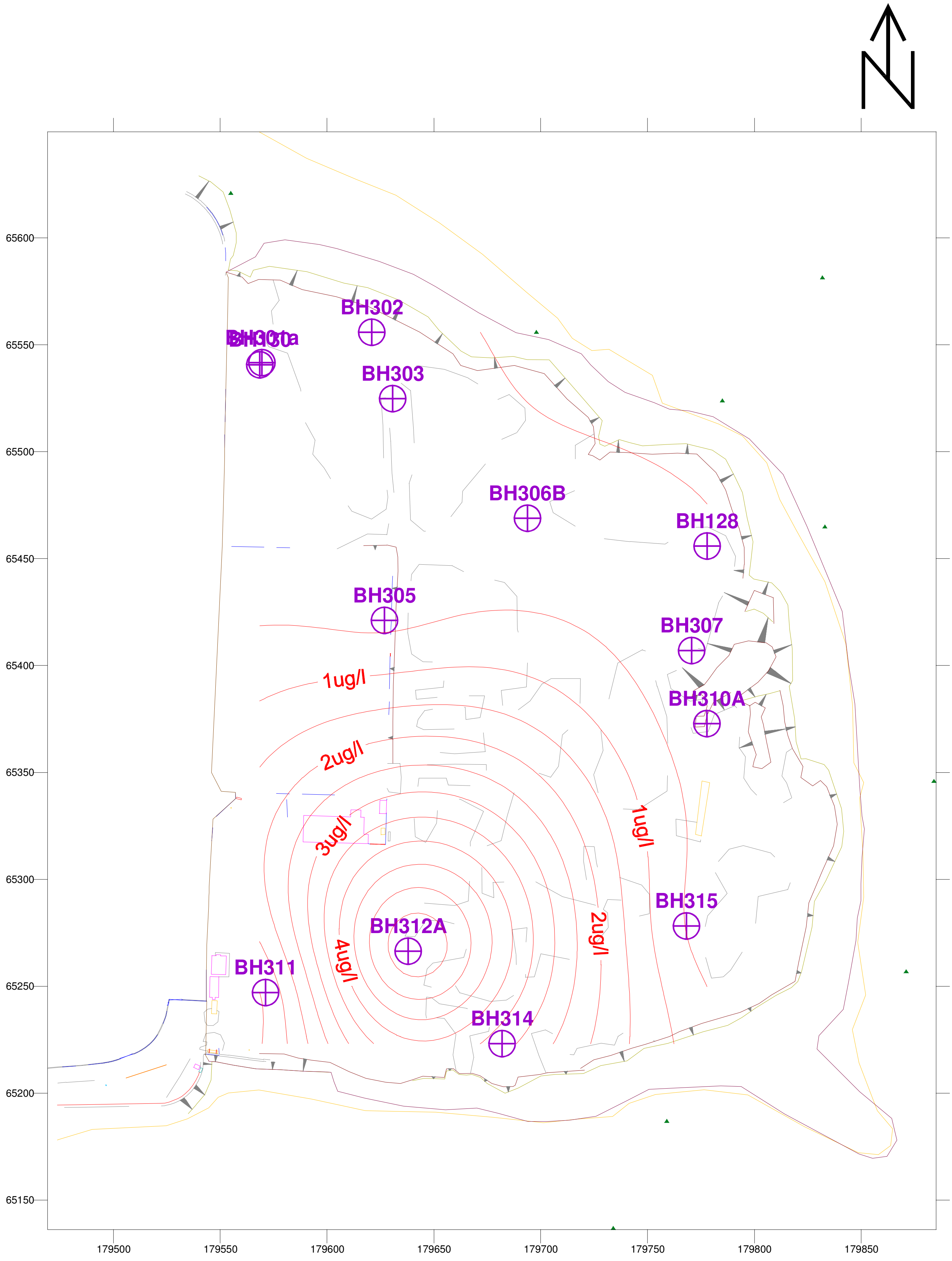
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer



Lead Concentrations within Slag at Low Tide

WQS - 7.2ug/l

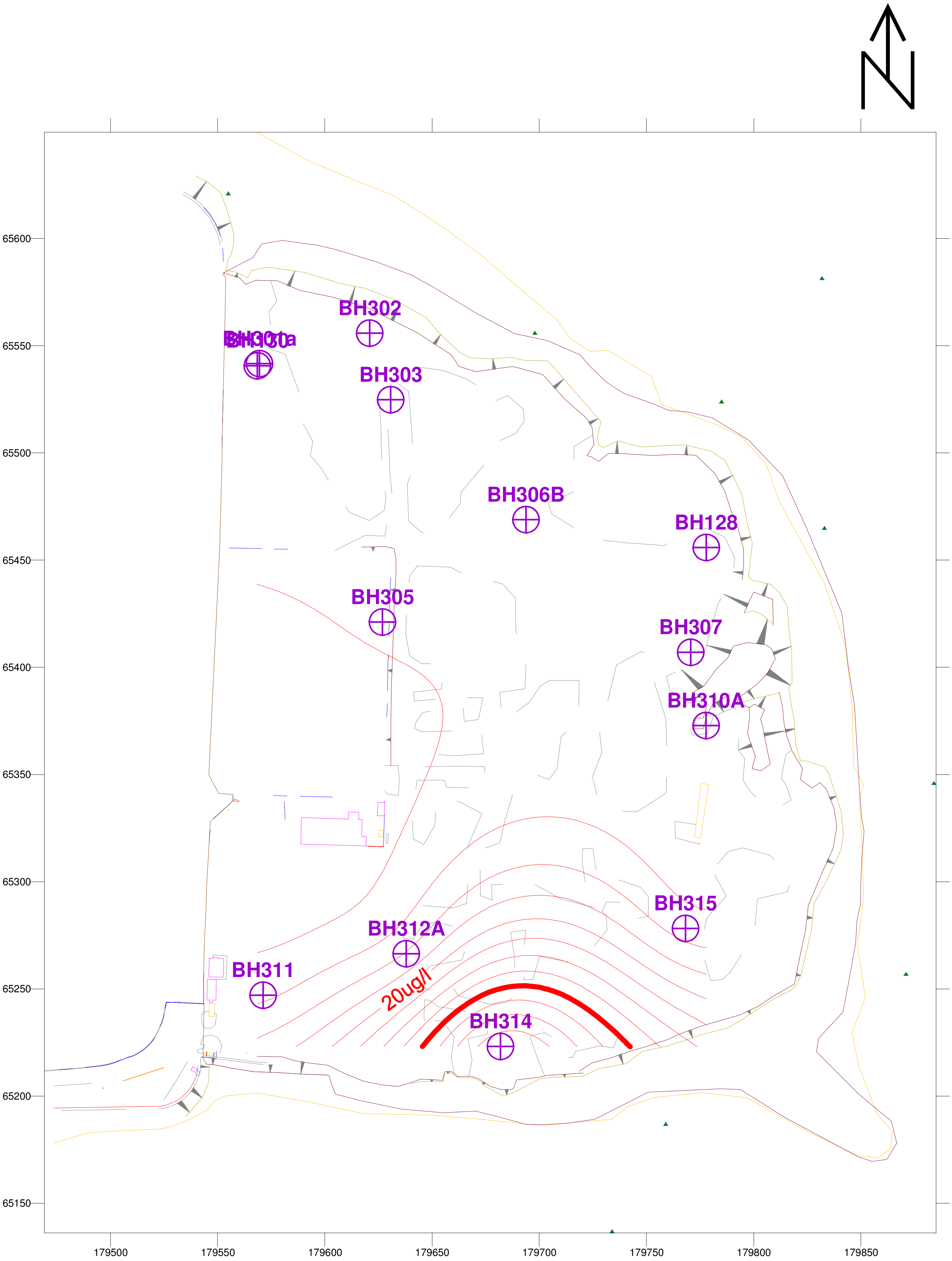
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142 /DWG/ENV/Surfer



Lead Concentrations within Slag at High Tide

WQS - 7.2ug/l

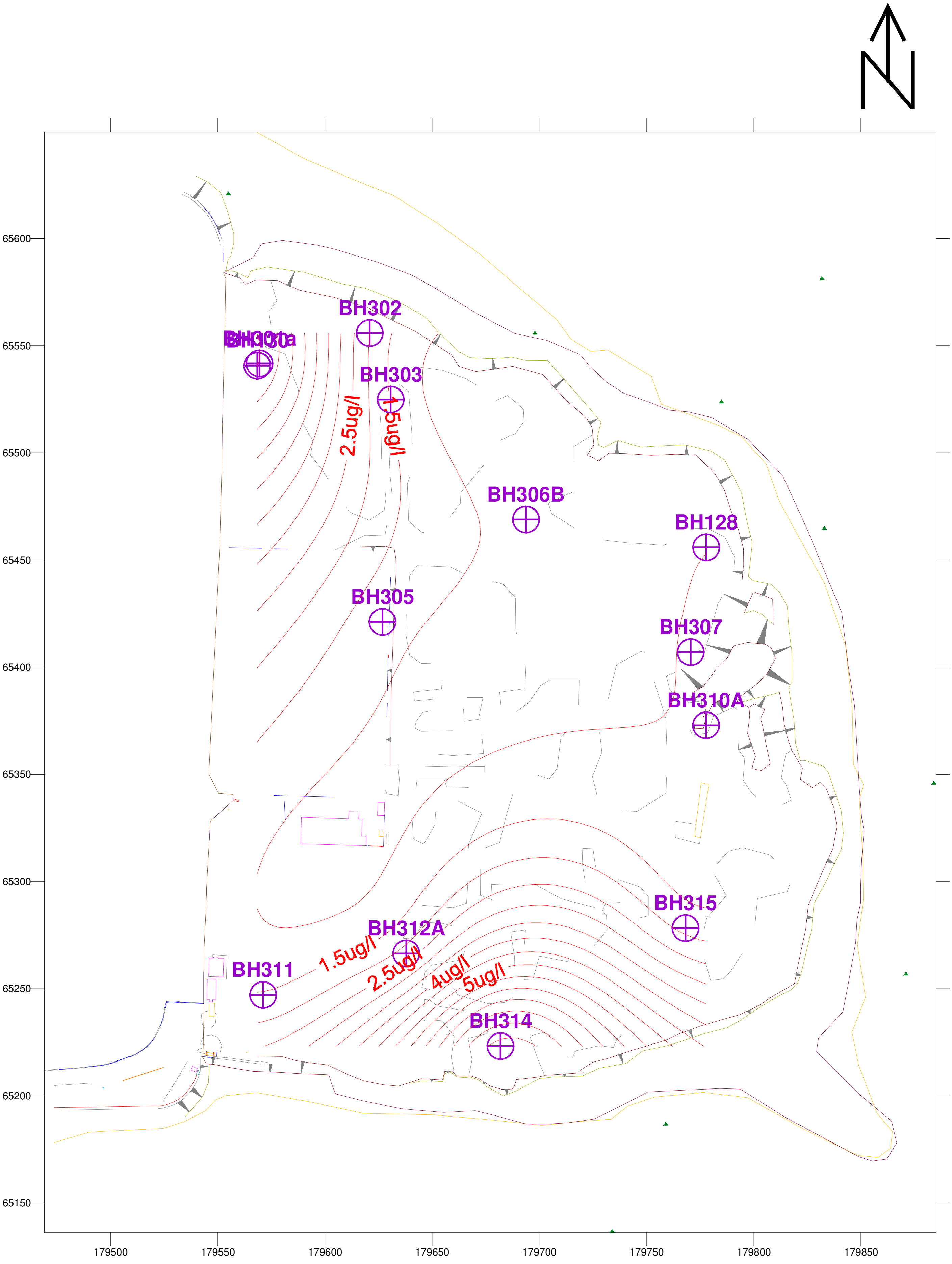
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer



Zinc Concentrations within Slag at High Tide

WQS - 40ug/l

Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer

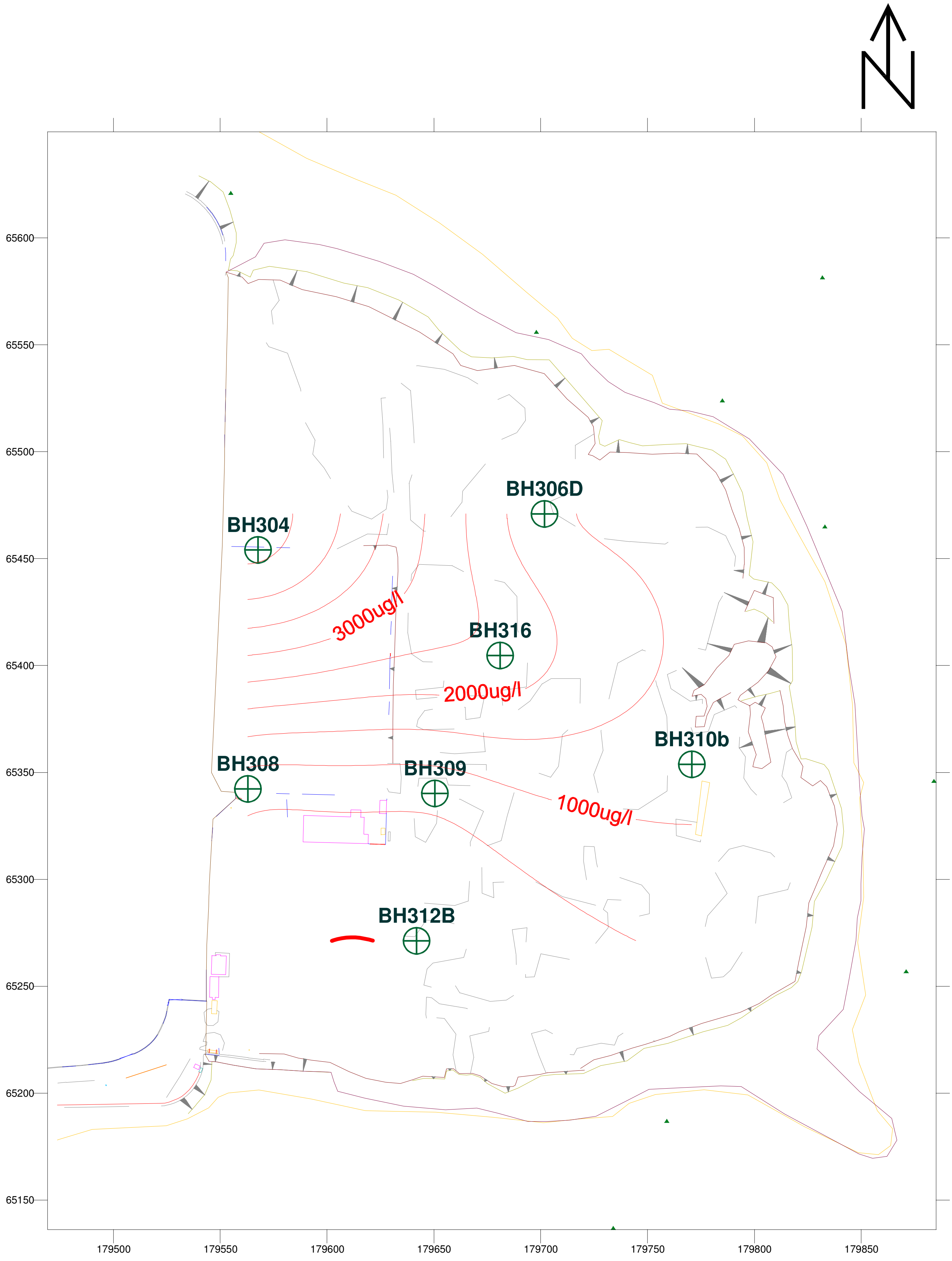


Zinc Concentrations within Slag at Low Tide

WQS - 40ug/l

Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer

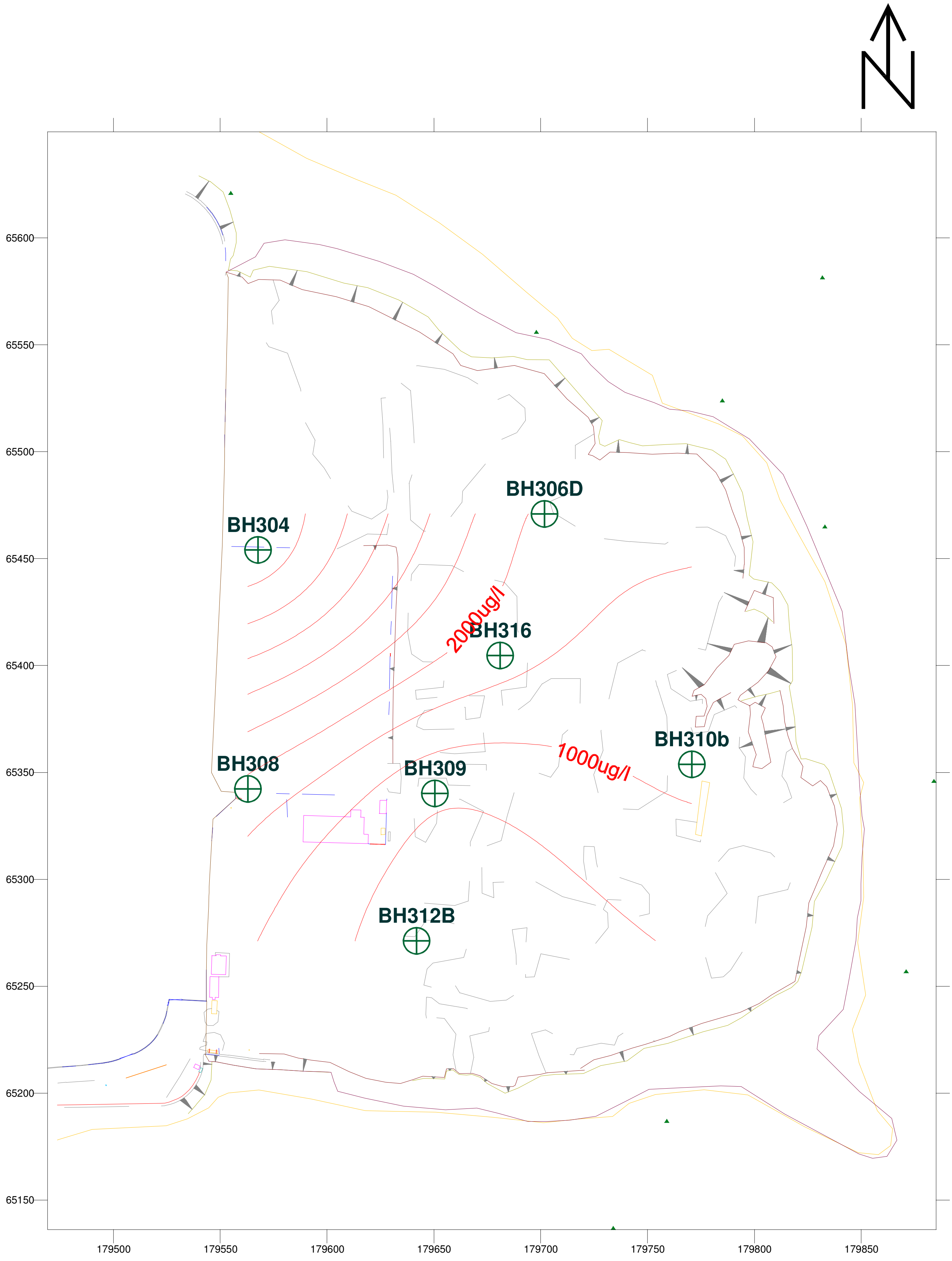
Appendix V Groundwater Contaminant Concentration Plots for Alluvium only



Manganese Concentrations within Silt at Low Tide

WQS - 30ug/l

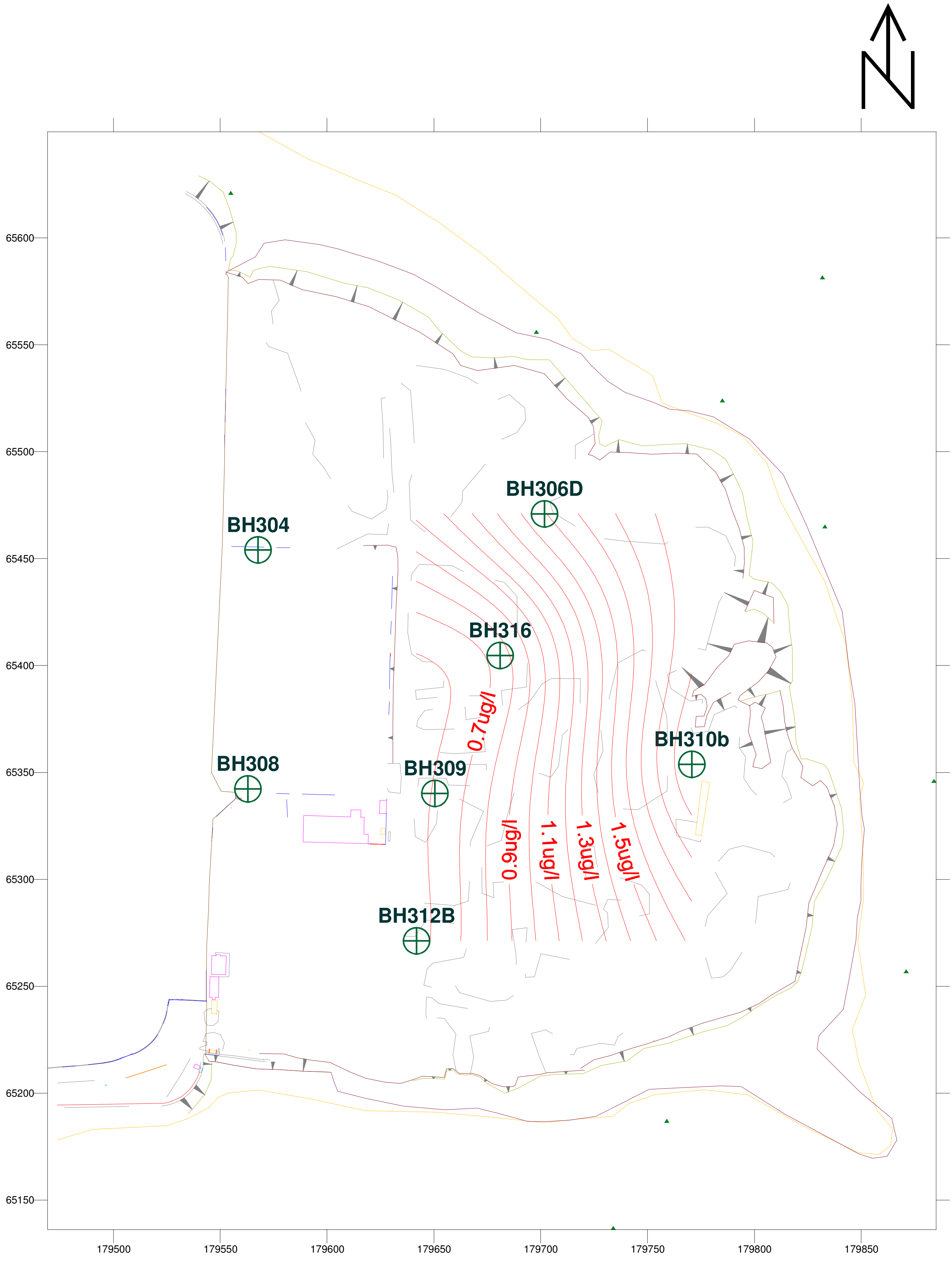
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142 /DWG/ENV/Surfer



Manganese Concentrations within Silt at High Tide

WQS - 30ug/l

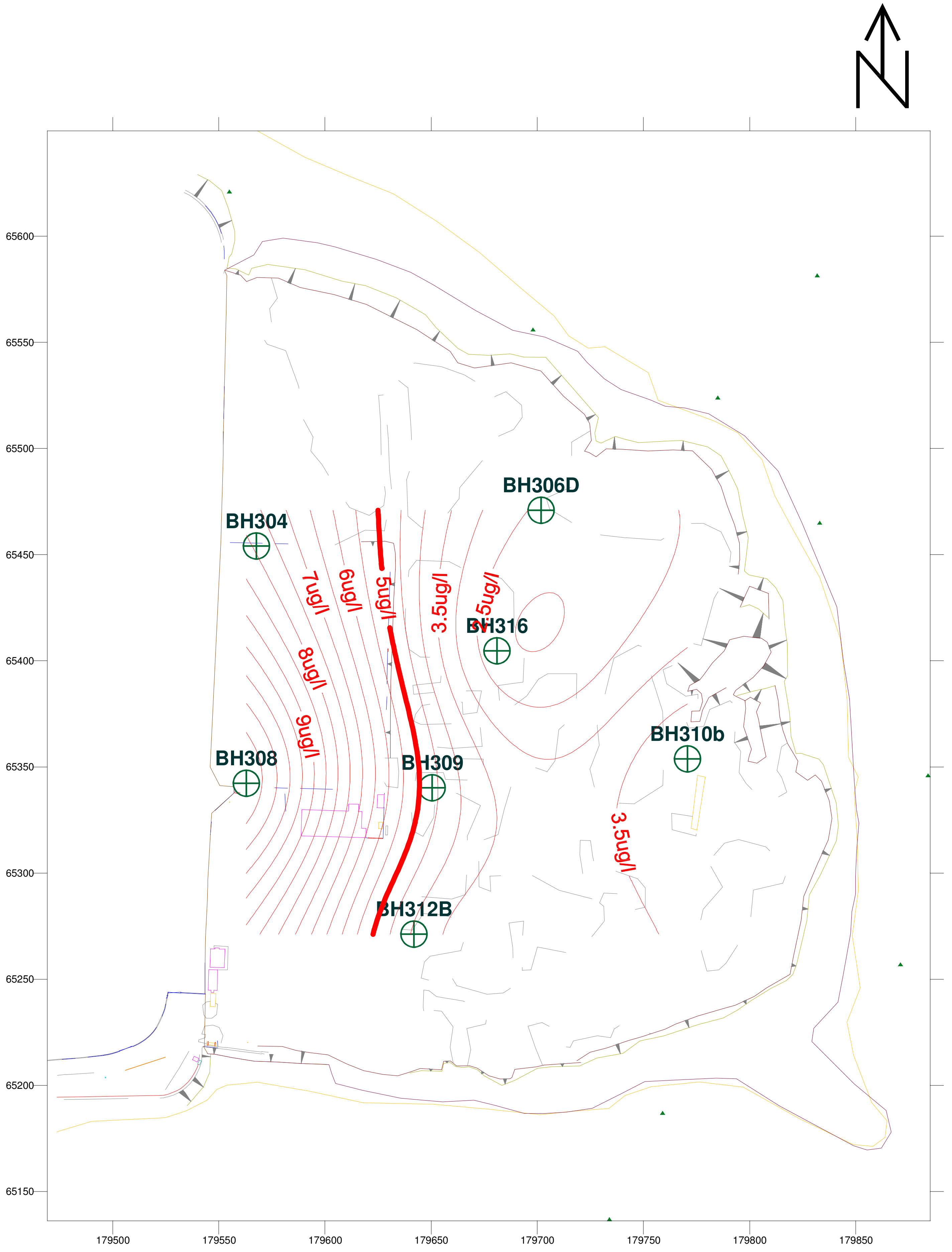
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer



Copper Concentrations within Silt at Low Tide

WQS - 5ug/l

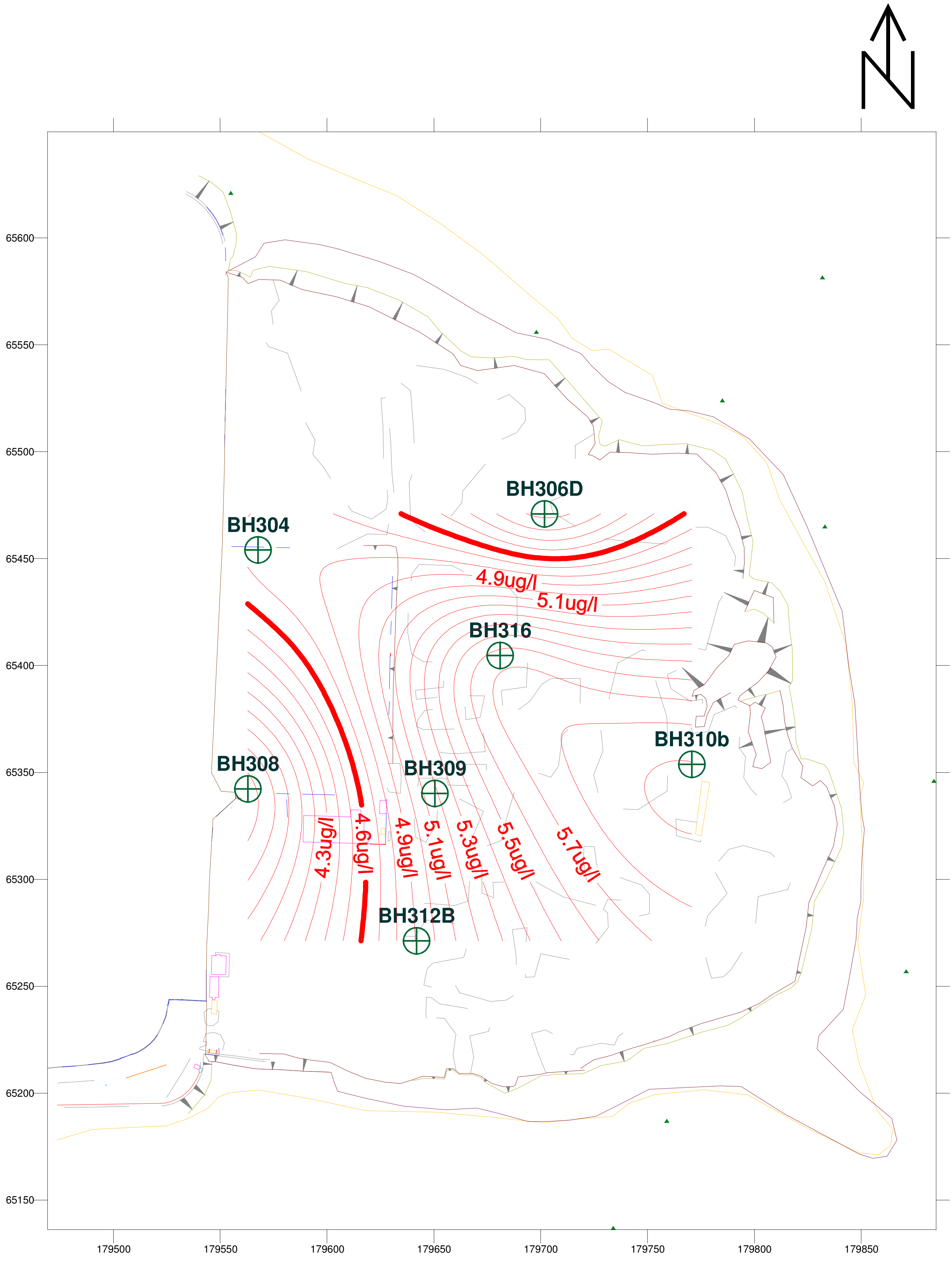
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer



Copper Concentrations within Silt at High Tide

WQS - 5ug/l

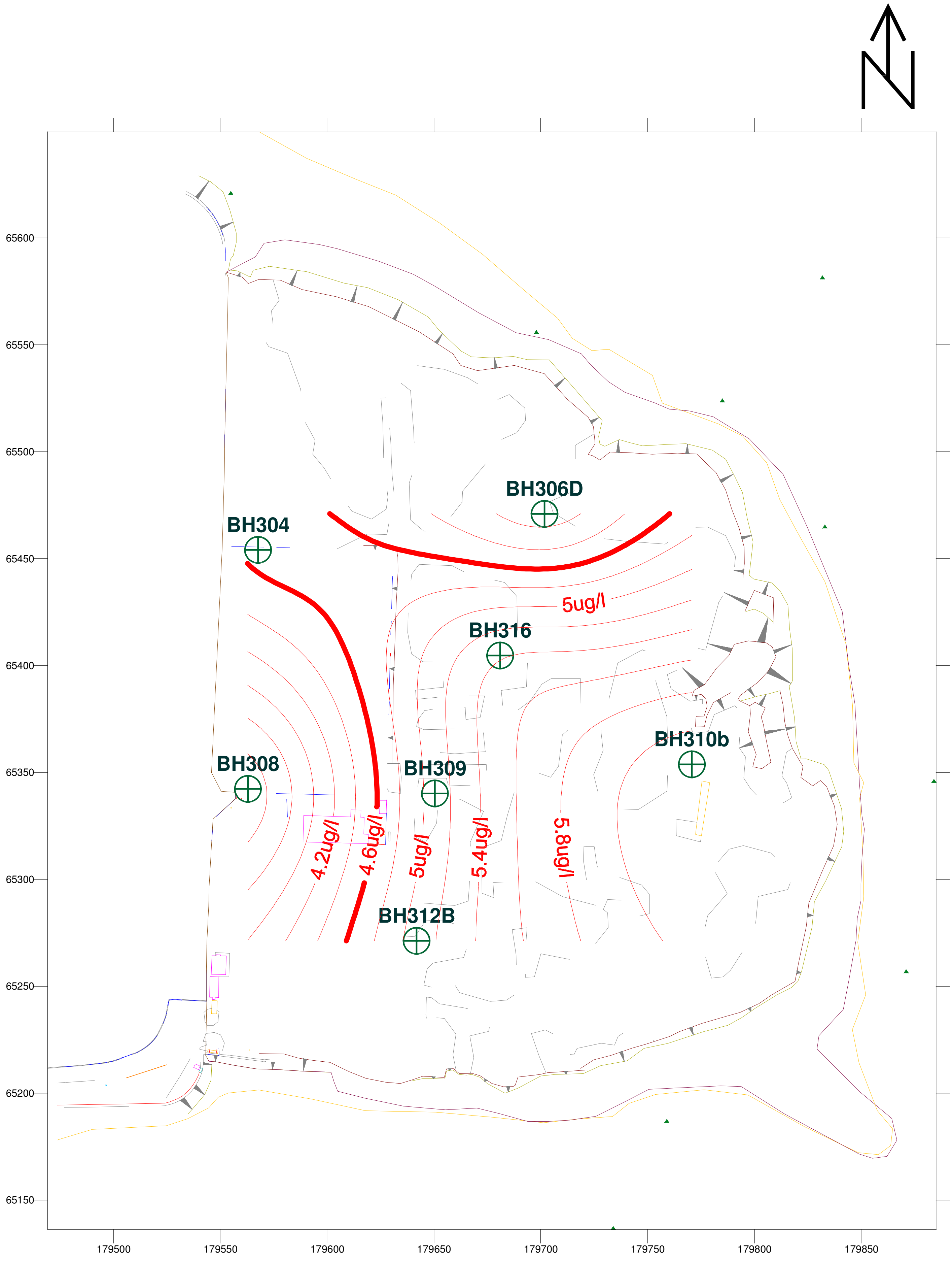
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer



Chromium Concentrations within Silt at Low Tide

WQS - 4.6ug/l

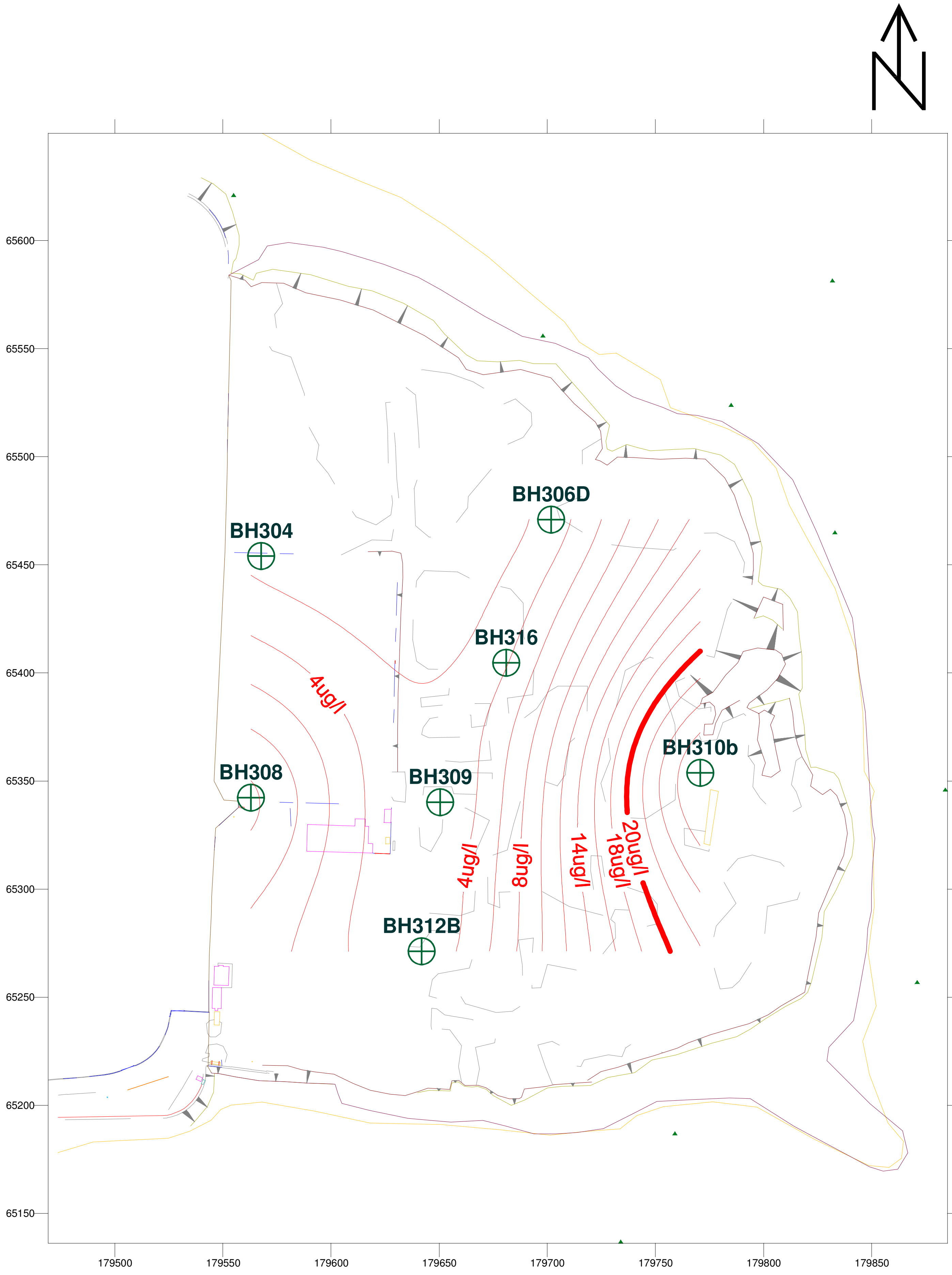
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer



Chromium Concentrations within Silt at High Tide

WQS - 4.6ug/l

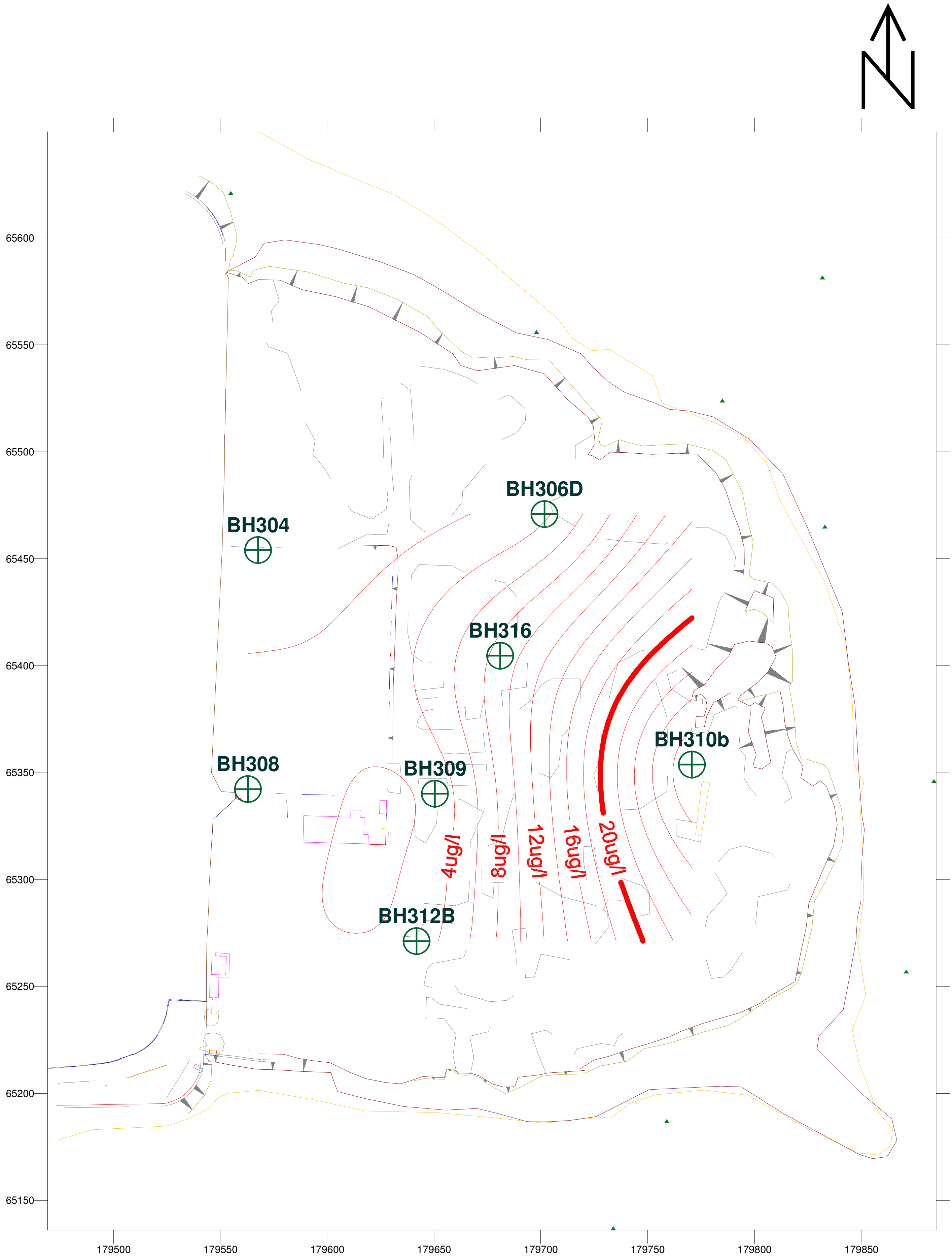
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer



Arsenic Concentrations within Silt at Low Tide

WQS - 20ug/l

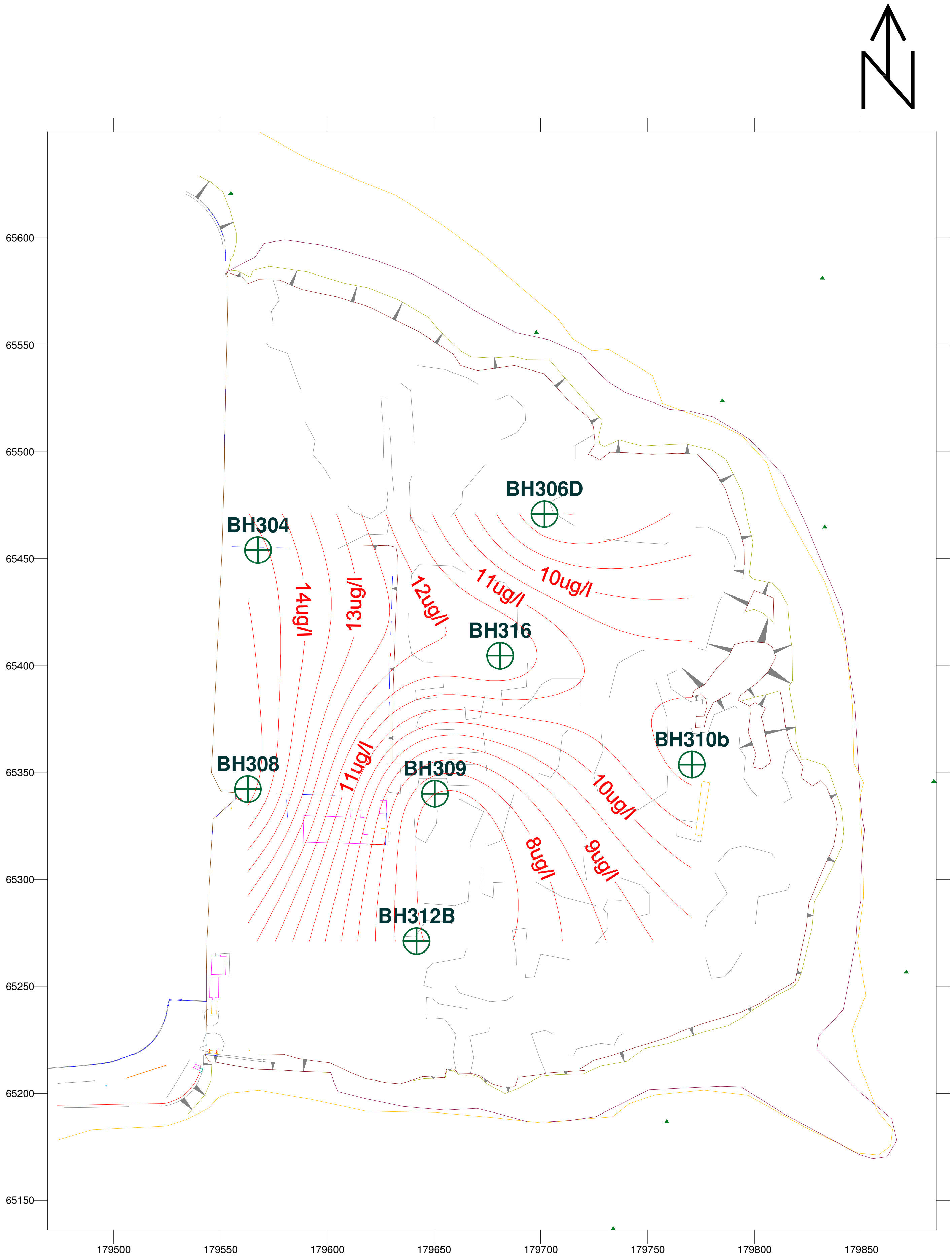
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142 /DWG/ENV/Surfer



Arsenic Concentrations within Silt at High Tide

WQS - 20ug/l

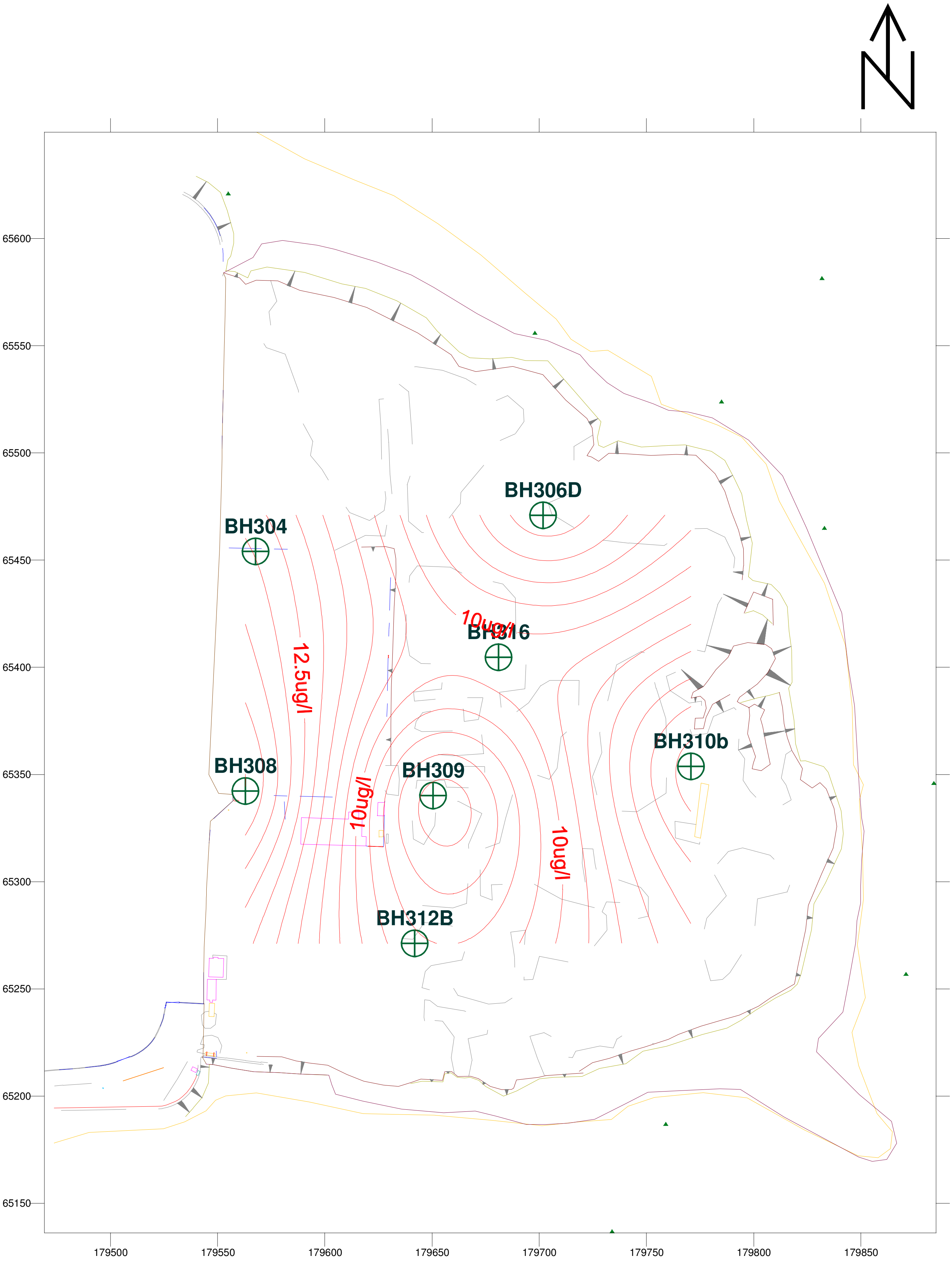
Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer



NIckel Concentrations within Silt at Low Tide

WQS - 20ug/l

Client: Cork County Council		
Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142 /DWG/ENV/Surfer



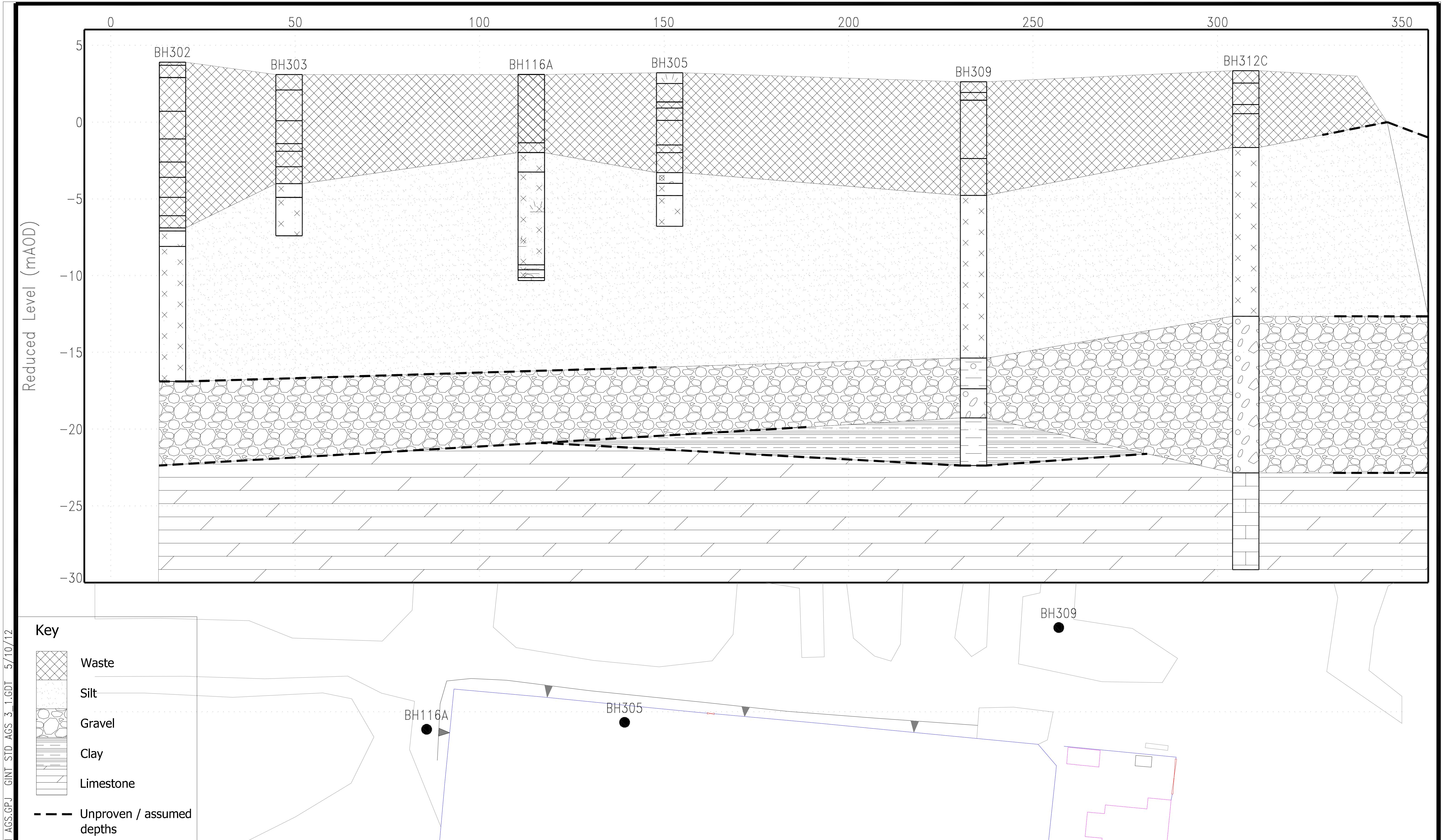
NIckel Concentrations within Silt at High Tide

WQS - 20ug/l

Client: Cork County Council

Date: Oct 2012	Drawn by: SM	
Job No.: A043142	Revision 1	File Location: G:/Projects/A043/A043142/DWG/ENV/Surfer

Appendix W Geological Cross Sections



WYG
1 Locksley Business Park
Belfast BT6 9UP
Telephone: 028 9070 6000

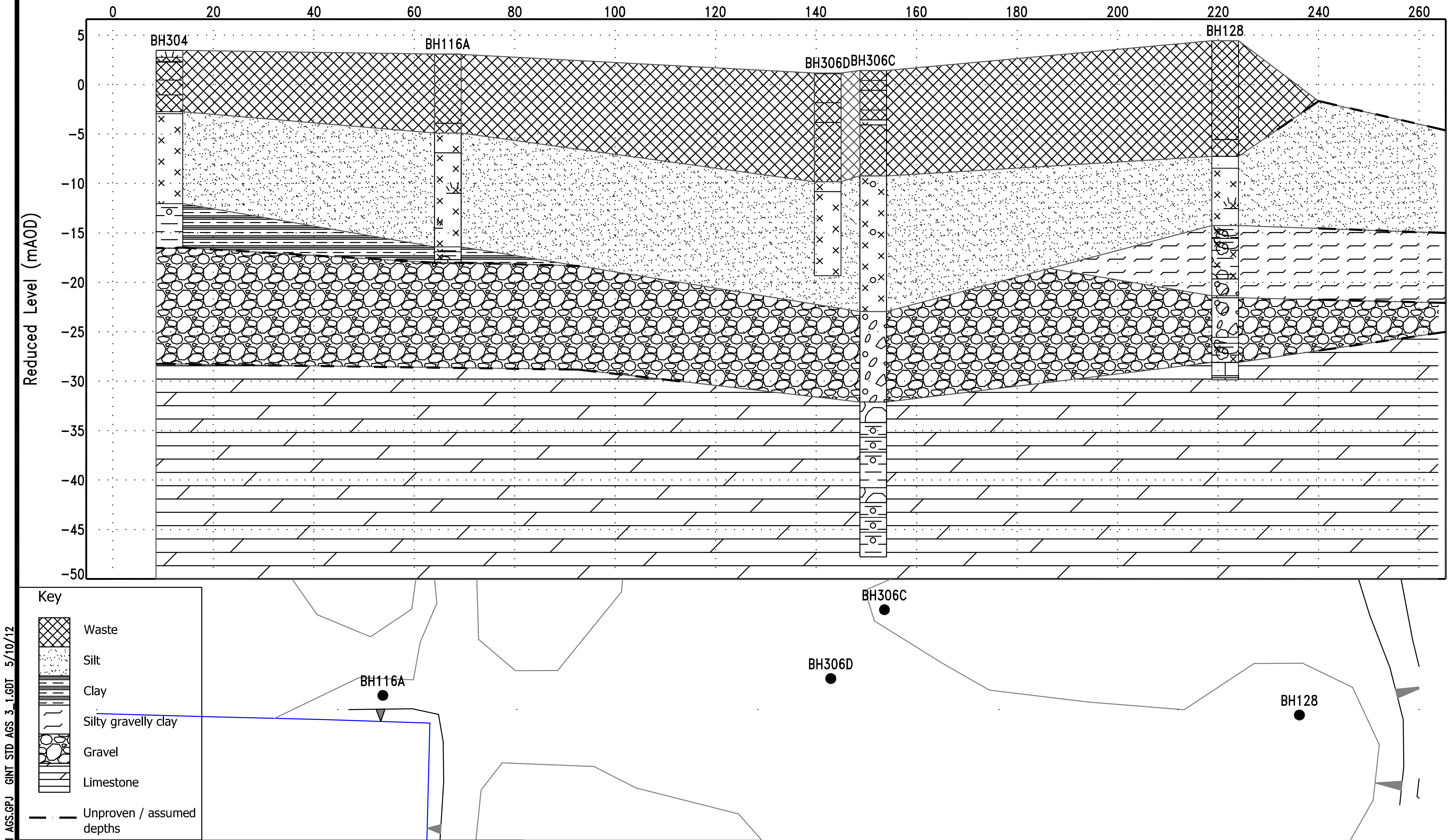
SUBSURFACE SECTION A–A'

Client: CORK COUNTY COUNCIL

Project: HAULBOWLINE EAST TIP, CO. CORK

Number: A075294

AGS3 LITHOLOGY SITEMAP GSI AGS.GPJ GINT STD AGS 3_1.GDT 5/10/12



Key

- Waste
- Silt
- Clay
- Silty gravelly clay
- Gravel
- Limestone
- Unproven / assumed depths

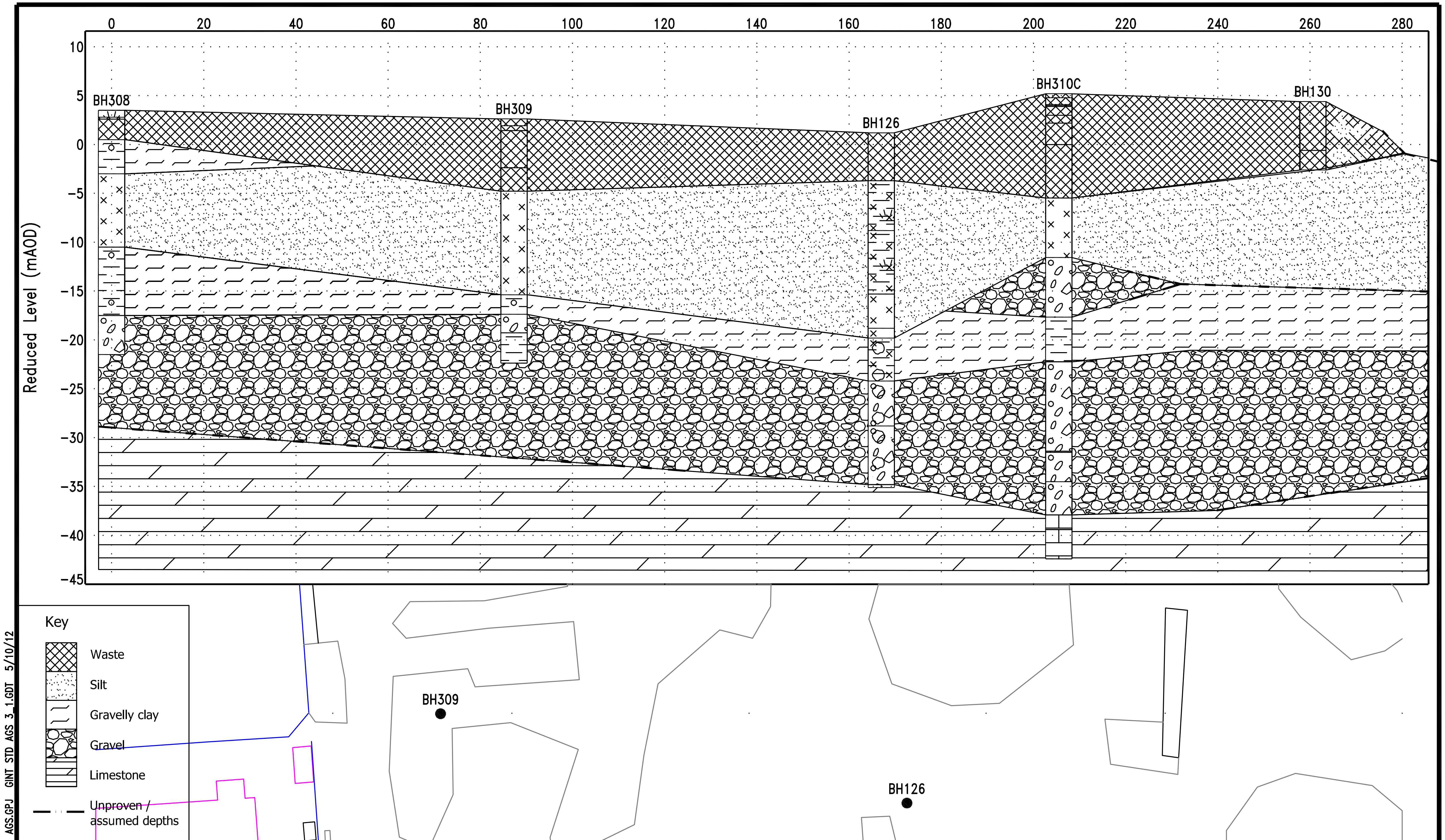
WYG
1 Locksley Business Park
Belfast BT6 9UP
Telephone: 028 9070 6000

SUBSURFACE SECTION B-B'

Client: CORK COUNTY COUNCIL

Project: HAULBOWLINE EAST TIP, CO. CORK

Number: A075294



WYG
1 Locksley Business Park
Belfast BT6 9UP
Telephone: 028 9070 6000

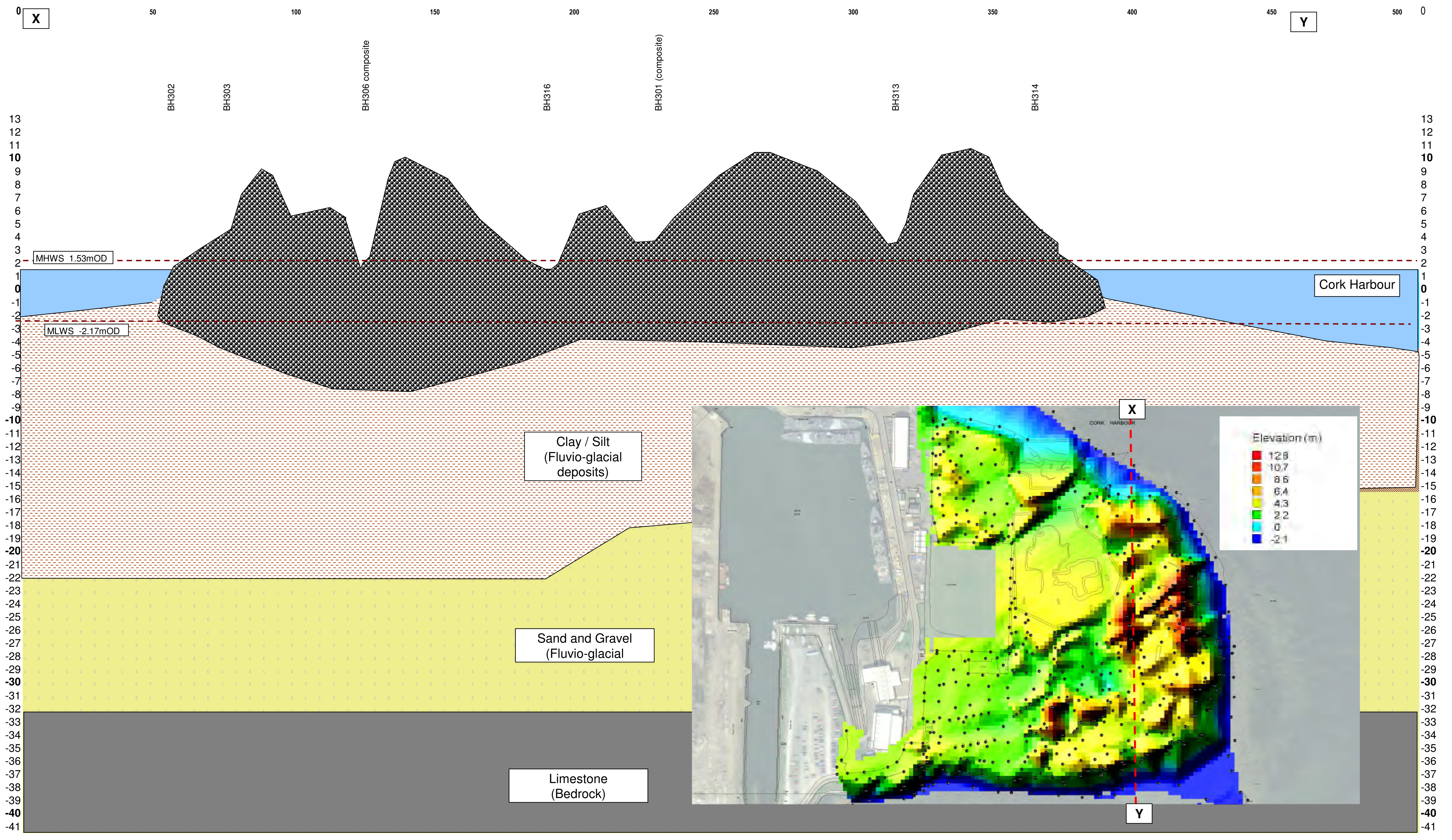
SUBSURFACE SECTION C–C'

Client: CORK COUNTY COUNCIL

Project: HAULBOWLINE EAST TIP, CO. CORK

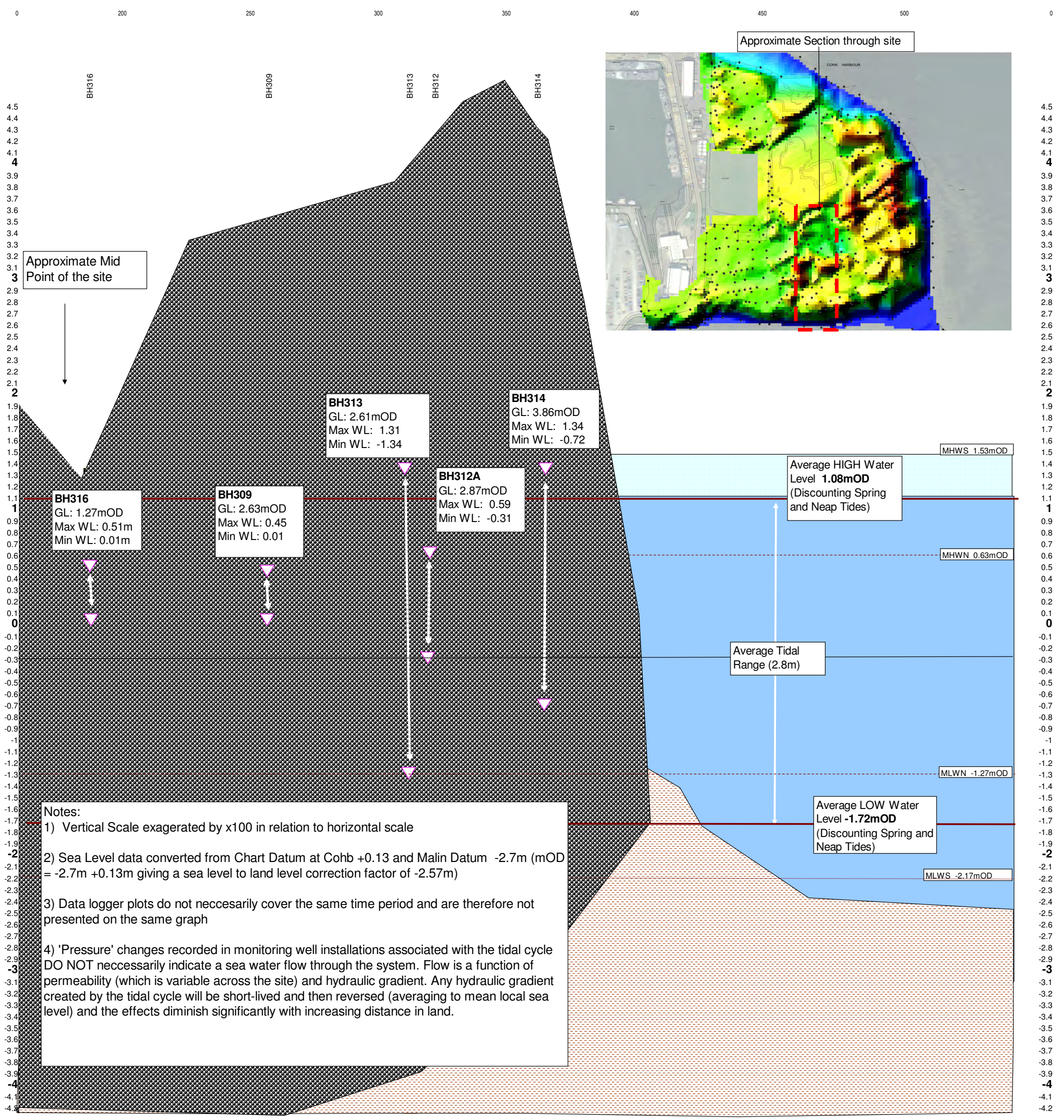
Number: A075294

Appendix X East Tip Cross Section, Groundwater and Sea Level

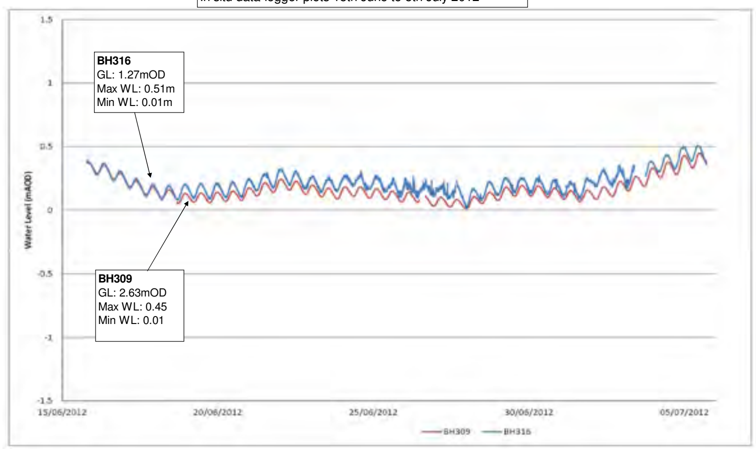


X
Y
BH302
BH303
BH306 composite
BH316
BH301 (composite)
BH313
BH314
MHWS 1.53mOD
MLWS -2.17mOD
Cork Harbour
Clay / Silt
(Fluvio-glacial
deposits)
Sand and Gravel
(Fluvio-glacial
Limestone
(Bedrock)
Elevation (m)
12.8
10.7
8.6
6.4
4.3
2.2
0
-2.1

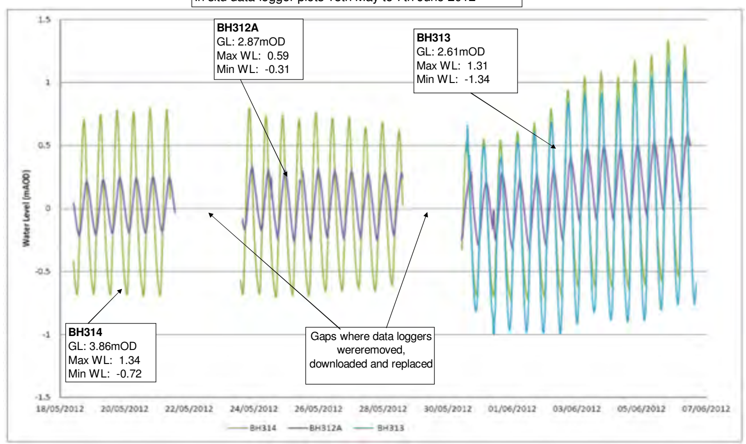
Appendix Y East Tip Tidal CSM, Groundwater and Tidal Influence



In situ data-logger plots 15th June to 5th July 2012



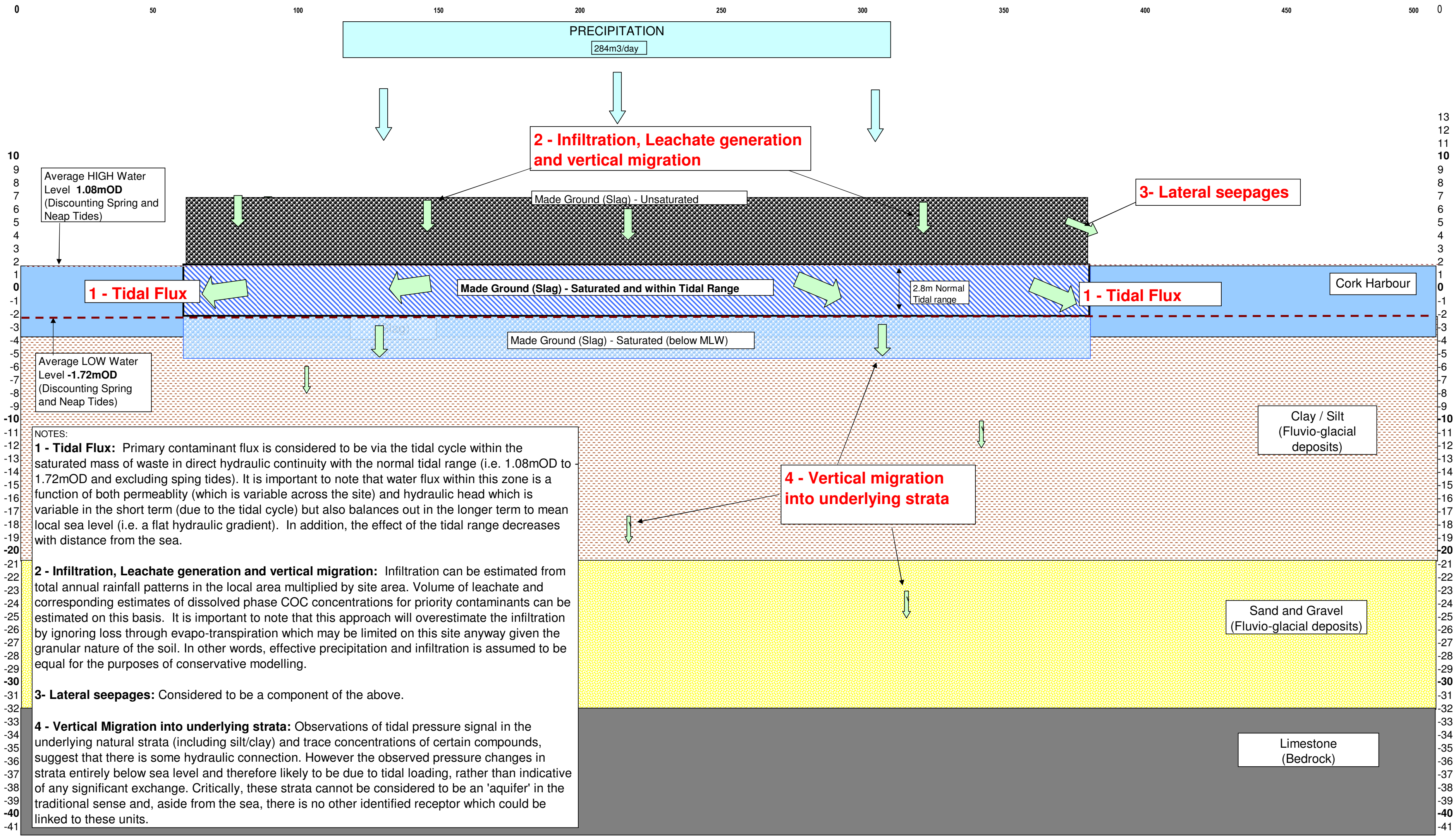
In situ data-logger plots 18th May to 7th June 2012



Tidal influence along transect (from mid point on site)

Monitoring well	Meters from sea	GL (mOD)	Max WL	Min WL	Range
BH316	200	1.27	0.51	0.01	0.5
BH309	140	2.63	0.45	0.01	0.44
BH313	90	2.61	1.31	-1.34	2.65
BH312	80	2.87	0.59	-0.13	0.60
BH314	25	3.86	1.34	-0.72	2.06

Appendix Z Tier 4 Conceptual Site Models



NOTES:

1 - Tidal Flux: Primary contaminant flux is considered to be via the tidal cycle within the saturated mass of waste in direct hydraulic continuity with the normal tidal range (i.e. 1.08mOD to -1.72mOD and excluding sping tides). It is important to note that water flux within this zone is a function of both permeablity (which is variable across the site) and hydraulic head which is variable in the short term (due to the tidal cycle) but also balances out in the longer term to mean local sea level (i.e. a flat hydraulic gradient). In addition, the effect of the tidal range decreases with distance from the sea.

2 - Infiltration, Leachate generation and vertical migration: Infiltration can be estimated from total annual rainfall patterns in the local area multiplied by site area. Volume of leachate and corresponding estimates of dissolved phase COC concentrations for priority contaminants can be estimated on this basis. It is important to note that this approach will overestimate the infiltration by ignoring loss through evapo-transpiration which may be limited on this site anyway given the granular nature of the soil. In other words, effective precipitation and infiltration is assumed to be equal for the purposes of conservative modelling.

3- Lateral seepages: Considered to be a component of the above.

4 - Vertical Migration into underlying strata: Observations of tidal pressure signal in the underlying natural strata (including silt/clay) and trace concentrations of certain compounds, suggest that there is some hydraulic connection. However the observed pressure changes in strata entirely below sea level and therefore likely to be due to tidal loading, rather than indicative of any significant exchange. Critically, these strata cannot be considered to be an 'aquifer' in the traditional sense and, aside from the sea, there is no other identified receptor which could be linked to these units.

Appendix AA Tier 4 Calculations

WATER FLUX MODEL

Site Dimensions	Notations	Values	Units	Source / Comments
Length (m)		440	m	North - South
Width (m)	**l**	**154**	m	East - West (from mid-point to shoreline)
Area (m2)		101,422	m2	Approximate from CAD plan
Perimeter of shoreline (m)	r	865	m	Approximate from CAD plan
Precipitation				
Total rainfall		1022	mm/year	Annual Average =1022mm Cork Airport (2011)
Effective Precipitation:		100%	mm/year	Conservative over estimate but loss via evapotranspiration and run-off is expected to be low on this site given the granular (high permeability) nature of the soils
Daily average inflitration		2.80	mm/day	Total annual precipitation divided by 365 days
Total infiltration per day		283982	mm/day	Daily average mutiplied by site area
Total infiltration per day	**p**	**284**	m3/day	Average daily infiltration at 100% of total
Topography				
Max ground level (m)		12	mAOD	Estimate based on Topo survey
Average thickness of Made Ground		9.7	mAOD	Estimate based on geo-physics survey
Maximum depth of fill below mOD		-9	mAOD	From Logs
Total Made Ground volume		983793	m3	Average thickness of Made Ground x Site Area
Aquifer				
Saturated Made Ground volume		639466	m3	Estimated on 65% of total mass
Unsaturated Made Ground volume		344328	m3	Estimate on 35% of total mass
Saturated Made Ground volume within normal Tidal cycle		283982	m3	Average tidal range x site area
Effective porosity	34%	96554	m3	Mid-range estimate of Sand/Gravel (Fine Sand) Brassington 2007 provides an estimate of the total volume of water held within slag
Specific Yeild	25%	70995	m3	Mid-range estimate of Sand/Gravel (Fine Sand) Brassington 2007 - provides an estimate of the total volume of water held within slag which could theoretically drain in perfect conditions (i.e. without hydrostatic pressure from surrounding soil/water mass)
Tides				
Mean High Water Spring	MHWS	1.53	mOD	mOD (corrected from local Chart Datum (-2.57m)
Mean High Water Neap	MHWN	0.63	mOD	mOD (corrected from local Chart Datum (-2.57m)
Mean Low Water Neap	MLWN	-1.27	mOD	mOD (corrected from local Chart Datum (-2.57m)
Mean Low Water Spring	MHWS	-2.17	mOD	mOD (corrected from local Chart Datum (-2.57m)
Calculated average High Water Level		1.08	mOD	Mid point between Spring High and Neap High Water
Calculated average mid tide		-0.32	mOD	Meal Local sea Level (corrected to mOD)
Calculated average Low Water Level		-1.72	mOD	Mid point between Spring Low and Neap Low Water
Calculated average Tidal range		2.8	mOD	Range between Mid Point Estimates (i.e. 'Normal Tidal Range' averaging Spring and Neap Tides)
Flow Calculations input parameters (Darcys Law Q=KIA)				
Nominal Hydraulic Head (conservative hypothetical value adopted for modelling purposes)	**h**	**1.4**		NB: In situ data logger results show hydraulic head averaging to Mean Local Sea Level (i.e. no net hydraulic head level oberserved). This nominal value takes account of the diminishing effect of the tidal pressure signal with increasing distance inland and away from the shoreline by averaging the total 12 hour range (i.e. 50% of total range). Any hydraulic gradient caused by the tidal cycle will be short-lived and then reversed with the incoming tide.
Cross sectional area	**a**	**2422**	m2	Perimeter of shoreline x normal tidal range. Area of made Ground material through which tidal flux can occur within the normal tidal range
Hydraulic Gradient (h/l)	**i**	**0.009090909**	Dimensionless	Change in hydraulic head over distance. In this instance assumed to be the nominal head level across transect site (1.4m) divided by the half site width (154m)
Alternative Hydraulic Gradient (h/l) for sensitivity analysis	i(1)	0.018181818	Dimensionless	Using full 2.8m tidal range is extremely conservative given that the observed change in head level for the inland wells (upto 200m from shoreline) exhibit only small changes in head (circa 0.5m range)
Permeability				
Values for permeability have been selected from a range of testing including; Rising Head tests, Falling Head Tests and correlations from lab PSD testing using Hazen / Lange / Kozney / Breyer methods. Falling and rising head estimates are subject to interference from the tidal cycle and should be viewed as indicative only. However, these results are in broad agreement with correlation results from PSD which are not effected by the tidal regime.				
Maximum	K(0)	2.98E-02	m/second	Unrealistic over-estimate - see sensitivity analysis
		2572	m/day	
Average	**K(1)**	**2.13E-03**	**m/second**	**Adopted conservative and representive value**
		184	**m/day**	
Average - decreased by 1 order of magnitude (for sensitivity analysis)	K(2)	2.13E-04	m/second	Less conservative estimate
		18	m/day	
Average - decreased by 2 orders of magnitude (for sensitivity analysis)	K(3)	2.13E-05	m/second	Estimates for sensitivity analysis and outline remedation/risk management design
		2	m/day	
Average - decreased by 4 order of magnitude (for sensitivity analysis)	K(4)	2.13E-06	m/second	
		0.18	m/day	
Minium measured permeability (for sensitivity analysis)	K(5)	2.10E-07	m/second	
		0.02	m/day	
Flow Calculations			m3/day	Q (Flow) = k i a
Maximum Flow calcuation	Q(0)	56624	m3/day	Permeability (2.98 E-02)
Representative Flow Calculation	**Q(1)**	**4057**	**m3/day**	**Assuming average permeability (2.13 E-03)**
	Q(2)	406	m3/day	Permeability (2.13 E-04)
	Q(3)	41	m3/day	Permeability (2.13 E-05)
	Q(4)	4	m3/day	Permeability (2.13 E-06)
Minimum Flow calcuation	Q(5)	0.40	m3/day	Assuming Minimum permeability (2.10 E-07)
Total flux calculation				
Representative estimated daily flux	**Q1 + p**	**4341**	**m3/day**	Precipitation/infiltration plus tidal flux assuming 24 hour outgoing tide based on'Representitive flow' (Q1)

WATER FLUX MODEL - SENSITIVITY ANALYSIS

Context - Reconciliation of estimated tidal flow compared to specific yield of the saturated soil mass within normal tidal range

	Estimated Flow (Darcy) (m3)	Estimated Specific Yield (m3)	% flux	
Maximum Theoretical Flow calcuation (assuming the highest recorded permeability 2.98 E-02)	56624	70995	80%	This scenario envisages 40% of the total saturated water mass being discharged/exchanged in each tidal cycle which is considered to be an over-estimate. Whilst the observations of average head variations are pronounced around the periphery of the site and in the order of 2m, simlar observation in the central region of the site are in the order of 0.5m. However, given the relatively high permeabilties locally encountered across the site, an element of flow may be occuring at least from the periphery of the site but it is considered unlikely that this would be as high as 40% of the total specific yeild*
Average Flow calculation	4057	70995	6%	This scenario envisages 3% of the total saturated water mass being discharged/exchanged in each tidal cycle which is considered to be a reasonable estimate on the basis that flow is only likely to be occuring around the periphery of the site within the first few meters. Critically, any hydralic gradient created by the tidal cycle is short-lived and then reversed, leaving relatively little time for flow to occur. **On this basis, this value is considered to represent a reasonable but conservative estimate**.

* Specific yeild is the maximum theoretical volume of water which could drain from the saturated soil mass if there was no resisting hydrostatic pressure or re-charge (i.e. if sea level remained permenantly below the MLWS). However, this theoretical value is considered to be useful in contextualising the range of fluxes estimated using Darcy's Law.

Sensitivity Analysis

Darcys Law - Calculations - sensitivity analysis on hydraulic gradient (i) in Darcys Law flow calculations assuming a full **2.8m normal tidal range** rather than adopted value

Maximum Flow calcuation	Q(0)	113247	m3/day	Assuming Highest (worst case) permeability
Average Flow calcuation	Q(1)	8115	m3/day	Assuming average permeability
Minimum Flow calcuation	Q(5)	1	m3/day	Assuming Minimum permeability

Notes: Assuming a hydrualic head created by full **2.8m** tidal range is extremely conservative as this siutation would only occur for a few minutes each tide and there is insufficent time to drain the site in this period. There is also limited evidence of actual flow in the central regions of the site. However, for the purposes of sensitivity analysis, this assessment is considered to be useful in providing a theoretical upper limit on flux estimates which is highly unlikely to be reached in reality.

Total flux calculation - Sensitivity analysis on total flux by varying Permeability (k) In Darcys Law calcuations

Estimated daily flux assuming 2 tidal cycles per day and an average daily contribution from infiltration	Q(0)*2 +p	113531	m3/day	Using Q(0) flow estimate, the flux estimate in this scenario would require approximately 80% of all available water within the saturated mass (i.e. specific yeild) to be discharged into the estuary each day, which in the absence of any measureable hydraulic gradient is considered not to be viable.
	Q(1)*2 +p	8399	m3/day	Using Q(1) flow estimate, the contribution from flow is approaximately 6% of specific yeild, which is considered to be conservative but theoretically viable. In this sceanrio the contribution from precipitation/Infilitration is realtively small by comparison to the main tidally driven flux estimate.
	Q(2)*2 +p	1095	m3/day	Using Q(2) flow estimate, the contribution from precipitation/Infilitration accounts for approximately 40% of the total flux. In theory, this estimate may be realisitic given that model has adopted an artificial hydraulic gradient in order to drive flow (using Darcys Law). However, in the interests of maintaining conservatism throughout every element of this model, a higher flow rate has been adopted (i.e. Q(1))
	Q(3)*2 +p	365	m3/day	Using (Q3) and Q(4) flow estimates, the contribution from precipitation/Infilitration is the main flow driver. The tidally driven flow volumes (in conjunction with precipitation/Infilitration) are considered to be too low to account for the more signifncant variations in head level observed in wells around the 865m shoreline of the site.
	Q(4)*2 +p	292	m3/day	
	Q(5)*2 +p	285	m3/day	Using Q(5) flow estimate, the contribution from precipitation/Infilitration is the only discharge

DILUTION MODEL

Site Dimensions	Units	Values	Source / Comments
Site perimeter (shoreline)	m	865	Approximate from CAD plan
Radius	m	275.35	Assuming the site is a semi-circle for modelling purposes
Site area	m2	119083	Assuming the site is a semi-circle for modelling purposes

	Site area	Radius	Water Area (less site area)	Water depth	Volume of water	Volume of water	Tidal flux
					m3	litres/day	litres/day
Zone 1 (Shoreline perimeter to 10m)	119083	285.35	8818	3	3.E+04	3.E+07	5.E+07
Zone 2 (Shoreline perimeter to 15m)	119083	290.35	13340	3	4.E+04	4.E+07	8.E+07
Zone 3 (Shoreline perimeter to 25m)	119083	300.35	22619	3	7.E+04	7.E+07	1.E+08
Zone 4 (Shoreline perimeter to 50m)	119083	325.35	47190	3	1.E+05	1.E+08	3.E+08
Zone 5 (Shoreline perimeter to 100m)	119083	375.35	102223	3	3.E+05	3.E+08	5.E+08
Zone 6 (Shoreline perimeter to 200m)	119083	475.35	235850	3	6.E+05	6.E+08	1.E+09

Daily Water Flux	m3	litres /day	Comments
Representative estimated daily flux	**4341**	**4341389**	Precipitation/infiltration plus tidal flux assuming 24 hour outgoing tide based on'Representitive flow' (Q1)
High Level Estimate	5427	5426737	Conservative over-estimate of daily flux based on 50% increase over Representative estimate (for sensitivity analysis)

Priority CoCs

Groundwater chemistry results obtained from within the saturated mass of the Waste.

Determinant	WQS (µg/l)	Total No. of Samples	Minimum	Average	Maximum	No. Samples Exceeding WQS	Comments
Chromium VI	0.6	40	<2	**22**	117	1	Average' values adopted for modelling to be representative of the groundwater as a whole. 'Maximum' values used in sensitivity analysis
Chromium	4.6	43	<0.2	**11**	123	22	
Copper	5	43	<1	**12**	146	4	
Zinc	40	43	1.8	**9**	76	1	
Lead	7.2	43	2.4	**2.4**	7.79	1	
Manganese	30	43	<0.3	**535**	13300	4	
Nickel	20	43	<0.2	**6.4**	41.4	1	
Mercury	0.05	49	<0.0005	**0.2**	1.15	16	
Benzo(a)pyrene	0.05	26	<0.01	**0.024**	0.08	1	
Benzo(k)-fluorathene	0.03	26	<0.01	**0.018**	0.06	1	
Fluorathene	0.1	26	<0.01	**0.04**	0.06	1	

* LOD > WQS. Only 1 sample recorded concentrations above WQS

Estimated diluted concentrations

Conservatively representative scenario assuming average concentration of contaminant is distributed equally through entire saturated mass (groundwater) and diluted into a static water body. The model outputs predicted concentrations of the COC within the harbour water at each distance increment (ug/l)

	WQS (µg/l)	**Zone 1 (Shoreline perimeter to 10m)**	**Zone 2 (Shoreline perimeter to 15m)**	**Zone 3 (Shoreline perimeter to 25m)**	**Zone 4 (Shoreline perimeter to 50m)**	**Zone 5 (Shoreline perimeter to 100m)**	**Zone 6 (Shoreline perimeter to 200m)**
Dilution Factor		**8.E-02**	**5.E-02**	**3.E-02**	**2.E-02**	**8.E-03**	**4.E-03**
Chromium VI	**0.6**	1.81	1.19	0.70	0.34	0.18	0.08
Chromium	**4.6**	0.90	0.60	0.35	0.17	0.09	0.04
Copper	**5**	0.98	0.65	0.38	0.18	0.10	0.04
Zinc	**40**	0.74	0.49	0.29	0.14	0.08	0.03
Lead	**7.2**	0.20	0.13	0.08	0.04	0.02	0.01
Manganese	**30**	43.90	29.02	17.11	8.20	4.48	1.92
Nickel	**20**	0.53	0.35	0.20	0.10	0.05	0.02
Mercury	**0.05**	0.02	0.01	0.01	0.00	0.00	0.00
Benzo(a)pyrene	**0.05**	0.00	0.00	0.00	0.00	0.00	0.00
Benzo(k)-fluorathene	**0.03**	0.00	0.00	0.00	0.00	0.00	0.00
Fluorathene	**0.1**	0.00	0.00	0.00	0.00	0.00	0.00

DILUTION MODEL - SENSITIVITY ANALYSIS

Dilution factor - Assuming Maximum (rather than average) recorded concentration is distributed equally through entire saturated mass (within normal tidal range)

	WQS (µg/l)	Zone 1 (Shoreline perimeter to 10m)	Zone 2 (Shoreline perimeter to 15m)	Zone 3 (Shoreline perimeter to 25m)	Zone 4 (Shoreline perimeter to 50m)	Zone 5 (Shoreline perimeter to 100m)	Zone 6 (Shoreline perimeter to 200m)
Dilution Factor		**8.E-02**	**5.E-02**	**3.E-02**	**2.E-02**	**8.E-03**	**4.E-03**
Chromium VI	**0.6**	9.60	6.35	3.74	1.79	0.98	0.01
Chromium	**4.6**	10.09	6.67	3.93	1.89	1.03	0.18
Copper	**5**	11.98	7.92	4.67	2.24	1.22	0.03
Zinc	**40**	6.24	4.12	2.43	1.17	0.64	0.01
Lead	**7.2**	0.64	0.42	0.25	0.12	0.07	0.01
Manganese	**30**	1091.28	721.39	425.46	203.93	111.26	0.03
Nickel	**20**	3.40	2.25	1.32	0.63	0.35	0.01
Mercury	**0.05**	0.09	0.06	0.04	0.02	0.01	0.01
Benzo(a)pyrene	**0.05**	0.01	0.00	0.00	0.00	0.00	0.01
Benzo(k)-fluorathene	**0.03**	0.00	0.00	0.00	0.00	0.00	0.01
Fluorathene	**0.1**	0.00	0.00	0.00	0.00	0.00	0.01

Dilution factor - High Level Estimate with 50% increase over average estimated flux

	WQS (µg/l)	Zone 1 (Shoreline perimeter to 10m)	Zone 2 (Shoreline perimeter to 15m)	Zone 3 (Shoreline perimeter to 25m)	Zone 4 (Shoreline perimeter to 50m)	Zone 5 (Shoreline perimeter to 100m)	Zone 6 (Shoreline perimeter to 200m)
Dilution Factor		**1.E-01**	**7.E-02**	**4.E-02**	**2.E-02**	**1.E-02**	**4.E-03**
Chromium VI	**0.6**	2.26	1.49	0.88	0.42	0.23	0.10
Chromium	**4.6**	1.13	0.75	0.44	0.21	0.12	0.05
Copper	**5**	1.23	0.81	0.48	0.23	0.13	0.05
Zinc	**40**	0.92	0.61	0.36	0.17	0.09	0.04
Lead	**7.2**	0.25	0.16	0.10	0.05	0.03	0.01
Manganese	**30**	54.87	36.27	21.39	10.25	5.59	2.40
Nickel	**20**	0.66	0.43	0.26	0.12	0.07	0.03
Mercury	**0.05**	0.02	0.01	0.01	0.00	0.00	0.00
Benzo(a)pyrene	**0.05**	0.00	0.00	0.00	0.00	0.00	0.00
Benzo(k)-fluorathene	**0.03**	0.00	0.00	0.00	0.00	0.00	0.00
Fluorathene	**0.1**	0.00	0.00	0.00	0.00	0.00	0.00

Dilution factors considering a range permeability estimates used in the Flux model

Permeability (2.98 E-02)

	WQS (µg/l)	Zone 1 (Shoreline perimeter to 10m)	Zone 2 (Shoreline perimeter to 15m)	Zone 3 (Shoreline perimeter to 25m)	Zone 4 (Shoreline perimeter to 50m)	Zone 5 (Shoreline perimeter to 100m)	Zone 6 (Shoreline perimeter to 200m)
Dilution Factor		2.E+00	1.E+00	8.E-01	4.E-01	2.E-01	9.E-02
Chromium VI	0.6	47.21	31.21	18.40	8.82	4.81	2.06
Chromium	4.6	23.60	15.60	9.20	4.41	2.41	1.03
Copper	5	25.75	17.02	10.04	4.81	2.63	1.13
Zinc	40	19.31	12.77	7.53	3.61	1.97	0.84
Lead	7.2	5.15	3.40	2.01	0.96	0.53	0.23
Manganese	30	1147.95	758.86	447.56	214.52	117.04	50.17
Nickel	20	13.73	9.08	5.35	2.57	1.40	0.60
Mercury	0.05	0.43	0.284	0.167	0.080	0.044	0.019
Benzo(a)pyrene	0.05	0.05	0.034	0.020	0.010	0.005	0.002
Benzo(k)-fluorathene	0.03	0.04	0.026	0.015	0.007	0.004	0.002
Fluorathene	0.1	0.09	0.057	0.033	0.016	0.009	0.004

Permeability (2.13 E-04)

	WQS (µg/l)	Zone 1 (Shoreline perimeter to 10m)	Zone 2 (Shoreline perimeter to 15m)	Zone 3 (Shoreline perimeter to 25m)	Zone 4 (Shoreline perimeter to 50m)	Zone 5 (Shoreline perimeter to 100m)	Zone 6 (Shoreline perimeter to 200m)
Dilution Factor		2.E-02	1.E-02	8.E-03	4.E-03	2.E-03	9.E-04
Chromium VI	0.6	4.55E-01	3.01E-01	1.78E-01	8.51E-02	4.64E-02	1.99E-02
Chromium	4.6	2.28E-01	1.51E-01	8.88E-02	4.26E-02	2.32E-02	9.95E-03
Copper	5	2.48E-01	1.64E-01	9.69E-02	4.64E-02	2.53E-02	1.09E-02
Zinc	40	1.86E-01	1.23E-01	7.26E-02	3.48E-02	1.90E-02	8.14E-03
Lead	7.2	4.97E-02	3.28E-02	1.94E-02	9.29E-03	5.07E-03	2.17E-03
Manganese	30	1.11E+01	7.32E+00	4.32E+00	2.07E+00	1.13E+00	4.84E-01
Nickel	20	1.33E-01	8.76E-02	5.17E-02	2.48E-02	1.35E-02	5.79E-03
Mercury	0.05	4.14E-03	2.74E-03	1.61E-03	7.74E-04	4.22E-04	1.81E-04
Benzo(a)pyrene	0.05	4.97E-04	3.28E-04	1.94E-04	9.29E-05	5.07E-05	2.17E-05
Benzo(k)-fluorathene	0.03	3.73E-04	2.46E-04	1.45E-04	6.96E-05	3.80E-05	1.63E-05
Fluorathene	0.1	8.28E-04	5.47E-04	3.23E-04	1.55E-04	8.44E-05	3.62E-05

Permeability (2.13 E-05)

	WQS (µg/l)	Zone 1 (Shoreline perimeter to 10m)	Zone 2 (Shoreline perimeter to 15m)	Zone 3 (Shoreline perimeter to 25m)	Zone 4 (Shoreline perimeter to 50m)	Zone 5 (Shoreline perimeter to 100m)	Zone 6 (Shoreline perimeter to 200m)
Dilution Factor		7.E-03	5.E-03	3.E-03	1.E-03	7.E-04	3.E-04
Chromium VI	0.6	1.52E-01	1.00E-01	5.92E-02	2.84E-02	1.55E-02	6.64E-03
Chromium	4.6	7.59E-02	5.02E-02	2.96E-02	1.42E-02	7.74E-03	3.32E-03
Copper	5	8.28E-02	5.47E-02	3.23E-02	1.55E-02	8.44E-03	3.62E-03
Zinc	40	6.21E-02	4.11E-02	2.42E-02	1.16E-02	6.33E-03	2.71E-03
Lead	7.2	1.66E-02	1.09E-02	6.46E-03	3.09E-03	1.69E-03	7.24E-04
Manganese	30	3.69E+00	2.44E+00	1.44E+00	6.90E-01	3.76E-01	1.61E-01
Nickel	20	4.42E-02	2.92E-02	1.72E-02	8.25E-03	4.50E-03	1.93E-03
Mercury	0.05	1.38E-03	9.12E-04	5.38E-04	2.58E-04	1.41E-04	6.03E-05
Benzo(a)pyrene	0.05	1.66E-04	1.09E-04	6.46E-05	3.09E-05	1.69E-05	7.24E-06
Benzo(k)-fluorathene	0.03	1.24E-04	8.21E-05	4.84E-05	2.32E-05	1.27E-05	5.43E-06
Fluorathene	0.1	2.76E-04	1.82E-04	1.08E-04	5.16E-05	2.81E-05	1.21E-05

Permeability (2.13 E-06)

	WQS (µg/l)	Zone 1 (Shoreline perimeter to 10m)	Zone 2 (Shoreline perimeter to 15m)	Zone 3 (Shoreline perimeter to 25m)	Zone 4 (Shoreline perimeter to 50m)	Zone 5 (Shoreline perimeter to 100m)	Zone 6 (Shoreline perimeter to 200m)
Dilution Factor		6.E-03	4.E-03	2.E-03	1.E-03	6.E-04	2.E-04
Chromium VI	0.6	1.21E-01	8.03E-02	4.74E-02	2.27E-02	1.24E-02	5.31E-03
Chromium	4.6	6.07E-02	4.01E-02	2.37E-02	1.13E-02	6.19E-03	2.65E-03
Copper	5	6.62E-02	4.38E-02	2.58E-02	1.24E-02	6.75E-03	2.90E-03
Zinc	40	4.97E-02	3.28E-02	1.94E-02	9.28E-03	5.07E-03	2.17E-03
Lead	7.2	1.32E-02	8.76E-03	5.17E-03	2.48E-03	1.35E-03	5.79E-04
Manganese	30	2.95E+00	1.95E+00	1.15E+00	5.52E-01	3.01E-01	1.29E-01
Nickel	20	3.53E-02	2.34E-02	1.38E-02	6.60E-03	3.60E-03	1.54E-03
Mercury	0.05	1.10E-03	7.30E-04	4.30E-04	2.06E-04	1.13E-04	4.83E-05
Benzo(a)pyrene	0.05	1.32E-04	8.76E-05	5.17E-05	2.48E-05	1.35E-05	5.79E-06
Benzo(k)-fluorathene	0.03	9.94E-05	6.57E-05	3.87E-05	1.86E-05	1.01E-05	4.34E-06
Fluorathene	0.1	2.21E-04	1.46E-04	8.61E-05	4.13E-05	2.25E-05	9.65E-06

Summary of key outputs of Groundwater DQRA

FLOW MODEL			
Darcys Law - Flow Calculations (Q = KIA)			
K - Permeability	184	(m/day)	Average permeability (2.13E-03m/s)
I - Hydraulic Gradient	0.0090	Dimensionless (h/l)	Conservative estimate using 1.4m (h) / 154 (half of l) 1.4m is 50% of normal tidal range of2.8m
A - Cross-sectional Area	2422	m2	Shoreline perimeter (865m) x normal tidal range (2.8m)
Flow	**4017**	**m3/day**	Conservative estimate of water flux leaving the saturated soil mass within each tidal cycle

Flux model			
A conservative assessment assuming total infiltration from precipitation and two times the conservative estimates of theoretical flow of water from the site.			
Estimated daily flux	**4341**	**m3/day**	Precipitation/infiltration (248m3/day based on local annual average) plus tidal flux (4017m3) assuming outgoing tide for full day

LEVEL 4 - DILUTION MODEL

Conservative assessment of estimated contaminant concentrations in water at varying distances away from the site assuming a static water environment rather than a system in perpetual tidal flux. Assessment also assumes a conservative 3m depth of water within the estuary.

	WQS (µg/l)	Zone 1 (Shoreline perimeter to 10m)	Zone 2 (Shoreline perimeter to 15m)	Zone 3 (Shoreline perimeter to 25m)	Zone 4 (Shoreline perimeter to 50m)	Zone 5 (Shoreline perimeter to 100m)	Zone 6 (Shoreline perimeter to 200m)
Dilution Factor		8.E-02	5.E-02	3.E-02	2.E-02	8.E-03	4.E-03
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Chromium VI	**0.6**	1.81	1.19	0.70	0.34	0.18	0.08
Chromium	**4.6**	0.90	0.60	0.35	0.17	0.09	0.04
Copper	**5**	0.98	0.65	0.38	0.18	0.10	0.04
Zinc	**40**	0.74	0.49	0.29	0.14	0.08	0.03
Lead	**7.2**	0.20	0.13	0.08	0.04	0.02	0.01
Manganese	**30**	43.90	29.02	17.11	8.20	4.48	1.92
Nickel	**20**	0.53	0.35	0.20	0.10	0.05	0.02
Mercury	**0.05**	0.02	0.01	0.01	0.00	0.00	0.00
Benzo(a)pyrene	**0.05**	0.00	0.00	0.00	0.00	0.00	0.00
Benzo(k)-fluorathene	**0.03**	0.00	0.00	0.00	0.00	0.00	0.00
Fluorathene	**0.1**	0.00	0.00	0.00	0.00	0.00	0.00

SUMMARY

Conclusions:

The highly conservative assessment presented herein indicates that the majority of identified COC's within the waste material on the site are not impacting upon local water quality in the estuary. This situation would be expected given that the majority of materials deposited on the site have been in situ for many years already and have a finite abilty to source leachable constituents.

Notwithstanding the above, water soluble manganese and chromium (VI) are assessed to represent a theoretical impact to near-shore waters within 25m of the site boundary. At distances beyond the 50m from the foreshore, the concentrations of both of these constituents drop below the relevant water quality standards by an order of magnitude.

NB: Mass transport models of this type are inherently conservative and the outputs should be considered as indicative only.

Appendix BB Geotechnical Assessment

Geotechnical Assessment

This Appendix of the report summarises the extent of and key geotechnical characteristics of each strata encountered during the ground investigation derived from in situ and laboratory testing. A full set of 2012 laboratory test results can be found in the site investigation factual report (PGL, 2012).

CC1 Waste

Waste was encountered from ground level in all exploratory holes to a maximum depth of 11mbgl (BH306D). Some boreholes (BH306A, BH306B, BH310A, BH311, BH314, BH315, TP01) were terminated in the waste indicating that it may be present to a greater depth locally across the site. The waste was highly variable in composition but was predominantly described as grey/black 'unprocessed slag'. The slag is commonly described as gravel and cobble sized with varying amounts of refractory bricks, timber, construction waste, metal, plastics, steel and iron.

Generally the full thickness of waste comprised slag material, although occasionally it encountered where the predominant material was not slag. This was described as millscale, sandy clay, topsoil, shells with metal debris, sandy gravel and black sludge/sand. The slag thickness was generally greater in the centre and along the eastern boundary of the site (7 to 11m) and thinnest along the western boundary (2 to 5m). Due to the very hard/dense nature of the waste deposits across the site, a full profile of standard penetration tests (SPT) could not be carried out in the waste in every borehole. Where tests were feasible (where more loose/softer deposits were present), 27 No. tests returned results indicating an SPT 'N' values of between 11 and 65 (typically greater than 40) indicating it to be dense to very dense. These high test results are indicated on the SPT versus depth graph in Appendix AA where they do not fit the general trend of increasing SPT 'N' with depth.

Twenty nine slag samples were tested at Thomas Research Services Ltd (TRS) laboratory during the 2005 ground investigation to identify the range and relative concentrations of any iron and steel making slags present in the samples and to assess their ability to expand. A full suite of testing was carried out on the samples which included petrological examination, thermal analysis, analysis for free CaO and free MgO and finally the TRS accelerated expansion test. It was determined that basic steel slag and millscale were the dominant constituents of the samples along with more minor amounts of basic refractory material. Tests indicated that although the material had already expanded the material was still free to expand further which was proven in the accelerated expansion tests with a maximum expansion of 12% (range 0.08-12%, average 2.53%).

Due to the asbestos contamination within the majority of slag samples, few could be tested for geotechnical properties. One cohesive sample of waste was tested for Atterberg Limits ands returned a plastic limit of 28%, liquid limit of 51% and plasticity index of 23% indicating a high plasticity material.

Nine particle size distribution tests carried out on the waste material indicate the majority of samples passing the 63mm sieve (coarse gravel) but not the 0.63mm sieve. This indicates the composition of the waste material lies predominantly within the coarse SAND, fine, medium and coarse GRAVEL size.

Twelve bulk and dry density tests carried out on unprocessed slag returned bulk values of between 1.74 and 2.62 Mg/m^3 and dry densities of between 1.16 and 2.32Mg/m^3. One sample of millscale was tested and returned a bulk density of 2.20Mg/m^3 and dry density of 1.93Mg/m^3. A sample described as demolition waste was tested which returned a bulk density of 2.06Mg/m^3 and dry density of 1.84Mg/m^3.

Fifty five samples were tested for pH value and water soluble sulphate 2:1 extract. The values for pH ranged between 8.96 and 12.7 and sulphate concentrations between <0.008g/l and 3.97g/l.

CC2 Alluvium

Alluvial deposits were encountered across the site in all of the boreholes which fully penetrated the waste material. The material was described as silt to a maximum depth of 24.38mbgl (BH306C) although some boreholes were terminated in the alluvium therefore deeper alluvium may be present locally across the site. The alluvium directly underlies the waste material (from a minimum depth of 5mbgl) and has an average thickness of 10m. The composition of the silt varied across the site containing low to high sand content. Six particle size distribution tests carried out on the silt indicated between 6 and 36% sand, between 48 and 72% silt and between 15 and 23% clay particles.

Fifty four SPT tests carried out within the SILT returned 'N' values of between 0 and 19 (predominantly 1-10) indicating very soft/loose material. The low SPT 'N' values are indicated on the SPT versus depth graph in Appendix AA.

Ten Atterberg Limit tests were carried out on samples of the SILT. Results returned plastic limits of between 16 and 27%, liquid limits of between 35 and 52% and plasticity index values of between 15 and 26%. These results indicate an intermediate to high plasticity material.

Six bulk and dry density tests carried out on the SILT and returned bulk values of between 1.73 and 2.26 Mg/m3 and dry densities of between 1.12 and 2.04Mg/m^3.

Five one dimensional consolidation tests were carried out on the SILT and returned co-efficient of volume compressibility (mv) values of between 1.843 and 4.871m^2/MN.

Eight quick undrained triaxial tests were carried out on piston samples of the silt material. Results returned undrained cohesion values of between 10 and 70kPa indicating a very soft to firm material.

Twenty three samples were tested for pH value and water soluble sulphate 2:1 extract. The values for pH ranged between 7.85 and 9.17 and sulphate concentrations between 0.14g/l and 0.951g/l.

CC3 Clay

Clay was encountered in six exploratory holes below the alluvium from a minimum depth of 14mbgl (BH308) to a maximum depth of 27.43mbgl (BH310C). The average thickness of the clay was 3.8m with two boreholes (BH301A and BH304) terminating with the clay. It was absent in five boreholes (BH310B, BH312B, BH313, BH306C and BH312C) where alluvium directly overlies the fluvio-glacial sands and gravels below. The material is generally described as a brown slightly sandy, slightly gravelly clay with occasional cobbles. Seventeen SPT tests carried out within the clay returned 'N' values of between 2 and 50 (typically >25) indicating a predominantly stiff to very stiff clay.

Three Atterberg tests were carried out on the clay and returned plastic limits of between 15 and 17%, liquid limits of between 25 and 26% and plasticity index values of between 8 and 11% indicating a low plasticity. Seven hand vane tests were carried out on bulk samples of the clay in the laboratory. These returned undrained shear strength values of between 4 and 28kPa indicating a very soft to soft material. These results are not in line with SPT results and it is believed that this may be due to sample disturbance.

Four bulk and dry density tests carried out on samples of the clay returned bulk values of between 2.04 and 2.24 Mg/m3 and dry densities of between 1.86 and 1.98Mg/m3.

Four samples were tested for pH and water soluble sulphate 2:1 extract. The values for pH ranged between 7.94 and 8.91 and sulphate concentrations between 0.0162g/l and 0.258g/l.

CC4 Glacial Sands and Gravels

Glacial sands and gravels were encountered in eleven exploratory holes underlying the Glacial Till from a minimum depth of 14mbgl (BH312B) to a maximum depth of 36.58mbgl (BH310C). The average thickness of this strata is 6.9m although four boreholes terminated within the material. The material is generally described as slightly sandy and occasionally slightly clayey GRAVEL with cobbles throughout. In BH125R, a drillers' description of fine blowing SAND is given from 30.5mbgl although this may be due to not keeping the borehole topped up with water.

Seventeen SPT tests carried out in this material returned 'N' values of between 23 and 75 (increase with depth) indicating a medium dense to very dense material.

Two bulk and dry density tests carried out on bulk samples of gravel and returned bulk values of 1.96 and 2.02Mg/m3 and dry densities of 1.82 and 1.85Mg/m3.

CC5 Carboniferous Limestone

Limestone bedrock was encountered in exploratory holes BH310C, BH312C and BH117R from a minimum depth of 23.8mbgl to a maximum drilled depth of 47.6mbgl. The rock is described as strong grey limestone which is slightly weathered. In BH310C the rock was recovered as cobbles, boulders and gravel from 36.58mbgl to 43.10mbgl and therefore low total core recovery (TCR), solid core recovery (SCR) and rock quality designation (RQD) was achieved. All other cores were recovered with TCR between 20 and 100%, SCR between 0 and 100% and RQD between 0 and 100%.

Eight point load tests were carried out on samples of the limestone rock and returned point load index values of between 0.03 and 4.44MPa indicating a low to very high strength rock. One unconfined compressive strength test was carried out on the limestone and returned a strength value of 58.97MPa indicating a strong rock.

Representative core photos are included in the Priority Geotechnical Limited Factual Report (PGL, 2012).

A summary of the geotechnical properties of each strata is summarised in Table CC1.

Table CC1 Summary of Geotechnical Parameters

	Waste	Alluvium	Glacial Till	Sands and Gravels	Limestone
SPT range	11-65	0-19	2-50 (>25)	23-75	-
Plasticity Index (%)	23	15-26	8-11	-	-
Undrained strength (kPa)	-	10-70	100-150[1]	-	-
Compressibility Mv (m^2/MN)	-	1.843-4.871	-	-	-
Bulk density (Mg/m^3)	1.74-2.62	1.73-2.26	2.04-2.24	1.96-2.02	-
Dry density (Mg/m^3)	1.16-2.32	1.12-2.04	1.86-1.98	1.82-1.85	-
UCS (MPa)	-	-	-	-	58.97
pH	8.96-12.7	7.85-9.17	7.84-8.91	-	-
2:1 water soluble SO_4 (g/l)	<0.008-3.97	0.14-0.951	0.0162-0.258	-	-

1 Based on SPT

Z6 Groundwater

Groundwater was encountered during drilling of the boreholes between 0.5m (0.57m AOD) and 14mbgl (-11.24m AOD). Changing ground water levels due to tidal fluctuations have been proven through groundwater monitoring as described in Section 5 of this report.

Z7 GROUND ENGINEERING CONSIDERATIONS

Proposed Development

No specific develop plans have been outlined for the site although it is understood that it may be used as recreational land in the future with capping of the waste material and containment or coastal defence works around the site. This geotechnical assessment gives a broad overview of the geotechnical constraints at the site in relation to the potential end use and gives some recommendations for construction processes.

It is understood that the site was not originally part of Haulbowline island and has been created by tipping furnace slag and other waste products from the steel making process onto marine deposits to the east of the island, progressing eastwards with time. The geology of the site is outlined briefly in this section and also in previous sections of this report. The ground conditions are generally in line with those previously encountered during historical ground investigations at the site comprising waste (predominantly slag and refractory material) over alluvium, glacial till, glacial sands and gravels and limestone at depth.

Expansive Slag

Slag is a bi-product of the refining of iron ores. It constitutes Made Ground or fill material and therefore inherits similar hazards as use in construction. Guidance document BRE 481 'Regeneration of Brownfield Sites containing Ferrous Slag' details the properties of and risks associated with development on slag material. Ground settlement is one of the main risks associated with the material as a result of self weight, external loads or by infiltration of groundwater which in this case is shallow at the site. In addition to this, certain slags can undergo significant expansion upon contact with moisture which can result in significant differential movement across sites (which can ultimately result in damage to any overlying structures, roads and services). Movements can be reduced where slag has been treated (excavated, crushed, blended and replaced in compacted layers) although significant movements have still been recorded on treated sites.

Foundations

Due to the variable nature and thickness of Waste deposits, particularly with the presence of slag, this material is not recommended as a bearing strata for shallow foundations for any buildings which may be associated with the development. The principal constraint at the site is the significant thickness of potentially expansive slag deposits and highly compressible alluvium below it. These constraints could lead to significant structural damage of buildings, roads and services. If any structures are proposed on the site, a detailed assessment of potential ground movements would be required together with an assessment of potential remedial options (which could include sleeved piled structures with suspended floor slabs, stiffened raft construction or use of compressible void formers beneath the foundations).

Piled foundations may be feasible however these would need to be taken a sufficient depth into the underlying natural strata and would need to be sleeved through the slag to remove the risk of slag expansion. The piles would need to be founded either within the glacial till, the sands and gravels or Limestone rock, depending upon the structural load requirements. The fused slag could also present significant obstructions to driven piles and it is likely that some form of bored pile would be required.

Groundwater

Groundwater strikes during the ground investigation were encountered between 0.5m and 14mbgl. These are generally in continuity with the surrounding sea level. If the site is to be capped then there are no anticipated groundwater issues for construction. Consideration should be given to groundwater control should excavations associated with the development be required (removal of slag, service trenches) to prevent unstable excavations and contact with potentially contaminated groundwater.

Earthworks

Any development plans for the site will require removal of the stockpiles of Slag which are present in abundance across the site. If the site is to be capped, then the material may be used to re-profile the site, particularly towards the centre which lies at a lower elevation. This would create a more level site for a recreational development.

Due to the proven expansive and contaminated nature of the slag and waste deposits on site it is unlikely that the stockpiled material will be suitable for re-use off site.

As the site is to be redeveloped for recreational playing fields, it is assumed that some degree of differential movement will be acceptable. In order to ensure the effects of any differential movement are minimised, consideration could be given to the use of a capping layer. The thickness would be dependent upon the amount of differential movement that would be considered acceptable. A minimum thickness of 600mm is recommended with some differential settlement anticipated. Alternatively the upper 2 to 3m of slag material could be excavated and treated as discussed above, to reduce the magnitude of differential settlement.

East Tip, Haulbowline Island,
Waste Licensing Project