December 21, 2011

SUPPLEMENTAL STAGE 1 PRELIMINARY SITE INVESTIGATION AND DETAILED SITE INVESTIGATION

Ladysmith Harbour
Ladysmith, BC

Submitted to:
Crown Land Opportunities and Restoration Branch
Ministry of Forests, Lands and Natural Resource Operations
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REPORT

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Executive Summary

Golder Associates Ltd. (Golder) was retained by the Crown Lands Opportunities and Restoration Branch (CLORB) of the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) to conduct a Stage 1 Preliminary Site Investigation (Stage 1 PSI), Detailed Site Investigation (DSI), sediment investigation and preliminary geotechnical investigation at Ladysmith Harbour in the Town of Ladysmith, on Vancouver Island, British Columbia (the "Site").

It is understood that CLORB of MFLNRO and the Town of Ladysmith, as well as other stakeholders, desire to develop the Site for potential residential, park, and/or commercial land use. The primary objectives of the investigation activities were to refine remedial and geotechnical costs and options for the Site. This report presents the results of the Stage 1 PSI and DSI. Results of the sediment and preliminary geotechnical investigations are presented under separate covers.

The Site is irregular in shape and consists of three areas, including the Uplands, Slack Point and two water lots within Ladysmith Harbour. The Site has an area of approximately 336,000 square metres (m^2) or 33.6 hectares (ha). The land portions comprise approximately 14.5 ha, or 43 percent, of the Site. The water lots comprise the remaining approximately 19 ha, or 57 percent. The Site is generally configured in a northwest to southeast configuration.

Background

Ladysmith Harbour was an industrial harbour for the majority of the last century. The main industries were a coal washing and load out facility, logging activities (sorting, dumping, storing and shipping) and railway yard facilities. These industries discharged waste to the Site.

Former activities at the Site have included the washing and transporting of coal (leading to the dumping of waste coal into Ladysmith Harbour forming Slack Point) and off-loading of logs from the railway into Ladysmith Harbour, where dumping, sorting, storing, and shipping took place. In addition, the Upland area was historically used as a working rail yard which at one time contained fuel tanks, a train station, a locomotive and railcar repair shop, a roundhouse, and underground maintenance pits.

Stage 1 PSI

Environmental investigations have taken place at Ladysmith Harbour beginning in 1989, in response to requests from previous owners to assess environmental liabilities of the historic activities, and later to aid in the evaluation of the feasibility of a new waterfront development. The Site and surrounding Ladysmith Harbour area has served a variety of industries and activities, including several CSR Schedule 2 activities, since the late 1800's. The Stage 1 PSI scope of work included a review of available historical reports. During the Stage 1 PSI, 21 on-Site and 4 off-Site likely APECs or AECs were identified, including the following.

Area of Potential Concern Identifier	Information Obtained By Historic Review and Stage 1 PSI
Slack Point	
AEC 1	Coal Fill at Slack Point.
AEC 2	Surficial Fill from Non-Coal sources at Slack Point.
APEC 3	Former Wood Waste and Dredgate Stockpile.
APEC 4	Former Boat Repair Shop On Slack Point.
APEC 5	Buried Refuse and Possible Abandoned Landfill.
APEC 6	Stockpiles of Imported Sand and Gravel.
APEC 7	Former Buildings Associated with Logging Activities.
Uplands	
APEC 8	Fill Material in the Uplands.
APEC 9	Former Scale Pit and Possible PCB Storage.
AEC 10	Former Pump Islands, ASTs, Pump House and Possible PCB Storage.
APEC 11	Historic Fuel Pipelines from Uplands to the Harbour.
AEC 12	Former Maintenance Area and Current Boat Repair and Construction Operations.
AEC 13	Former Waste Oil Storage Area and Compressor Storage Location.
APEC 14	Former Location of Oil Drum, Scrap Metal Storage, and Stockpiles of Unknown Quality.
APEC 15	Former Cable Splicing Shed.
APEC 16	Suspect UST Adjacent the Washroom Building.
Filled Foreshore	
APEC 17	Fill Material at Block B and D of DL 2016 (former Location of the Shingle Mill).
APEC 18	Small Saw Mill.
AEC 19	Former Log Dump (DL17G).
APEC 20	Former Location of ASTs at the Foreshore.
Sediments	
AEC 21	Foreshore Sediments – Quality of Sediment, Marina Activities, Sewage Outfall and Pressure Treated Piles.
Off-Site	
APEC 22	Off-Site Service Stations at 435 and 728 Esplanade.
APEC 23	Copper Smelter.
APEC 24	Burleith Log Sort Facility.
APEC 25	Iron Foundry.

At the conclusion of the Stage 1 PSI, some of the APECs were eliminated based on historical information available, and as such, were not retained for further investigation. A total of eight AECs and nine APECS were retained for further investigation and or delineation. A scope of work was developed for the DSI to investigate and delineate the retained APECs and/or AECs.

DSI

The objectives for the DSI were to:

i) Assess soil, soil vapour, and groundwater quality in each of the APECs identified at the Site;

ii) Determine if the APECs should be considered areas of environmental concern (AEC);

iii) Characterize and delineate the extent of soil and/or groundwater contamination at the Site associated with the AECs; and,

iv) Provide supporting information for a risk assessment and remedial plan for the Site. The objective of the sediment investigation was to obtain data to refine remedial costs and options, including an assessment of whether ocean disposal is a viable option, for potential developers of the Site.

The remedial costs and options are presented under separate cover.

The DSI activities were conducted between November 2009 and February 2011 and included surface soil sampling, testpitting, drilling of boreholes and installation of monitoring wells, and soil and groundwater sampling.

Following the completion of the DSI, the following APECs/AEC, and their respective contamination of concern have been identified.

AEC or APEC	Summary	COC
SLACK POINT		
AEC 1 - Coal Fill.	Coal fill material contains concentrations of PAHs, LEPH, and HEPH at concentrations above PL/RL standards.	Soil: naphthalene LEPH and HEPH Soil vapour: naphthalene
AEC 2 - Surface Fill.	Samples collected form surface fill (non-coal) contained concentrations of LEPH, HEPH and metals exceeding the CSR PL/RL standards and zinc concentrations exceeding the CL/IL standards.	Soil: LEPH, HEPH, metals
AEC 5 - Buried Refuse.	Samples collected from the area of the buried refuse contained concentrations of LEPH, HEPH and metals exceeding the CSR CL/IL standard and/or the CSR RL/PL standards.	Soil: LEPH, HEPH, metals

AEC or APEC	Summary	COC
UPLANDS		
AEC 10 - Former fuel pump islands, ASTs and possible PCB Storage.	VPH contamination exceeding the CSR CL/IL standard was identified in the southern areas of AEC 10. Xylene and naphthalene were detected in soils but were below standards. In the northern area of AEC 10, surficial soil samples contained HEPH concentrations over the CSR RL/PL or CL/IL standards. The HEPH appears to be limited to a surficial area adjacent to a concrete slab; and is not adjoining the VPH contamination located in the southern area of AEC 10. One groundwater sample, in the southern area of AEC 10, contained VPH concentrations exceeding the CSR standards. While the groundwater contamination has not been delineated horizontally or vertically, groundwater contamination is expected to be limited to the area of soil contamination.	Soil: VPH, HEPH Groundwater: VPH Soil Vapour: VPHv, xylene, naphthalene
AEC 12 - Former Maintenance Area and Current Boat Repair and Construction Operations.	LEPH contamination was observed in the area of AEC 12. Contamination appeared to be patchy, and not associated with one contiguous source/activity. In addition, styrene was observed at concentrations exceeding the PL/RL standards. LEPH contamination was historically observed in groundwater, however, subsequent sampling do not indicate the presence of groundwater contamination.	Soil: LEPH, styrene
AEC 13 - Former Waste Oil Storage Area and Compressor Storage Area.	Near-surface soil contamination of LEPH and HEPH concentrations exceeding the CSR PL/RL standards. LEPH contamination was historically observed in the groundwater, however, subsequent sampling do not indicate the presence of groundwater contamination.	Soil: LEPH
FILLED FORESHORE		
APEC 17 – Fill Material at Block B and D of DL 2016 (former Location of the Shingle Mill), APEC 18 – Small Saw Mill (combined with APEC 17), APEC 23 – Tyee Copper Smelter, and APEC 25 – Iron Foundry (combined with APEC 17).	No soil or groundwater contamination identified during the DSI, as such, this area is not considered an APEC. However, the sampling program was limited in area, and additional sample collection along the filled area may be warranted, therefore, remains an APEC.	Potential COC: Soil: LEPH/HEPH, PAH, and metals Groundwater: LEPH/HEPH, PAH, metals Soil Vapour: VPHv, BTEX, naphthalene
AEC 19 - Former Log Dump (Lot 17G).	Presence of NAPL was observed during drilling boreholes along the shoreline in the vicinity of the former log dump. VPH, LEPH and HEPH concentrations exceeding CSR CL/IL standards in soil, and PAH constituents exceeding. NAPL was not observed in monitoring wells during monitoring events. Contamination appears to be limited to a particular range of depth and may be associated with the log dump or filling activities. Contamination in this area does not does not appear to be related to migration of contamination from areas where railway maintenance activities occurred.	Soil: VPH, LEPH Groundwater: PAH Soil Vapour: VPHv
SEDIMENTS		
APEC 21 – Foreshore sediments.	Reported under separate cover.	

Study Limitations

This report was prepared for the exclusive use of the Crown Lands Opportunities and Restoration Branch (CLORB) of the British Columbia Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) and the Town of Ladysmith and is intended to provide an assessment of environmental-related soil, groundwater, and soil vapour conditions at the Site.

The report is based on data and information collected during investigations conducted by Golder Associates Ltd.'s personnel and the review of reports prepared by others as listed in this report. It is based solely on the conditions of the subject property at the time of the site investigations conducted between 2009 and 2011, as described in this report. The data presented in this report represents soil, groundwater, and soil vapour conditions encountered at the sampling locations tested during this time period. Soil, groundwater, and/or soil vapour conditions may vary with location, depth, time, sampling methodology, analytical techniques and other factors. Golder Associates Ltd. makes no warranty, expressed or implied, and assumes no liability with respect to the use of the information contained in this report at the subject site, or any other site, for other than its intended purpose.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Golder Associates Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

If new information is discovered in the future, Golder Associates Ltd. should be requested to re-evaluate the conclusions of this report and provide amendments as required prior to any reliance upon the information presented herein.

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by the Crown Lands Opportunities and Restoration Branch (CLORB) of the Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) to conduct a Stage 1 Preliminary Site Investigation (Stage 1 PSI), Detailed Site Investigation (DSI), sediment investigation and preliminary geotechnical investigation at Ladysmith Harbour in the Town of Ladysmith, on Vancouver Island, British Columbia (the "Site"; see Figures 1 and 2).

It is understood that CLORB of MFLNRO and the Town of Ladysmith, as well as other stakeholders, desire to develop the Site for potential residential, park, and/or commercial land use. The primary objectives of the investigation activities were to refine remedial and geotechnical costs and options for the Site. Authorization to proceed was provided by Mr. Geoff Sinnett of MFLNRO.

This report presents the results of the Stage 1 PSI and DSI. Results of the sediment and preliminary geotechnical investigations are presented under separate covers.

1.1 Background

1.1.1 Location and Setting

The Site is located generally between Transfer Beach and Williams Point along Ladysmith Harbour in the Town of Ladysmith, BC. It includes Slack Point, which comprises the area between the harbour and the Vancouver Island Highway (referred to as the Uplands), and portions of Ladysmith Harbour.

Some areas of the site are currently undeveloped (for example Slack Point) and some portions of the Uplands are developed. The Site is understood to be zoned as a mix of park, residential, commercial and industrial land. There are existing roadways along the Uplands areas and southwest of Slack Point. A marina is located within Ladysmith Harbour to the northwest of Slack Point (Ladysmith Maritime Society Marina). Within the Uplands are existing rail tracks parallel to the Island Highway. Along the waterfront area, northeast of the Uplands, is an existing government wharf.

1.1.2 Historical Activities

Ladysmith Harbour was an industrial harbour for the majority of the last century. The main industries were a coal washing and load out facility, logging activities (sorting, dumping, storing and shipping) and railway yard facilities. These industries discharged waste to the Site.

Former activities at the Site have included the washing and transporting of coal (leading to the dumping of waste coal into Ladysmith Harbour forming Slack Point) and off-loading of logs from the railway into Ladysmith Harbour, where dumping, sorting, storing, and shipping took place. In addition, the Upland area was historically used as a working rail yard which at one time contained fuel tanks, a train station, a locomotive and railcar repair shop, a roundhouse, and underground maintenance pits.

1.1.3 Previous Investigations and Assessments

A number of previous investigations have addressed environmental conditions at the Site. In 2005, Golder was retained to conduct an assessment of the environmental liabilities for the Site. Historical reports that addressed environmental conditions were reviewed, and relevant soil, sediment and groundwater data were compiled and compared to regulatory standards/guidelines (applicable in 2005). Based on the report review, several data gaps were identified.

An opinion of probable costs of remediation was developed based on several assumptions that considered data gaps and uncertainties of the data, as well Site re-development. While there are no detailed plans available, it is understood that development may include a mix of residential, commercial and parkland areas.

As such, the range of opinion of probable costs was relatively large (between $539,000 and $9,168,000 for the upland area, and between $525,000 and $34,175,000 for the sediments, depending upon the remediation scenario). The report concluded that further investigation to address each of the data gaps identified for the Site would serve to refine the remediation cost estimates for identified areas of soil, groundwater, and sediment contamination.

1.2 Objectives

The primary objective of the Stage 1 PSI was to document historical activities or events on the Site and/or on adjacent properties that may have affected environmental soil, sediment, soil vapour, and groundwater quality at the Site. The assessment focused on identifying areas of potential and known environmental concern (APECs/AECs), and associated potential and known contaminants of concern (PCOCs/COCs).

The primary objectives for the DSI were to:

i) Assess soil, soil vapour, and groundwater quality in each of the APECs identified at the Site;

ii) Determine if the APECs should be considered areas of environmental concern (AEC);

iii) Characterize and delineate the extent of soil and/or groundwater contamination at the Site associated with the AECs; and,

iv) Provide supporting information for a risk assessment and remedial plan for the Site. The objective of the sediment investigation was to obtain data to refine remedial costs and options, including an assessment of whether ocean disposal is a viable option, for potential developers of the Site.

1.3 Scope of Work

The scope of work for the Stage 1 PSI and DSI consisted of the following tasks:

- Collecting and reviewing relevant information, in accordance with the requirements for a PSI as defined by the Contaminated Sites Regulation (CSR) under the *Environmental Management Act*;
- Reviewing and summarizing the existing environmental investigation reports and historical records for the Site;

- Conducting an intrusive investigation that included the collection of soil, sediment, and groundwater samples for chemical analysis; and,
- Compiling and interpreting the data and preparation of this report, which details the findings of the investigation.

Further to discussion in Section 4.1.1, soil vapour sampling program was not completed as part of the DSI.

The DSI methods and approach were designed to address site-specific conditions and constraints, conform where practical with CSR requirements for a DSI, and meet the needs of MFLNRO to meet project objectives.

1.4 Regulatory Framework

In British Columbia (BC), environmental matters pertaining to contaminated sites generally fall under the jurisdiction of the Ministry of Environment (MoE), pursuant to the *Environmental Management Act* ([SBC 2003]); Chapter 53 assented to October 23, 2003, as amended on July 8, 2004). Exceptions include federal lands and waters with migratory fish that fall under the jurisdiction of Environment Canada. The two key regulations under the *Environmental Management Act* relating to the assessment and remediation of contaminated sites are the CSR (BC Reg. 375/96, O.C. 1480/96 including amendments up to BC Reg. 97/2011, updated to May 31, 2011), and the Hazardous Waste Regulation (HWR), (BC Reg. 63/88, O.C. 268/88 including amendments up to BC Reg. 63/2009, updated to April 1, 2009).

As part of the development and approval process for the Site, an Approval in Principal (AiP) or Certificate of Compliance (CoC) may be required by the municipality to proceed with development of the Site, and a CoC may be required to obtain site occupancy. Prior to an application for an AiP or CoC, investigation and remediation activities and reports will be required or updated to meet MoE requirements for review. Since the foreshore sediments have been impacted from historical activities at the Site, it is likely that MoE will require a legal instrument for the foreshore lots prior to issuance of a CoC for the upland areas. The instrument may be either an AiP for the remediation of the sediments, or a CoC following remediation of the sediments.

1.4.1 Soil Standards

The CSR provides Generic Numerical Soil Standards (Schedule 4), Matrix Numerical Soil Standards (Schedule 5) and Generic Numerical Sediment Criteria (Schedule 9) for use in the assessment of soil and sediment quality at sites subject to investigation. The soil standards are divided into five categories based on land use and include standards for agricultural land use (AL), urban park (PL), residential land use (RL), commercial land use (CL) and industrial land use (IL). Applicable matrix numerical soil standards are determined based on land use and also on site-specific factors for protection of human health and the environment. There are several current municipal zoning areas that apply to the Site, and the future development of the Site is uncertain; therefore, both the residential/parkland land use (RL/PL) and the commercial/industrial (CL/IL) use standards were applied and used to assess soil quality for the Site. The applicable matrix soil standards site-specific factors include the following:

- Human health protection from intake of contaminated soil (mandatory application);
- Toxicity to soil invertebrates and plants (mandatory application);
- Protection of groundwater flow to surface water used by aquatic life;
- Groundwater used for drinking water; and,
- Groundwater used for irrigation watering.

The most stringent of the applicable and mandatory factors becomes the controlling factor for the determination of the applicable site-specific numeric standard. Of these factors, the nearest surface water body to the Site is Ladysmith Harbour. Portions of the Site are actually located in the wetted portion of Ladysmith Harbour (see Site Description; Section 3.0). Groundwater is not used for drinking or as a source of irrigation water. Therefore, the site-specific exposure pathways considered applicable are "groundwater flow to surface water used by aquatic life", "intake of contaminated soil" and "toxicity to soil invertebrates and plants".

1.4.2 Sediment Criteria

The CSR specifies sediment quality criteria for a) typical contaminated sites (SedQCTS), representing levels that provide moderate protection to sediment-dwelling organisms, and b) sensitive contaminated sites (SedQCSS), representing levels that provide a relatively high level of protection to sediment-dwelling organisms. Given the previous industrial state of Ladysmith Harbour and the likelihood that it will remain as a mixed use of industrial, residential and parkland, the SedQCTS were considered appropriate for the sediment investigation.

1.4.3 Groundwater Standards

The CSR provides Generic Numerical Water Quality Standards for the assessment of groundwater quality at sites subject to investigation. The water quality standards are divided into four categories that include standards for the protection of aquatic life (AW) and for defined groundwater uses including irrigation water (IW), water for livestock (LW) and drinking water (DW). Standards for the protection of aquatic life (AW) contain subcategories applicable on a site-specific basis where the proximity of the Site to receiving freshwater (F) and marine water (M) bodies must be considered.

The Site is located adjacent to and within Ladysmith Harbour, and the groundwater from the Site is likely to discharge northwest towards Ladysmith Harbour. Drinking water is supplied to the surrounding properties by a municipal water supply system.

An on-line search of the MoE Groundwater Database System was conducted for the Site and surrounding area (see Groundwater Usage; Section 3.2.5). Results of the search indicated that there are seven off-Site wells within 1,500 m of the Site. Five wells are located greater than 500 m to the west and cross gradient of the Site, a sixth well is located approximately 900 m southwest (and upgradient) of the Site, and a seventh well is located approximately 1000 m northeast of the Site, across Ladysmith Harbour on the Chemainus Indian Reserve (Figure 3). Based on the natural boundary of Ladysmith Harbour, there is low potential that the water well is hydraulically connected to the Site.

A technical guidance document was recently issued by the MoE entitled, "Technical Guidance #6 on Contaminated Sites – Water Use Determination" that came into effect on February 1, 2011. The document outlines a revised procedure for determining the water use for a Site, and takes into account not only present water use but also future water use. Site specific factors for drinking water apply to all sites, unless the applicability of future drinking water is assessed, by evaluating the hydraulic conductivity, yield, natural quality (including hardness), and presence of confining units in the aquifer. The scope of work of this investigation did not include evaluating the aquifer conditions. Based on the Site's close proximity to a marine water body, it is inferred that under the future development the Site will be supplied by the municipal system. In addition, as the Site is adjacent to the Ladysmith Harbour, it is also inferred that groundwater withdrawals would likely promote salt water intrusion yielding non-potable water, and therefore no future wells are anticipated at or downgradient of the Site. Based on this information, and that it is expected that a risk based remediation program will be required to manage the impacts to the groundwater at the Site, drinking water standards were not considered applicable to the Site for the purpose of this report. Since groundwater at the Site is not used for drinking, irrigation or livestock watering, the principle regulatory standards for the evaluation of groundwater quality at the Site are the CSR Aquatic Life (AW) marine (M) standards.

1.4.4 Surface Water Standards

It is likely that migratory fish are present in Ladysmith Harbour, and as such, this surface water body falls under the jurisdiction of Environment Canada. Therefore, the Canadian Council of the Ministers of the Environment ("CCME") Canadian Environmental Quality Guidelines ("CCME") guidelines are applicable to surface water as well as the porewater and seepage water samples collected from, or flowing into, Ladysmith Harbour.

1.4.5 Soil Vapour Guidelines and Standards

The CSR provides Generic Numerical Vapour Standards (Schedule 11) for use in the assessment of vapour quality at sites subject to investigation. The vapour standards are divided into three categories based on land use:

1) Agricultural (AL)/urban park, (PL)/residential (RL);

2) Commercial (CL); and,

3) Industrial (IL).

The current municipal zoning that applies to the Site includes residential, parkland, commercial, and industrial (Figure 4). The future development of the Site is uncertain; therefore, both the residential use (RL) and commercial use (CL) standards apply to the assessment of soil vapour quality for the Site.

The MoE document titled "Technical Guidance #4, Technical Guidance on Contaminated Sites – Vapour Investigation and Remediation" (2009) allows for the application of attenuation factors to take into account the dilution of soil vapours when transitioning from the sub-surface to indoor or outdoor air, based on the calculation:

$$C_{vapour} = C_{air}/\alpha$$

Where Cair is the estimated air concentration of the substance, Cvapour is the measured or predicted soil vapour or sub-slab vapour concentration of the substance, and α is the vapour attenuation factor. The selections of the appropriate vapour attenuation factors, which are depth dependant, are also a consideration when assessing soil vapour sampling results.

1.4.6 Petroleum Hydrocarbon Standards

The CSR does not include standards for extractable petroleum hydrocarbons (EPH) but has standards for volatile petroleum hydrocarbons (VPH) and light extractable petroleum hydrocarbons (LEPH) in soil and groundwater, and heavy extractable petroleum hydrocarbons (HEPH) in soil. VPH nC6 to nC10 (VPHC6-10), EPH nC10 to nC19 (EPHC10-19) and EPH nC19 to nC32 (EPHC19-32) are similar to VPH, LEPH and HEPH, respectively, except that VPH excludes select aromatic hydrocarbons, and LEPH and HEPH exclude select polycyclic aromatic hydrocarbons (PAHs).

In areas where hydrocarbons were considered a PCOC, most samples were analyzed for EPHC10-19 and EPHC19-32. Where visual or olfactory observations indicated the possible presence of PAHs, selected samples were analysed for LEPH/HEPH. Therefore, and in accordance with the current MoE policy, the LEPH standard was used as a conservative standard for comparison against measured EPHC10-19 concentrations, and HEPH was used as a conservative standard for comparison against measured EPHC19 32.

During some of the historical investigations where petroleum hydrocarbons were considered a PCOC, samples were analyzed for mineral oil and grease (MOG) and/or total extractable hydrocarbons (TEH). There are no current CSR standards for MOG or TEH. However, the concentrations of MOG and TEH were conservatively evaluated by comparison to the LEPH and HEPH standards to identify whether there is a potential that constituents of concern are present at concentrations above current standards.

1.5 Professional Statement

Pursuant to Section 63 of the Contaminated Sites Regulation, Golder confirms that this Stage 1 PSI and DSI report has been prepared in accordance with the applicable sections of the CSR (Part 5, 6 and 14).

Golder certifies that the senior reviewer for this report has demonstrated experience in the assessment and/or remediation of the contamination described and is familiar with the assessment activities carried out at the Site.

2.0 SUPPLEMENTAL STAGE 1 PRELIMINARY SITE INVESTIGATION

2.1 Objectives

The general objective of this Stage 1 PSI was to evaluate the Site and adjacent properties with respect to environmental conditions based on historical and current operations at the Site.

The scope of work for this Stage 1 PSI was conducted in general accordance with the standards outlined in the Canadian Standards Association ("CSA") document entitled "Phase 1 Environmental Site Assessment" (CSA document Z768-01) and was also consistent with the first stage "Preliminary Site Investigation" requirements of Section 58 (1) (a) of the BC CSR under the BC *Environmental Management Act* (EMA).

2.2 Scope of Work

For the Stage 1 PSI, Golder has undertaken three tasks which are described briefly below.

2.2.1 Task 1 – Historical Information Review

Golder reviewed and evaluated pertinent available data to investigate historical uses of the Site and properties immediately surrounding the Site, and to identify known and potential sources of contamination at the Site and on adjacent properties. Where warranted and available, Golder used the following sources of information:

- Surficial geology maps, published by the Geological Survey of Canada;
- Climate information;
- BC Water Resources Atlas database;
- Previous reports and other pertinent documents supplied by MAL and/or the Town of Ladysmith;
- Land title information, as provided by West Coast Title Search Ltd.;
- Historical aerial photographs provided by the University of British Columbia's Geographic Information Centre;
- City directory listings (if available), as provided by InfoAction, a division of the Vancouver Public Library;
- Historical aerial photographs, and Site maps or other plans obtained by Golder;
- Fire insurance maps;
- BC Ministry of Environment Site Registry database;
- The Federal Contaminated Sites Database; and,
- Information supplied by local regulatory agencies with respect to permits, orders, or violations of environmental requirements.

The information gained through this review helped guide the subsequent tasks and focused the Site reconnaissance, which is described below.

2.2.2 Task 2 - Site Reconnaissance

Golder conducted a Site reconnaissance of the subject Site and surrounding properties. Indications of possible hazardous material contamination, which were indicated during the review of historical information obtained from previous reports and interviews, were visually corroborated. In addition, Golder gathered visual evidence of other potential contamination issues that may exist at the Site and, where applicable, on accessible adjacent sites including, but not limited to, the following:

- Underground storage tanks (USTs) and supply lines;
- Hazardous material and hazardous waste storage or disposal areas including sumps, pits, ponds and landfills;
- Barren or discoloured unpaved surface conditions, including signs of stressed vegetation;
- Electrical transformers and capacitors;
- Maintenance areas;
- Evidence of recent spills; and,
- Interviews with long-term past employees or current tenants at the Site who have knowledge of the activities at the Site is included in the scope.

Interviews with Site personnel were also conducted to identify current and historical activities and to obtain information on activities that may have caused contamination.

2.2.3 Task 3 - Report Preparation

Golder prepared this report for the Site at the conclusion of the investigation. This report meets the requirements of a Stage 1 PSI as described by the BC MoE, and contains all information required for submission to MoE.

3.0 SITE DESCRIPTION

3.1 Site Location and Legal Description

The Site is located at Ladysmith Harbour, Ladysmith, BC (Figure 1). The Site comprises several lots. Property information is provided in Table 1 below.

Table 1: Property Information Summary

Civic Addresses	Only a portion of the Site contained civic addresses, these included: The main repair shop (610 Oyster Bay Drive); The washroom building (612 Oyster Bay Drive); The roundhouse (614 Oyster Bay Drive); The car shop (616 Oyster Bay Drive); and, The cable splicing shed (840 Oyster Bay Drive) (building locations are shown on Figures 5a and 5b).
Legal District	Oyster District, Ladysmith.
Parcel Identifier	Several (refer to Table 2).
Latitude/Longitude	48º 59' 44" North, 123º 48' 54" West (approximate centre of the Site).

The Site is irregular in shape (Figure 2) with an area of approximately 336,000 square metres (m^2) or 33.6 hectares (ha) (Baker & Osland, 2002). The land portions comprise approximately 14.5 ha, or 43 percent, of the Site. The water lots comprise the remaining approximately 19 ha, or 57 percent. The Site is generally configured in a northwest to southeast configuration. Each lot comprising the Site is described below and illustrated on Figure 2.

Table 2: Property Details

Area Description	Legal Description	Associated PIDs	Size (ha)	Comments
Uplands	■ Lot 4, District Lots (DL) 8G, 11G, 24 and 56, Oyster District, Plan 45800, except part in plans VIP64405, VIP71943 and VIP72131 ■ Lot 1 District Lots 24 and 56, Oyster District Plan VIP64405	010-208-828, 023-652-926, 006-088-597, 006-088-571	8.5	Referred to as "Uplands". The majority of the Uplands area is covered in gravel roads, low-lying vegetation, shrubs and grass. The occasional building is present on the Site (*e.g.*, former railway repair building, washroom, car shop, cable splicing shed and storage sheds). The former Esquimalt and Nanaimo (E&N) Railway tracks are located along the southwest side of the Uplands area. Lots 8G and 11G of the Uplands are composed of a narrow strip of waterfront.

Area Description	Legal Description	Associated PIDs	Size (ha)	Comments
Filled Foreshore	DL 16G, Oyster District[1]	009-695-001	5.329	Referred to as "Slack Point". Located at the south-eastern portion of the Site and is recognizable by the hook-shaped point.
	DL 17G, Oyster District	009-695-079	0.257	"Former Log Dump" represents the narrow parcel of filled foreshore land connecting Slack Point and the Uplands.
	DL 2016 Block B and Block D, Oyster District[2]	n/a	0.451	Located adjacent to the Government wharf and appears to be used as a parking area for the marina facilities. There were no associated civic addresses or PIDs for these Blocks.
Water Lot	DL 2016 Block C Oyster District[3]	n/a	8.210	This is a water lot located in the northwest portion of the Site adjacent the Government Dock. There was no associated civic address or PID for this lot.
	DL 651, Oyster District[4]	009-694-463	10.840	This is a water lot located in the eastern portion of the Site, adjacent to Slack Point.

Note: n/a – not available.
Several lot names have changed over the years; some previous investigations may refer to the former name; please refer to this table for clarity.

The two water lots are generally separated by the Ladysmith Maritime Society Marina and Wharf located in the approximate centre of the Site. A copy of the legal plan of the Site is included in Appendix I. Figure 2 and the legal plan illustrate Lot 5 of Plan 45800. This parcel is privately owned and is, therefore, not included in the subject Site area.

A zoning map was obtained from the Town of Ladysmith website indicating that the Site is a mix of parkland, residential, commercial and industrial land. The Water Lots (DL 651 and DL 2016 Block C) and filled foreshore DL 2016 Blocks B and D are zoned W-2 – water recreation; Slack Point and the former Log Dump area are zoned I-2 – heavy industrial; the Uplands area (Lot 1 and Lot 4) consists of four types of zoning, including MU-1 – mixed use residential and commercial, R-3 – multi-family residential, P-2 – parks, and CC-1 – community commercial. Figure 4 shows the relevant zoning for each section of the Site.

[1] Referred to as Lot 131 Block C in previous report (D&M, 1990)

[2] Referred to as DL 41G Block A and B and DL 2016 Blocks A and B in previous reports (Hardy BBT, 1990 and Pheonix, 1999)

[3] Referred to as DL 131 Block A and DL 659, Cowican District in previous reports (Hardy BBT, 1990 and Phoenix, 1999)

[4] Referred to as Lot 131 Block C and Block C DL 651 in previous reports (D&M, 1990)

3.2 Surrounding Land Use

Southeast: This area, known as Transfer Beach, historically comprised large wharf structures used for logging activities. In 1967, the Town of Ladysmith reclaimed this area for parkland. The area is currently zoned P-2 Parkland and includes an amphitheatre, a local beach and picnic area.

Southwest: Immediately southwest of the Site is the railway and Esplanade Avenue, which is a section of the Trans Canada Highway ("the highway"). The Town of Ladysmith resides southwest of the highway. The Town comprises a mixture of commercial businesses, residential homes and parkland. Two service stations are located southwest and hydraulically upgradient of the Site at 435 and 728 Esplanade Avenue.

Northwest: Various industrial activities occupy this area including the Government Wharf, and Western Forest Products sawmill and sorting facility. This area is located cross gradient of the Site.

Northeast: The northeast generally comprises open water passage (Ladysmith Harbour and Burleith Arm). Across Ladysmith Harbour is the Chemainus Indian Reserve 13.

3.2.1 Geographical Setting

The Site is located in Ladysmith, BC, on the southwest side of Ladysmith Harbour The Site includes Slack Point and extends northwest to (but not including) the Government Wharf, and includes two water lots that extend approximately 360 metres northeast of the foreshore. The area is bounded by the former EN Railway to the southwest. Figure 1 shows the Site and surrounding area, as well as topography. Key Site features are shown on Figure 5a and 5b.

3.2.2 Climate and Rainfall

The climate in Ladysmith is generally characterized by cool, wet winters and warm, dry summers. Climatic conditions at the Site are inferred to be similar to the data available for the nearby Nanaimo A station (Environment Canada Climate ID: 1025370), which is located approximately 8 km to the northwest of the Site and approximately 28 metres above sea level. The elevation at the Site is similar to that of the Nanaimo A station, and varies between sea level and approximately 23.5 m above sea level, based on a survey completed on December 10, 2009 by McElhanney Associates Land Surveying Ltd.

Climatic data for the Nanaimo weather station was obtained from Environment Canada Temperature and Precipitation Averages for BC. (Environment Canada, 2009) for the years 1971 through 2000. The mean annual daily temperature was 9.8°C for the thirty-year period, with the temperature ranging from a low daily average of 2.7°C in January to a high daily average of 18.0°C in August. The mean annual precipitation (rainfall and snowfall) for the same period was 1162.7 mm, with precipitation ranging from a low monthly average of 25.9 mm in August to a high monthly average of 198.6 mm in November.

The Site is generally vacant grass land with occasional dirt or gravel roads leading into and out of the Site. The occasional building is present on the Uplands portion of the Site (*e.g.*, former railway repair building, washroom, car shop, cable splicing shed and storage sheds). Rainfall infiltration rates into the soils are expected to be high, with a reduction near the buildings located in the rail yard in the Uplands portion of the Site (see Figure 5a).

3.2.3 Surficial Geology and Topography

Surficial Geology of Nanaimo, British Columbia Map 27-1963, Sheet 92 G4 and 92 F-1 East (1:63,360) indicates that the surficial geology of the Site is composed of marine deposits of gravel, sand and mainly marine veneer commonly less than 1.5 metres thick and overlain by ground moraine deposits of till, lenses of gravel, sand and silt. Bedrock composed of volcanic and sedimentary rock outcrops along the foreshore.

Based on historical information it is understood that the foreshore of Ladysmith Harbour was extended by filling activities, and that the fill used to create Slack Point was primarily composed of coal waste derived from the washing of coal mine and coal smelter wastes (D&M, 1990a). Based on previous investigation conducted at Slack Point by Golder (Golder 2005), the surficial geology of Slack Point is understood to be composed of up to 3 m of shallow fill consisting of sand, gravel, woodwaste, refuse, and silt, overlying an extensive deposit of coal waste. The coal waste was observed to extend to a maximum depth of 16 m below ground surface (m bgs) and was occasionally exposed at the surface. Natural sediments underlying the fill were observed to consist of marine silts and sands. The topography of Slack Point was generally flat with a slightly undulating surface.

Materials encountered in the Uplands area during previous investigations (Hardy BBT, 1990b; Levelton, 2000b) generally consisted of sand, gravel, and/or silt with some cobbles in the top 2 m to 6 m of soil. Bedrock was also encountered in some locations at a minimum depth of 1.6 m bgs (Hardy BBT, 1990b). The topography of the Uplands area is typically flat lying with terraces separated from the shoreline areas by steep rock bluffs along the northeast.

3.2.4 Hydrology and Hydrogeology

The regional topography surrounding the Site slopes to the northeast towards Ladysmith Harbour; the groundwater at the Site is expected to follow the topography and flow northeast. Groundwater at the Site is likely to be tidally influenced by Ladysmith Harbour. Groundwater depths likely correspond with fluctuating seawater levels, and hydraulic gradients may vary in response with the Harbour water levels. Based on results of previous investigations at the Site, shallow groundwater is understood to be present at the Site at approximately 2 m to 3 m bgs on Lot 4 and Slack Point (Golder 2005), and is shallower in other locations (Hardy BBT 1990a, and EBA 1994a).

Drainage ditches and underground service trenches may influence the local surface water flow patterns; however, it is anticipated that surface flow will be directed generally northeast, towards Ladysmith Harbour.

Elevations of the upland portions of the Site vary; however, the approximate elevation of the Uplands portion is 20 m above sea level (m asl). Based on Golder's experience and knowledge of Georgia Straight, the 200-year flood elevation occurs around 2.5 m asl and is typically no more than 3.0 m asl. Figure 2 illustrates the legal lot boundary of the Site and the location of the shoreline with respect to the property boundary, as surveyed in 2009.

No natural surface water courses are present on the Site. Water discharge is likely limited to surface run-off and water that infiltrates the unpaved ground surface, eventually discharging into Ladysmith Harbour. Fill materials and across the Site are highly permeable, and it is inferred that most surface water would infiltrate into the ground surface.

A drainage ditch is located in the south corner of the Site at Slack Point. Figures supplied by the Town indicate that there is a storm water ditch, as shown on the Town of Ladysmith storm water plan (included in Appendix I), that terminates on Slack Point, in the approximate location of the observed drainage ditch on Slack Point. This ditch flows through Slack Point and discharges into Ladysmith Harbour. It is inferred that the drainage ditch carries the storm water to the Harbour. The ditch has been observed to be dry during certain time periods.

Additional drainage ditches were identified in the Uplands portion of the Site, based on the storm water plans provided by the City of Ladysmith (shown in Appendix I).

3.2.5 Groundwater Usage

An on-line search of the BC Water Resources Atlas was conducted for the Site and surrounding area (Figure 3). Results indicated that there were seven off-Site wells within 1,500 m of the Site. Five of the wells (Well Tag #s - 86698, 86700, 86702, 86703, and 96062) are located 500 to 1000 metres west of and cross gradient to the Site. One well (Well Tag # 26120) is located approximately 900 m southwest (and upgradient) of the Site and another well is located approximately 1000 m northeast of the Site, across Ladysmith Harbour on the Chemainus Indian Reserve. Based on the natural boundary of Ladysmith Harbour, there is low potential that the water well across Ladysmith Harbour is hydraulically connected to the Site. Water well locations and details are presented in Figure 3 and in Appendix II respectively.

The Town of Ladysmith receives their drinking water from Holland Creek and Stocking Lake (shown on Figure 1).

3.3 Historical Information Review

A summary of the historical information pertaining to the Site is presented in the following sections.

3.3.1 Previous Reports

Environmental site assessments have been conducted at the Site since the early 1990's. The following environmental assessment reports were reviewed by Golder as a part of this Stage 1 PSI:

- Norecol Environmental Consultants Ltd. 1989. "Habitat Compensation Plan Ladysmith Waterfront Development Plan". Dated August, 1989;
- Dames & Moore. 1990a. "Fletcher Challenge Canada Environmental Inspection Report on Leases 101501, 101502 & 101503, Ladysmith Harbour". Dated August 24, 1990;
- Dames & Moore. 1990b. "Fletcher Challenge Canada Decommissioning Investigations – Leases 101501, 101502 & 101503 Ladysmith Harbour". Dated December 1990;
- Hardy BBT Limited. 1990a. "Preliminary Geotechnical Assessment for Ladysmith Waterfront Development Ladysmith, BC". Dated October 1990;

- Hardy BBT Limited. 1990b. “Environmental Review for Town of Ladysmith Waterfront Development Slack Point Area, Ladysmith, BC”. Dated October 1990;
- Subsea Enterprises Inc. 1993. “Summary Report of an Underwater Video Survey of Fletcher Challenge Lease (Lot 651) in Ladysmith Harbour, BC”. Dated September 30, 1993;
- EBA Environmental Ltd. 1994a. “Elk Falls Forest Industries Limited Phase II Environmental Assessment Ladysmith Harbour Leases Project Ladysmith, BC”. Dated January 1994;
- EBA Environmental Ltd. 1994b. “Elk Falls Forest Industries Limited Supplemental Information Ladysmith Harbour Leases Project Ladysmith, BC”. Dated February 4, 1994;
- Triton Environmental Consultants Ltd., “Slack Point Biophysical Inventory and Fish Habitat Compensation Plan”. Dated May 1996;
- Town of Ladysmith, “Waterfront Area Plan”, January, 1997;
- New Pacific Ventures, “Environmental Assessment of Proposed Developments at Burleith Log Sort Ladysmith Harbour”. Dated May 1998;
- The ReVelop Group. 1999. “Stage 1 Preliminary Site Investigation Ladysmith Waterfront Development Ladysmith, BC”. Dated August 10, 1999;
- Phoenix Environmental Services Ltd. 1999. “Environmental Impact Assessment Report Proposed Ladysmith Marina and Waterfront Development Project Ladysmith, BC.” Dated December 1999;
- Levelton Engineering Ltd. 2000a. “Preliminary Site Investigation Stage I and Stage II Lot 4, Plan 45800, District Lot 8G, District Lot 11G and Lot 1, Plan VIP64405, Oyster Land District. Ladysmith, BC”. Dated August 25, 2000;
- Levelton Engineering Ltd. 2000b. “Detailed Site Investigation Lot 4, Plan 45800, District Lot 8G, District Lot 11G and Lot 1, Plan VIP64405, Oyster Land District. Ladysmith, BC”. Dated October 25, 2000;
- Levelton Engineering Ltd. 2000c. “Remediation Plan Lot 4, Plan 45800, District Lot 8G, District Lot 11G and Lot 1, Plan VIP64405, Oyster Land District Ladysmith, BC”. Dated December 1, 2000;
- Westmar Consultants Inc. 2001. “Town of Ladysmith, Report for Waterfront Redevelopment”. Dated June 2001;
- Baker & Osland Appraisals Ltd. 2002. “Property Appraisal Report, Private and Crown Lands Front and Within Ladysmith Harbour Ladysmith, British Columbia”. Dated April 4, 2002;
- Phoenix Environmental Services Ltd. 2002. “Sediment Chemistry Investigation Report Ladysmith Harbour Proposed Waterfront Re-Development Ladysmith, BC”. Dated September 2002;
- W.R. Colclough & Associates Ltd. and D.F. Brown. 2004. “Review of Existing Environmental Reports Relating to Ladysmith Harbour and Uplands Proposed Waterfront Re-Development Ladysmith, BC”. Dated November 2004;

- EBA Engineering Consultants Ltd. "Stage 1 Preliminary Site Investigation Lot 5, Plan 45800, DL 24 and 56, Ladysmith, BC". Dated February 2005;
- G3 Consulting Ltd. 2005. "Report on Ladysmith Harbour Foreshore Fill Sampling & Analysis". Dated March 2005; and,
- Golder Associates Ltd. 2005. "Report on Supplemental Stage 1 Preliminary Site Investigation and Detailed Site Investigation Lot 16G Ladysmith Harbour Ladysmith, BC". Dated July 19, 2005.

Relevant information obtained during the report review is summarized below. Figures showing the approximate locations of historical Site features are provided in Figures 5a and 5b. Figure 6 illustrates the locations where historical soil, sediment, and groundwater samples were collected[5]. Tables presenting a summary of the historical sampling results compared to the current applicable CSR standards (discussed in Section 1.4) are provided in Tables 3 through 4 at the end of the report.

The information provided in the reports assisted in establishing areas of potential environmental concern requiring further investigation. Historical investigation results were also utilized to supplement the DSI (Section 4.0). Section 3.3.2, following the review of reports, provides a summary of the APECs and/or AECs identified in the historical reports. A copy of each report is included in Appendix III (electronic form).

3.3.1.1 Norecol Environmental Consultants Ltd. 1989 Habitat Compensation Plan

In 1989, Norecol Environmental Consultants Ltd. (Norecol) prepared a habitat compensation plan for a waterfront development plan. Details were documented in the report entitled "*Habitat Compensation Plan Ladysmith Waterfront Development Plan*" (Norecol, 1989). As part of its environmental liability assessment in 2005, Golder was provided the sediment composition section of the report by the Town of Ladysmith. The section indicated that three sediment samples were collected from three locations within the Site. Sampling location details were not provided. Of the samples, one contained a mercury concentration exceeding both the CSR sediment criteria and ocean disposal limits, and cadmium exceeding the ocean disposal limits only. The report stated that the only indication from the Site history that would suggest a possible source of mercury and cadmium was the previous discharge of sewage into Ladysmith Harbour.

3.3.1.2 Dames & Moore 1990 Environmental Inspection

In 1990, Dames & Moore (D&M) conducted an environmental inspection of three leased properties including 1) Slack Point, 2) the former Log Dump at Lot 17G, and 3) DL 651 (water lot) (Leases 101501, 101502 and 101503 respectively). Details were documented in the report entitled "*Fletcher Challenge Canada Environmental Inspection Report on Leases 101501, 101502 & 101503, Ladysmith Harbour",* dated August 24, 1990 (D&M, 1990a). The environmental inspection consisted of a field inspection and a review of available information. The purpose of the investigation was to determine the potential environmental impacts related to the occupancy of Fletcher Challenge Canada prior to the surrender of the leases back to the Crown.

[5] This figure also shows investigation locations from the current DSI investigation.

D&M's review of historical information indicated that coal mining and forestry operations had been the primary industrial activity in Ladysmith Harbour over the past century. A coal smelter, ore smelter, shingle mill and iron foundry had been established in the port by 1899 (no further reference of a coal smelter or iron foundry has been found during Golder's PSI). According to D&M's report, the fill used to create Slack Point was composed of coal, which was derived from the washing of coal mine and coal smelter wastes.

During the global economic depression in the 1930s, the coal industry began to decline and the logging industry began its rise. Between 1935 and 1953, the leased area was occupied by the Comox Logging and Railway Company. From 1953 to 1988, Crown Zellerbach Building Materials Ltd. (Crown Zellerbach) occupied the area. Fletcher Challenge assumed the lease in 1988. During logging operations, the railroad was extended out onto Slack Point. Logging activities in the area included the off-loading of logs from the railway to Ladysmith Harbour, where log dumping, sorting, storing, and shipping took place. In 1979, a hydraulic crane was installed on piles and was used to load barges.

The report stated that no treatment of wood reportedly occurred at the Site. D&M indicated that pressure treated piles were used for the dolphins associated with the wharfs on Slack Point. According to a former employee of Fletcher Challenge, interviewed by D&M, waste bark materials and other debris from the operations were burned on Slack Point.

Diesel engines replaced steam in the leased area around 1958. Diesel, gasoline and bunker fuels were reported to have been used over the years for various purposes related to the logging and railway operations in Ladysmith Harbour. Fuel was initially delivered to the tanks by barge, until the 1960s when fuel was delivered by trucks. Fuelling operations occurred on the Uplands portion of the Site, including operations near the former rail yard, where fuels from above-ground tanks were used to fuel trains and boats. Boats at the shore were fuelled by a gravity-fed pipeline. The pipeline system was in place at the time of D&M's inspection; however, their report did not indicate if the pipelines were above or below ground surface. Trains bringing logs to Site were fuelled at the main fuelling facility (presumably by the former pump islands shown on Figure 5a).

In 1981, three diesel fuel tanks were installed in a concrete containment, and were described as being located "on the upslope side of the lower track". For the purpose of this current PSI, the location has been interpreted as being in the vicinity of the present day Ladysmith Maritime Society Marina parking lot (located at the base of the Ladysmith Maritime Society Marina and Wharf, shown on Figure 5a). Pipelines from these tanks transferred fuel to a fuelling dock for the boats. Interviews conducted by D&M indicated that a leak was historically from one of the pipes from the upper ASTs, and the soil around a lower track ballast was subsequently removed. The area was replaced with clean fill, and the leaking pipe replaced. The time and precise location of the spill was not provided in the report.

No other historical spills were reported during the interview conducted by D&M. Small gasoline tanks (above ground) were used at various times and locations (including Slack Point) for fuelling gasoline-powered equipment. The report by D&M does not provide specific details about the usage of fuel or fuel storage locations at Slack Point.

During their occupancy (from approximately 1935), Comox Logging and Railway Company established a small boat yard in the west corner of Slack Point where wooden and steel vessels were built (shown on Figure 5a). In the 1970s, the boat yard was used as a boat repair and service shop until it burned down in 1987.

According to D&M, an untreated sewage pipe extended to the inner harbour area through a short outfall immediately north of the Government Wharf (off-Site) between 1905 and 1965. After 1965, the pipe became a storm water outfall, although the outfall acted as an overflow for sewage until 1985 when all sewage was directed to Holland point. The report indicated that the sewage outfall may be of considerable concern for the sediments in the area with regard to heavy metals and organic compounds that may have originated from industrial and domestic sources in Ladysmith.

D&M commented that the harbour was previously known for its shellfish but water quality concerns, including sewage discharge, recreational boaters and the forest industry, were indicated as likely major sources of the disappearance of a viable shellfish market. It was thought that the diversion of the raw sewage outfall (between 1965 and 1985) may have increased the potential for shellfish in the vicinity of Slack Point.

D&M did not identify any potential for residual chemicals on the lease areas originating from Fletcher Challenge Canada's activities. The report states that the marine log sort area would have deposited bark and other debris; however, D&M reported that there was no requirement to remove the debris from the lease area. The report did indicate, however, that given the extended past use of the area for coal washing and smelting and a raw sewage and storm water outfall into the harbour (occurring before occupancy by Fletcher), the quality of the sediments in the area would be a concern.

3.3.1.3 Dames & Moore 1990 Proposed Decommissioning

Following the report by D&M in 1990, the Ministry of Crown Lands requested that Fletcher Challenge Canada's leased area be "environmentally clean and suitable for residential development" prior to the surrender of the land back to the Crown. In a letter regarding "*Your Files: 1403254, 140255, 1403256 Lease # 101501, 101502, 101503 – Ladysmith*" dated September 5, 1990 (Fletcher Challenge, 1990), Fletcher Challenge Canada responded to the ministry and outlined a proposed clean up of the area, as described in the document entitled "*Fletcher Challenge Canada Decommissioning Investigations – Leases 101501, 101502 & 101503 Ladysmith Harbour*", dated December 1990 (D&M, 1990b).

Proposed activities included the removal of the following: steel cables and coils along the waterfront; three oil tanks, bases, piping and pump house; loose logs, floats, and sunken buildings; miscellaneous machinery, equipment and metal objects; railroad ties and tracks on Slack Point; boat ways and a burned boat haul; miscellaneous garbage; and boom shack, floats, stairways and piers.

3.3.1.4 Hardy BBT Limited 1990 Geotechnical and Environmental Assessments

3.3.1.4.1 Overview and Objectives

In 1990, Hardy BBT Limited (Hardy BBT) conducted a geotechnical assessment and an environmental review of the Site, with the exception of DL 2016 Block C (water lot) and Blocks B and D (filled foreshore), for the Town of Ladysmith. Details were documented in the reports entitled "*Preliminary Geotechnical Assessment for Ladysmith Waterfront Development Ladysmith, BC*", dated October 1990 (Hardy BBT, 1990a), and "*Environmental Review for Town of Ladysmith Waterfront Development Slack Point Area, Ladysmith, BC*", dated October 1990 (Hardy BBT, 1990b).

The Town of Ladysmith requested the work to assess the possibility of future development of the area. The objective of the environmental assessment was to determine if significant soil contamination was present in the proposed development area. The purpose of the geotechnical investigation was to identify any significant foundation problems for the potential future development of residential and/or commercial buildings.

3.3.1.4.2 Historical Information

Hardy BBT's reports indicated that historical activities in Ladysmith Harbour included the shipping and handling of coal from rail cars onto ships. The waste materials from coal washing operations were discharged into the harbour to form Slack Point. Hardy BBT indicated that after the coal mining industry ceased, the area was used by forest product companies, and Slack Point was generally used as a dry land sort for logs and as a storage/disposal area for waste material and other debris from the harbour bottom.

3.3.1.4.3 Observations of Slack Point

An approximately 4 m high stockpile of wood debris (with an estimated volume of 4,200 m^3) was observed in the central portion of Slack Point (shown on Figure 5a). Communications with the Site representative at the time of the Hardy BBT report suggested that the material was dredged from the log dump area and transported via rail. The subsurface stratigraphy encountered on Slack Point consisted of up to 2 m wood waste covering up to 1.2 ha of the northern and northeast surface of Slack Point, overlying coal waste. Based on grain size analyses of the coal waste, the hydraulic conductivity of the waste was estimated to be in the order of 10^{-1} centimetres per second (cm/s) to 10^{-2} cm/s.

Surface features on Slack Point observed by Hardy BBT included: the presence of a timber bulkhead and log-hauling ramp at the north end of Slack Point; the burned remains of the former boat maintenance facility at the west corner of Slack Point; the previously discussed stockpile of wood waste and suspected harbour debris near the end of a former rail road track, and a drainage ditch at the south eastern perimeter of Slack Point. Midway along the northern side of Slack Point, in the intertidal zone, the remains of a pile of dredged coal waste from the harbour was observed. A small landfill associated with the former logging activities was also identified on Slack Point; however, the exact location was not described. The inferred locations of historical features on Slack Point are shown on Figure 5a.

3.3.1.4.4 Observations of the Uplands

In the Uplands portion of the Site, Hardy BBT observed the following:

- One 500-gallon (approximately 1,900 L) underground storage tank (UST) in the vicinity of the washroom building that was reported to have been installed in the mid 1960s and was reported to have contained both heating oil and diesel fuel[6];

[6] During the present Stage 1 PSI, Golder concluded that the UST was installed as a component of a sewage pump-out facility connected to the Town of Ladysmith's municipal sewage system, and was not used for fuel storage. Therefore, it is not considered an area of potential environmental concern

- Three above-ground fuel tanks (ASTs) (size was not reported) described as being located, “adjacent to a disused railway spur line along the shoreline downslope of the Railway Museum” (interpreted as being in the vicinity of the present day Maritime Society Marina parking lot);
- A pump island located approximately 100 to the southeast of the main repair building, supplied by nearby ASTs;
- Storage of electrical transformers, likely containing polychlorinated biphenyls (PCBs) approximately 100 m southeast of the main repair building; and,
- A waste oil storage area adjacent (southeast of) the main repair shop.

The inferred locations of historical features in the Uplands are shown on Figures 5a and 5b.

3.3.1.4.5 Soil Investigation Program

A total of 25 test pits were advanced during Hardy BBT’s geotechnical and environmental assessments. Fifteen of the test pits were installed for geotechnical assessment purposes (see locations “TP90-01” through TP90-15” on Figure 6); ten were installed for environmental assessment purposes (see locations “CTP 1” through “CTP 10” on Figure 6). Samples taken during the geotechnical investigations were not analysed for potential contaminants of concern. Samples from select locations during the environmental assessment were analysed for potential contaminants of concern, including metals and petroleum hydrocarbons.

The test pits were excavated to total depths ranging from 1.4 m and 4.0 m bgs (depth was limited due to a high water table and sloughing conditions). The report indicated that test pits installed for environmental assessment purposes were advanced in the vicinity of the pump islands, the UST, the railway siding used for railcar and engine maintenance, the scrap metal storage area (inferred to be located to the northwest of the main repair building in the rail yard area), the concrete bunker containing the three ASTs, the main repair building in the rail yard area, the former cable slicing shed, the stockpiled area of unknown fill on Slack Point, and the small landfill identified at Slack Point.

3.3.1.4.6 Observed Stratigraphy

Stratigraphy encountered in the Uplands area of the Site included fill material consisting of loose brown, gravelly sand fill with trace to some cobbles from 0.4 m to 2.8 m bgs, overlying native soils consisting of sand or sandy silts. Bedrock was also encountered at a minimum depth of 1.6 m bgs. Stratigraphy encountered on Slack Point consisted of approximately 0 m to 2.2 m of wood debris, overlying coal waste. Refuse (*i.e.*, scrap metal, gypsum board, ash, oil and paint cans, wood debris, hoses, *etc.*) was observed in CTP 10, located Slack Point in an area that was understood to be a small abandoned landfill (shown on Figure 5a and Figure 6), associated with former Crown Forest operations.

3.3.1.4.7 Soil Chemistry

Golder's review of the analytical results for metals in soil (shown in Table 3a) indicated that the soil samples collected from CTP 9 and CTP 10 were above the current CSR CL/IL and RL/PL standards for arsenic. Two duplicate soil samples collected from CTP 10 also had concentrations of nickel and zinc greater than the current CSR RL/PL standards, and one of the two duplicate samples collected from CTP 10 exceeded the current CSR CL/IL and RL/PL standards for copper. Test pits CTP 9 and CTP 10 were installed in Slack Point, in the area that was understood to be the abandoned landfill.

Golder's review of the analytical results for petroleum hydrocarbons in soil (shown in Table 3b) indicated that the soil samples collected from CTP 3 and CTP 10 may have been above the CSR CL/IL and RL/PL standard for LEPH, based on the measured concentration of oil and grease, and the sample collected from CTP 1 exceeded the CSR CL/IL and RL/PL standards for xylenes and the CSR RL/PL standards for ethylbenzene and toluene. As shown on Figure 5a, test pit CTP 1 was excavated near the former fuel pump island (shown on Figure 5a and Figure 6); CTP 3 was installed near the main repair building; and CPT 10 was installed on Slack Point. Figure 5a and Figure 6).

3.3.1.5 EBA Environmental Ltd. 1994 Phase II ESA and Supplemental Investigation

3.3.1.5.1 Overview and Purpose

In 1994, a Phase II ESA was conducted at the Site by EBA Environmental Ltd. (EBA) on behalf of Elk Falls Forest Industries Limited (Elk Falls). A subsequent supplemental investigation was conducted to obtain additional information as requested of BC Ministry of Environment, Lands and Parks (currently MoE). The investigations were conducted over the entire Site with the exception of Blocks B and D of DL 2016. Elk Falls was the lease holder of the investigated properties at the time of the investigations. The purpose of the investigations was to further characterize soil and groundwater such that the land leases could be returned to the Crown. Details of the investigations were documented in the reports entitled "*Elk Falls Forest Industries Limited Phase II Environmental Assessment Ladysmith Harbour Leases Project Ladysmith, BC*, dated January 1994 (EBA, 1994a), and "*Elk Falls Forest Industries Limited Supplemental Information Ladysmith Harbour Leases Project Ladysmith, BC*", dated February 4, 1994 (EBA, 1994b).

3.3.1.5.2 Historical Information

According to EBA, the area was used for log handing and sorting between 1935 and 1987. The operations involved transferring logs into the harbour. The boat repair facility located on the western portion of Slack Point burned down in the late 1980s and the burned debris was removed in 1992. The three ASTs located at the shoreline near DL 17G (shown on Figure 5a) had been removed by 1994, and there was no evidence of surficial staining or distressed vegetation. The log dump area had been removed and backfilled and the railway tracks had been removed.

According to EBA, extensive clean-up activities were reported to have been completed in 1992 and included the removal of "piles, dolphins, wharfs and piers, floats, boom shacks, buildings, equipment, cable, burned boat-repair ways, miscellaneous dumped garbage, and other scattered debris" (EBA, 1994a). No further documentation of the decommissioning activities at the Site was available for Golder's review.

3.3.1.5.3 Scope of Investigation

EBA's intrusive investigation consisted of the excavation of seventeen test pits, to a maximum depth of approximately 4.5 m bgs (see locations “1” through “11” and “14” through “19” on Figure 6). Thirteen test pits were advanced around Slack Point; specifically, five were advanced near the former boar repair area, two were advanced in the vicinity of the landfill, and the remainder were advanced through-out Slack Point. Four additional test pits were hand excavated using a shovel in the Uplands area.

3.3.1.5.4 Observations

During the investigation, shallow groundwater was observed in some of the test pits at 1.5 m to 2 m below grade. Subsurface stratigraphy encountered at Slack Point was similar to that observed by Hardy BBT, which consisted of up to 3.5 m of wood waste, with other debris in some locations, underlain by coal waste. No visual evidence of contaminants or buried hazardous materials was noted at the former boat repair area, and no significant garbage or other debris was uncovered from the test pits near the inferred location of the former landfill (shown on Figure 5a). EBA inferred that the area was potentially associated with unauthorized dumping.

3.3.1.5.5 Soil Chemistry

Chemical analysis of select soil samples collected from the test pits included MOG, sulphur, metals (two samples only), and chlorinated phenols (one sample only). Results of the analysis were compared to current CSR CL/IL and RL/PL standards, where applicable. The two soil samples analysed for metals (collected from test pit “1” and test pit “2” adjacent to the former boat repair area on Slack Point) had concentrations of metal parameters that were below the CSR standards (as shown in Table 3a). The sample analysed for chlorinated phenols (collected from test pit “9”, containing wood waste materials) had concentrations that were below the CSR standards and below the laboratory detection limits.

The seven samples (test pits “1”, “2”, “3”, “4”, “6”, “7”, and “10” in Table 3b) collected and analysed for MOG from Slack Point during the Phase II ESA (EBA, 1994a) had concentrations of MOG ranging between 2,400 µg/g and 5,500 µg/g, which may have been above the CSR CL/IL and RL/PL standard for LEPH, based on the measured concentration of MOG. However, during the supplemental investigation (EBA, 1994b) an additional seven samples (from test pits “17, “18”, and “19”) collected and analysed from Slack Point had concentrations of MOG that were below the laboratory detection limit of 10 µg/g. According to EBA, the reason for the difference in MOG concentration in the samples (of similar material) was due to a change in the extraction method and solvent type used in the sample analysis.

Of the four test pits sampled and analysed for MOG in the Uplands and Foreshore area, the highest concentration was detected at test pit “11” (located on DL 17G referred to as the Filled Foreshore, the former Log Dump) where an MOG concentration of 16,000 µg/g was detected. This result may have been above the CSR CL/IL and RL/PL standard for LEPH or HEPH, based on the measured concentration of MOG. In test pit “14” (also located on DL 17G), an MOG concentration of 1,100 µg/g was detected and may have been above the CSR RL/PL standard for LEPH, based on the measured concentration of MOG.

The concentrations of sulphur in a number of the soil samples were also elevated, and ranged in concentration from 1,530 to 3,030 µg/g (0.15 to 0.3 %); however, there are no current CSR standards for sulphur.

3.3.1.5.6 Groundwater Chemistry

During the investigations, EBA collected groundwater from four of the test pits (test pit "4", "17", "18", and "19"). At test pit "4", a water sample was obtained from a standpipe piezometer installed in the test pit. The other samples were collected directly from ponded water within the test pits and were reported to contain high amounts of suspended coal sediment.

Chemical analysis of the groundwater samples included MOG, salinity, total metals, chloride (test pit "4" only), sulphate (test pit "4" only), and sulphur (test pit "4" only). The CSR AW standards for metals parameters do not apply to these samples as the CSR AW standards are for dissolved metals, and the analysis conducted by EBA was for total metals. EBA noted that the high amount of coal fines in the water was likely the cause of some of the higher than expected concentrations of parameters. For comparison purposes, the total metals results were compared to the current CSR standards (see Table 4b).

Results indicated that groundwater in test pit "4" (near the small landfill on Slack Point) and test pits "17", "18", and "19" (near the former boat repair building on Slack Point) contained concentrations of total copper and lead exceeding the CSR AW standard (for dissolved metals). Groundwater collected from test pits "17", "18", and "19" also contained concentrations of cadmium, cobalt, mercury, nickel and zinc above the CSR AW standards; groundwater collected from test pit "19" also contained concentrations of total arsenic and chromium above the CSR AW standards.

For comparison purposes, the MOG results were compared to the current CSR standards (see Table 4c). Results indicated that groundwater from test pits "4", "17", and "19" may have exceeded the CSR AW standard for LEPHw, based on the measured MOG concentration.

The measured concentrations of salinity ranged between 4.29 and 20.1 g/L (see Table 4b). According to Schedule 6 of the BC CSR freshwater is defined as water with a natural salinity less than 1.5 g/L

3.3.1.5.7 Underwater Survey

As part of their Phase II ESA, EBA conducted a review of an underwater video survey report for DL 651 that was prepared by Subsea Enterprises Inc. (Subsea) in 1993. The report was entitled "*Summary Report of an Underwater Video Survey of Fletcher Challenge Lease (Lot 651) in Ladysmith Harbour, BC*", dated September 30, 1993 (Subsea, 1993). The survey indicated that DL 651 comprised a silt bottom with considerable amounts of wood debris (bark and pieces of log) in and overlying the sediments (increasing towards the shore line). The sediments were generally 2 m thick throughout the lot. Anchor blocks and concrete piling structures were observed in the central part of the lot and wooden piles and dolphins remained on the northwest portion of the lot. In addition, the diversity and abundance of marine life in DL 651 was "minimal due to the lack of hard substrate for the attachment of organisms and the anoxic state of the sub-surface sediments" (EBA, 1994a). Mats of *Beggiatoa* bacteria were found on the bottom of the bay, indicating anaerobic conditions as a result of organic debris.

3.3.1.5.8 Ministry of Environment Correspondence

Appended to EBA's supplemental investigation report (EBA, 1994b) is a letter of correspondence from the MoE (referred to as the Ministry of Environment Lands and Parks at the time of the report) to EBA providing a summary of the reports reviewed by the MoE. One document identified in the letter was a proposal for an environmental assessment of Leases 101501, 101502, & 101503 (Norecol Environmental Consultants Ltd., titled "*Proposed Methodology for Environmental Site Assessment Leases 101501, 101502, & 101503, Ladysmith Harbour, BC*.", dated August 12, 1991). This document was not available to Golder for review. Additional information provided in the letter indicates that smelter waste (slag), originating from the former Tyee Copper Company in Ladysmith, may also have also been used as (deep) fill material at Slack Point. The MoE concluded that Fletcher Challenge's responsibility for clean-up at the Site is limited to the wood waste and dredged materials dumped on the Site (estimated to have a total volume of 20,000 m^3), and to any soil and groundwater impacts related to the boat repair operations.

3.3.1.6 Triton Environmental 1996 Biophysical Inventory and Fish Habitat Compensation Plan

In 1996, Triton Environmental Consultants Ltd. (Triton) conducted a detailed biophysical inventory of foreshore habitats in the vicinity of Slack Point. The work was conducted on behalf of Sea Vision Resorts Development Ltd. (Sea Vision), at the request of F&OC and the MoE (Ministry of Environment Lands and Parks at the time of the report), for the purpose of identifying and mapping fish habitat types in the proposed development area (Slack Point). Details were documented in the report "*Slack Point Biophysical Inventory and Fish Habitat Compensation Plan",* dated May 1996 (Triton, 1996).

The report indicated that Ladysmith Harbour supports a number of salmon-bearing streams including Thomas Creek, Walker Creek, Bush Creek, Rocky Creek and Holland Creek, located in the area but not on the subject Site of the current investigation. Triton proposed construction protocols to minimize the impacts on the foreshore and nearshore subtidal fish habitats. The report did not identify areas or activities of environmental concern or potential environmental concern.

3.3.1.7 Town of Ladysmith 1997 Waterfront Area Plan

In 1997, a waterfront area plan (WAP) was developed by the Town of Ladysmith (Town of Ladysmith, 1997) to provide guidance for future land use of the Ladysmith waterfront. The WAP illustrated the planned use of Slack Point as a mixture of park and residential/commercial properties. The remainder of the Site was planned for multi-family residential, mixed-use residential/commercial land use.

The WAP did not identify areas or activities of environmental concern or potential environmental concern.

3.3.1.8 New Pacific Ventures 1998 Environmental Assessment at Burleith Log Sort

In 1998, New Pacific Ventures (New Pacific) conducted an Environmental Assessment at the Burleith Log Sort on Ladysmith Harbour, located north of the Site and across Ladysmith Harbour (off-Site), for the Burleith Log Sort. Details were documented in "*Environmental Assessment of Proposed Developments at Burleith Log Sort*

Ladysmith Harbour", dated May 1998 (New Pacific, 1998). The report indicated that the Burleith Log Sort area has been substantially altered from the natural condition by logs and wood debris associated with the log sorting activity, as well as the ongoing activity of boom boats. A thick layer of wood debris was observed in the intertidal and subtidal regions of the area.

3.3.1.9 The ReVelop Group 1999 Stage 1 PSI

A Stage 1 PSI of Slack Point and surrounding areas was conducted by the Revelop Group (Revelop) on behalf of Concept Bank Corporation and SVR Acquisitions Limited, who were reported to be the lease holder at the time. Details were documented in the report, "*Stage 1 Preliminary Site Investigation Ladysmith Waterfront Development Ladysmith, BC*", dated August 10, 1999 (ReVelop, 1999).

The investigation included the Site, with the exception of Blocks B, C and D of DL 2016, and additionally included Lot 5 (which is not part of the Site in the current investigation). The general description of the investigation area was described as extending towards the Harbour shoreline from the rail lines to the waterfront shoreline, and from Transfer Beach Park to the Government Wharf. Information contained in the Stage 1 PSI conducted by ReVelop (*i.e.*, historical fire insurance plans, city directories, site inspection details, *etc.*) is referenced, where applicable, in the current investigation.

The report identified 15 APECs including:

- The abandoned fuel pump island southeast of main repair shop (location of historical Site features are shown on Figures 5a and 5b);
- Former electrical transformer storage area near pump island;
- Railway siding formerly used for railcar and engine maintenance;
- Former waste oil disposal area at southeast end of the main repair shop;
- Underground storage tank behind the washroom building (inferred by Golder to be the sewage pump-out facility connected to a the Town of Ladysmith's municipal sewage system);
- Cable splicing shed;
- Coal waste material at Slack Point;
- Former landfill at Slack Point;
- Former logging building on Slack Point;
- Former log dump area (DL 17G);
- Former above ground storage tank at the shoreline;
- Sewage disposal outfalls in the harbour area;
- Off Site copper smelter; and,
- Areas surrounding railway buildings formerly used for maintenance.

- Railway buildings including:
  - The main repair building used for machining, welding and major mechanical repair of locomotives. The building was also leased by a small boat building companies and a wood pellet company;
  - The roundhouse that was used for short term maintenance on the locomotives; this building contained below-ground maintenance pits, which were reported to have been filled in; and,
  - Car shop located west of the roundhouse.

3.3.1.10 Phoenix Environmental 1999 Environmental Impact Assessment and 2002 Sediment Chemistry Investigation

In 1999, Phoenix Environmental Services Ltd. (Phoenix) was retained by the Town of Ladysmith to conduct an environmental impact assessment of the proposed marina and waterfront development project. Details were documented in the report, "*Environmental Impact Assessment Report Proposed Ladysmith Marina and Waterfront Development Project Ladysmith, BC*", dated December 1999 (Phoenix, 1999). The project area assessed in this report included DL 2016 Blocks B, C and D, and parts of DL 8G and 11G of Lot 4. For the proposed development, an approximate area of 3.8 ha of existing intertidal and subtidal mudflats was proposed to be dredged to a minimum depth of 2 m bgs. Dredged material was anticipated to be deposited offshore at Porlier Pass, in accordance with Environment Canada's Ocean Disposal Limits (ODL).

Historical information provided in the report indicated that the Township of Ladysmith discharged untreated sewage through an outfall into the water lots in the vicinity of the Log Dump in DL 17G. A small sawmill was reported to have been historically located in the northwest corner of the Site near the boat launch adjacent the government wharf[7]. During their investigation, a timber cribbing retaining wall was observed along the shoreline of DL 11 and a small spit was observed "near the north edge at the former location of one of the former mills". The location of the spit was not clearly described in the report. Discarded batteries and other refuse in the water were visible from the small marina located in the centre of the Site. In addition, it was reported that onboard repairs, painting, and other marina related activities could have resulted in sediment contamination around the marina.

As part of their assessment, sediment samples were collected and analysed for metals, organic carbon and AVS/SEM ratio. The purpose of the sampling was to determine sediment quality with respect to the aquatic habitat and to determine the suitability of the sediments for ocean or upland disposal. A total of six samples ("S1" through "S7", shown on Figure 6) were collected using a Ponar dredge. Results of the analysis indicated that none of the six samples had concentrations of metals above the CSR $SedQC_{TS}$ (see Table 5a). However, Phoenix indicated that concentrations of cadmium were higher than the ODLs in sediment samples from four locations, S1, S4, S5, and S7.

[7] There has been no other reference to or evidence of a sawmill at this location, and Golder infers this area to be the location of the former shingle mill.

In 2002, additional sediment sampling was conducted by Phoenix on behalf of Water and Land British Columbia Inc. Details were documented in the report entitled, "*Sediment Chemistry Investigation Report Ladysmith Harbour Proposed Waterfront Re-Development Ladysmith, BC*", dated September 2002 (Phoenix, 2002). During the sediment investigation, Phoenix identified five areas of potential environmental concern including:

- Former log booming, storage and barge loading areas;
- Former sawmill at the northwest corner of the Site (Golder infers this area to comprise the former shingle mill on Block B and D of DL 2016 shown on Figure 5a);
- Former coal trans-shipment area (Slack Point);
- Former sewage effluent pipe (south of Ladysmith Maritime Society Marina and Wharf); and,
- Existing small boat moorage.

The sediment investigation included the collection of 58 surface sediment samples (40 grab samples, 4 core samples, plus duplicate samples) at 42 locations (locations "A3" through "N7" on Figure 6), which were analyzed for trace metals (55 samples), PAHs (22 samples), PCBs (7 samples), particle size (47 samples), and/or total organic carbon (TOC; 55 samples).

Of the 55 samples analysed for metals in sediment, none had concentrations above the CSR $SedQC_{TS}$. Twenty of the samples contained concentrations of cadmium that were greater than the ODL for cadmium.

Of the 22 samples analysed for PAHs, 19 contained concentrations of total PAHs that were greater than the ODL for total PAHs, and 18 contained concentrations of one or more PAHs that were above the CSR $SedQC_{TS}$ (Table 5b).

Based on the results of the investigation, Phoenix concluded that ocean disposal appeared to be an unlikely candidate for disposal because cadmium concentrations were greater than the applicable criteria, with some concentrations that were more than double the ODLs. In addition, PAH contamination was widespread, with concentrations up to five times the ODLs in some locations. Phoenix also concluded that the source of the metals and/or PAHs in sediment could be attributed to past coal transhipment, log handling activities or sewage disposal, as well as small boat moorage uses.

3.3.1.11 Levelton Engineering 2000 Stage I and II PSI, DSI, and Remediation Plan

3.3.1.11.1 Overview

Levelton Engineering Ltd. (Levelton) was retained by the Town of Ladysmith in 2000 to carry out a Stage I and II PSI, a DSI, and a Remediation Plan for the Uplands portion of the Site. The purpose of the work was to identify potential environmental liabilities and prepare the area for the potential sale of the property. Details were documented in the following reports: "*Preliminary Site Investigation Stage I and Stage II Lot 4, Plan 45800, District Lot 8G, District Lot 11G and Lot 1, Plan VIP64405, Oyster Land District. Ladysmith, BC*", dated August 25, 2000 (Levelton, 2000a); "*Detailed Site Investigation Lot 4, Plan 45800, District Lot 8G, District Lot 11G and Lot 1, Plan VIP64405, Oyster Land District. Ladysmith, BC*", dated October 25, 2000 (Levelton, 2000b); and, "*Remediation Plan Lot 4, Plan 45800, District Lot 8G, District Lot 11G and Lot 1, Plan VIP64405, Oyster Land District Ladysmith, BC*", dated December 1, 2000 (Levelton, 2000c).

3.3.1.11.2 Areas of Potential Environmental Concern

The Stage I identified both onsite and offsite areas of potential environmental concern. Additional information contained in the Stage I PSI is referenced, where applicable, in the current investigation. On-site areas of environmental concern included:

- Fill from copper smelting operations, located at the northwest edge of site;
- Cable splicing shed (locations of historical Site features are shown on Figures 5a and 5b);
- Railway maintenance area;
- Transformer and shop area;
- Former waste oil area;
- Former AST and fuel island area;
- Former scale pit, where PCB-containing transformers were suspected to exist; and,
- Water front area above the high tide mark.

Levelton also used ground penetrating radar to identify a UST by the washroom building (Levelton, 2000c); however, Golder infers this to be the sewage pump out facility connected to a the Town of Ladysmith's municipal sewage system.

Off-site areas of environmental concern included:

- Two gas service stations within 50 metres of the property boundary along the west side of Esplanade Avenue (currently a Petro Canada located at 435 Esplanade Avenue, and a Shell Canada located at 728 Esplanade Avenue).

Levelton also reported that a truck repair and salvage business was located northwest of the Site; however, the business was not considered an area of potential concern.

3.3.1.11.3 Stage II Test Pit Investigation

The Stage II PSI included the excavation of eleven test pits ("TP1" to "TP4", "TP6" to "TP8", and "TP10" to "TP13" on Figure 6) to a maximum depth of 4 m in areas of suspected contamination around the Uplands. Soil samples were analysed for metals, benzene, toluene, ethylbenzene and xylene (BTEX), EPH10-19, and EPH19-32, and PCBs. Two sediment samples were also collected using a hand auger and analysed for metals ("TP14" and "TP15" on Figure 6).

3.3.1.11.4 Stage II Soil Chemistry

Of the five samples collected and analysed for metals in soil, and the two samples analysed for lead only, none had concentrations above the CSR standards (see Table 3a).

Of the four samples analysed for BTEX and VPH, none had concentrations above the CSR standards (see Table 3b).

Of the twelve samples collected and analysed for EPH10-19 and EPH19-32, two (both from TP4) are inferred to have exceeded the CSR RL/PL and CL/IL standards for LEPH, based on the measured EPH10-19 concentrations. Test pit TP4 was located near the maintenance railway buildings (see Figure 5b and Figure 6). The samples exceeding the CSR standard for LEPH were collected at depths of 2 m and 4 m bgs.

Of the two samples collected and analysed for PCBs, concentrations were below the laboratory detection limits.

3.3.1.11.5 Stage II Sediment Chemistry

Of the two sediment samples collected and analysed for metals, one sample (from TP15), located at the base of the Ladysmith Maritime Society Marina and Wharf) had a concentration of lead that was above the CSR $SedQC_{TS}$. Remaining metals parameters were below CSR $SedQC_{TS}$.

3.3.1.11.6 DSI Sampling Program

The DSI included the drilling of fourteen boreholes (locations “BH00-01” to “BH00-14” on Figure 6); five of the boreholes were completed as monitoring wells. The DSI also included the collection of four foreshore sediment samples (locations “FS1” to “FS4”), the collection of four groundwater samples, and the collection of one surface soil sample.

3.3.1.11.7 DSI Soil Chemistry

Soil samples collected during the drilling program were analysed for BTEX (one sample only), VPH (one sample only), and EPH10-19, and EPH19-32. BTEX and VPH were below CSR standards. Of the 18 samples analysed for EPH10-19, and EPH19-32, two were inferred to exceed the CSR standards for LEPH and/or HEPH. One sample from BH00-03, taken from the former waste oil disposal area located at the southeast end of the main shops building, had concentrations of EPH10-19 and EPH19-32 that were greater than the CSR RL/PL standards. One sample from BH00-08, located approximately 3 m to the northeast of test pit TP4, had a concentration of EPH10-19 that was greater than both the CSR RL/PL and CL/IL standards. In both locations, the samples exceeding standards were collected within 1 m of ground surface, and underlying soil samples, collected approximately 1 m below, were less than the CSR standards.

3.3.1.11.8 DSI Sediment Chemistry

Of the four sediment samples analysed for metals, none had concentrations above the CSR $SedQC_{TS}$.

3.3.1.11.9 Groundwater Chemistry

Of the four groundwater samples collected and analysed for EPH10-19 and EPH 19-32, the sample from MW00-02, also located near the former waste oil disposal area at the southeast end of the main shops building (near BH00-03), had a concentration of EPH10-19 that is inferred to exceed the CSR AW standard for LEPHw. The remaining three groundwater samples had concentrations below the CSR AW standards.

Monitoring well MW00-11, which was installed to assess groundwater quality downgradient of an off-Site gas station (in the western portion of the Uplands), was found dry during the investigation. Levelton reasoned that due to the lack of odour and staining in the boreholes, groundwater contamination was not expected.

3.3.1.11.10 Surface Soil

One surficial soil sample was taken on Lot 11G to assess soil potentially impacted from the (off-Site) copper smelter. The sample contained concentrations of chromium exceeding the applicable CSR standard of 60 mg/kg; however the sample concentration (72 mg/kg) was less than the regional background concentration of 90 mg/kg as defined by CSR Protocol 4 “Determining Background Soil Quality”, and is therefore was not considered a contaminant for the Site. Levelton concluded that the former off-Site copper smelter had not impacted Lot 11G.

3.3.1.11.11 Remediation Plan

Details of Levelton’s Remediation Plan (Levelton, 2000c) were not considered relevant to the current investigation.

3.3.1.12 Westmar Consultants Inc. 2001 Cost Estimate for Redevelopment

In 2001, Westmar Consultants Inc. (Westmar) was retained by the Town of Ladysmith to prepare an order-of-magnitude cost estimate for proposed redevelopment of the Ladysmith harbour. Proposed works included dredging, filing, slope protection, removal of wood waste, soil improvement at Slack Point, and a provision for basic site infrastructure. Details were documented in the report, *“Town of Ladysmith Report for: Waterfront Redevelopment,”* dated June 2001.

The report did not identify areas or activities of environmental concern or potential environmental concern.

3.3.1.13 Baker & Osland 2002 Property Appraisal

In 2002, Baker & Osland Appraisals Ltd. (Baker & Osland) prepared an appraisal report for the Site, including Lot 5 and the unsurveyed water lot adjacent to the Government wharf (not investigated in this report), to determine a total market value for the Site. Details were documented in the report entitled, “P*roperty Appraisal Report, Private and Crown Lands Front and Within Ladysmith Harbour Ladysmith, British Columbia*”, dated April 4, 2002.

The report contained photographs, building and area descriptions, sizes and construction details as of 2002 (the Site in the 2002 photographs appeared similar to the current Site configuration). In addition, the report supplied civic addresses for the buildings on Lot 4 including: the main repair shop (610 Oyster Bay Drive), the washroom building (612 Oyster Bay Drive), the roundhouse (614 Oyster Bay Drive), the car shop (616 Oyster Bay Drive) and the cable splicing shed (840 Oyster Bay Drive).

The report did not identify areas or activities of environmental concern or potential environmental concern.

3.3.1.14 W.R. Colclough & Associated Ltd. 2004 Report Review

In 2004, W.R. Colclough & Associated Ltd. (Colclough) was retained by Land and Water British Columbia Inc. (now Integrated Land Management Bureau) to review existing environment reports relating to Ladysmith Harbour, and to identify areas where additional investigation was required. Details were documented in the report entitled, *"Review of Existing Environmental Reports Relating to Ladysmith Harbour and Uplands Proposed Waterfront Re-Development Ladysmith, British Columbia,"* dated November 2004.

The report reviewed 16 reports that were also reviewed by Golder. In addition, the Colclough review also included a review of a 1990 report entitled *"Yearly Mine Reports for Ore and Coal Processing,"* prepared for by the Ministry of Energy, Mines and Petroleum Resources, which provided information relating to the Tyee copper smelter. The report indicated that the smelter operated from 1902 to 1913 and that copper ore was received from various mines operating on the west coast and as far away as Mexico.

Based on their review, Colclough summarised that:

- The waterlots contain coal and wood wastes on the bottom;
- Contamination levels vary across the harbour;
- Some samples indicated levels of cadmium exceeding the ODLs;
- Some samples indicated levels of total PAHs exceeding the ODLs;
- Cadmium and PAH contamination may not be bioavailable; and,
- Lot 16G and Lot 17G are contaminated.

3.3.1.15 EBA Engineering Consultants Ltd. 2005 Stage 1 PSI

In 2005, EBA conducted a Stage 1 PSI for Lot 5, Plan 45800, DL 24 and 56, of Ladysmith, BC on behalf of Land and Water British Columbia (now Integrated Land Management Bureau). While the property (Lot 5) is not a portion of the Site, the area is located between the Uplands and Slack Point and therefore may be relevant for the current investigation. Details of the investigation were documented in "Stage 1 Preliminary Site Investigation Lot 5, Plan 45800, DL 24 and 56, Ladysmith, BC", dated February 2005.

The investigation identified two areas of potential environmental concern on adjacent properties as follows:

- The former pump island and railway maintenance building; and,
- Coal fill on Slack Point.

No areas of potential environmental concern were identified on Lot 5.

3.3.1.16 G3 Consulting Ltd. 2005.

In 2005, G3 Consulting Ltd. (G3) was retained by Land and Water British Columbia Inc. (now Integrated Land Management Bureau) to determine the suitability of Ocean Disposal as a disposal method for dredgate from the Ladysmith Harbour. Results of the investigation were documented in the report entitled, "Report on Ladysmith Harbour Foreshore Fill Sampling & Analysis", dated March 2005.

The investigation examined surface and subsurface substrates from DL 2016 Block C and DL 651 (the report also included the unsurveyed lot adjacent the Government Wharf, not investigated during this report).

Twenty-one grab samples and sixteen core samples from seven different areas (locations "E6" to "N7" on Figure 6) were analysed for total metals, sulphide and total organic carbon (TOC). In addition, bioavailability, porewater chemistry, and bioassay and sediment toxicity were also assessed. Sample locations were based on a review of previous sediment investigations. PAH and PCBs were not assessed during the study. Sediments were described as debris-laden (woody debris, logs, wood pieces and bark) and anaerobic (notable H_2S-like odour), and coal waste was also observed particularly near Slack Point.

Of the 37 sediment samples collected and analysed for metals, one surface sample (sample "J7-R2" from location "J7" on Figure 6) had a concentration of copper that was above the CSR $SedQC_{TS}$. None of the other samples had concentrations of metals parameters that were above the CSR $SedQC_{TS}$. G3 indicated that sediment sample results for cadmium exceeded the ODLs in six of the seven stations, generally from samples collected at surface to approximately 2.12 m bgs. As mentioned in Section 3.3.1.10, while concentrations above the ODLs are not indicative of sediment contamination under the CSR, they do present a limitation of disposal options for development plans that include dredging operations.

Results of the porewater sampling indicated:

- Concentrations of total zinc in seven of the samples were greater than one-tenth of the CSR AW standard for dissolved zinc;
- Concentrations of total mercury in three of the seven samples were greater than one-tenth of the CSR AW standard for dissolved mercury, and the CCME guideline for total mercury; and,
- A Concentration of copper in one of the seven samples was greater than the CSR AW standard for copper.

Concentrations of dissolved metals in the seven samples were below both one-tenth of the CSR AW standards and the CCME standards for metals parameters.

Results of the bioavailability assessment indicated reduced bioavailability and toxicity testing indicated no observable toxic responses in bioassays.

3.3.1.17 Golder Associates Ltd. 2005 Stage 1 PSI and DSI

In 2005, Golder was retained by the Crown Contaminated Sites Branch to conduct a Supplemental PSI and a DSI on Slack Point. Details were documented in the report entitled, *"Supplemental Stage 1 Preliminary Site Investigation and Detailed Site Investigation Lot 16G Ladysmith Harbour Ladysmith, BC,"* dated July 19, 2005.

The DSI investigated six APECs on Slack Point identified during the Supplemental PSI. The APECs included:

- Coal Fill;
- Surficial wood waste fill;
- Buried refuse and possible landfills;
- Former boat repair shop;
- Former wood waste and dredgate stockpile (that was present on the site between 1984 and 1994);and,
- A stockpile of imported material of unknown quality observed during the 2005 site reconnaissance (not observed during the Site reconnaissance associated with this current report).

The investigation consisted of a geophysical survey, test pitting (locations "TP05-1" to "TP05-15" on Figure 6), borehole drilling (locations "BH05-1" to "MW05-24" on Figure 6) and subsequent groundwater monitoring well installation, soil and groundwater sampling, seepage water sampling, and soil vapour sampling.

Following the investigation of the soil, groundwater, and seepage water at Slack Point (analytical results shown in Tables 3 and 4), three of the six APECs were considered AECs. These included:

- **Coal Fill** - Hydrogen sulphide odours were observed in the coal fill at depths below 12 metres at Slack Point, well below the surface of the groundwater table (generally 2 m to 3 m below ground surface). LEPH, HEPH and PAH in soils were present at concentrations greater than the CSR RL/PL standards throughout Slack Point. Elevated concentrations of sulphur were present in the coal fill. Groundwater samples collected during the DSI did not contain concentrations of potential contaminants of concern (PCOCs) at concentrations greater than the CSR AW standards. Of the non-regulated parameters, elevated concentrations of dissolved calcium, iron, manganese, magnesium and sodium were detected at several monitoring wells at the Site. These concentrations were suspected to be caused by leachate or salt water intrusion (*i.e.*, sea water). No other indications of leachate from the coal (*i.e.*, low pH, elevated metal concentrations) were measured on Slack Point. A seepage water sample collected from the western foreshore area (near the former boat yard) indicated concentrations of LEPHw and a numerous PAHs that were greater than one-tenth of the CSR AW standards. It was suspected that the elevated concentrations of these parameters were a result of suspended coal particles (sediment) in the water, suggesting that PAHs associated with the coal may be transported via surface water and other modes of particulate transport;
- **Surficial wood waste fill** - LEPH, HEPH and metals were detected at concentrations greater than CSR RL/PL standards, and concentrations of zinc were greater than the CSR CL/IL standard. Of the hydrocarbons, HEPH was thought to be naturally occurring in wood that may have been entrained in the samples. The volume of the surface fill materials at Slack Point was estimated to be between about 34,000 m^3 and 67,000 m^3. The contamination identified appeared to be related to the quality of materials used as surface fill at the Site. Some of these materials may have included sediments historically dredged from Ladysmith Harbour; and,

- Buried **refuse and possible land filling** – The investigation identified areas containing metal debris and refuse along the northwest portion of the Slack Point. Concentrations of PCOCs in groundwater were below the CSR AW standards in this area; however, the area contained concentrations of LEPH, HEPH and metals above the CSR CL/IL and/or the CSR RL/PL soil standards.

The other APECs (including the former boat repair shop) identified in the supplemental PSI were investigated and no concentrations of PCOCs were found that exceeded the applicable standards. These APECS were not considered AECs for Slack Point and are not considered AECs for this current report.

During the investigation, two surface water samples were collected and analysed from a drainage ditch located on the eastern perimeter of Slack Point. As discussed in Section 3.2.4, it is inferred that the ditch carries storm water to the Harbour and that the water in the ditch is not associated with Slack Point. As such, the chemistry results for water samples collected from the ditch in 2005 have not been included in the current investigation.

3.3.2 Summary of the Review of Historical Reports

A review of the historical reports for the Site and surrounding area identified activities and/or areas located both on and off-Site that may have affected the quality of the soil, groundwater, or sediments at the Site. These are listed in Table 5, below, and include:

Table 5: Results of Previous Report Review

Area of Potential Environmental Concern	Source
SLACK POINT	
Coal Fill - including: coal washing and smelter wastes.	EBA 1994
Coal trans-shipment area including coal bunkers and wharfs built on pressure-treated lumber piles.	Phoenix 1999
Abandoned landfill/waste dump.	Hardy BBT 1990a; EBA 1994a; ReVelop 1999; Golder 2005
Wood waste and dredgate stockpile.	Hardy BBT 1990a; Golder 2005
Stockpile of unknown quality imported materials on Slack Point.	Golder 2005
Former boat yard, boat repair and service shop on Slack Point.	D&M 1990a; EBA 1994b; Golder 2005
Former buildings associated with logging activities.	ReVelop 1999
Potential for smelter waste to be used as fill at Slack Point.	EBA 1994

Area of Potential Environmental Concern	Source
UPLANDS	
Former scale pit.	Hardy BBT 1999
PCB Storage near former pump islands and/or near former scale pit.	Hardy BBT 1990; ReVelop 1999; Levelton 2000a;
Former pump islands, pump house, ASTs and possible PCB Storage.	Hardy BBT 1990; ReVelop 1999; Levelton 2000a; EBA 2005
Historic fuel line spill from ASTs and the associated piping.	D&M 1990
Former maintenance area, underground storage pits, current boat repair and construction operations, drum storage.	Hardy BBT 1990a, ReVelop 1999; Levelton 2000a; EBA 2005
Former waste oil storage area adjacent main repair building.	Hardy BBT 1990; ReVelop 1999; Levelton 2000a
Former location of stockpiles of unknown quality and scrap metal storage.	Hardy BBT 1990; Levelton, 2000a
Former cable splicing shed.	D&M 1990; ReVelop 1999; Levelton 2000a
Suspect UST (1,900 L) heating oil or diesel fuel UST adjacent the washroom building.	Hardy BBT 1990a; ReVelop 1999; Levelton 2000a
FILLED FORESHORE	
Fill associated with Blocks B and D of DL 2016 - Former location of the shingle mill, associated unknown quality of backfill post removal.	Phoenix 1999
Fill of unknown quality at the former log dump.	EBA 1994
Former location of ASTs in concrete containment at the foreshore.	D&M 1990; Hardy BBT 1990a; EBA 1994; Levelton 2000
Activities associated with the former log dump, log booming, storage and barge areas and associated unknown quality of backfill.	ReVelop 1999, Phoenix 1999
Small saw mill - unknown location, likely associated with the former shingle mill.	Phoenix 1999 and 2002
SEDIMENTS	
Quality of sediments - wood debris and coal waste.	D&M 1990; EBA 1994, Phoenix 1999 and G3 2005
Marina activities including: dumping of waste (paint, batteries), onboard boat repairs and boat moorage.	Phoenix 1999
Sewage outfalls.	Norecol 1989, D&M 1990; ReVelop 1999; Phoenix 1999
Woodwaste/debris overlying the sediments in the harbour.	EBA 1994

Area of Potential Environmental Concern	Source
OFF-SITE	
Off-Site service stations 728 Esplanade and 435 Esplanade.	Levelton 2000a
Former location of copper smelter: unknown use of wastes as fill on and offsite.	ReVelop 1999; Levelton 2000a;
Burleith log sort facility.	(New Pacific 1998)
Ore smelter.	D&M 1990a
Iron foundry.	D&M 1990a
Copper smelter.	D&M 1990a

The locations of the test pits, boreholes and/or monitoring wells installed as part of these investigations (discussed in Section 3.3.1.1 through 3.3.1.17) are shown on Figure 6. Available soil and groundwater analytical results were compiled in Tables 3 through 4. Soil and groundwater results were summarised on Figures 7a, 7b, 8a, and 8b[8].

3.3.3 Land Title Information

Golder retained West Coast Title Search in Victoria, BC to conduct a current title search of the Site. Historical searches and land lease agreements from previous reports were also reviewed. West Coast Title was unable to locate lease information on the properties. Land lease agreements for Slack Point were provided to Golder in 2005 by Mr. Scott Bailey of MAL (now MFLNRO).

Currently, the Uplands area (Lots 1 and 4 (Including DL 24, DL 56, 8G and 11G)) is owned by the Town of Ladysmith, and portions of the Filled Foreshore (DL 16G and 17G) and Water Lot (DL 651) are owned by the Crown (Her Majesty the Queen). Titles were not available for the remaining DL 2016 Blocks B, C and D (which are portions of the Filled Foreshore and Water Lot). A summary of the title history by area is provided below. Copies of the land titles are included in Appendix IV and a copy of a survey illustrating the legal plan for the Site is included in Appendix I.

3.3.3.1 Uplands

The Town of Ladysmith has held the title of the Uplands area of the Site since at least 1988[9] (Revelop, 1999). Before this time the Crown, Majesty the Queen in Right of the Province of British Columbia held title. Existing and former lease holder agreements were not available for Golder's review.

[8] These figures also shows compiled soil and groundwater data from the current DSI investigation.

[9] Excluding Lot 5 which is not part of the subject Site area.

3.3.3.2 *Filled Foreshore*

Titles were not available for DL 2016 Blocks D and B. Her Majesty the Queen in Right of the Province of British Columbia has held the title for DL 17G since at least 1988.

The title search indicated that Slack Point (DL 16G) is also currently owned by the Crown, Her Majesty the Queen in Right of the Province of BC. The land was registered to the Crown in January 1988; prior to that the Site was not registered. A number of land lease agreements related to the Site were provided to Golder in 2005 by Mr. Scott Bailey of MAL (now MFLNRO). Copies of the land lease arrangements are included in the 2005 Golder report.

Based on Golder's review, the Site appears to have been occupied by various logging companies since at least 1942. The Crown was listed as the "Lessor" on the lease agreements, indicating that the land was owned by the Crown as far back as 1942. Activities conducted at Slack Point included log dumping, booming, sorting, tug and barge moorage, loading and unloading of barges, storing of equipment and wood products, and other industrial purposes.

The available lease agreements for Slack Point identified some activities and operations considered to be an issue of potential environmental concern. Logging companies have leased areas of Slack Point from at least 1942, and activities on-site may have been included those listed in Schedule 2 of the CSR (*i.e.*, wood, pulp and paper products and related industries and activities). Common contaminants of concern associated with logging activities include: metals, petroleum hydrocarbons, PAHs, sulphur, chlorinated phenols and volatile organic compounds (VOCs).

3.3.3.3 *Water Lots*

Titles were not available for DL 2016 Block C. The Crown, Her Majesty the Queen in Right of the Province of British Columbia has held the title for DL 651 since at least 1988. According to a previous report (D&M, 1990), Canadian Collieries Ltd. held the lease of this area from 1921 to 1960. Comox Logging and Railway Company sublet the area between 1936 and 1960, and Crown Zellerbach Building Materials Limited sublet until 1986.

3.3.4 Historical Aerial Photograph Review

Historical aerial photographs for the Site and the adjacent properties were obtained from the University of British Columbia Geographic Information Centre. Aerial photographs from 1952 to 2007 were available for review. Table 6 presents a summary of the aerial photograph interpretation. Selected aerial photographs are reproduced in Appendix V.

Table 6: Aerial Photograph Interpretation for the Site and Surrounding Land Use

Date	Aerial Photograph	Site Description	Surrounding Area
1952	BC1443:115-117	The extent of the fill at Slack Point appears generally similar to present day. There appear to be several roadways through the area and a building appears on the western portion of Slack Point. Several small structures appear on the north side of Slack Point. A parking area is noted on the east side of Slack Point. Logging activities are present through-out the waterlot area of the Site including several log booms and sorting pockets. A log dump is observed at Lot 11G. Several roads and rail spurs are present on the Uplands and along the foreshore, downslope of the Uplands area. Buildings, in the configuration as they are currently known, are present at the Uplands portion, including the main repair shop, car shop, roundhouse, washroom and cable splicing shed. To the northeast of the main repair building, a clearing is observed and a structure is visible in the approximate area of Lot 1 (see Figure 2). The current areas, Blocks B and D of DL 2016 have not yet been filled; however, the shingle mill referred to in previous reports (and visible on the 1902 map of Ladysmith (Appendix I) further discussed in Town of Ladysmith Archives Section 3.3.6.4) is visible (on a wharf) in the area of Block B.	The current day government wharf (to the northwest of the Site) is not visible. The area to the north west of the Site has been filled and appears to have a hook-like pattern similar to the 1902 map of Ladysmith (see Town of Ladysmith Archives; Section 3.3.6.4 and Appendix I). To the southwest of the Site, the railway and major highway are visible and several residential housing plots are observed occupying the Town of Ladysmith. To the southeast of the Site, the Loading Wharf and Transfer Wharf evident of the 1902 map of Ladysmith (see Town of Ladysmith Archives Section 3.3.6.4 and Appendix I) are also visible.
1957	BC2086:29,30	The Site appears similar to the 1952 aerial photograph; however, the photograph quality and scale of photograph prevent identification of specific Site features.	The Site appears similar to the 1952 aerial photograph; however, the photograph quality and scale of photograph prevent identification of specific Site features.

Date	Aerial Photograph	Site Description	Surrounding Area
1962	BC5047:114,115	The northern tip of Slack Point has been expanded slightly and includes the distinctive hook-shaped point that is present today. The shingle mill has been removed. Filling has taken place in the area near Block B and D of DL 2016 (to the north west). There appears to be less evidence of logging activities; at least half of the sorting pockets have been removed in the water area in the north west portion of the Water Lot. The building structure southeast of the main repair building appears to have been removed and a new structure is observed in the area inferred to be the location of the former pump islands (based on Hardy BBT, 1990a).	To the northwest of the Site the Government wharf has been constructed. A square shaped filled area has been constructed immediately adjacent Block B and D, which is connected to the Government wharf. The area to the southwest of the Site appears similar to 1952, with the exception of increased housing development to the southwest of the Site. The Loading Wharf to the southeast of the Site is no longer evident.
1968	BC7076: 067-068	It appears that more fill has been added to the northern portion of Slack Point and fewer logs, machinery and buildings were observed. Some areas of Slack Point are observed to be vegetated (trees are observed). A long breakwater has been constructed extending from Block B and D of DL 2016 into Ladysmith Harbour, and more fill appears to have been added in the area of Block B and D.	There appears to have been more filling to the northwest of the Site and the former hook-like pattern observed in the 1952 photograph appears to have been completely filled in. The Transfer Wharf to the southeast of the Site is no longer evident.
1975	BC7751: 191, 192	The Site appears generally unchanged with the exception of a wide road extending through Slack Point from Lot 4.	More filling has occurred northwest of the Site. Two large areas appear to have been paved and are utilized for industrial activity. Log sorting is observed along the water adjacent these areas.
1984	BC84029: 135, 136	The Site appears generally unchanged, except the hydraulic crane used for loading barges (D&M, 1990a) is visible in waterlot DL 651, northwest of Slack Point. A large stockpile of material is present in the central portion of Slack Point. The road through Slack Point observed in 1975 is less prominent in the 1984 aerial photograph.	To the northwest of the Site, the two paved areas identified in 1975 were expanded and more fill added to this area.

Date	Aerial Photograph	Site Description	Surrounding Area
1988	30BCC98037, 013	The majority of the logging operations have ceased at the Site. A small marina has been constructed in the centre of the Site; a few scattered log booms remain. All of the sorting pockets have been removed. The area around the base of the Government Wharf and including Blocks B and D of DL 2016 has been further infilled and appears similar to the current configuration; it appears to be paved and utilized as a storage area. Slack Point is further vegetated and the building in the western area is no longer visible. The northern tip of Slack Point has been further expanded and appears slightly rounded.	To the northwest of the Site extensive infilling is again observed, and appears to connect the two paved areas observed in the 1975 aerial photograph.
1993	BCB93093, 229, 230	Appears similar to the 1988 photograph. The large stockpile of material on Slack Point remains present and is now covered in vegetation.	Appears similar to the 1988 photograph.
1998	30BCC98037, 014 and 015	The small marina in the centre of the Site has been expanded and includes a narrow breakwater area and several boats are visible. The cable splicing shed is not visible, likely owing to tree cover. The large stockpile of material on Slack Point is no longer visible.	Appears similar to the 1993 photograph
2007	ME07 460C, 0381, 0382	The marina has expanded to include at least two docks; the breakwater has been removed. A road from the main highway leading into the area southwest of Slack Point has been constructed (Transfer Beach Boulevard). The hydraulic crane piles are no longer visible on DL 651; however, many boats and other structures are visible in the water northwest of Slack Point. The structure to the southeast of the main repair building (inferred to be the location of the former pump islands) has been removed.	Park-like features are observed on the southeast portion of Slack Point, including a baseball field and amphitheatre. Immediately east of the Site there is another residential development (what is now 63B Avenue). Other surrounding properties appear similar to the 1987 aerial photograph.

By at least the 1950s, logging activities were observed at the Site and in the area to the northeast of the Site. By the time of the 1988 aerial photograph, all logging activities had ceased and the Site appears vacant with the exception of the buildings in the Uplands.

The shingle mill wharf was visible on the 1952 through 1962 aerial photographs. The Government wharf and Blocks B and D are observed from the 1962 photograph to present. Filling appears to have been occurring in that area and the area appears similar to the current configuration as of the 1988 aerial photograph. The Ladysmith Maritime Society Marina and Wharf was observed as of the 1988 photograph in conjunction with the slowdown of logging activities in the area.

Slack Point, the railway, log booms, repair shop and other logging activities were visible from the 1952 photograph to the 1988 photograph. Additional filling of Slack Point was observed up until 1988. The boat repair on Slack Point had been removed by the 1988 photograph.

Several buildings were observed on the Uplands. In 1952, a building structure was observed in the inferred location of the former pump islands (based on Hardy BBT, 1990b). In 1962, the original building was replaced with a new structure, which was observed in 1998, and had been removed by the 2007 photograph.

The aerial photograph review confirmed the potential for activities and/or operations within the local area that can be considered as issues of potential environmental concern (*i.e.,* transportation industries, operations and related activities or waste disposal and recycling operations and activities and/or activities described in Schedule 2 of the CSR). Copies of select aerial photographs are presented in Appendix V.

3.3.5 Directory Search

On September 4, 2009, Golder contacted Vancouver Public Library's (VPL) Information and Research Centre to request city directories for the Town of Ladysmith. A representative from VPL indicated that there were no city directories with street indexes for Ladysmith. The response is included in Appendix VI.

ReVelop (1999) conducted a search of city directories for the Site; they reported that the Comox Logging Company and Railway Co. was listed at the Site on the city directories from 1950 to 1957 (not available for review by Golder). In addition, Revelop obtained an early 1900 microfiche business directory information (not reviewed by Golder) that included a description of Ladysmith Harbour in the 1902-1910 directories. The description was as follows:

> *"Ladysmith in the Nanaimo district.... is the shipping point for the Wellington Collieries where the largest ships afloat can come alongside and tie up to the capacious wharves. Here you will find the latest and most up-to-date improved machinery on the Pacific Coast for the quick dispatch of colliers. The wharves are substantially built on copper covered pile. Here also is the transfer wharf for the Canadian Pacific Railway. ..."* (Revelop, 1999).

The directory indicated that the wharves may have been built on copper covered piles, potentially affecting the quality of sediments in the vicinity.

3.3.6 Agency Inquires

3.3.6.1 Historical Fire Insurance Plans

SCM Risk Management Services Inc (SCM) was contacted on September 4, 2009 for fire insurance information pertaining to the Site. Although a 1954 fire insurance map was available for the Town of Ladysmith, the map did not include the Site itself. Fire insurance maps were therefore not obtained during this investigation.

The 1999 ReVelop report contained a 1911 fire insurance map. The map was limited to portions of the Uplands area and did not include the filled foreshore or the water lots. The map showed that the railway was present along the shoreline of Ladysmith in 1911. The map also includes information on the former Tyee Copper Smelter northwest of and cross gradient to the Site. Extracts from the insurance maps previously obtained by Revelop in 1999 are included in Appendix VII.

3.3.6.2 MoE Site Registry

The BC MoE maintains a Site Registry database that contains environmental information pertaining to non-contaminated, contaminated and previously contaminated (*i.e.,* subsequently remediated) sites. Using geographic location co-ordinates of the approximate centre of the Site, the database was searched for records such as previous environmental investigations, waste management permits and pollution abatement orders.

An on-line search of the Site Registry for registered properties within a 0.5 kilometre (km) radius from the approximate centre of the Site was conducted on September 11, 2009. The search resulted in five registered properties.

A summary of the property details identified are provided in Table 7 below. The results of the search are presented in Appendix VIII and on Figure 7.

Table 7: Registered Sites Identified and within 500 m of the Site

Property ID#	Site Address	Description	Status	Location Relative to the Site
1700	Slack Point	Last updated: October 13, 2005 The details listed the entire Site (Uplands, Filled Foreshore and Water Lots), and includes Lot 5 (not assessed during this investigation).	Details indicated that the Site was **Active and Under Assessment** and included multiple suspected land uses: coal, dry docks, landfill, petroleum storage, bulk freight handling, and logging activities.	On-Site.
6836	728 Esplanade Avenue	Last updated: June 09, 2003 (currently occupied by a Shell Service Station).	A notice of independent remediation was filed in 2000. The Site is listed as **active and under remediation**.	Approximately 50 m southwest of and upgradient the Uplands portion of the Site.
3687	610 First Avenue	Last updated: December 30, 2003 (currently occupied by a commercial businesses including a Canada Post Outlet).	Described as “Tombstone data only for site registry” – Federal. Land. Currently registered **inactive and no further action was required**.	Approximately 200 m southwest of and upgradient the Uplands portion of the Site.

Property ID#	Site Address	Description	Status	Location Relative to the Site
5775	840 First Avenue	Last updated: March 17, 2000 (currently occupied by a retail business adjacent a Big O Tire Shop).	The details did not indicate previous activities at the Site or the reason for the Site profile. Currently registered **inactive and no further action was required**.	Approximately 200 m southwest of and upgradient the Uplands portion of the Site.
5352	Foot of Oyster Cove Road	Last updated: March 14, 2001.	Details suggested that a Phase I and 2 Environmental Site Assessment was performed on a harbour or port in 1997 and 1999 respectively, initiated by Transport Canada. It appears that the reports were submitted for external review in 1998. Currently registered **inactive and no further action was required.**	Approximately 350 m southeast of and cross gradient the Site.

The search identified five registered sites ("properties") on the database. Of the five properties, one was located on-Site and four were located within 500 m of the Site (Figure 9). One off-Site property was considered cross gradient to the Site and three of the off-Site properties were considered upgradient of the Site. The properties are further discussed below.

Property ID #1700 is located on-Site. The Site status remains active and under assessment. Suspected land uses listed in the details were coal, dry docks, landfill, petroleum storage, bulk freight handling, and logging practices. These indicate several CSR Schedule 2 activities. It is not known what triggered the Site Profile for the Site; however, after the logging activities had ceased in the area, several investigations were performed, the likely basis for the site profile.

Property ID #6836 is currently a Shell Service Station. This property was listed as active and under remediation. The property is located approximately 50 metres upgradient from the Site, and therefore may have the potential to impact the quality of the soil and/or groundwater at the Site.

Property ID #3687 was registered as inactive, no further action required. The detail description states that the data is "Tombstone data only for the Site registry – federal land". The property is located approximately 200 metres upgradient from the Site. Based on the distance to the Site, it is not considered likely that the property activities would impact the quality of the site soil or groundwater.

Property ID #5775 was registered as inactive, no further action required. Details obtained through the site registry review did not provide information regarding historic activities at the property or provide information regarding the contaminants of concern; however, a notice of independent remediation was submitted to the MoE by EBA Environmental in 1999. The property is located approximately 200 metres upgradient from the Site. Based on the distance to the Site, it is not considered likely that the property activities would impact the quality of the Site soil or groundwater.

Property #5352 is located approximately 350 m to the southeast of the Site. Details for the site suggest that it is inactive. Due to the location of the property (cross-gradient to the Site), it is unlikely that this property could have adversely affected the Site.

3.3.6.3 Federal Contaminated Site Inventory

A search of the online Federal Contaminated Site Inventory (FCSI) database was conducted on September 17, 2009 for information on contaminated sites on federally administered lands. Two Federal Real Property (FRP) locations were associated with the Site (Figure 9 shows the approximate locations of the FRPs locations and the details from the database are included in Appendix VIII). FRP location 17511 was located in the approximate centre of the Subject Site and comprised seven associated FSCI Identifier numbers (or "Contaminated Sites"). The Identifier numbers indicated a Site Name, Contaminant Type, and Media Type. The details provided are summarised in Table 8, below. The status of the site activity for FRP location 17511 indicated that the historical review was completed and initial testing was underway.

Table 8: Details from FSCI Database for the Site (FRP Location 17511)

FSCI Identifier	Site Name	Contaminant Type	Media Type
00021348	Waste Oil ASTs	PAHs, PHCs (petroleum hydrocarbons)	Sediment
00021350	Nearshore Sediment and surface water	PAHs, PHCs	Sediment
00021351	Creosote treated batteries	PAHs, PHCs	Sediment Surface water
00021352	Boat Grid	Metal; metalloid; and, organometallic PAHs PHCs	Surface water
00021353	Fill Material	Metal; metalloid; and, organometallic	Soil
00021354	Stormwater Discharge	Metal; metalloid; and, organometallic	Sediment
00021355	Ladysmith	n/a	n/a

The inventory indicated several CSR Schedule 2 activities associated with FRP 17511. Exact locations of the activities were not identified on the FCSI; however, the majority of the activities have been identified during the previously described historical investigations and were further investigated during the DSI (Section 4.0).

FRP location 84352 was located north of and off the Subject Site and comprised one associated FCSI inventory number 00020503. Federal site 00020503 (Ladysmith Boat Basin No. 1), did not have any information on contaminants or media type. The report indicated that the site was not yet classified and that an historical review was planned.

3.3.6.4 Town of Ladysmith Archives

A copy of a 1902 Town of Ladysmith map was obtained from the archives (Ladysmith Archives, 1902) and is included in Appendix I. The map illustrates the Site as of 1902. On-Site, it appears that Slack Point does not extend as far into the Harbour as in current conditions. There are three wharfs visible in the area of Slack Point

including: the loading wharf, the transfer wharf, and a T-shaped wharf. The area below the T-shaped wharf is labelled “Dirt Dump". A washer and scales are also observed on the Uplands portion of the Site and appear to be associated with the operations on Slack Point. Railway tracks and a depot are also evident in the Uplands area. In the northwestern portion of the Site, a shingle mill is observed extending through the present Blocks B and D, near the present Government wharf. To the northwest of the shingle mill is the Tyee Copper Company smelter and foundry, located off-Site and cross gradient to the Site.

Also available from the Town of Ladysmith archives were photographs dating back to 1903. Copies of the historic photographs are included in Appendix IX. They identify the coal bunkers and wharfs (Photos 1 and 2) and the Log Dump (Photo 3). Approximately three silo-like features (inferred to be ASTs) located in the Uplands portion southeast of the railyard were visible in Photo 3.

3.4 Site Reconnaissance

Ms. Amber Bongiovanni, Ms. Dawn Flotten, and Mr. Anthony Fuller of Golder conducted an initial reconnaissance of the Site on September 23, 2009. The purpose of the visit was to assess the current conditions of the Site, verify information gained during the historical records review, collect site photographs of potential environmental concerns, and verify the locations of existing monitoring wells. A second Site visit was conducted on November 18, 2009 by Amber Daniels to interview former and current tenants of the Ladysmith Harbour area. Information obtained through the Site reconnaissance, interviews and photographs has been incorporated into this summary.

During the reconnaissance, brief interviews were conducted with the following Site representatives:

- Ms. Susan Jones, President of the Ladysmith Historical Society;
- Mr. Harry Blackstaff, retired Crown Zellerbach employee and local resident;
- Mr. Dougall Warren, D&E Marine Consulting;
- Mr. Dave Ehrismann, Ladysmith Maritime Society;
- Mr. Paul Steele, PMG Heritage Yachts; and,
- Mr. Robin Thacker, Atlantis Kayaks.

Subsequent Site visits were conducted during the Stage 2 PSI and Detailed Site Investigation. Photographs of the Site are presented in Appendix IX.

3.4.1 Site Description

The following sections provide a description of the Site, as described by areas, including: filled foreshore including Slack Point, DL 17G, Blocks B and D; the Uplands; and, the waterlots.

3.4.1.1 Filled Foreshore

3.4.1.1.1 Slack Point

Slack Point is a portion of the filled foreshore that is generally triangular in shape and is an extension to the northeast of the original foreshore. The area borders water on the eastern and northwest sides. The southwest portion of Slack Point is adjacent to Lot 5 (not included in the investigation; see Figure 2). A hook-shaped bulge is located on the northern tip of Slack Point.

At the time of the Site reconnaissance, Slack Point was undeveloped and generally covered with vegetation (trees and shrubs), and cleared roadways (Photo 4 in Appendix IX). The area is currently used as a pedestrian trail and for dog walking. Unauthorized camping was also observed along the northwest shore during the reconnaissance.

A dry ditch (a part of the Town of Ladysmith's storm sewer system) was observed at the southeast entrance of Slack Point and flowed along the eastern perimeter of the point towards Ladysmith Harbour. Monitoring wells previously installed by Golder during the 2005 investigation were observed through-out Slack Point; six of the original wells (MW05-05, MW05-06, MW05-07, MW05-11, MW05-19 and MW05-24) were observed to be missing or destroyed. Damaged materials (stick-up casings, and well piping) from the destroyed monitoring wells were observed on the shoreline or scattered around the Site.

Black coal fill material was observed at the surface, in stockpiles (Photo 5), and along the shoreline (Photo 6). Burn pits, metal, and concrete debris were observed along the northwest shoreline of Slack Point (Photos 7, 8 and 9).

The Site reconnaissance was performed during a relatively high tide event. During this time, a small berm (salt marsh) was formed and water divided a portion of Slack Point along the northwest shoreline (Photo 10).

Debris, shells, and two dead crabs were observed along the northwest perimeter of Slack Point (Photo 11).

The location of the former boat repair facility (shown on Figure 5a) was covered by grass. A wooden pile, metal rebar and piping were observed in a small inlet in the vicinity of the former boat repair facility (Photo 12a). The Site representatives confirmed that the wooden piles were used as the foundation for the boat repair and service shop on Slack Point (Photo 12b). According to the Site representatives, the shop was used to repair Tug Boats. They recalled that many of the Tug Boats leaked oil on the land and water in this area and that batteries and oil were changed and discarded into the harbour area.

Six concrete footings were observed in the approximate centre of Slack Point (Photo 13), which were historically used to support a hydraulic crane installed in 1979 to load barges from Slack Point (D&M, 1990). The Site representative was unsure when the crane was removed.

The small stockpiles previously observed by Golder (2005) were not observed during the Site reconnaissance. It was understood that this stockpile material consisted of imported fill material comprising sand and gravel used by the Town of Ladysmith. Golder is not aware of the current location of the stockpiled material; however, the Town of Ladysmith is currently using a portion of the Uplands (Pt. 4 of Lot 4; see Figure 2) as a staging area. Logging debris and gravel stockpiles were observed in this area (Photo 14), which was previously used as a campsite and trailer park. The area was locked with a new steel swinging gate with bollard posts during the Site reconnaissance (Photo 15). The Site representatives were not aware of any historic industrial activity in this area.

3.4.1.1.2 DL17G

DL17G is a portion of the filled foreshore located northwest of Slack Point and southeast of the Ladysmith Maritime Society Marina parking lot. It is the location of the former log dump. Previous reports and the Site representatives suggested that the log dump and former rail spur (leading to the area) were removed and backfilled (EBA, 1999) sometime in the 1980s. The Site reconnaissance occurred during high tide (Photo 16). Some logs and wood were observed along the shoreline from the parking area (Photo 17a); however, other historically referenced infrastructure had been removed. The area suspected to have formerly contained the three diesel ASTs is currently paved and serves as the Ladysmith Maritime Society Marina parking area (Photo 17b). The Site representatives did not have knowledge of the former diesel ASTs.

The Site representatives indicated that historically there was a road extending from the Government wharf access to DL 17G. Boats, locomotives and trucks were fuelled via pipelines running down the steep cliff. The pipelines originated from ASTs located in the Uplands portion of the Site, near the former pump islands on Lot 1.

3.4.1.1.3 Blocks B & D

Blocks B & D are the portion of the filled foreshore located in the north western area of the Site. At the time of the Site reconnaissance, the area appeared to be used as a parking facility for the Government Wharf and other businesses. A boat launch was visible at the northeast end of Blocks B & D (Photo 18).

The Site representatives were not aware of any historical activity on Blocks B & D and recalled that this area was always used for parking.

3.4.1.2 Uplands

The Uplands portion of the Site includes Lot 4 and Lot 1. Lot 4 comprises six buildings that were constructed between 1935-1952 (Revelop, 1999; Levelton, 1998). These buildings include the former locomotive and railcar repair shop (main repair building) (Photo 19), washroom (Photo 20), car shop (Photo 21), roundhouse (Photo 22), first aid shed (Photo 23) and cable splicing shed (Photo 24). The locations of the buildings are shown on Figure 5b.

The main repair shop is approximately 62 m long by 23m wide and 12 m high, with galvanized iron reinforced walls. This building was historically divided into two areas: the rear of the building comprised the repair shop and the front was partitioned into several compartments and storage. Currently the building is fronted by the Maritime Society office building, Liquid Gold Art Studios, and the Arts Council of Ladysmith and District. The rear of the building (or the northwest end) is currently occupied by two tenant operations including Atlantis Kayaks and Southwood Products.

According to the Site representatives, a six cylinder compressor was historically stored immediately adjacent to the southwest side of the main repair building. The compressor was used for the air lines associated with the locomotives. The Site representatives commented that the compressor leaked on a steady basis; they were unsure when the compressor had been removed. In addition to the compressor, a waste oil tank car was stored in this area. Oil from locomotive and truck maintenance was generally stored in the waste oil tank car and used by surrounding municipalities to irrigate the roads to keep the dust down. The Site representatives mentioned that oil was frequently discarded onto the ground as opposed to disposal in the waste oil tank car. This area also

contained buckets of pyrene used for washing metal parts. The use of the waste oil area likely ceased when the logging operations halted in the mid 1980s. Currently this area is paved with asphalt and comprises a waste area for garbage and a small amphitheatre used by the Maritime Marine Society (Photo 25).

Atlantis Kayaks, located at the northwest end of the main repair shop, uses fibreglass resins, polyester composites, glue and acetone. In general, used acetone is kept outside on a skid in a concrete containment unit and allowed to evaporate off (Photo 26). The polyester composites harden and are thrown in the garbage. The floor of the Kayak building area is constructed of asphalt. Many sink holes, cracks and staining were observed on the floor. One 200-Litre tank of Stypol (polyester composite) was observed in the building. Some staining was observed beneath the tank. Outside of the entrance to Atlantic Kayaks, a sewer-like odour was present. According to the site representative, the sewage system frequently backs up near the main entrance of the Kayak building; he stated that on occasion, he has observed raw sewage outside of the building. A maintenance pit was observed at the southeastern end of the Kayak building area under the rail spur. According to the Site representative, the pit extends into the Southwood Products work area (not observed during the Site reconnaissance). The pit was covered with plywood (Photo 27) and several 5-gallon (20 L) pails of acetone and resins rested on the plywood. The Site representative commented that the pit was hollow and that he does not place heavy objects on the wood. There were no odours noted in the area of the maintenance pit.

Previous reports indicated that there was a fuel UST located adjacent the washroom building; however, the infrastructure associated with the UST (*i.e.*, a manhole) is an underground sewage pump (confirmed by the Town of Ladysmith) for the washroom facilities at the Site (Photo 20). According to the Site representatives, the washroom building was historically used as the electrical shop for the logging activities and railway. The building currently consists of two washrooms, showers and a changing area used by the tenants and marina clients.

The roundhouse building is approximately 23 m by 8 m and is similar in construction to the main repair shop. It is currently occupied by PMJ Yachts, which builds and repairs large vessels. Storage of approximately 4-litre containers of xylene, acetone, epoxy, and methyl hydrate was observed in the building. According to the Site representatives, daily locomotive maintenance was historically performed in this area (*i.e.*, oil changes, small engine repair). The area was historically used by the logging industry to store the locomotives and keep the steam up in the engines. A rail spur was visible in the building. The Site representative noted that there is a maintenance pit located under the plywood covered rail spur (Photo 28). The pit appeared to have been infilled and covered over; there was no odour observed from the maintenance pit.

The former car shop is approximately 25 m by 12 m and is located southwest of the roundhouse. It is currently used by the Ladysmith Maritime Society for vessel restoration products and storage. Historically, the car shop was used as a repair facility for train wheels and axles (Photo 21*).*

The first aid building is located north of the roundhouse and is generally used as a pump house for the sewer system and as a storage shed for PMJ Yachts.

Two smaller sheds were observed in the vicinity of the car shops. According to the Site representative, the small sheds are used for storage by Atlantis Kayaks and PMJ Yachts (Photo 29).

The former cable splicing shed is located in the northwest portion of Lot 4. According to the Site representatives, the building has been used for wood and galvanized steel siding construction, wood manufacturing, storage of explosives, and street lights and used for cable splicing. Currently the building is being used for painting and staining wooden cabinetry.

A rock-filled drainage channel was observed adjacent to the splicing shed and was directed downgradient to Blocks B & D towards Ladysmith Harbour (Photo 30). The channel is understood to be a part of the Town of Ladysmith's storm water drainage system.

3.4.1.3 Water Lots

The two water lots were divided by the Ladysmith Maritime Society Marina and Wharf (the "Marina"), which comprises a long dock with several moored boats and covered boat houses. A portion of the Marina is located within DL 651. East of the Marina dock, there are several wooden booms followed by randomly placed and generally tied together materials and vessels including dolphins, boats, house boats, portions of dry dock and other floating debris (locally referred to as the "dog patch") (Photo 31).

DL 2016 Block C was located between the Marina and the Government Wharf (with the exception of the filled areas Block B and D). As with DL 651, a portion of the Marina is located on DL 2016 as well. Further west from the Marina, a small pile of logging debris was observed (Photo 32). Adjacent to the Government wharf, a breakwater was under construction and a pipe was observed in the water (Photo 33), likely extending from the drainage channel observed near the former splicing shed (Photo 30).

3.4.2 Waste Management and Handling

Refrigerators, batteries, concrete, metal and other debris were observed along the shore line at Slack Point. Abandoned boats and storage were observed at the car shop (Photo 34) in the Uplands area.

There is no municipal garbage pickup for the Ladysmith Harbour area. One garbage bin was observed adjacent to the main repair building (Photo 25). According to the site representatives, the bin is used for the buildings associated with the former main repair shop. Atlantis Kayaks and PMJ Yachts generally store their garbage until the quantities warrant a pickup from the municipal landfill. They generally store their garbage near the entrance to their individual buildings. There were stains and slight odours observed around the garbage from Atlantis Kayaks and there were cracks observed in the underlying asphalt. Garbage was not observed at the PMJ Yacht facility.

According to the Site representatives, coal sorting bins were historically stored along the side of the road southeast of the main repair shop. The number of bins was unknown and these bins were not observed during the Site reconnaissance.

3.4.3 Pesticides and Fertilizers

Generally, the use of herbicides and pesticides is a practise around railways and in railway yards; however, no herbicides or pesticides were observed at the Site and the Site representatives were not aware of any use or storage at the Site.

3.4.4 Storage Tanks

At the time of the Site reconnaissance, USTs and ASTs were not observed on the Site. Previous reports indicated that trains and boats were fuelled using a pump island located approximately 100 m to the southeast of the main repair shop in the Uplands. The pump island was reported to be connected to above-ground tanks. Fuel was gravity fed down to the shoreline via pipes and used to fuel boats, locomotives and trucks. A structure was observed in this area on aerial photographs, between 1962 and 1998. According to the Site representatives, a pump house/shed cantilevered over the cliff to the northeast and was held up by stilts. The Site representatives said that PCB storage may have been located in this area; however, the contents, locations and size were unknown. This area is currently vacant and covered by gravel (Photo 35), a concrete pad was observed in the vicinity (Photo 36).

Previous reports suggest that three diesel fuel tanks were installed in 1981 in a concrete containment located in the area currently used by the Ladysmith Maritime Society as parking for the Marina (Photo 17b) (D&M, 1990). Piping from these tanks ran to a fuelling dock for the boats. ASTs or associated piping were not observed during the Site reconnaissance, and the Site representatives were not aware of any tanks historically located along the shoreline.

3.4.5 Chemical Storage

At the time of the Site reconnaissance, chemical products were observed in the Atlantis Kayak and the PMJ Yachts buildings. The Arts Council of Ladysmith and District, Liquid Gold Studios, Southwood Projects and the Splicing Shed (Bondeau's Cabinets and Millwork) were not inspected during the Site reconnaissance; therefore, it is unknown if chemical storage took place in conjunction with those operations.

Atlantis Kayaks stored mainly acetone and polyester composite. One 200-Litre drum of Stypol (polyester composite) was observed in the building and several five-gallon (20 L) pails containing acetone and Stypol were observed. The exterior area of Atlantis Kayaks contained several empty drums of acetone and Stypol; according to the Site representative, the empty drums are stored outside of the building (on the grass) until there are enough drums accumulated to warrant a pick up by an environmental disposal company (generally up to 40 drums). Five-gallon (20 L) open pails of acetone were observed inside the concrete containment area.

Small amounts of acetone and xylene were observed at Atlantis Kayak. According to the Site representative, no more than four litres of xylene, acetone, epoxy, and methyl hydrate are contained in the building at any time.

3.4.6 Hazardous Building Materials

There were no buildings observed at the Site, with the exception of those located on Lot 4; therefore, it is unlikely that any hazardous building materials are present at locations other than Lot 4.

For the purposes of this investigation, hazardous building materials comprise:

- Asbestos containing materials ("ACMs") - found in plaster, mechanical insulation, gaskets, thermal insulation on pipes, refractory material, roofing felts, floor tiles, ceiling tiles and pargings, heat resistant panels, incandescent light fixture reflector plates and any other material requiring a high degree of durability and/or thermal resistance. The common use of potential friable (breakable by hand) ACMs in construction voluntarily stopped in the mid-1970s;

- Polychlorinated biphenyls ("PCB") - are dielectric fluids in electrical equipment such as transformers, fluorescent lamp ballasts and capacitors; common up to about 1980. The Federal Chlorobiphenyls Regulation, SOR/91-152, prohibited the use of PCBs in the above electrical equipment installed after July 1, 1980;
- Ozone-depleting substances (ODS) – commonly used in equipment that could potentially contain ozone-depleting substances (ODS) including: aerosols, foam plastics, dry cleaning equipment, refrigeration systems, air conditioning units and some portable fire extinguishers;
- Lead-based paints (LBPs) - were banned from use on exterior or interior surfaces of buildings, furniture, or household products in the 1970s, although various commercial paints are still known to contain lead in concentrations greater than 0.5 percent weight to weight of lead (*e.g.,* road paint); and,
- Mercury vapour - is present in fluorescent light tubes and elemental mercury is present within most thermostats. Mercury, or mercury vapour within these fixtures, poses no risk to workers or visitors, provided the mercury containers remain intact and undisturbed. When taken out of service, the handling, storage and disposal of mercury-containing materials should be conducted in accordance with provincial requirements.

An inspection of the building interiors and a hazardous building material survey was not performed nor reviewed by Golder during this investigation. According to the Site representatives, the buildings were not historically insulated. In the late 1980s, some insulating of the buildings was performed to accommodate new tenants; any insulation observed was fibreglass. However, due to the age of the buildings, primarily built in approximately 1935, it is possible that asbestos is contained in the pipes or other areas specified above. It is also likely that the buildings contain or have contained materials with the presence of PCBs, LBPs, ODS, or mercury.

In addition, PCBs were reportedly stored in the vicinity of the scale pit (shown on Figure 5a; Levelton, 2000) and near the former pump islands and ASTs (Figure 5a; Hardy BBT, 1999).

3.4.7 Radioactive Materials

No radioactive materials or sources were observed at the Site at the time of the Site reconnaissance.

3.4.8 Radon Gas

Radon gas is a product of the natural decay series that begins with uranium. Radon is produced directly from radium, which can be commonly found in geological units that contain black shale and/or granite. Radon gas can migrate through the ground and enter buildings through porous concrete or fractures. Radon tends to accumulate in poorly ventilated basements. In general, soils in the coastal regions of southern British Columbia have a low radon gas generating potential, as such radon gas is not suspected to be an environmental issue of concern at the Site.

3.5 Discharges, Releases, Odours and Staining

During the Site reconnaissance, a strong solvent-like odour was observed inside the Atlantis Kayak building and a mild sewer-like odour was observed outside of the building. The floor at the Kayak building was asphalt and significant staining and holes were observed.

PMG Yachts building contained a paint-like odour and had significant staining on the floors.

The previously suspected UST adjacent the washroom building has been determined to be a sewage pump out facility that discharges via pump to the Town of Ladysmith's municipal sewage system.

Several catch basins were observed at the Site, which collect stormwater from the roads on Lot 4. A rock-filled drainage channel was observed adjacent to the splicing shed and was directed downgradient to Blocks B & D towards Ladysmith Harbour (Photo 30). It was understood to be a part of the Town of Ladysmith's storm water drainage system.

A drainage ditch is located in the south corner of the Site at Slack Point. A representative from the Town of Ladysmith explained that the ditch is not part of the storm water drainage plan; however, the storm sewers from the town terminate at the foot of Slack Point and appear to flow into this ditch, through Slack Point and then into Ladysmith Harbour.

According to the Site representatives, the scales used to weigh the railcars containing coal were formerly located northwest of the intersection of Oyster Bay Rd and Transfer Beach Boulevard. The Site representatives indicated that the scales were removed, the area was filled in (unknown quality of fill) and the road was built on top of the former location. The Site representatives indicated that it was possible that derailments and/or surficial leaks from the rail cars occurred in this area.

3.5.1 Natural Environmental Receptors

3.5.1.1 Surface Water

The Site comprises a portion of Ladysmith Harbour including two water lots. The nearest surface water body is Ladysmith Harbour. Several creeks are located in the area of the Site; however, none pass through the Site. Holland Creek is located to the south and west, and Tyee Creek is located to the north and west (Figure 1).

3.5.2 Surrounding Land Use

During the Site reconnaissance, surrounding properties were observed to be mixed commercial and parkland developments. The following summarizes land use in the area of the Site:

Southeast: Southeast of Slack Point is the Transfer Beach area, which is zoned parkland.

Southwest: Immediately southwest of the Site is the Trans Canada Highway, followed by the Town of Ladysmith. The Town comprises a mixture of commercial businesses, residential homes and parkland. Two service stations were observed to be southwest of the Site.

Northwest: To the northwest are industrial activities, including the Government wharf and the Western Forest Products sawmill and sorting facility, followed by the Town of Ladysmith. A service station is located northwest of and cross gradient to the Site.

Northeast: The area to the northeast generally comprises open water passage and Ladysmith Harbour followed by Burleith Arm.

3.6 Discussion of Stage 1 Results and Identified APECs

Investigations have taken place at Ladysmith Harbour beginning in 1989, in response to requests from previous owners to assess environmental liabilities of the historic activities, and later to aid in the evaluation of the feasibility of a new waterfront development. Based on the previous reports and a historical title search, the Site and surrounding Ladysmith Harbour area has served a variety of industries and activities, including several CSR Schedule 2 activities.

The present Stage 1 PSI identified 21 on-Site and 4 off-Site APECs or AECs. A summary of the APECs and AECs, and their general location (Slack Point, Uplands, Filled Foreshore, sediment, and off-Site), is provided in Table 9, below. The approximate location of each APEC/AEC is shown in plan on Figure 10. The locations are based on descriptions within the text of the reviewed reports and/or locations shown on or interpreted from the report's figures. This has been summarized in Table 9 below.

Table 9: Summary of APECs and AECs Identified in the Stage 1 PSI

Area of Potential Concern Identifier	Information Obtained By Historic Review and Stage 1 PSI
Slack Point	
AEC 1	Coal Fill at Slack Point.
AEC 2	Surficial Fill from Non-Coal sources at Slack Point.
APEC 3	Former Wood Waste and Dredgate Stockpile.
APEC 4	Former Boat Repair Shop On Slack Point.
APEC 5	Buried Refuse and Possible Abandoned Landfill.
APEC 6	Stockpiles of Imported Sand and Gravel.
APEC 7	Former Buildings Associated with Logging Activities.
Uplands	
APEC 8	Fill Material in the Uplands.
APEC 9	Former Scale Pit and Possible PCB Storage.
AEC 10	Former Pump Islands, ASTs, Pump House and Possible PCB Storage.
APEC 11	Historic Fuel Pipelines from Uplands to the Harbour.
AEC 12	Former Maintenance Area and Current Boat Repair and Construction Operations.
AEC 13	Former Waste Oil Storage Area and Compressor Storage Location.

Area of Potential Concern Identifier	Information Obtained By Historic Review and Stage 1 PSI
APEC 14	Former Location of Oil Drum, Scrap Metal Storage, and Stockpiles of Unknown Quality.
APEC 15	Former Cable Splicing Shed.
APEC 16	Suspect UST Adjacent the Washroom Building.
Filled Foreshore	
APEC 17	Fill Material at Block B and D of DL 2016 (former Location of the Shingle Mill).
APEC 18	Small Saw Mill.
AEC 19	Former Log Dump (DL17G).
APEC 20	Former Location of ASTs at the Foreshore.
Sediments	
AEC 21	Foreshore Sediments – Quality of Sediment, Marina Activities, Sewage Outfall and Pressure Treated Piles.
Off-Site	
APEC 22	Off-Site Service Stations at 435 and 728 Esplanade.
APEC 23	Copper Smelter.
APEC 24	Burleith Log Sort Facility.
APEC 25	Iron Foundry.

The following section provides discussion for the identified APECs and AECs both on and off-Site.

3.6.1 Slack Point

3.6.1.1 AEC 1 - Coal Fill at Slack Point

Based on a review of historical information, it is understood that Slack Point is a peninsula of land that was created by infilling the foreshore with coal waste products during the early 1900s. It is reported that approximately two million tonnes of coal material derived from the washing of coal mine and coal smelter wastes, were used for filling the Site (Revelop, 1999). The location of the coal smelter was not discussed; there is no evidence that a coal smelter was located on Site. In addition, it has been reported that waste materials from copper smelter activities may also have been used as deep fill material (EBA, 1994a) at Slack Point. Previous intrusive investigations indicated that the coal fill at Slack Point extends to depths ranging from 8.5 m to 10 m bgs in the most southwest portion of Slack Point, and to 14.5 m to 15.5 m below surface in the remainder of the Site (Golder, 2005).

Previous environmental investigations have indicated that LEPH/HEPH and PAHs were present in soil samples at concentrations greater than the CSR RL/PL standards throughout the Site. Elevated concentrations of sulphur are present in the in the coal fill. Groundwater samples did not contain metals and/or hydrocarbon concentrations greater than the CSR AW standards; however, EPH10-19 was detected in groundwater at

MW05-07 (Golder, 2005) and elevated concentrations of dissolved calcium, iron, manganese, magnesium, sulphur and sodium were detected at several of the monitoring wells.

Because soil contamination above the CSR standards was identified in the coal fill layers at Slack Point, this area has been retained as an AEC.

3.6.1.2 AEC 2 - Surface Fill from non-coal sources at Slack Point

Approximately 50 years of logging activities were conducted on the Site, and it suspected that significant amounts of debris and wood waste may have accumulated or were deposited on the surface of the Slack Point, overlying the coal fill. Previous intrusive investigations conducted at the Site indicated the presence of significant quantities of wood waste and other surface fill materials, and debris in the upper 3.5 m of soil at some locations. The Golder 2005 report indicated that the concentrations of hydrocarbons (LEPH, HEPH) and metals were detected at concentrations greater than CSR RL/PL standards, and concentrations of zinc were greater than the CSR CL/IL standard in some locations.

Soil contamination above the CSR CL/IL and RL/PL standards was identified in the surficial soil layers at Slack Point; therefore, this area has been retained as an AEC.

3.6.1.3 APEC 3 – Former Woodwaste and Dredgate Stockpile

A large stockpile (estimated volume of 4,200 m^3) was present in the central portion of Slack Point, adjacent to (northwest of) the former railroad track, between approximately 1984 and 1994. This stockpile was reported to be composed of wood waste and dredged materials left by the logging industry. The stockpile was observed on historical air photos taken between 1984 and 1993, but it was not observed during the Site reconnaissance. Soil chemical analysis of surface fill samples collected during the Golder 2005 intrusive investigation had similar characteristics through-out Slack Point, and did not indicate that surface materials in this area were impacted directly by the former wood waste and dredgate stockpile; however, the final disposition of the stockpile materials was not identified, and there is a possibility that the materials were spread through-out Slack Point; therefore, APEC 3 has been combined with AEC 2 – Surface Fill, which is retained as an AEC.

3.6.1.4 APEC 4 – Former Boat Repair Shop on Slack Point

The boat yard facility on Slack Point was established in approximately 1935 by Comox Logging and Railway Company, and was where wooden and steel vessels were built (D&M, 1990). In the 1970s, the facility was used as a boat repair and service shop until it burned down in 1987. The debris was removed in 1992 (EBA, 1994). During the Site reconnaissance, the area of the former boat yard/repair facility was covered by grass. A wooden pile, metal rebar and piping were observed in a small inlet in the vicinity of the former boat repair facility.

Activities at the former boat repair shop are inferred to have included boat repairs, fuelling, and maintenance of boats or other machinery. No observations of impacts from the former boat repair activities were observed during previous investigations. During the 2005 Golder investigation, elevated concentrations of petroleum hydrocarbons were found in the miscellaneous fill materials, which did not appear to be related specifically to potential activities at the boat repair shop. Rather, the contamination was generally consistent with the contamination found in the surficial soils through-out Slack Point; therefore, this area was not retained as an AEC.

3.6.1.5 APEC 5 - Buried Refuse and Possible Abandoned Landfill

A small landfill, associated with the former logging operations, was suspected to be present on Slack Point at the time of Hardy BBT's investigations in 1999. Soil samples collected by Hardy BBT from shallow test pits excavated in this area contained concentrations of arsenic and copper in soil exceeding the CSR CL/IL standards, and concentrations of chromium, zinc and nickel exceeding the CSR RL/PL standards.

Samples collected from this area in 2005 during Golder's investigation indicated concentrations of HEPH, antimony, arsenic, barium, cadmium, chromium, copper, lead and zinc were above the CSR CL/IL standards, and concentrations of LEPH molybdenum, nickel, and tin above the CSR RL/PL standards. Concentrations of PCOCs in groundwater above the CSR AW standards were not observed.

Concentrations of contaminants were unique relative to other Site locations, in the area suspected to contain buried metal debris and refuse; therefore, this area been retained as AEC 5.

3.6.1.6 APEC 6 Stockpiles of Imported Sand and Gravel

Imported stockpiles of sand and gravel were observed during the Site visits conducted by Golder in 2005. Approximately 500 m^3 of imported material (of unknown quality) was observed to have been stockpiled on-Site. Results of stockpile sampling by Golder in 2005 indicated that the materials met the CSR PL and RL standards. Therefore, this area was not retained as an APEC.

3.6.1.7 APEC 7 Former Buildings Associated with Logging Activities.

According to EBA, 1994, extensive clean-up activities took place in 1992 at Slack Point and other lease areas, and included the removal of "piles, dolphins, wharfs and piers, floats, boom shacks, buildings, equipment, cable, burned boat-repair ways, miscellaneous dumped garbage, and other scattered debris." No further documentation regarding the removal of buildings associated with the logging activities was identified. The buildings generally occupied the northern portion of Slack Point. Analytical results indicated that metal and hydrocarbon concentrations of surface materials in this area had similar characteristics to APEC 2 (Surface Fill from non-coal sources at Slack Point) and do not specifically indicate that surface materials in this location were impacted by former buildings. Therefore, APEC 7 has not been retained as an APEC or AEC.

3.6.2 Uplands

3.6.2.1 3.6.2.1 APEC 8 Fill Material in the Uplands

The Uplands areas have been the site of historical industrial activities for many years during which time fill of variable thickness and composition has been placed. The fill materials generally consisted of silt, sand and gravel, cobbles and boulders. In addition, organic material (roots and woody debris), isolated coal waste, and anthropogenic materials including concrete and metal, were encountered in the fill layers. The thickness of the fill ranged from approximately 0.1 m to 3.4 m bgs and, on average, extends to about 1.3 m bgs.

Several boreholes, monitoring wells and test pits have been advanced in the Uplands during previous investigations, and results have indicated elevated concentrations of petroleum hydrocarbons in some locations. In particular, further investigation is considered necessary in the Town staging area (near the former campsite area) and at the foreshore to define the extent of contamination; therefore, APEC 8 is retained as an AEC.

3.6.2.2 APEC 9 Former Scale Pit and Possible PCB Storage

During coal handling activities, a scale pit was constructed south of Slack Point, approximately at the intersection of Oyster Bay Rd and Transfer Beach Boulevard. The scales were used to weigh railcars containing coal before transfer. The Site representatives indicated that the scales were removed and the area infilled (quality of soil unknown), and a road was built on the former location. This area was also speculated to have stored PCBs (Levelton, 2000). One soil sample was taken previously at TP13 (Levelton, 2000) at 1 m bgs (above the water table) in this area, and was found to meet applicable standards at the time for the parameters tested. However, soil quality at and below the water table is unknown and the exact location of the former scale pit is unclear; therefore, APEC 9 is retained.

3.6.2.3 AEC 10 Former Pump Islands, Former ASTs, Pump House, and PCB Storage

A former pump island and possible associated ASTs containing bunker fuel, gasoline and/or diesel fuel (D&M, 1990a) were historically located approximately 100 m southeast of the main repair building (on Lot 1). Historical data was inconclusive, but suggested that storage of PCBs may also have taken place in this area. Ethylbenzene and toluene concentrations in soil above CSR RL/PL standards, and total xylenes concentrations in soil above CSR CL/IL standards, were measured at CTP 1 (a 1.55 m bgs) (Hardy BBT, 1999). The test pit did not encounter groundwater and the maximum depth of soil contamination is unknown. Further groundwater investigation and delineation is required at AEC 10.

3.6.2.4 APEC 11 Historic Fuel Pipelines from Uplands to the Harbour

Historic fuelling operations occurred on the Uplands portion of the Site (in AEC 10), where fuels from above-ground tanks were used to fuel trains and boats. According to D&M, during their 1990 investigation boats at the shore were fuelled by a gravity-fed pipeline. A leak was detected from one of the pipes from the upper ASTs (timelines was not discussed); the soil around a lower track ballast was removed, the area was replaced with clean fill, and the leaking pipe replaced. The exact location of the spill was not reported and it was unclear if the pipelines were over or underground. The fuel lines may have historically run through Lot 5 (not investigated). The historic spill and the potential impacts on the soil and groundwater have not yet been investigated; therefore, this area has been retained and incorporated with AEC 10.

3.6.2.5 AEC 12 Former Maintenance Area and Current Boat Repair and Construction Operations

During historic logging operations, the former railcar and engine maintenance area (rail yard) contained several sub-areas for train and truck repair, including: the main repair shop, car shop and roundhouse. The shops historically used underground pits for maintenance. The current operations in the area include kayak manufacturing, boat construction and repair; specialty wood product construction occurs in the main repair shop and roundhouse. A chemical storage area containing drums of polyester composites, resins and acetone were present between the buildings. Staining was observed on the floors of the buildings and in the outside general storage area.

Historical investigations in this area indicated that:

- Soil at 3 m bgs in TP6 (Levelton, 2002) exceeded the CSR PL/RL and CL/IL standards for metals; however, the maximum depth and aerial extent of metals contamination at TP6 was not delineated;
- LEPH concentrations in soil above CSR CL/IL standards were measured at BH00-08 (0.2 m) and at TP4 (2.0 m and 4.0 m) (Levelton, 2002). The maximum depth of contamination was not assessed, and the aerial extent of the contamination to the west was not fully delineated; and,
- Groundwater at MW00-09 and MW00-06 (Levelton, 2002) contained detectable concentrations of EPH 10-19.

As such, further groundwater and soil investigation and delineation is considered necessary at AEC 12.

3.6.2.6 AEC 13 Former Waste Oil Storage Area and Compressor Storage Area

Previous reports indicated that the former waste oil area was located on the southeast side of the main repair shop (currently used as a waste bin storage area). In addition, Site representatives indicated that this area formerly comprised a large compressor that was prone to leaks. LEPH concentrations in a soil sample from this area were greater than the CSR PL/RL standard at BH00 03 at 0.2 m bgs (Levelton, 2002). Although a deeper sample at 0.5 m bgs was collected and found to be below CSR PL/RL standards, the hydrocarbon contamination in soil was not delineated laterally, or sampled at the water table. In addition, EPH10-19 concentrations in water greater than CSR AW standard were measured at nearby monitoring well MW00-02 (Levelton, 2002). The extent of hydrocarbon contamination in groundwater has not been delineated and, therefore, this area has been retained as AEC 13.

3.6.2.7 APEC 14 Former Location of Oil Drum, Scrap Metal Storage, and Stockpiles of Unknown Quality

An oil drum and scrap metal storage area was identified by Hardy BBT in 1990 (Hardy BBT, 1990b). Two test pits were advanced in this area and analysed for metals (at depths of 0.7 m and 2.5 m bgs). Metal concentrations were below the CSR criteria. Levelton (2000) indicated that the same area comprised stockpiles of unknown quality of fill. Oil drums, scrap metal and stockpiles were not observed during the 2009 Site reconnaissance.

Test pits previously advanced in the area did not indicate contamination; however, groundwater was not analysed. Therefore, this area was retained as APEC 14.

3.6.2.8 APEC 15 – Former Cable Splicing Shed

The former cable splicing shed has been used for wood and galvanized steel siding construction, wood manufacturing, explosives storage, storage of street lights and as a cable splicing area. It is currently being used for painting and staining wooden cabinetry.

Two testpits (CTP 8 and TP2) indicated that metals and hydrocarbon concentrations in soil were below CSR standards for PL/RL; however, the test pits did not penetrate down to the water table, therefore soil quality at the water table and groundwater quality were not assessed. The Former Cable Splicing Shed has been retained as APEC 15.

3.6.2.9 APEC 16 Suspected UST Adjacent the Washroom Building

Hardy BBT (1999) indicated that a 500-gallon (approximately 1,900 L) underground storage tank (UST) was located in the vicinity of the washroom building that was thought to have been installed in the mid 1960s and thought to have contained both heating oil and diesel fuel. Levelton used ground penetrating radar to locate an abandoned UST near the washroom building in 2000. Detections of EPH 10 to 19 were found in groundwater at monitoring wells MW00-09 and MW00-06 installed in the vicinity of the sewage pump out facility during the Levelton 2002 investigation.

The current investigation suggests that the UST is used as a sewage pump-out facility connected to the Town of Ladysmith's municipal sewage system. Therefore, the former UST is no longer considered an APEC. However, the area remains an APEC, owing to the detection of contamination in this vicinity and will be incorporated into AEC 12 for further investigation.

3.6.3 Filled Foreshore

3.6.3.1 APEC 17 – Fill Material at Block B and D of DL 2016 (former Location of the Shingle Mill)

Blocks B and D of DL 2016 were created by infilling the water lot in the area previously occupied by the shingle mill wharf. Based on the aerial photograph review, filling of this area appeared to take place between 1962 and 1988. No previous investigations are known to have occurred at Blocks B and D. The Site representatives indicated that the area has been used as a parking facility for its entire history. The fill used for this area has not been evaluated and it is therefore retained as an APEC.

3.6.3.2 APEC 18 – Small Saw Mill

The investigation by Phoenix in 1999 indicated that a small sawmill was located in the northwest corner of the Site near Block B and D of DL 2016, adjacent to the government wharf (there has been no other reference to or evidence of a sawmill at this location). Golder infers this area to be the location of the former shingle mill. Because there is potential for fill quality issues that are associated with the shingle mill, APEC 18 has been incorporated with APEC 17.

3.6.3.3 AEC 19 – Former Log Dump (Lot 17G)

The former log dump on Lot 17G was established in the 1930s and used to transport logs from railcars to the Harbour for bundling and shipping. The area is an extension of the natural foreshore and therefore contains fill materials of unknown quality. The log dump was reported to have been removed in 1992 (EBA, 1994).

MOG concentrations, inferred to be above CSR CL/IL standards for LEPH, were measured at EBA's Test Pit 11 in 1994 (16,000 µg/g relative to 2,000 µg/g). MOG concentrations, inferred to be above the CSR RL/PL for LEPH, were also measured at EBA test pit 14, although concentrations (1,100 mg/kg), if equivalent to LEPH, were only slightly above the LEPH standard (1,000 µg/g). The maximum depth of soil contamination in this area was not assessed and the aerial extent to the northeast and southwest was not delineated. The Log Dump has been retained as AEC 18.

3.6.3.4 APEC 20 – Former Location of ASTs at the Foreshore

Previous reports have indicated that three diesel ASTs were installed in 1981 in the location of the current Ladysmith Maritime Society parking facility near the marina, adjacent to the shoreline. It is reported that the tanks were contained within a concrete bunker. The area is currently paved with asphalt; there was no evidence of the tanks or concrete bunker during the investigation, and site representatives were not aware of the location of the ASTs.

Test pits were advanced in this area during the EBA and Levelton investigations (1994 and 2002). Soil did not exceed the CSR standards; however, the test pits did not encounter the water table. As the soil quality at the water table and groundwater quality were not assessed, this area has been retained as an APEC.

3.6.4 Sediments

3.6.4.1 AEC 21 – Foreshore Sediments – Quality of Sediment, Marina Activities, Sewage Outfall and Pressure Treated Piles.

Sediments in Ladysmith Harbour have been affected by the various activities at the Site. Previous reports indicated that concentrations of numerous PAHs in sediments are above the CSR SedQCTS and above the ODLs (Phoenix, 2002). The reports also indicated concentrations of cadmium above the ODLs in numerous locations (Phoenix, 1999; Phoenix, 2002; G3, 2005) and concentrations of other metals (copper or lead) above CSR SedQCTS in two locations (G3, 2005; Levelton, 2000). Concentrations above the ODLs are not indicative of sediment contamination under the CSR; however, they represent a limitation of disposal options for development plans that include dredging.

Sediment impacts at the Site could be attributed to past coal transhipment, smelter operations, log handling activities, pressure-treated or copper-covered piles, sewage disposal, and small boat moorage uses.

The extent of the PAH-contaminated sediments has not been defined and, based on a review of the data; PAH, impacts may extend beyond the limits of the Site area. The PAH constituents identified at the Site appear to be associated with the coal waste filling that has occurred on Slack Point. In addition to the large amount of sediments surrounding Slack Point that contain coal waste, the extent of woodwaste present in the sediments is also unknown. It is estimated that, generally, a thickness of 2 metres of sediments may contain concentrations exceeding the ODLs, based on the core samples collected by G3 (2005).

The spatial distributions of metal concentrations generally indicated higher concentrations of metals in the vicinity of the DL 651 area. The spatial distributions of PAHs in this study were not restricted to any particular area, with concentrations exceeding the sediment numerical criteria distributed over the entire study area.

The Phoenix 2002 report suggested that a sanitary sewer line was formerly located southeast of the Ladysmith Maritime Society marina in the vicinity of the former Log Dump at Lot 17G. Dames and Moore (1990) suggested that the sanitary pipe extended to the inner harbour area through a short outfall immediately north of the Government Wharf (off-Site). The reports inferred that biological solids and a wide range of more persistent contaminants may have been dispersed around the outfall from past disposal into sanitary sewers.

This area has been retained AEC 21. An investigation of Site sediments has been reported under separate cover.

3.6.5 Off-Site

3.6.5.1 APEC 22 – Off-Site Service Stations at 435 and 728 Esplanade

Two off-Site gas stations including a Petro Canada at 435 Esplanade Avenue and a Shell Service Station at 728 Esplanade Avenue are located approximately 50 m southwest of the Site and are considered to be hydraulically upgradient of the Site. An attempt to sample groundwater downgradient of the service station was conducted by Levelton in 2000 (MW00-11 and TP3). However, groundwater quality down-gradient of gas stations was not evaluated because of shallow bedrock present in the areas investigated. Further groundwater investigation is considered necessary; therefore, the off-Site gas stations have been retained as APEC 22.

3.6.5.2 APEC 23 – Copper Smelter

The Tyee Copper Smelter located northwest of the Site, was built in 1902 and closed in 1911. Ore was brought to the roast yards (located west of the Smelter at the top of the slope). The ore was piled and left to burn for up to four weeks, to burn off sulphur and other impurities, and then brought to the smelter where the gold and silver were extracted. The ore was then further refined to concentrate copper (Soroka, 2004). The operation produced a substantial amount of waste material (slag). EBA (1994) indicated that smelter slag may have been used as (deep) fill material at Slack Point. There is potential that smelter wastes were used to infill Slack Point and/or Blocks B and D, of DL 2016; however, due to the cross gradient location of the smelter to the Site, it is considered unlikely that the land portions of the Site have been impacted from the smelter operations.

There remains the potential that waste from smelter operations was placed as fill at the Site, and there is potential for contamination via water transport, should the actual local groundwater flow direction differ from the inferred direction (*i.e.*, towards Ladysmith Harbour), or if contaminated water was re-directed via drainage ditches *etc.* Consequently, the copper smelter has been retained as APEC 23.

3.6.5.3 APEC 24 – Burleith Log Sort Facility

An environmental assessment was performed at the Burleith log sort facility located north of the Site (across Ladysmith Harbour). A thick layer of wood debris was observed in the intertidal and subtidal regions of the area. It is likely that the activities at the Site and those at the Burleith Log sort would have similar adverse affects to the sediments, and it would be difficult to specifically indicate that the Site was impacted by the off-Site log sort. Due to the distance from the Site and the hydraulic separation due to Ladysmith Harbour, the Burleith Log Sort Facility would not likely have affected the Site, and is no longer considered an APEC.

3.6.5.4 APEC 25 – Iron Foundry

In 1990, D&M reported that an iron foundry had been established in the port by 1899. There has been no further reference to an iron foundry in the documents reviewed during this PSI. It is possible that an Iron foundry did exist in the port area; however, likely not at the Site. Reference to a foundry located in the vicinity of the copper smelter (to the northwest of the Site) was observed on a 1902 Town of Ladysmith map (Appendix I). It is possible that slag resulting from the foundry and smelter was used as fill at the Site; therefore, APEC 25 has been incorporated into APEC 17 (fill associated with Blocks B and D of DL 2016).

3.7 Conclusions of Stage 1 PSI

Based on the results of this Stage 1 PSI, a total of eight AECs and nine APECs are retained for further investigation. The AECs and APECs are summarised in Table 10 below, which also lists the PCOCs associated with each area.

Table 10: Summary of APECs and AECs Retained for Further Investigation

Area		PCOCs
Slack Point		
AEC1	Coal Fill at Slack Point.	Soil: LEPH/HEPH, PAH, metals, sulphur Groundwater: LEPH/HEPH, PAH, metals Soil Vapour: naphthalene and VPHv
AEC 2 and 3	Surficial Fill from Non-Coal Sources at Slack Point.	Soil: BTEX, VPH, LEPH/HEPH, PAH, Chlorinated Phenols, metals Groundwater: BTEX, VPH, LEPH/HEPH, PAH, Chlorinated Phenols, metals Soil Vapour: BTEX, VPH, naphthalene.
AEC 5	Buried Refuse and Possible Abandoned Landfill.	Soil: BTEX, VPH, LEPH/HEPH, PAHs Sulphur, Chlorinated Phenols Groundwater: BTEX, VPH, LEPH/HEPH, PAH Soil Vapour: BTEX, VPH, naphthalene
Uplands		
APEC 8	Fill Material in the Uplands.	Soil: LEPH/HEPH, PAH, and metals Groundwater: LEPH/HEPH, PAH, and metals Soil vapour: BTEX, VPH, naphthalene
APEC 9	Former Scale Pit and Possible PCB Storage.	Soil: LEPH/HEPH, PAH, metals and PCB Groundwater: LEPH/HEPH, PAH, PCB
AEC 10 and APEC 11	Former Pump Islands, ASTs and Possible PCB Storage and Historic Fuel Pipelines from Uplands to the Harbour.	Soil: BTEX, LEPH/HEPH, PAH, VOCs, metals and PCBs Groundwater: BTEX, LEPH/HEPH, PAH, VOCs and metals Soil Vapour: VPHv, BTEX, naphthalene
AEC 12	Former Maintenance Area and Current Boat Repair and Construction Operations.	Soil: BTEX, LEPH/HEPH, PAH, VOCs and metals Groundwater: BTEX, LEPH/HEPH, PAH, VOCs and metals Soil Vapour: BTEX, naphthalene, VPHv, VOC
AEC 13	Former Waste Oil Storage Area and Compressor Storage Area.	Soil: BTEX, VPH, LEPH/HEPH, PAH, and metals Groundwater: BTEX, VPH, LEPH/HEPH, PAH, metals and PCBs Soil Vapour: BTEX, naphthalene, VPHv
APEC 14	Former Location of Oil Drum, Scrap Metal Storage, and Stockpiles of Unknown Quality.	Soil: BTEX, LEPH/HEPH, PAH, and metals Groundwater: BTEX, LEPH/HEPH, PAH, metals
APEC 15	Former Cable Splicing Shed.	Soil: BTEX, LEPH/HEPH, PAH, VOCs and metals Groundwater: BTEX, LEPH/HEPH, PAH, VOCs and metals Soil Vapour: BTEX, Naphthalene, VPHv

Filled Foreshore		
APEC 17 and 18	Fill Material at Block B and D of DL 2016 (former Location of the Shingle Mill).	Soil: LEPH/HEPH, PAH, and metals Groundwater: LEPH/HEPH, PAH, metals Soil Vapour: VPHv, BTEX, naphthalene
AEC 19	Former Log Dump (Lot 17G).	Soil: BTEX, LEPH/HEPH, PAH, and metals Groundwater: BTEX, LEPH/HEPH, PAH, metals
APEC 20	Former Location of ASTs at the Foreshore.	Soil: BTEX, LEPH/HEPH, PAH, and metals Groundwater: LEPH/HEPH/PAH, BTEX/VPH, and metals Soil Vapour: VPHv, BTEX, naphthalene
Sediments		
AEC 21	Foreshore Sediments – Quality of Sediment, Marina Activities, Sewage Outfall and Pressure Treated Piles.	Sediments: metals, PAH, LEPH/HEPH
Off-Site		
APEC 22	Off-Site Service Stations at 435 and 728 Esplanade.	Groundwater: BTEX, MTBE, LEPH/HEPH, PAH, metals
APEC 23	Tyee Copper Smelter.	Groundwater: LEPH/HEPH, PAH, metals Soil: LEPH/HEPH, PAH, and metals

Notes: BTEX/VPH= benzene, toluene, ethylbenzene, xylene and volatile petroleum hydrocarbons. MTBE = methyl tert butyl ether. LEPH = light extractable petroleum hydrocarbons; PAH = polycyclic aromatic hydrocarbons; HEPH = heavy extractable petroleum hydrocarbons;

3.8 Housekeeping issues

There were several reported leaks from the sewage system located on the Uplands portion of the Site. Site representatives complained about odours from the ground.

4.0 DETAILED SITE INVESTIGATION

The objectives of the DSI were to provide additional characterization of the soil, soil vapour and groundwater quality at the Areas of Potential Environmental Concern (APEC) and Areas of Environmental Concern (AEC) identified during the Stage 1 PSI, and to characterize and delineate the extent of contamination, if present, at the Site. The results of the DSI were intended to provide supporting information to: a) conduct a risk assessment that would encompass Ladysmith Harbour and surrounding areas (if applicable); and b) develop a remediation plan.

4.1 Scope of Work

The scope of work of the DSI consisted of the application of several investigative techniques including test pitting, borehole drilling, groundwater monitoring well installation, and soil and groundwater sampling at the identified APECs. With the exception of the proposed soil vapour sampling, the following specific tasks, as outlined in our proposal, were conducted:

- Preparation of a health and safety program to identify and address potential hazards associated with the scope of work and Site-specific issues;
- Excavation and sampling of 20 test pits;
- Drilling and sampling of 18 boreholes, with monitoring wells installed in boreholes at 14 locations;
- Collection of representative soil and groundwater samples;
- Completion of a vertical and horizontal elevation survey of each of the sampling locations; and,
- Development and completion of a quality assurance and quality control (QA/QC) program.

The DSI was conducted between November, 2009 and February 2011. Historical data from previous investigations were incorporated into the DSI and have been used to supplement the soil and groundwater data set for the Site. The data from November 2009 was reviewed and the results were used to develop the sampling program conducted in February 2011 for the purpose of delineating some of the identified areas of contamination. Section 4.1.1 discusses soil vapour and the rationale for excluding soil vapour sampling from the DSI program.

The investigation locations were targeted to the APECs and AECs identified in the Stage 1 PSI. They were selected to assess soil and groundwater quality, and to better characterize the fill materials. Sample depths were selected to provide representative coverage of the different soil conditions and stratigraphy encountered beneath each APEC and AEC.

A summary of the investigation locations and associated targeted APECs is presented below in Table 11, APEC and AEC locations are shown in Figure 10, and investigation locations are shown in plan on Figure 6.

Table 11: Investigation Sampling Locations and Rationale

AEC or APEC[10]	Investigation Sampling Location[11]	Rationale
AEC 1 - Coal Fill, AEC 2 - Surface Fill and AEC 5 - Buried Refuse (Slack Point).	MW05-02, MW05-04, MW05-08, MW05-09, MW05-12, MW05-17, MW05-20, MW05-22	During this investigation, previously installed monitoring wells which were accessible on Slack Point were re-sampled to evaluate general groundwater quality associated with the APEC/AECs. It was noted during the field program that several of the previously installed wells has been destroyed.
APEC 8 – Fill Material in Uplands.	TP09-01, TP09-04, TP09-05 TP09-07, TP09-08, TP09-09, TP09-10, TP09-11 and TP09-12, TP11-04, TP11-05, MW09-10, MW09-11, KE SA1, KE SA2, KE SA4, SA5/6/7 (near TP8)	Selected (soil) samples of fill were collected and submitted for analysis. In addition, the town staging area had not been previously investigated for general fill quality. Test pits TP09-10, TP09-11 and TP09-12 were specifically advanced to assess soil quality in the staging area. Monitoring wells located in the upland area as part of investigation of APEC 9, AEC 10, AEC 12, AEC 13, APEC 14, APEC 15, AEC 19 and APEC 22, were also utilized to assess groundwater quality associated with potential fill materials.
APEC 9 - Former scale pit and possible PCB storage.	MW09-06 and TP09-09	Monitoring well (MW09-06) and test pit (TP09-06) were placed in the vicinity of the former scale pit and near a possible PCB storage area to assess the soil and groundwater quality.
AEC 10 and APEC 11- Former fuel pump islands, ASTs and possible PCB Storage and Historic Fuel Pipelines from Uplands to the Harbour.	MW09-01, MW09-03, MW09-08, BH09-14, TP09-01, TP09-02, TP09-03, TP09-04, TP09-07 and TP09-08 and nearTP-8-SA5, ; TP11-01, TP11-2, TP11-03, TP11-04 near TP-8-SA6, and nearTP-8-SA7	Monitoring well MW09-01 was installed downgradient of CTP1 to assess soil and groundwater quality. In addition, soil quality in this area was assessed at TP09-01 through TP09-04 and three surface soil samples (near TP8: SA5, SA6, and SA7). Because this area was also speculated to have stored PCBs (Levelton, 2000), soil quality related to possible PCBs was assessed by two additional test pits (TP09-07 and TP09-08). TP11-1 through TP11-04 were advanced to delineate VPH contamination in soil found at TP09-03.
AEC 12 - Former Maintenance Area and Current Boat Repair and Construction Operations.	MW09-09 and MW09-10, MW09-11, TP09-05, TP09-06, KE-SA1, KE-SA2, KE-SA3, KE-SA4, MW00-09, MW00-04; TP11-05, TP11-06, TP11-07, TP11-08 and MW11-02	MW09-09 was installed in the vicinity of the chemical storage area to assess groundwater conditions to the east of AEC 12. MW11-02 was installed to assess the groundwater quality downgradient of the AEC. Test Pits TP09-05 and TP09-06 were also advanced in this area to confirm the general quality of soil and to delineate the extent of hydrocarbon contamination found at TP4 and BH00-08. TP11-05 through TP11-08 were advanced to delineate contamination identified at TP09-05 and TP09-06.

[10] AEC = Area of Environmental Concern; APEC - Area of Potential Environmental Concern

[11] MW – monitoring well; TP – test pit; BH – borehole; KE - ; SA – surficial soil sample

AEC or APEC[10]	Investigation Sampling Location[11]	Rationale
AEC 13 - Former Waste Oil Storage Area and Compressor Storage Area.	MW09-03, MW00-02, MW11-02	Monitoring well (MW09-03) was installed downgradient of MW00-02 to assess and delineate groundwater quality. MW11-02 was installed at depth, near MW09-03, to assess potential for hydrocarbon plume to be in the bedrock, and to evaluate the potential for a connection to contamination identified at AEC 19, the former log dump.
APEC 14 – Former Location of Oil Drum, Scrap Metal Storage, and Stockpiles of Unknown Quality.	MW00-11, MW09-04	Monitoring well MW09-04 was installed in the area of APEC 14, where accessible, owing to underground utilities to assess for groundwater quality near APEC 14. Additionally, MW00-11, located downgradient, was sampled to assess for the potential impact to groundwater quality.
APEC 15 - Former Cable Splicing Shed.	MW09-05	MW09-05 was installed downgradient of the splicing shed to assess soil and groundwater quality.
APEC 17 – Fill Material at Block B and D of DL 2016 (former Location of the Shingle Mill), APEC 18 – Small Saw Mill (combined with APEC 17), APEC 23 – Tyee Copper Smelter, and APEC 25 – Iron Foundry (combined with APEC 17).	MW09-16	One monitoring well installed in this filled area to assess soil and groundwater quality.
AEC 19 - Former Log Dump (Lot 17G).	MW09-07, MW09-08, MW00-02, MW11-01, MW11-02, BH09-12 through BH09-15 and sediment samples	One monitoring well, MW09-07, was installed downgradient of the test pits to determine soil and groundwater quality in the area. Several step-out locations were completed to delineate the observed contamination to the northwest. MW00-02 was installed upgradient, and at depth within the bedrock, to evaluate the potential for contamination observed in the former log dump area to be connected to the former maintenance area (AEC 12). Sediment samples were collected along the intertidal and subtidal areas adjacent to the log dump area to assess the potential for contamination observed at the former log dump area to have migrated into Ladysmith Harbour. Based on observations during the sampling, no sediment samples were submitted for analysis.

AEC or APEC[10]	Investigation Sampling Location[11]	Rationale
APEC 20 - Former ASTs at foreshore.	BH09-13, BH09-15	Monitoring well MW09-08 was installed at the southern end of the Ladysmith Marine Society Parking area adjacent to the suspected location of the former ASTs. Contamination was observed in MW09-08; therefore, step-out boreholes BH09-12 through BH09-15 were drilled to delineate the contamination. Contamination appeared to be consistent with that observed near the log dump.
APEC 21 – Foreshore sediments.	Reported under separate cover	
APEC 22 – Off-Site service stations.	MW09-04, MW09-02, MW00-02	MW09-04 and MW09-02 were installed to assess groundwater downgradient of the offsite service stations.
APEC 23 – Former Tyee Copper Smelter.	MW09-16	MW09-14 was installed in an area that may have received smelter wastes as fill, and the well was installed to determine soil and groundwater quality.

4.1.1 Revisions to Proposed Scope of Work

Soil vapour sampling is typically conducted during DSI activities when volatile substances are identified as potential contaminants of concern, or when these substances are detected in soil or groundwater. In the original scope of work, soil vapour sampling activities were outlined as a task, with the recommendation that sampling locations would be identified following review of the initial soil and groundwater sampling results. The soil and groundwater sampling program identified several localized areas at depth in the upland areas where petroleum hydrocarbon contamination was present. The near-surface contamination was often characterized by volatile (e.g., ethyl benzene, toluene, styrene, VPH) and/or semi-volatile (LEPH, naphthalene) constituents in soil that were expected to have associated vapour concentrations potentially above applicable CSR standards. Given their accessibility, these areas would likely be remediated as part of any future Site development activities. However, in some locations where full excavation may not be practical, contamination would likely remain in place and a risk-management approach would likely be adopted. In either case, confirmatory soil and soil vapour sampling would be required following soil remediation, regardless of the concentrations that may currently exceed applicable standards. Consequently, soil vapour sampling was deferred during the DSI, with the recognition that a confirmatory soil vapour sampling program will be implemented at a future date.

4.2 Field Methodology

The following summarizes the field investigation methods used to obtain representative soil and water samples from the Site during the DSI.

4.2.1 Location Clearance

Prior to any ground disturbance, a utility locator was contracted to locate and mark utilities on the Site. The utility locates were completed using ground penetrating radar (GPR) to locate and then mark the utilities.

4.2.2 Borehole Drilling and Monitoring Well Installation

Sixteen boreholes (BH09-1 through BH09-16; Figure 6) were drilled between November 10 and 14, 2009 using a DB 320 mini-tracked Sonic drill rig owned and operated by MudBay Drilling Co. Ltd. Of the sixteen boreholes, 12 were completed as monitoring wells. Two additional wells (MW11-01 and MW11-02) were advanced on February 8 and 14, 2011. MW11-01 was advanced using an Odex Downhole Hammer drill (ODEX) and the MW11-02 was installed using a HQ-3 rock coring drill, both supplied and operated by Beck Drilling and Environmental Services. The boreholes were drilled to depths ranging from 2.0 m to 20.4 m bgs. Twelve boreholes were completed as monitoring wells while the remaining boreholes (were backfilled with soil cuttings and bentonite).

Soil sampling was conducted during the drilling program by collecting soil samples at regular depth intervals from soil cores encased in plastic sleeves (Sonic Rig) or collected from soils recovered from a split spoon sampler, which was advanced into undisturbed soils using a standard penetration test (SPT) hammer (ODEX).

Monitoring wells were constructed of washed and wrapped 51 mm diameter, flush threaded, Schedule 40 PVC casing with varying screen lengths between 0.9 m and 3 m long) #10 slot PVC screen (refer to borehole logs; Appendix X). The annular space around each well was backfilled with clean silica sand and the installation was sealed above the sand pack with bentonite to prevent the sand pack from acting as a vertical pathway for the potential downward migration of surficial contamination sources. The monitoring wells were completed at the ground surface using a mounted well cover placed in concrete, with the exception of MW09-01 and MW09-04 which were completed with a stick-up monument.

Details of soil conditions encountered during drilling and monitoring well construction are provided on the borehole logs provided in Appendix X. A summary of well completion depths is provided below in Table 12.

Table 12: Summary of Monitoring Well Locations

Well	Depth of Well (m below grade – approx.)	Screened Depth Interval (m)
MW09-01	4.3	2.8-4.3
MW09-02	1.9	1-1.9
MW09-03	4.4	2.9-4.4
MW09-04	6.4	4.3-6.4
MW09-05	7.5	6.0-7.5
MW09-06	5.1	3.6-5.1
MW09-07	4.3	2.8-4.3
MW09-08	5.4	2.4-5.4
MW09-09	1.9	0.8-1.9
MW09-10	2.7	1.2-2.7
MW09-11	1.9	0.7-1.9
MW09-16	5.5	2.5-5.5
MW11-01	4.3	2.8-4.3
MW11-02	20.0	18.5-20

4.2.3 Test Pit Excavation

During the field program, 20 test pits (TP09-01 through TP09-12 and TP11-01 through TP11-08 Figure 6) were excavated using a Bobcat 335 mini excavator supplied by Hazco Environment on December 15, 2009 and on February 9, 2011. Golder personnel monitored the excavation activities, logged and recorded soil conditions encountered, and noted any visual/olfactory evidence of potential contamination. At each location, soil samples were generally collected from each stratigraphic horizon for visual classification and measurement of its headspace organic vapour concentration. Samples were collected directly from walls of the test pit or from the excavator bucket dependant on depth of the test pit.

4.2.4 Soil Sampling Program

Soil sampling procedures were consistent with generally accepted industry standards and with the approaches described in *"Technical Guidance #1, Technical Guidance on Contaminated Sites – Site Characterization and Confirmation Testing."* For boreholes and test pits, the samples collected were discrete samples, which met the following criteria:

- Collected from similar *in situ* fill or soil at one location;
- Confined to a collection within a contiguous volume of one cubic metre;
- Collected over a maximum depth of 0.5 metres within the soil face;
- Not collected from two distinct fill or soil zones;
- Not collected on two sides of a saturated/unsaturated interface; and,
- Not made up of a mixture of obviously contaminated material and non-contaminated material as determined from field observations.

Field-screening of soil samples was completed using the dry headspace method, whereby sample jars were filled two-thirds full with soil, then sealed, shaken, and left to stand for several minutes. The headspace over the soil was then monitored for the presence of organic vapours using a Photovac 2020 photo-ionization detector ("PID") containing a 10.2 eV ultraviolet lamp calibrated to 100 parts per million ("ppm") isobutylene.

Soil samples for laboratory analysis were collected into pre-cleaned 125 ml glass soil sample jars supplied by the laboratory. Based on the history of the Site, field observations, and field screening results, selected soil samples were analyzed for the PCoCs including LEPH/HEPH, VPH, PAHs, VOCs, BTEX, PCBs and metals. Samples collected for hydrocarbon analysis were thumb-packed in 125 ml jars to minimize the release of volatile hydrocarbons in the soil. Sample jars were packed in cardboard boxes, placed in a cooler with a chain-of-custody form and several ice packs, and delivered to the laboratory via courier. Parameters were analyzed at the laboratory within their specified holding times.

Soil cuttings obtained during borehole advancement were collected in 200-Litre steel drums and stored in the waste storage area in the northeast portion of the Site. The drums were disposed of by Hazco Environmental at their provincially regulated disposal facility on January 8, 2010 and on March 29, 2011.

Analytical results of soils analysis are presented in Tables 13a, 13b, 13c and discussed in Section 4.3.4.

4.2.5 Groundwater Sampling Program

The depth to groundwater was measured at each monitoring well by lowering a water-level probe affixed to a graduated tape into the well. When the tip of the water level probe is submersed in water, an electrical circuit is completed and an alarm is triggered. The water level was recorded off of the graduated tape, and referenced to the previously surveyed well casing. Water levels were measured both prior to developing, and prior to sampling.

Monitoring wells were developed after installation to remove silt and drilling fluids from the well and to improve the hydraulic connection of the well with the surrounding soil.

As part of the sampling procedure, dedicated Waterra™ tubing and foot valves were used first to purge water from each well until field parameters (*i.e.,* pH, conductivity, temperature, redox and dissolved oxygen) had stabilized at each well, or until six well volumes of groundwater had been removed. Groundwater sampling immediately followed purging. With the exception of MW11-02, sampling was conducted using dedicated high density polyethylene (HDPE) tubing and a low-flow peristaltic pump (less than 0.200 litres per minute), to minimize agitation and contaminant volatilization during sampling. MW11-02 was sampled using a bailer.

Water obtained during well development, purging and groundwater sampling was collected in one 200-Litre steel drum and then stored in the waste storage area in the northeast portion of the Site. The drum was disposed of by Hazco Environmental at their provincially regulated disposal facility.

Groundwater samples from the monitoring wells were analysed for LEPH/HEPH, VPH, PAHs, VOCs, BTEX, chlorinated phenols, sulphide anions, alkalinity and/or dissolved metals.

Water samples scheduled for dissolved metals analysis were first field-filtered with a 0.45 μm in-line filter, collected in 250 ml plastic bottles, and then preserved with nitric acid. Water samples analyzed for BTEX, VPH and VOCs were collected in duplicate 40 ml glass vials with teflon-coated septas that contained a 10 percent sodium bisulphate preservative. Water samples analyzed for LEPHw, HEPHw and PAHs were collected in duplicate 500 ml amber glass bottles. Water samples analyzed for chlorinated phenols and sulphate were collected in a 1 Litre amber glass bottle and water samples collected for anions and alkalinity were collected in 1 litre plastic bottles.

The following Table 14 describes the parameters analysed at each APEC.

Table 14: Analysed Parameters in Groundwater

Well	Depth of Well (m below grade – approx.)	Screened Depth Interval (m below grade – approx.)
MW09-01	4.3	2.8-4.3
MW09-02	1.9	1-1.9
MW09-03	4.4	2.9-4.4
MW09-04	6.4	4.3-6.4
MW09-05	7.5	6.0-7.5
MW09-06	5.1	3.6-5.1
MW09-07	4.3	2.8-4.3
MW09-08	5.4	2.4-5.4

Well	Depth of Well (m below grade – approx.)	Screened Depth Interval (m below grade – approx.)
MW09-09	1.9	0.8-1.9
MW09-10	2.7	1.2-2.7
MW09-11	1.9	0.7-1.9
MW09-16	5.5	2.5-5.5
MW11-01	4.3	2.8-4.3
MW11-02	20.0	18.5-20

Monitoring well development and sampling sheets are provided in Appendix II. Analytical results of the groundwater analysis are presented in Table 15 on the next page and discussed in Section 4.3.5.

Table 15: Summary of Field Parameters, Groundwater Levels, and Observations in Groundwater

APEC Number	Location	Date	Water level (m btoc?)	Temperature (°C)	pH (pH units)	Electrical Conductivity (µS/cm)	Redox (mV)	Dissolved Oxygen	Observation
AEC 13	MW00-02	Nov.18/09	0.641	10.80	7.55	242	31.6	11.7%	Clear, colourless, no odour or sheen
APEC 22	MW00-04	Dec.10&11/09	0.906	8.69	6.66	230	-62.7	2.91 mg/L	Light brown, moderately turbid, no odour or sheen
APEC 12	MW00-09	Dec.10&11/09	0.882	9.21	6.33	96	144.2	4.41 mg/L	Slightly reddy-orange colour, turbid, no odour or sheen
AEC 13	MW00-11	Dec.10&11/09	3.152	10.40	7.33	386	18.7	2.67 mg/L	Reddy-orange colour, turbid, no odour or sheen
AEC 1 and 2 and APEC 3	MW05-2	Nov.24/09	2.757	9.40	7.04	531	-15.9	10.9%	Light rust-orange colour, turbid, no odour or sheen
AEC 1 and 2 and APEC 3	MW05-4	Nov.24/09	1.913	10.62	7.06	510	-34.0	9.4%	Light brown, turbid, no odour or sheen
AEC 1 and 2 and APEC 3	MW05-8	Nov.24/09	3.946	10.9	6.74	1054	-39.2	13.9%	Light brown, slightly turbid, no odour or sheen
AEC 1 and 2 and APEC 3	MW05-9	Nov.24/09	3.790	13.61	7.23	9547	17.3	18.6%	Light brown, slightly turbid, no odour or sheen
AEC 1 and 2 and APEC 3	MW05-12	Nov.24/09	4.480	12.61	6.60	1331	110.9	21.1%	Light orange, slightly turbid, no odour or sheen

APEC Number	Location	Date	Water level (m btoc?)	Temperature (°C)	pH (pH units)	Electrical Conductivity (µS/cm)	Redox (mV)	Dissolved Oxygen	Observation
AEC 1 and 2 and APEC 3	MW05-17	Nov.24/09	5.160	11.32	7.51	33734	-219.6	14.4%	Slightly grey coloured, slightly turbid, moderate sulphur like odour, no sheen
AEC 1 and 2 and APEC 3	MW05-20	Nov.24/09	5.270	9.40	8.40	900	-121.6	60.2%	Grey coloured, turbid, no odour or sheen
AEC 1 and 2 and APEC 3	MW05-22	Nov.24/09	3.406	11.12	6.59	1032	-61.6	9.6%	Rusty orange colour, turbid, no odour or sheen
AEC 10	MW09-01	Nov.18/09	2.794	10.29	7.97	301	-130.6	36.0%	Brown, slightly turbid, no odour or sheen
APEC 22	MW09-02	Nov.18/09	0.100	10.44	7.36	370	-80.0	23.6	Light grey, slightly turbid, no odour or sheen
AEC 13	MW09-03	Nov.18/09	1.336	10.44	7.69	390	-121.6	14.3%	Light grey slightly turbid, hydrocarbon like odour, slight sheen (disappearing after purging)
		Dec.10&11/09	1.402	11.70	7.31	355	-116.9	1.56 mg/L	Light grey, turbid, faint hydrocarbon like odour, slight sheen.
APEC 22	MW09-04	Nov.19/09	3.420	12.80	7.64	460	45.3	8.9%	Light brown, turbid, no odour or sheen
APEC 15	MW09-05	Nov.19/09	2.160	10.33	7.60	410	-50.4	11.0%	Grey, turbid, no odour or sheen

APEC Number	Location	Date	Water level (m btoc?)	Temperature (°C)	pH (pH units)	Electrical Conductivity (µS/cm)	Redox (mV)	Dissolved Oxygen	Observation
APEC 9	MW09-06	Nov.20/09	0.989	11.20	6.76	411	31.0	NA	Grey, silty, no odour or sheen
AEC 19	MW09-07	Nov.19&20/09	2.970	11.33	7.22	1420	13.0	8.91%	Brown, turbid, hydrocarbon like odour and slight sheen
		Feb.16/11	3.431 (low tide)	6.6	6.34	2960	-	-	Slight hydrocarbon odour, light tan, low turbidity
		Feb.22/11	3.294 (high tide)	6.2	6.49	4100	-	-	Moderate hydrocarbon-like odour, clear, colourless
AEC 19 and 20	MW09-08	Nov.19&20/09	2.969	9.66	6.92	14210	45.1	6.70%	Grey-brown, turbid, hydrocarbon like odour and thick sheen and product
		Feb.16/11	3.963 (low tide)	7.77	6.99	8360	-95.9	-	Slightly milky/turbid, slight hydrocarbon-like odour
		Feb.22/11	2.315 (high tide)	6.84	6.68	33274	64.0	-	Strong hydrocarbon-like odour, slight hydrocarbon like sheen
APEC 12	MW09-09	Nov.24/09	0.566	10.30	6.75	402	-54.8	7.87 mg/L	Brown slightly turbid, no odour or sheen
APEC 12	MW09-10	Nov.19/09	1.024	11.49	8.13	401	6.4	10.9%	Brown, slightly turbid, no odour or sheen

APEC Number	Location	Date	Water level (m btoc?)	Temperature (°C)	pH (pH units)	Electrical Conductivity (µS/cm)	Redox (mV)	Dissolved Oxygen	Observation
APEC 12	MW09-11	Nov.19/09	0.891	11.31	7.88	410	12.6	7.1%	Dark brown, turbid, slight hydrocarbon like odour, no sheen
APEC 17	MW09-16	Nov.20/09	1.906	10.51	7.62	347	24.7	10.7%	Light brown, slightly turbid, no odour or sheen
	MW11-1	Feb.16/11	3.623 (low tide)	6.6	7.69	23500	192.9	-	Dark brown, very turbid, getting slightly lighter brown at end of purge (low tide)
		Feb.22/11	3.110 (high tide)	5.1	6.76	41100	-	-	Light brown, minimal turbidity (high tide)
	MW11-2	Feb.16/11	8.355 (low tide)	10.2	8.05	402	158.7	-	Milky whitish (rock dust?), turbid water, slight to moderate hydrocarbon-like odour, slight to moderate hydrocarbon-like sheen (low tide)
		Feb.22/11	8.798 (high tide)	10.03	7.87	437	51.3	-	Foamy, strong hydrocarbon-like odour, slight to moderate (streaky) hydrocarbon-like sheen, light grey silt (rock dust) (high tide)

4.2.6 Laboratory Analysis

Cantest Analytical and Testing Laboratories of Burnaby, BC. (Cantest) performed chemical analyses for the soil and groundwater samples collected in 2009, and ALS Environmental Laboratories of Burnaby (ALS) performed the analysis the during 2011 investigation.

Cantest and ALS are both certified by Canadian Association for Laboratory Accreditation (CALA) for the analytical methods used for this program. Each batch of samples analyzed by the laboratory included the analysis of replicates, blanks and reference materials. All reports from the laboratories were internally reviewed prior to submission to Golder. If any internal QA/QC problems are encountered, the field samples and internal QA/QC samples are re-analyzed.

The results of the laboratory QA/QC analyses and a copy of the lab data quality objectives are provided with the analytical reports presented in Appendix XII.

4.2.7 Sample Handling and Shipping

Samples were collected by Golder personnel using clean disposable nitrile gloves and packed into laboratory-prepared and sealed sample jars or bottles. All containers were placed in a chilled cooler and submitted to either Cantest or ALS for analysis of PCOCs. As part of Golder's QA/QC program for this investigation, the sample submissions to the laboratories were accompanied by appropriately completed Chain-of-Custody forms (Appendix XIII). Field duplicate soil and groundwater samples were collected and submitted for laboratory analysis at a rate of approximately one duplicate for every ten samples submitted for analysis.

Samples were transported to the laboratory in chilled coolers with Chain-of-Custody forms via courier. Information pertaining to sampling location and the identity of duplicate samples was not provided to the laboratory to ensure that unbiased analytical procedures were observed and that the results of the duplicate analyses could be used to assess the quality of the laboratory analyses. The samples were received by the laboratory within 48 hours of sampling. Hydrocarbon analysis was conducted within seven days of sample receipt for all soil and groundwater samples. Soil metals analysis was conducted within the allowed 40-day holding period. Copies of the analytical reports and the corresponding Chain-of-Custody forms are presented in Appendix XII and XIII respectively.

4.2.8 Site Survey

The locations and elevations of the monitoring wells and the locations of the existing and newly installed boreholes were surveyed on December 10, 2009 and March 3, 2011 by McElhanney Associates Land Surveying Ltd. Included in the survey was the elevation of the top of each well pipe and grade elevations. The locations surveyed are illustrated on Figure 6 and a copy of the survey is provided in Appendix X.

During the 2011 test pit investigation, test pit locations were surveyed using a hand-held GPS device by Golder employees. The location of the testpits are illustrated on Figure 6.

4.2.9 Quality Assurance and Quality Control - Golder Quality Assurance Program

To ensure that the sampling and analytical data are interpretable, meaningful and reproducible, the following Golder QA/QC program was followed:

Standard industry field procedures were used throughout the field investigation to ensure that reproducibility would be achieved. The previously described field methods included the following:

All sampling techniques were performed according to Golder established written protocol;

1) The geographic locations of all samples collected were accurately reported so that sampling locations could be revisited, if necessary;

4) Field notes were recorded during all stages of the investigation, together with a photographic record;

5) Chain-of-Custody procedures were used for the shipment of samples to laboratories. All samples included in a shipment were identified on a Golder Chain-of-Custody form, with one copy retained by Golder personnel;

6) A system of sample identification using unique Golder Sample Control Numbers (SCN) was used. In general, only the SCN was used to communicate data with the laboratory. Samples were identified by SCN on Chain-of-Custody forms used for the delivery of samples from the field to the laboratory;

7) Approximately one duplicate sample was collected and analysed for every ten samples analyzed;

8) All samples were stored in coolers and chilled with ice prior to submission to the analytical laboratory;

9) The laboratory used has achieved proficiency certification by the Canadian Association for Laboratory Accreditation (“CALA”) for the analyses conducted; and,

10) The analytical laboratory incorporated and reported the results of internal checks to Golder. These were used to assess the reliability, accuracy and reproducibility of the data.

The results of the QA/QC comparison are discussed in Section 4.3.5.

4.3 Results

The DSI was conducted between November, 2009 and February 2011. The following sections provide the results from the DSI investigation. Section 4.4, Areas of Environmental Concern, provides the discussion of the results of the DSI as well as the historical data from previous investigations to summarize and present conclusions for each of the identified APEC and AECs at the Site.

4.3.1 Geology

The geology encountered during the investigation was in general accordance with the surficial geological summary outlined in Section 3.2.3 of this report. Geological cross sections illustrating the stratigraphy encountered in the boreholes and test pits across the Site are shown on Figure 11a and Figure 11b, respectively. Test pit and borehole logs are attached in Appendix X.

4.3.1.1 Slack Point

Based on historical information, it is understood that the foreshore of Ladysmith Harbour was extended by filling activities, and that the fill used to create Slack Point was primarily composed of coal waste, derived from the washing of coal mine and coal smelter wastes (Golder, 2005) overlain by a shallow layer of sandy fill material. The results of the historical investigation activities indicate that Slack Point is underlain by fill consisting of surficial mineral materials – sand, gravel, cobbles and possibly boulders – as well as, concrete, metal and woodwaste, overlying an extensive deposit of coal waste. Within the fill zone, there are also remnants of historical structures located on the site. These include timber piles and a concrete pad.

The coal waste at Slack Point was encountered underlying the surficial fill and also exposed at surface. The deposit comprises very loose to loose, moist to wet, black coal waste extending to depths of between 6.5 m to 16.6 m (elevation -3.3 to -12.7 m). The coal fill material generally consisted of loose to compact, black, gravel-, sand- and silt-sized particles of coal. Native sandy silt with shells and small cobbles was observed below the coal fill unit. Fill units of wood waste, approximately 0.5 m thick, were observed within the coal fill unit at 4 m below ground surface in MW05-17 and at 5.8 metres in MW05-19 (Golder, 2005; Golder 2011a).

The natural sediments underlying the fill consist of marine silts and sands, followed by a deposit of sands and gravels. The extent of the sand and gravel is not known fully; however, two of the geotechnical boreholes penetrated this layer and were terminated within either an underlying dense silt/sand layer (BH09-03) at a depth of about 26.5 m (elevation -24.6 m), or bedrock mudstone (BH09-04) at a depth of 12.2 m (elevation -8.9 m).

4.3.1.2 Uplands

The uplands are underlain by fill soils of variable thickness overlying native silt, sand and gravel overlying sedimentary bedrock. These units are described in greater detail below.

4.3.1.2.1 Fill Materials

Historical industrial activities took place on the uplands areas for many years. During these activities, fill soils of variable thickness and composition were placed throughout the area. The fill materials generally consisted of silt, sand and gravel, cobbles and boulders. In addition, organic material (roots and woody debris), isolated coal waste, and anthropogenic materials including concrete and metal, were encountered in the fill layers.

The thickness of the fill ranges overall from about 0.1 m to 3.4 m, and on average is about 1.3 m. In the area south of the bluff and along Oyster Bay Drive, the fill layer typically ranged in thickness from about 0.1 m to 1.6 m, and on average was about 0.7 m. The composition of the fill material encountered in this area consisted of silty sand with minor gravel to sand and gravel. Also included in this layer is cobbles, boulders and concrete, metal and wood debris.

Boreholes drilled within the areas near the harbour, below the bluff (including the Filled Foreshore areas) also encountered fill. The fill consisted generally of silty sand and gravel to sand and gravel, and included cobbles and woodwaste. The thickness of the fill in this area ranged from about 1.1 m to 3.4 m.

4.3.1.2.2 Native Soil

Underlying the fill materials, native deposits of silts, sands and gravels were encountered overlying, in some locations, glacial till-like deposits. The depths to which these deposits extended ranged broadly from about 0.4 m to 5.9 m bgs, but were generally in the range of about 1 m to 4 m bgs.

4.3.1.2.3 Bedrock

Underlying the native soil deposits, sedimentary bedrock was encountered in approximately half of the test pits and monitoring wells/boreholes drilled in the Uplands. Where encountered, the depth to bedrock ranged widely among the boreholes and test pits, from 0.6 m to 8.1 m bgs.; however, at most locations it was generally between 1 m and 4 m bgs. The rock consisted of sedimentary sandstone and mudstone (argillite).

4.3.1.3 Field Observations and Measurements

Visual and olfactory observations during the drilling and test pitting program were recorded (refer to Appendix X). In addition, a semi-quantitative assessment of volatile vapours was completed by measuring organic vapour concentrations in the field with a PID. PID measurements ranged from below the instrument detection limit (less than 0.1ppm) to 460 ppm (at BH09-13). Observations indicating a potential for contamination included:

- AEC 10 – Former Pump Islands and Associated ASTs – concrete, metal, wood and coal debris was observed in the test pits advanced in this area. A hydrocarbon-like odour between 1.3 m and 2.0 m bgs, and a strong hydrocarbon-like odour and sheen on the water between 2.2 m and 2.4 m bgs, were observed at TP09-02. TP09-03 contained a strong hydrocarbon-like odour between 1.3 m and 1.9 m bgs. Metal debris, pipes and cans were observed in TP11-2 between 0.3 m and 0.5 m bgs. At TP11-4, wood waste was observed between 0.5 m and 0.6 m bgs;
- AEC 12 – Former Railyard: A hydrocarbon-like odour was observed at TP09-05 between 0.6 m and 1.2 m bgs, and between 0.9 m and 1.2 m bgs at TP09-06. Wood debris was observed at MW09-09 between 0.15 m and 0.3 m bgs. Black woodwaste was observed at TP11-06 between 0.1 m and 0.5 m bgs, and at TP11-08 between 1.0 and 1.3 m bgs. Strong to slight hydrocarbon-like odours were noted at TP11-7 between 1.2 m and 3 m bgs, with PID measurements ranging between 33 and 165.2 ppm. A slight hydrocarbon-like odour was observed at MW11-02 between 3.6 m and 4.3 m bgs;
- APEC 15 – Former Cable Splicing Shed: Trace wood debris and a solvent-like odour was observed at MW09-05 between 0.15 m and 0.76 m bgs;
- APEC 17 - Fill at Blocks B and D: Wood debris was observed in MW09-16 between 2.4 m and 2.7 m bgs;
- AEC 19 and 20 - Former log dump and former ASTs at shoreline:
  - MW09-08: Wood debris was observed between 0.15 m and 0.30 m bgs, and between 0.70 m and 1.19 m bgs. Strong hydrocarbon like odour, black viscous free product (on soil samples) and sheen on the water was observed between 2.74 m to 3.96 m bgs;
  - BH09-14 (installed approximately 14 m east of MW09-08): Hydrocarbon-like odour and sheen on the water between 3.05 m and 3.96 m bgs;

- BH09-12 (approximately 15 metres west of MW09-08): wood debris and hydrocarbon-like odour, black viscous free product and sheen on the water between 2.44 m to 2.74 m bgs;
- BH09-13 (approximately 30 metres west of MW09-08): similar observations of odours, free product and sheen on the water between 3.048 m and 3.96 m bgs; and,
- BH09-15 (approximately 45 metres west of MW09+-08): similar observations of odours, free product and sheen on the water between 3.05 m and 4.01 m bgs.

Detailed borehole logs are provided in Appendix X.

4.3.2 Hydrogeological Conditions

4.3.2.1 Water-Level Measurements

Groundwater levels were measured in boreholes and test pits during the investigation completed between November 18 and December 10, 2009 and February 2011, and in monitoring wells and piezometers after the investigation.

Measured water levels indicate that the near-surface groundwater level within Slack Point is close to that of the ocean, approximately 1 m to 2 m below ground surface (about elevation 0.0 m to 0.5 m). Within the Uplands area of the Site, the depth to groundwater ranged from about 0.1 m to 3.4 m below the existing ground surface, with the exception of MW11-02. At MW11-02, which is a deep well installed in bedrock to a depth of approximately 20 m bgs, the water level was 8.4 m bgs.

4.3.2.2 Field Parameters and Observations

Field parameters (temperature, pH, conductivity, redox, dissolved oxygen, and groundwater levels) and observations were recorded during sampling and are summarized in Table 15 and can be found at the end of the report. As discussed in the following section, the groundwater quality at the Site is influenced by the tidal influence mixing seawater with the groundwater near the shoreline. The highest conductivity values were obtained from wells located near the foreshore. Groundwater data sampling sheets are provided in Appendix XIV.

4.3.2.3 Tidal Influence of Groundwater Quality

Tides in Ladysmith Harbour are expected to influence water quality near the shoreline (*i.e.*, the groundwater will be a mixture of upgradient groundwater and seawater). Mixing occurs as a result of repeated seawater infiltration into the Upland soil during high tide and discharge during low-tide.

In 2005, Golder conducted groundwater tidal monitoring at Slack Point. Overall, groundwater flow direction and the magnitude of the hydraulic gradient at the Site fluctuate daily in response to ocean tides. During high tide, the instantaneous hydraulic gradient briefly reverses and groundwater flows inland away from Ladysmith

Harbour. The hydraulic head measured in MW05-22 and MW05-16 shows that the instantaneous hydraulic gradient at high tide is directed away from the shoreline for a brief period of time, but its magnitude is relatively small. Throughout the most of the tidal cycle, groundwater flow is directed towards the shoreline, with the magnitude of the hydraulic gradient changing from hour to hour. On average, the groundwater flow is directed towards the shoreline. This is illustrated on Figure 12a and Figure 12b, which present contours of average hydraulic heads for the beginning and end of monitoring period, respectively. These results suggest that flow at the Site is semi-radial, directed from monitoring well MW05-22 perpendicularly towards the shoreline.

To assess potential mixing of sea water and groundwater during the DSI, major cation and anion chemistry results were examined for the following wells: MW09-16 (located in the vicinity of APEC 11), MW09-07, MW09-08, MW11-01 and MW11-02 (located in the vicinity of APEC 19), and eight previously installed wells on Slack Point. A sea water sample was also obtained for reference purposes. In addition, selected wells were sampled at multiple events, including falling tides close to high tide and low tide events. On November 20, 2009, chloride concentrations in MW09-08, MW09-16, MW05-09 and MW05-17 ranged between 2,700 mg/L and 6,480 mg/L chloride, and were significantly elevated relative to chloride concentrations (between 6.1 mg/L and 76.4 mg/L) in other monitoring wells of similar elevation. During low and high tide sampling events in February 2011, MW09-07 and MW09-08 and MW11-01 contained elevated salinity and dissolved chloride concentrations, indicating the presence of dilute seawater in these wells.

Piper plots illustrating the major cation and anion chemistry for selected samples, and seawater, are illustrated in Appendix XI. As shown on the piper plots, selected wells during the 2009 sampling including MW05-17, MW05-09 and MW08-08, and MW11-01 and MW09-08 during the 2011 sampling events are indicative of sea water. Other wells, including MW09-16, and MW09-07 indicate sea water / groundwater interaction.

4.3.2.4 Estimated Groundwater Velocities

Hydraulic heads at the Site are strongly influenced by ocean tides, as presented in Table 15. Several wells were monitored during tidal events, and wells on Slack point, and the filled foreshore areas, as well as the deep well MW11-01 installed Uplands, exhibited tidal influence[12]. The amplitude of tidal fluctuations observed in monitoring wells was greatest near the shoreline and decreased inland. An examination of the hydraulic heads measured at the Site in 2005 showed that the instantaneous hydraulic gradient at high tide is directed away from the shoreline for a brief period of time, but its magnitude is relatively small. Throughout the most of the tidal cycle, groundwater flow is directed towards the shoreline, with the magnitude of the hydraulic gradient changing from hour to hour. On average, the groundwater flow is directed towards the shoreline. Single groundwater level measurements cannot be utilized to assess groundwater flow direction and gradient. As such, the Golder 2005a tidal evaluation is summarized below.

The average groundwater velocity was estimated to range from 0.4 to 0.8 m/d (146 to 292 m/year) on the north side of Slack Point, and 0.2 to 0.4 m/d (73 to 146 m/year) on the east side of Slack Point.

[12] It is noted that the measurements were collected at the high and low tide events, illustrating a change in water elevation in the water well. The measurements were not collected over a tidal cycle, therefore, these may not be the typical high or low groundwater levels observed in these wells.

The average groundwater velocities discussed above represent the hydrogeologic conditions observed in May 2005. The average velocities are expected to vary seasonally in response to changes in recharge to the groundwater system. That is, during wet winter months when the recharge is higher, average velocities may increase, whereas during dry summer months these velocities may be less.

4.3.3 Soil Analytical Results

The laboratory Chemical Analysis Reports are provided in Appendix XII. Selected soil samples were analyzed for BTEX, VOCs, VPHs, LEPH and HEPH, PAHs, metals, and PCBs. Samples were selected for analysis based on location, field observations and field screening measurements.

4.3.3.1 Comparison of Chemical Analyses with Assessment Criteria

Where applicable, the chemical testing results have been compared to CSR residential land (RL), park land (PL), commercial land (CL) and industrial land (IL) use standards in Tables 13a, 13b, and 13c. Samples containing chemical concentrations above the CSR RL/PL, CL and/or IL land use standards are summarized and included on Figures 7a and 7b. Results are summarized and discussed below for each AEC and APEC, with the exception of AEC 1 and 2. The Golder 2005a (DSI of Slack point) provided characterization and delineation of the soil quality at AEC 1 and 2. The figures include a summary of both the results of the DSI as well as the historical chemistry results.

4.3.3.2 APEC 8 – General Fill Quality in Uplands

Fill samples were collected from various locations in the uplands portion of the Site. Concentrations exceeding standards were detected in surface soil samples only, at SA2, SA6 and SA7, as follows:

- Concentrations of ethylbenzene and styrene exceeded the CSR RL and IL standards respectively at a depth of 0.3 m to 0.5 m bgs, and HEPH exceeded the CSR RL and CL standards, at two surface samples SA6 and SA7, respectively; and,
- SA2 contained concentrations of styrene exceeding the CSR RL/PL standard.

The purpose of these surface soil samples was to assess the potential for presence of contamination from activities associated with AEC 10 and AEC 12, and is likely attributable activities in these areas rather than related to the quality of the fill. The concentrations of metals and hydrocarbons in the remaining samples collected within fill units across the Site (as referenced on Tables 13a, 13b and 13c) meet the applicable standards.

4.3.3.3 APEC 9 – Former Scale Pit

Samples were analysed from MW09-06 and TP09-09, and no constituents exceeded applicable CSR criteria. PAHs (including naphthalene) were detected, but below standards, in TP09-09.

4.3.3.4 AEC 10 and APEC 11 – Former Fuel Pump Islands, Associated ASTs and Historical Fuel Pipelines

Samples were collected from ten locations in AEC 10 and APEC 11 (MW09-01, TP09-01, TP09-02, TP09-03 TP09-04, TP09-07 and TP09-08 and nearTP-8-SA5, nearTP-8-SA6, and nearTP-8-SA7). The purpose of the sampling was to assess for the presence of contamination from activities associated with AEC 10 and APEC 11, and to delineate areas of known contamination.

PAHs were detected but below standards in MW09-01 and TP09-02, TP09-03 and TP09-08, and LEPH and HEPH were detected but below standards in TP09-02 and TP09-08.

Parameters exceeding CSR CI/IL soil standards are as follows:

- Naphthalene:
  - MW09-1 (0.6 m and 0.76 m bgs);
  - TP11-02 (1.8 m to1.9 m bgs); and,
  - TP11-04 (0.5 m to 0.6 m bgs).
- VPH:
  - TP09-02 (2.2 m to 2.4 m bgs). LEPH and HEPH were detected but below standards at TP09-02 between 1.5 and 2.4 m bgs, and VPH was also detected but below standards between 1.5 m and 1.7 m bgs; and,
  - TP09-03 (1.8 m to1.9 m bgs).
- Xylene:
  - TP09-01 (1.0 m to1.2 m bgs); and,
  - TP11-02 (1.8 m to 1.9 m bgs).

4.3.3.5 AEC 12 – Former Railyard

Samples were collected in the area of AEC 12 to assess the presence of contamination and to delineate the known areas of contamination. Sampling was conducted by surficial soil sampling, testpitting and drilling methods. The following organic constituents were detected but below standards:

- PAHs in MW09-10;
- styrene in KE-SA1; and,
- styrene and xylene in KE-SA4.

Parameters exceeding CSR RL/PL or CL/IL soil standards were as follows:

- Styrene:
  - KE-SA2. The same sample also contained detections of benzene, toluene, ethylbenzene, xylene and VPH.
- Naphthalene:
  - MW09-10 (1.5 m to 1.7 m bgs).
- Ethylbenzene:
  - TP09-05 (0.3 m to 0.5 m bgs).
- Xylene:
  - TP09-05 (0.3 m to 0.5 m bgs) – exceeded CSR CL/IL.
- LEPH:
  - TP09-06 (0.9 m to 1.1 m bgs) - exceeded CSR CL/IL; and,
  - TP11-7 (1.5 to 1.6 m bgs) – exceeded CSR CL/IL; sample also contained detections of HEPH.
- HEPH:
  - TP09-06 (0.9 m to 1.1 m bgs) - LEPH and naphthalene were detected at a depth of 1.7-1.9 mbgs.

Step out test pit TP11-5 located northwest of TP09-05 and TP09-06 contained detections of naphthalene at 0.3 to 0.4 mbgs; however concentrations of LEPH, HEPH, PAHs and BTEX below the laboratory detection and below CSR PL/RL standards

Test pit TP11-7 located northeast of TP09-06 contained concentrations of LEPH in exceedance of the CSR IL standard at a depth of 1.5-1.6 m bgs, and contained detections of HEPH.

TP11-8 located northwest of TP11-7 contained detections of HEPH and xylene; however concentrations were less than the CSR PL/RL standard.

4.3.3.6 AEC 13 – Former Waste Oil Area

Two monitoring wells (MW09-03 and MW11-02) were installed at a location downgradient of AEC 13 to provide data to delineate the contamination identified in the former waste oil area. Soil samples collected from MW09-03 were generally below the MDL and below the applicable standards.

4.3.3.7 APEC 15 – Former Cable Splicing Shed

One monitoring well was installed near the former cable splicing shed to assess the presence of contamination. No constituents exceeded the CSR RL/PL and CL/IL standards in the soil samples analysed from MW09-05. Naphthalene, benzene, ethylbenzene, toluene and xylenes were detected but below standards.

4.3.3.8 AEC 19/20 – Former Log Dump and ASTs at Shoreline

Soil samples were analysed from MW09-08, BH09-13 through BH09-15 and MW11-01 to delineate contamination along the shoreline that was historically detected. While observation of presence of hydrocarbon were noted at several locations, the following summarizes the analytical results. Concentrations of metals, PAHs and BTEX were below the applicable CSR standards at the sampling locations; however detections of BTEX and PAHs were observed.

Parameters exceeding standards are as follows:

- HEPH and naphthalene were detected in soil between 2.1-2.3 m bgs and naphthalene was detected in soil a depth of 3.9-4.1 mbgs at MW09-7 and 4.0-4.1 mbgs at MW11-01;
- Concentrations of LEPH and HEPH exceeded the CSR RL/PL standard and VPH exceeded the CSR CL/IL standard at MW09-8 at a depth of 2.9-3.0 m bgs; concentrations of similar parameters were below the laboratory detection limit at a depth of 3.9-5.0 m bgs; and,
- Concentrations of LEPH exceeded the CL/IL standard and concentrations of HEPH exceeded the CSR RL/PL in BH09-13, BH09-14, and BH09-15.

4.3.3.9 APEC 17, APEC 23 and APEC 25– Fill in Blocks B and D (Possible Copper Smelter Impacts on Groundwater, and Possible Iron Foundry)

One monitoring well was completed to assess the potential for contamination from historical filling activities. No constituents exceeded the CSR RL/PL and CL/IL standards in the soil samples analysed from MW09-16. Apart from some metals, parameters were less than the laboratory detection limits.

4.3.4 Groundwater Analytical Results

Golder completed seventeen of the boreholes as groundwater monitoring wells on the Site. Table 12 presented in Section 4.2.8 provides a summary of the installation details of the wells completed on the Site and Figure 6 illustrates the well locations. Samples containing chemical concentrations above the CSR AW-Marine standards are summarized and included on Figures 8a and 8b.

4.3.4.1 Comparison of Chemical Analyses with Assessment Criteria

The laboratory analysis reports are provided in Appendix XII. Selected groundwater samples were analyzed for VPHs, BTEX, EPHs, PAHs, PCBs, VOCs, metals and chlorinated phenols, dependent on the potential contaminants of concern for the area. The analytical results for the groundwater analysis are presented in Tables 16a, 16b, 16c, and 16d.

Groundwater samples collected from the Site between 2009 and 2011 met the applicable CSR AW marine standards for all parameters analyzed with the exception of the following (see Figure 8a and 8b):

- AEC 10: VPHw at MW09-01 (benzene, ethylbenzene, toluene, xylene, PAHs including naphthalene, and LEPH were also detected but below standards);

- AEC 10 and 12: Chloroform in MW11-02 (HEPH was also detected but below standard);
- AEC 12 and 13: Benzo(a)pyrene and pyrene in MW11-01 (HEPH and PAHs were also detected but below standard);
- AEC 19 and 20: Pyrene at MW09-08 and in a duplicate sample (HEPH and PAHs were also detected but below standard); and,
- Dissolved sulphate[13] in MW09-08, MW11-01 and a sample collected from the Wharf.

Several additional organic constituents were detection in groundwater at concentrations below standards. These comprised the following:

- AECs 3 and 4: Tetrachlorophenols and pentachlorophenol in MW05-02 and MW05-20;
- AEC 12: PAHs in MW09-09;
- AEC 13: Ethylbenzene and HEPH in MW00-2; HEPH in MW11-02;
- APEC 15: Benzene, toluene and PAHs in MW09-05;
- APEC 17, 18 and 25: HEPH in MW09-16;
- AEC 19 and 20: benzene, ethylbenzene, xylene, VPHs and PAHs in MW09-07; and,
- APEC 22: Ethylbenzene, toluene, xylene and naphthalene in MW09-02.

4.3.5 Quality Assurance and Quality Control

The focus of the Quality Assurance/Quality Control (QA/QC) program was to evaluate the quality and appropriateness of the analytical data with respect to potential decision criteria. This discussion of data applicability focuses on the precision and accuracy of reported results for the identified parameters, particularly at concentrations that may be used as decision criteria.

The quality of the analytical data was assessed using field duplicate quality control samples. Eight percent of the soil sample field duplicates were collected and scheduled for analyses during the investigation. The results of the soil data quality assessment are provided in Table 17a. In addition, two duplicate groundwater samples (12% of samples) were collected and scheduled for analyses during the investigation. The results of the groundwater data quality assessment are provided in Tables 17b and 17c.

Approximately 63 soil samples were collected and eight duplicates obtained; therefore, a duplicate collection average of 14.5% was obtained, exceeding the target of 10%.

[13] Elevated sulphate is inferred to reflect the presence of seawater intrusion via tides.

The relative percent difference (RPD – the absolute difference between the two values, divided by the mean) of duplicate analyses is used to evaluate the sample result variability. An RPD value of less than 0.3 (30%) for soil and less than 0.2 (20%) for groundwater is considered an indication of acceptable sample variability, and therefore represents a good correlation between the duplicate samples. Where the concentration of a given parameter is less than five times the method detection limit (MDL), the results are less precise and the RPD is not calculated. For parameters with concentrations less than five times the MDL, the variance between the samples (the absolute difference between the two values) should be less than two times the MDL.

The quality of the laboratory data generated was assessed using the appropriate laboratory quality control samples and laboratory quality replicate samples. Quality control samples consisted of analytical method blanks, analysis of reference materials, laboratory replicate samples and laboratory analytical spikes for soil analysis. A review of the laboratory data determined that the laboratory appears to have met it own internal standards and targets. Golder has reviewed the laboratory QA/QC procedures and objectives and has found the results of the analyses to be acceptable. The results of the internal laboratory QA testing are provided on the laboratory reports included as Appendix XII.

4.3.5.1 Assessment of Soil Data Quality

The RPDs calculated are provided in Table 17a. The results indicate that for field supplicate samples, there were very few constituents of concern present at concentrations exceeding the five times MDL and having RPDs greater than 30%. With the exception of one sample, MW09-8, the sample and duplicate results were generally similar in magnitude and concentrations were both below applicable standards.

The sample and duplicate from MW09-8 was submitted for LEPH and HEPH analysis and the calculated RPDs exceed 110%. This sample was observed to be contaminated during sample collections, and the variance of the duplicate result is likely attributable to in jar heterogeneity of the sample. The higher of the two results was reported, as this sample exceeds the applicable CSR CL/IL standards.

It is concluded that, based on the quality of the field data collected and the laboratory data generated, the soil analytical data provided is of sufficient quality with which to base decisions on the presence and distribution of soil contaminants assessed in this investigation.

4.3.5.2 Assessment of Groundwater Data Quality

The RPDs calculated are provided in Table 17b and 17c, and show that for the field duplicate sample, there were some RPD values greater than the 20%, specifically for metals and PAHS for one of the two sampling events for a sample and duplicate collected from a well with known contamination (MW09-08). A review of the sampling program indicate that there were no issues noted with the sampling methodology. In addition, the RPD for the LEPHw concentrations meet the recommended values.

It is concluded that, based on the quality of the field data collected and the laboratory data generated, the groundwater analytical data provided is of sufficient quality with which to base decisions on the presence and distribution of groundwater contaminants assessed in this investigation.

4.4 Areas of Environmental Concern

The following sections discuss the results of the investigation, as described per APEC/AEC. Figure 13 illustrated the location of the retained AECs and APECs.

4.4.1 AEC 1 – Coal Fill at Slack Point

The coal fill material at the Site is characterized as having concentrations of naphthalene, phenanthrene, LEPH, and HEPH above the CSR RL/PL standards, but below the CSR CL/IL standards, and can be classified as "commercial quality" material (Golder 2005). The observed depth of the coal fill at the Site unit ranged from 6.5 m to 10 m below surface level in the most southwestern (upland) portion of the Site, to 16.6 metres below surface in the remainder of the Site. Though there are no applicable standards, this material also contains elevated concentrations of sulphur. Based on the elevated sulphur concentrations and indications of the presence of H_2S odours in deep groundwater, it is possible that dissolved sulphide and dissolved sulphate are present in groundwater at the Site at elevated concentrations. However, based on a review of sampling data available, the dissolved sulphides appear to be related to the naturally occurring conditions associated with the underlying native sediments and ocean water, rather than the presence of the coal material. No other groundwater impacts were detected. Additional groundwater sampling during the DSI activities in 2009 confirmed that no groundwater impacts have been detected. Therefore, based on the soil contamination above the CSR RL/PL standards in the coal fill at Slack Point, this area has been retained as an AEC for RL/PL use, however, could be removed if commercial or industrial development is contemplated for Slack Point.

It is estimated that the total volume of coal fill present at Slack Point is approximately 725,000 m^3 (roughly one million tons), and that an additional 100,000 to 225,000 m^3 (140,000 to 300,000 tons) of coal fill likely extends into the harbour (based on an angle of repose of 15° to 30°).

4.4.2 AEC 2 and 3 – Surficial Fill from Non-Coal Sources at Slack Point and Former Woodwaste and Dredgate Stockpile

Based on a review of investigation completed by Golder in 2005, surface fill materials (not including coal fill) were observed as discontinuous units across the Site and ranged in thickness up to a maximum of 3 m. Little to no surface fill materials were observed above the coal fill unit in the south corner of the Site. Surficial fill was found to have concentrations of LEPH, HEPH, molybdenum, nickel and tin greater than the CSR RL/PL standards, and concentrations of zinc greater than the CSR CL/IL standard. Concentrations of PCOCs in groundwater above the CSR AW standards were not observed. Elevated concentrations of petroleum hydrocarbons in surficial fill were observed at several locations in Slack Point; however, elevated concentrations of LEPH and HEPH in this AEC may also be a false positive, resulting from the analysis of naturally occurring hydrocarbons in wood; HEPH concentrations above the CSR RL/PL standards were associated with sampling locations where wood waste was present.

Groundwater sampling during the DSI activities in 2009 confirmed that no groundwater impacts have been detected.

Therefore, based on the soil contamination exceeding CSR CL/IL in the surface fill (non-coal source) in Slack Point, this area has been retained as an AEC.

The extent of the surface fill materials at the Site, including the concentrated regions of buried metal debris and refuse (AEC 5, summarized below), are estimated to have an approximate volume between 34,000 m^3 and 67,000 m^3.

4.4.3 AEC 5 – Buried Refuse and Possible Abandoned Landfill

Based on a review of Golder 2005, it is understood that regions of concentrated buried metal debris and refuse are present on Slack Point, but no underground storage tanks were identified. Groundwater sampling during the Golder 2005 and the current DSI activities in 2009 confirmed that no groundwater impacts have been detected.

Areas investigated were found to have metal debris, car parts, bricks, wire cable, oil and paint cans, and wood waste. Soil samples collected (Golder 2005) from area where refuse was present contained concentrations of LEPH and HEPH, molybdenum, nickel and tin above the CSR RL/PL standard, and concentrations of HEPH and antimony, arsenic, barium, cadmium, chromium, copper, lead and zinc above the CSR CL/IL standard. As such, this area has been retained as an AEC.

4.4.4 APEC 8 – Fill Material in the Uplands

The Uplands areas have been the site of historical industrial activities for many years during which time fill of variable thickness and composition has been placed. The fill materials generally consisted of silt, sand and gravel, cobbles and boulders. In addition, organic material (roots and woody debris), isolated coal waste, and anthropogenic materials including concrete and metal, were encountered in the fill layers. The thickness of the fill ranged from approximately 0.1 m to 3.4 m bgs and, on average, extends to about 1.3 m bgs.

Several boreholes, monitoring wells and test pits have been advanced in the Uplands during previous investigations, and results have indicated elevated concentrations of petroleum hydrocarbons in some locations.

During the DSI activities, several samples collected from fill across the site were submitted for laboratory analysis for metals and hydrocarbons. With the exception of three surface soil samples, there were no exceedances of metals or hydrocarbons in the fill unit at the sampling locations, however, some location did contain detectable concentrations of volatile components.

The three surface soil samples were located to target two AECs, including AEC 10, the former pump island and PCB storage area, and AEC 12, the former railway yard and current boat construction area. Based on the observation during the investigation, and the results of the sampling program, the presence of the hydrocarbons is likely attributable to AEC 10 and 12, and not directly related to the quality of the fill at these locations. As such, APEC 8 is not considered an AEC and no longer retained as an APEC.

4.4.5 APEC 9 – Former Scale Pit and Possible PCB Storage

Based on a review of historical investigation information, the former scale pit area was noted to be infilled (with fill of unknown quality) and speculated to have been an area where PCBs were stored. As part of the DSI, soil and groundwater samples were collected in the vicinity of the former scale pit.

Soil and groundwater samples concentrations were below the applicable standards. Naphthalene was detected in soil at one location, at a depth of 0.4 to 0.6 m bgs, and may be indicative of fill quality in this area, however is unlikely related to the former scale pit and possible PCB storage area.

Based on the results of the investigation, with the soil and groundwater meeting the CSR standards, this area has not been retained as an AEC.

4.4.6 AEC 10 and APEC 11 – Former Pump Islands, Former ASTs, Historical Fuel Pipelines, Pump House and PCB Storage Areas

Based on a review of historical investigation information, contamination, including ethylbenzene and toluene concentrations were confirmed at one location in the uplands area. In addition, contamination was observed in the foreshore filled area and the results along the foreshore is discussed in AEC 19. For the purposes of the DSI, AEC 10 was retained as an AEC, and investigation to delineate soil and confirm groundwater quality was completed.

During the completion of investigation activities, including surficial soil sampling, testpits, drilling and groundwater sampling, indications of hydrocarbon contamination were identified. Step-out sampling was completed to delineate the contaminated area in the uplands areas.

In general, petroleum hydrocarbon contamination was identified in the southern sides of the AEC 10 in soils overlying bedrock. VPH contamination exceeding the CSR CL/IL standard was identified. In addition, xylene, naphthalene and LEPH and HEPH were detected but were below standards. Two surficial soil samples contained HEPH concentrations over the CSR RL/PL or CL/IL standards. The HEPH appears to be limited to a surficial area adjacent to a concrete slab; PCBs were not detected. Based on the results of the soil sampling and field observation, the soil contamination has been delineated.

One groundwater sample, in the southern area of AEC 10, contained VPH concentrations exceeding the CSR standards. While the groundwater contamination has not been delineated horizontally or vertically, groundwater contamination is expected to be limited to the area of soil contamination.

Owing to the presence of soil and groundwater contamination, this area is considered an AEC. The extent of the contamination in this area of the Site is generally shallow in nature, to depths up to approximately 2.4 m below ground surface, and is estimated to have an approximate volume of 1,000 m^3.

4.4.7 AEC 12 – Former Railway Yard area and Current Boat Repair and Construction Operations

Based on a review of historical information, contamination, including ethylbenzene and toluene concentrations were confirmed in the area of the former railway yard at one location. For the purposes of the DSI, this area was retained as an AEC, and investigation to delineate soil and confirm groundwater quality was completed.

During the investigation, indications of petroleum hydrocarbon contamination were observed in shallow soils (depths up to approximately 2 metres bgs) on the northwest side of the former maintenance building area. In addition, the contamination appeared to be patchy, and not associated with one contiguous source in the former railway maintenance area.

A series of testpits delineated contamination to the northwest and southeast, and a downgradient monitoring well delineates the area of contamination to the northeast. Soil contamination is not delineated towards the west (upgradient); however, based on the review of the data and the heterogeneous nature of the contamination in the soil, the contamination is not expected to be widespread and would be limited in area and depth.

This area is considered an AEC. The extent of soil contamination in this area is generally shallow, to depths up to 4 metres. The volume of contaminated soils in the area to the northwest of the former maintenance building is estimated to be 2,000 m^3.

4.4.8 AEC 13 – Former Waste Oil Storage Area and Compressor Storage Area

Historical investigations identified near-surface soil contamination and some hydrocarbon concentrations (EPH10-19) in groundwater. Soil contamination was delineated vertically; however, further work was identified to confirm the extent of the contamination.

As part of the DSI, an additional monitoring well was installed downgradient to the northeast. Additionally, a well was installed to investigate off-Site APECs to the southeast. Groundwater sampling results indicated that hydrocarbon concentrations met the CSR standards in new and existing wells in the area.

The area is confirmed to be an AEC as soil contamination has been identified. However, based on the soil sampling results in the shallow soils, and the absence of groundwater contamination, the area of soil contamination is likely limited in area. The volume of contaminated soils is estimated to be 20 m^3.

4.4.9 APEC 14 – Former Location of Oil Drum, Scrap Metal Storage and Stockpile of Unknown Quality

Historical investigations included soil sampling in this area and, as discussed, the results did not indicate presence of soil contamination; however, no groundwater sampling had been undertaken and therefore this APEC was retained.

As part of the DSI, groundwater samples were collected from an existing well located southeast, along the downgradient area of this APEC. Results indicated that metals and petroleum hydrocarbons were below the CSR standards and, therefore, this area has not been retained as an AEC.

4.4.10 APEC 15 – Former Cable Splicing Shed

Historical investigations included soil sampling in this area, and the results indicated that the soil samples met the CSR standards. However, sampling was limited to depths above the water table and, therefore, this area was retained as an APEC.

The DSI included drilling and installation of one (1) monitoring well and groundwater sampling. Results indicated that soil and groundwater samples met the CSR standards and, therefore, this area is not considered an AEC.

4.4.11 APEC 17 and 18 – Small Saw Mill and Fill Material at Block B and D of DL 2016 (former Location of the Shingle Mill)

Blocks B and D of DL 2016 were created by infilling the water lot, in the area previously occupied by the shingle mill wharf. Historical investigations indicated that a small sawmill was located in the northwest corner of the Site near Block B and D of DL 2016 and adjacent to the government wharf (there has been no other reference or evidence of a sawmill at this location). Golder infers this area to be the location of the former shingle mill. There is potential for fill quality issues associated with the shingle mill; therefore, APEC 18 was combined with APEC 17.

No previous investigations have occurred at Blocks B and D. As such, the DSI including soil and groundwater sampling at one location. Results of the investigation indicated that the fill soil and groundwater did not contain metals or hydrocarbon concentrations exceeding the CSR standards. It is noted that the sampling program (location) was limited, and additional sample collection along the filled area may be advisable to provide greater certainty. As such, this area is not considered an AEC, however, retained as an APEC.

4.4.12 AEC 19 – Former Log Dump (Lot 17G)

The former log dump on Lot 17G was established in the 1930s and used to transport logs from the railcars to the Harbour for bundling and shipping. The area is an extension of the natural foreshore and therefore contains fill materials of unknown quality. Historical investigation indicated that hydrocarbon parameters (including MOG) concentrations may, by comparison, be present at concentrations exceeding the CSR standard. As such, additional investigation was undertaken.

The planned DSI included drilling and installation of a monitoring well at AEC 19. At the time of the investigation, observations of Site soil conditions indicated hydrocarbon like odours, sheet and product droplets, likely indicative of contamination. As such, several boreholes, and subsequent monitoring wells, were completed as step outs along the shoreline to the northwest. Soil and groundwater contamination was confirmed at several of these locations. Based on the results of the DSI and historical investigation activities, the contamination has been delineated along the shoreline. In addition, as part of the sediment sampling program in Ladysmith Harbour, several sediment samples were collected near to the shoreline, adjacent to the log dump area. No indication of hydrocarbon contamination were observed during the sediment sampling program (Golder 2011c), and the contamination is inferred to be limited to the near shore filled area. However, there was uncertainty as to whether this contamination was from former log dump, filling activities, or subsurface migration to the area from the former railway yard activities.

To address this issues, a deep groundwater well was completed in the bedrock, on the bedrock terrace located up gradient from the former log dump, and down gradient of the former maintenance building. This well was installed at a depth intersecting the elevation of the contamination observed at the log dump. While no evidence of contamination was observed while drilling the well, some hydrocarbon parameters were measured in groundwater at concentrations exceeding the CSR standards. Concentrations were insufficiently high to suggest the presence of petroleum product. Consequently, it is concluded that the contamination at the former log dump appears to be associated with log dump or filling activities in the filled foreshore area, and is not related to the former railway maintenance area. As such, the area if generally delineated to the southwest however, it is not known whether contamination extends onto Lot 5. The former log dump area has been retained as an AEC.

The extent of the contamination in this area of the Site was observed to be between 2.5 and 5.5 m below ground surface. The contamination is estimated to have an approximate volume of 5,800 m^3.

4.4.13 APEC 20 – Former Location of ASTs at the Foreshore

Previous reports have indicated that three diesel ASTs were located in the area of the current Ladysmith Maritime Society parking facility near the marina and adjacent the shoreline. It is reported that the tanks were contained within a concrete bunker.

Historical investigation activities, including test pitting, were conducted in APEC 20, and soil samples did not exceed the CSR standards. However, the test pits did not encounter the water table. As the soil quality at the water table and groundwater quality were not assessed, this area was retained as an APEC.

During the DSI activities, contamination along the log dump area (AEC 19) was observed, and several boreholes and monitoring wells were installed to delineate the observed contamination. Observations of contamination in the former log dump area extended into APEC 20, and appeared to be associated with the log dump and/or former filling activities. No indication of contamination from former ASTs was observed and, as such, APEC 20 is not considered an AEC.

4.4.14 AEC 21 – Foreshore Sediments – Quality of Sediment, Marina Activities, Sewage Outfall and Pressure Treated Piles.

Sediments in Ladysmith Harbour have been affected by the various activities at the Site. Previous investigation activities indicated that concentrations of numerous PAHs in sediments are above the CSR $SedQC_{TS}$ and above the ODLs. In addition, concentrations of cadmium were observed above the ODLs in numerous locations, and concentrations of other metals (copper or lead) were found above CSR $SedQC_{TS.}$

As discussed in this report, the area has been retained AEC 21. An investigation of Site sediments has been reported under separate cover.

4.4.15 APEC 22 – Off-Site Service Stations at 435 and 728 Esplanade

Two off-Site gas stations, including a Petro Canada at 435 Esplanade Avenue and a Shell Service Station at 728 Esplanade Avenue, are located approximately 50 m southwest (upgradient) of the Site.

The DSI included installation of two monitoring wells to assess the quality of groundwater downgradient from the APECs. The results of the groundwater sampling indicate that concentrations of hydrocarbons and metals meet the CSR standards; therefore, these areas are not considered AECs.

4.4.16 APEC 23 – Copper Smelter

The Tyee Copper Smelter located northwest of the Site, was built in 1902 and closed in 1911. Ore was brought to the roast yards (located west of the Smelter at the top of the slope). The ore was piled and let burn up to four weeks to burn off the sulphur and other impurities, then brought to the smelter where the gold and silver were extracted and further refined the ore into copper. There was a substantial amount of waste material (slag). Historical reports indicated that smelter slag may also have been used as (deep) fill material at Slack Point.

There is potential that smelter wastes were used to infill Slack Point and/or Blocks B and D, of DL 2016; however, the results of investigation at the on-Site AECs and APECs (AEC 1 and APEC 17) do not indicate potential contamination from copper smelter wastes. As such, APEC 23 has not been retained.

4.4.17 APEC 25 – Iron Foundry

Historical investigations reported that an iron foundry had been established in the port by 1899. There has been no further reference of an iron foundry has been found during this investigation. It is possible that such a foundry did exist in the port area; however likely not at the Site. It was considered possible that slag resulting from the foundry and smelter was used as fill at the Site, in particular at Slack Point and/or Block B and D of DL 2016. However, the results of investigation at AEC 1 in 2005 (Golder 2005a) and within APEC 17 as part of this DSI, do not indicate potential contamination from iron foundry wastes. As such, APEC 25 has not been retained as an AEC or APEC.

5.0 SUMMARY AND CONCLUSIONS

Golder completed a Stage 1 Preliminary Site Investigation, Detailed Site Investigation, sediment investigation and preliminary geotechnical investigation at Ladysmith Harbour in the Town of Ladysmith between 2009 and 2011. The primary objectives of the investigation activities were to refine remedial and geotechnical costs and options for the Site. Geotechnical and sediment investigation activities and results are presented under spate cover.

The objective of the Stage 1 PSI was to document historical activities or events on the Site and/or on adjacent properties that may have affected environmental soil, sediment, soil vapour, and groundwater quality at the Site. The assessment focused on identifying areas of potential and known environmental concern (APECs/AECs), and associated potential and known contaminants of concern (PCOCs/COCs). At the conclusion of the Stage 1 PSI, a total of 25 APECs were identified: seven (7) on Slack Point; nine (9) within the uplands areas; four (4) in the filled foreshore area; one (1) in the harbour area; and four (4) off-Site.

The objectives for the DSI were to:

i) Assess soil, soil vapour, and groundwater quality in each of the APECs identified at the Site;

ii) Determine if the APECs should be considered areas of environmental concern (AEC);

iii) Characterize and delineate the extent of soil and/or groundwater contamination at the Site associated with the AECs; and,

iv) Provide supporting information for a risk assessment and remedial plan for the Site. The objective of the sediment investigation was to obtain data to refine remedial costs and options, including an assessment of whether ocean disposal is a viable option, for potential developers of the Site.

The remedial costs and options are also prepared under separate cover.

As part of the Stage 1 PSI, historical investigation data and reports were reviewed. The DSI activities included soil and groundwater sampling completed by several investigation methods, including surface soil sampling, testpitting, borehole drilling, and installation of monitoring wells. Based on the review of the historical data and the results of the DSI, the following APECs/AEC listed in Table 18 and their respective COCs have been identified.

Table 18: Areas of Environmental Concern

AEC or APEC	Summary	COC
SLACK POINT		
AEC 1 - Coal Fill.	Coal fill material contains concentrations of PAHs, LEPH, and HEPH at concentrations above PL/RL standards.	Soil: naphthalene LEPH and HEPH Soil vapour: naphthalene
AEC 2 - Surface Fill.	Samples collected form surface fill (non-coal) contained concentrations of LEPH, HEPH and metals exceeding the CSR PL/RL standards and zinc concentrations exceeding the CL/IL standards.	Soil: LEPH, HEPH, metals
AEC 5 - Buried Refuse.	Samples collected from the area of the buried refuse contained concentrations of LEPH, HEPH and metals exceeding the CSR CL/IL standard and/or the CSR RL/PL standards.	Soil: LEPH, HEPH, metals
UPLANDS		
AEC 10 - Former fuel pump islands, ASTs and possible PCB Storage.	VPH contamination exceeding the CSR CL/IL standard was identified in the southern areas of AEC 10. Xylene and naphthalene were detected in soils but were below standards. In the northern area of AEC 10, surficial soil samples contained HEPH concentrations over the CSR RL/PL or CL/IL standards. The HEPH appears to be limited to a surficial area adjacent to a concrete slab; and is not adjoining the VPH contamination located in the southern area of AEC 10. One groundwater sample, in the southern area of AEC 10, contained VPH concentrations exceeding the CSR standards. While the groundwater contamination has not been delineated horizontally or vertically, groundwater contamination is expected to be limited to the area of soil contamination.	Soil: VPH, HEPH Groundwater: VPH Soil Vapour: VPHv, xylene, naphthalene
AEC 12 - Former Maintenance Area and Current Boat Repair and Construction Operations.	LEPH contamination was observed in the area of AEC 12. Contamination appeared to be patchy, and not associated with one contiguous source/activity. In addition, styrene was observed at concentrations exceeding the PL/RL standards. LEPH contamination was historically observed in groundwater, however, subsequent sampling do not indicate the presence of groundwater contamination.	Soil: LEPH, styrene
AEC 13 - Former Waste Oil Storage Area and Compressor Storage Area.	Near-surface soil contamination of LEPH and HEPH concentrations exceeding the CSR PL/RL standards. LEPH contamination was historically observed in the groundwater, however, subsequent sampling do not indicate the presence of groundwater contamination.	Soil: LEPH

AEC or APEC	Summary	COC
FILLED FORESHORE		
APEC 17 – Fill Material at Block B and D of DL 2016 (former Location of the Shingle Mill), APEC 18 – Small Saw Mill (combined with APEC 17), APEC 23 – Tyee Copper Smelter, and APEC 25 – Iron Foundry (combined with APEC 17).	No soil or groundwater contamination identified during the DSI, as such, this area is not considered an APEC. However, the sampling program was limited in area, and additional sample collection along the filled area may be warranted, therefore, remains an APEC.	Potential COC: Soil: LEPH/HEPH, PAH, and metals Groundwater: LEPH/HEPH, PAH, metals Soil Vapour: VPHv, BTEX, naphthalene
AEC 19 - Former Log Dump (Lot 17G).	Presence of NAPL was observed during drilling boreholes along the shoreline in the vicinity of the former log dump. VPH, LEPH and HEPH concentrations exceeding CSR CL/IL standards in soil, and PAH constituents exceeding. NAPL was not observed in monitoring wells during monitoring events. Contamination appears to be limited to a particular range of depth and may be associated with the log dump or filling activities. Contamination in this area does not does not appear to be related to migration of contamination from areas where railway maintenance activities occurred.	Soil: VPH, LEPH Groundwater: PAH Soil Vapour: VPHv
SEDIMENTS		
APEC 21 – Foreshore sediments.	Reported under separate cover.	

6.0 CLOSURE

We trust the information presented in this report is sufficient for your needs at this time. Should you have any questions or concerns, please do not hesitate to contact the undersigned at 604-296-4200.

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CSR Standards for PL/RL (MW)	MCS	CSR Standards for CL (MW)	MCS	CSR Standards for IL (MW)	MCS	BH05-1 0019-08 6.9 28-Mar-05 Golder	BH05-1 0020-03 13.7 28-Mar-05 Golder	MW05-2 0020-05 0.15 28-Mar-05 Golder	MW05-2 0020-08 1.8 28-Mar-05 Golder	MW05-3 0021-01 0.15 28-Mar-05 Golder	MW05-3 0021-03 0.9 28-Mar-05 Golder	MW05-4 0022-01 1.7 29-Mar-05 Golder	MW05-4 0022-02 2.7 29-Mar-05 Golder	MW05-5 0022-10 2.7 29-Mar-05 Golder FDA	MW05-5 0023-06 9.4 29-Mar-05 Golder	MW05-6 0023-08 0.15 29-Mar-05 Golder	MW05-6 0023-10 0.9 29-Mar-05 Golder FDA	MW5-6 0023-12 1.8 29-Mar-05 Golder	MW05-7 0024-04 0.15 29-Mar-05 Golder	MW05-7 0024-06 0.9 29-Mar-05 Golder	MW05-7 0024-09 2.7 29-Mar-05 Golder	MW05-7 0025-04 9.4 29-Mar-05 Golder	MW0 0025 14. 29-Ma Gol
						8.65	8.98	7.76	8.13	8.01	8.47	9.07	8.64	8.40	9.11	7.96	7.50	8.75	6.56	6.70	8.37	8.93	8.7
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	G	40	G	40	G	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1
25	MW	25	MW	25	MW	<5.0	<5.0	5.1	9.3	5.4	5.8	<5.0	<5.0	<5.0	<5.0	7.6	<5.0	<5.0	16.3	<5.0	<5.0	<5.0	24.
1000	T	1,500	T/MW	1,500	G	213	175	177	226	144	198	124	192	191	190	713	52.2	162	79.7	52.7	131	147	21
4	G	8	G	8	G	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-35	MW/I/pH	2-100	MW/I/pH	2-200	MW/pH	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1.30	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.
60 (90[13])	V	60 (90[13])	V	60 (90[13])	V	9.1	5.4	37.6	39.9	31.5	35.9	19.1	11.1	16.5	7.0	40.7	14.2	27.1	16.0	11.1	21.8	24.4	14.
50	G	300	G	300	G	4.7	3.4	9.0	10.1	8.4	9.8	6.1	4.4	5.6	4.5	10.5	3.8	6.1	7.3	3.5	6.2	6.0	4.
90-150	MW/T/pH	90-250	MW/T/pH	90-250	MW/T/pH	56.4	33.4	115	79.2	84.0	80.0	76.9	53.4	74.4	45.2	226	31.9	71.3	78.4	32.6	68.8	63.1	52.
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
150-500	MW/I/pH	150-1,000	MW/I/pH	150-2,000	MW/T/pH	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	677	<50	<50	<50	<50	<50	<50	<5
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1800	S	19,000	S	19,000	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	I	40	I	150	T	0.153	0.169	0.288	0.291	0.338	0.394	0.229	0.210	0.220	0.170	0.107	0.081	0.188	0.328	0.062	0.623	0.576	0.8
10	G	40	G	40	G	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	4.3	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.
100	G	500	G	500	G	17.2	10.3	56.5	63.0	45.4	57.5	26.9	18.0	25.5	14.0	33.5	16.1	38.6	14.1	11.0	31.5	38.4	24.
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	G	10	G	10	G	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.
20	G	40	G	40	G	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
47,000	S	100,000	S	100,000	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	S	300	S	300	S	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	23.6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
200	G					33.5	25.1	45.0	50.9	40.9	41.1	30.6	26.7	28.3	28.0	63.6	24.1	41.5	36.5	22.4	40.7	37.8	35.
150-450	MW/T/pH	150-600	MW/T/pH	150-600	MW/T/pH	34.2	27.5	156	68.6	81.6	81.7	58.4	41.6	51.6	32.5	1240	79.8	77.9	94.5	94.4	51.1	47.4	34.
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						2.32	3.54	-	-	-	-	-	-	0.520	2.31	-	-	-	-	-	0.630	0.800	2.0

nated Sites Regulation (CSR), enacted in 1997, and updated May 31, 2011.

rk Land); RL (Residential); CL (Commercial); IL (Industrial).

s per gram (ug/g) unless othwise indicated.

servative value of generic (G), intake of contaminated soil (I), toxicity to soil invertebrates and plants
e (MW) and schedule 10 (S).

.

most conservative standard is used (CrIV)

D = Field duplicate.

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t. Ladysmith, B.C. Dated October 25, 2000.

tion for Chromium (CSR Protocol 4) is 90µg/g.

CSR Standards for PL/RL (MW)	MCS	CSR Standards for CL (MW)	MCS	CSR Standards for IL (MW)	MCS	BH05-10 0027-04 0.9 30-Mar-05 Golder	BH05-10 0027-07 3.7 30-Mar-05 Golder	BH05-10 0028-02 9.6 30-Mar-05 Golder	BH05-10 0028-06 14 30-Mar-05 Golder	BH05-13 8721-06 2.8 31-Mar-05 Golder FDA	BH05-13 8721-11 7.1 31-Mar-05 Golder	BH05-13 8715-06 15.5 31-Mar-05 Golder	BH05-15 33753-07 2 31-Mar-05 Golder	BH05-15 33754-08 13.1 31-Mar-05 Golder	MW05-17 0029-01 1.7 1-Apr-05 Golder	MW05-17 0029-12 12.7 1-Apr-05 Golder	MW05-18 0030-05 0.47 1-Apr-05 Golder	MW05-18 0030-07 1.7 1-Apr-05 Golder	MW05-18 0031-07 8.4 4-Apr-05 Golder	MW05-18 0031-10 12.1 4-Apr-05 Golder	MW05-19 0131-02 0.47 11-Apr-05 Golder	MW05-19 0131-09 6 11-Apr-05 Golder	MW05 0131- 7.5 11-Ap Gold
						6.91	8.25	8.59	8.72	8.10	8.68	8.82	8.04	8.67	8.05	8.78	7.38	6.31	7.79	7.88	7.86	7.17	8.6
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	G	40	G	40	G	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<1
25	MW	25	MW	25	MW	<5.0	<5.0	21.8	<5.0	<5.0	<5.0	<5.0	5.5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6.5	<5.0	<5.
1000	T	1,500	T/MW	1,500	G	35.4	148	225	185	139	150	222	177	216	201	235	98.1	123	213	235	193	29.0	28
4	G	8	G	8	G	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.5
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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2-35	MW/I/pH	2-100	MW/I/pH	2-200	MW/pH	1.21	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.5
60 (90^{13})	V	60 (90^{13})	V	60 (90^{13})	V	16.1	29.0	12.9	7.2	30.8	11.3	6.1	30.9	7.4	33.7	7.5	29.7	22.6	8.0	11.1	33.6	2.6	27.
50	G	300	G	300	G	4.4	6.3	4.4	3.9	7.3	4.7	3.8	9.4	5.0	9.6	4.1	10.7	6.5	3.7	4.2	9.0	<2.0	7.9
90-150	MW/T/pH	90-250	MW/T/pH	90-250	MW/T/pH	55.4	79.5	51.3	36.0	69.5	53.6	41.9	72.9	34.5	111	38.5	74.6	60.3	40.8	56.8	86.5	9.7	57.
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
150-500	MW/I/pH	150-1,000	MW/I/pH	150-2,000	MW/T/pH	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<5
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1800	S	19,000	S	19,000	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	I	40	I	150	T	0.397	0.400	0.761	0.939	0.427	0.366	0.252	0.625	0.372	0.489	0.194	0.061	0.131	0.256	0.183	0.406	0.091	0.35
10	G	40	G	40	G	8.5	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	5.1	<4.0	<4.0	<4.0	<4.0	<4.
100	G	500	G	500	G	14.5	41.6	21.2	11.9	48.9	18.5	11.7	54.2	14.4	55.2	14.8	19.9	26.4	13.6	18.4	49.7	<5.0	27.
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	G	10	G	10	G	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.
20	G	40	G	40	G	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
47,000	S	100,000	S	100,000	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	S	300	S	300	S	6.7	<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.
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
200	G					37.9	40.2	35.3	35.5	38.3	40.7	30.7	40.0	35.2	39.1	30.4	65.5	33.9	28.6	29.1	44.9	5.3	43.
150-450	MW/T/pH	150-600	MW/T/pH	150-600	MW/T/pH	147	69.3	33.6	42.3	61.1	80.5	24.9	73.0	35.1	78.8	26.4	68.1	516	29.8	37.4	78.3	10.3	46.
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	0.340	1.77	2.12	0.370	2.32	2.06	0.280	2.39	0.280	1.26	-	-	1.51	1.07	-	-	-

minated Sites Regulation (CSR), enacted in 1997, and updated May 31, 2011.

Park Land); RL (Residential); CL (Commercial); IL (Industrial).

ms per gram (ug/g) unless othwise indicated.

nservative value of generic (G), intake of contaminated soil (I), toxicity to soil invertebrates and plants
ife (MW) and schedule 10 (S).

rd.

most conservative standard is used (CrIV)

FD = Field duplicate.

005. Report on Supplemental Stage 1 Preliminary Site Investigation and Detailed Site Investigation Lot
BC. Dated June 30, 2005.

0. Environmental Review for Town of Ladysmith Waterfront Development Slag Point Area,
.

1994. Elk Falles Forest Industries Limited Phase II Environmental Assessment Ladysmith Harbour
d January 1994.

g Ltd. 2000a. Preliminary Site Investigation Stage 1 and Stage II Lot 4, Plan 45800, District Lot 8G,
64405, Oyster Land District. Ladysmith, B.C. Dated August 25, 2000.

g Ltd. 2000b. Detailed Site Investigation Lot 4, Plan 45800, District Lot 8G, District Lot 11G and Lot
ict. Ladysmith, B.C. Dated October 25, 2000.

ration for Chromium (CSR Protocol 4) is 90µg/g.

CSR ndards PL/RL MW)	MCS	CSR Standards for CL (MW)	MCS	CSR Standards for IL (MW)	MCS	BH05-23 0133-03 0.47 11-Apr-05 Golder	BH05-23 0134-06 14.9 11-Apr-05 Golder	MW05-24 0047-01 0.15 21-Apr-05 Golder	TP05-1 0032-06 0.67 6-Apr-05 Golder	TP05-2 0032-07 0.9 6-Apr-05 Golder	TP05-4 0033-04 1 6-Apr-05 Golder	TP05-8 0034-03 0.4 6-Apr-05 Golder	TP05-9 0034-05 0.6 6-Apr-05 Golder	TP05-10 0034-07 0.6 6-Apr-05 Golder	TP05-11 0034-09 0.3 6-Apr-05 Golder	TP05-11 0034-11 1.6 6-Apr-05 Golder	TP05-12 0035-02 2.5 6-Apr-05 Golder	TP05-13 0035-04 0.4 6-Apr-05 Golder	TP05-14 0035-06 0.5 6-Apr-05 Golder	TP05-15 0035-08 1.2 6-Apr-05 Golder	Stockpile A 0094-01 n/a 5/18/2005 Golder FDA	Stockpile A 0094-05 n/a 5/18/2005 Golder	Stockpil COMP n/a 5/18/20 Golde
						7.44	9.10	7.81	5.66	5.99	5.77	7.97	7.01	6.81	5.89	6.59	7.81	6.55	8.04	7.10	6.67	6.86	6.52
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	G	40	G	40	G	<10	<10	<10	<10	<10	<10	<10	46	34	<10	<10	<10	<10	<10	<10	<10	<10	<10
25	MW	25	MW	25	MW	<5.0	<5.0	<5.0	<5.0	10.8	<5.0	14.2	15.8	13.5	<5.0	<5.0	5.2	<5.0	<5.0	<5.0	6.3	5.8	5.5
1000	T	1,500	T/MW	1,500	G	110	230	183	68.8	76.2	104	2890	370	750	61.1	32.6	156	42.6	184	296	143	89	89.4
4	G	8	G	8	G	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.90	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.5
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-35	MW/I/pH	2-100	MW/I/pH	2-200	MW/pH	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1.48	2.92	4.72	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.5
(90^{13})	V	60 (90^{13})	V	60 (90^{13})	V	29.4	8.4	34.6	16.5	26.3	21.4	38.6	100	101	14.2	11.9	29.2	15.0	25.3	29.4	22.7	21.5	22.1
50	G	300	G	300	G	9.9	4.3	8.7	6.5	7.5	6.8	13.8	19.0	25.4	3.7	3.0	7.3	2.6	6.1	10.8	9	9.1	9
0-150	MW/T/pH	90-250	MW/T/pH	90-250	MW/T/pH	59.5	43.0	75.8	57.1	64.2	75.8	1000	4780	3540	69.9	47.8	76.4	31.5	107	73.1	60.1	57.7	58.9
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50-500	MW/I/pH	150-1,000	MW/I/pH	150-2,000	MW/T/pH	<50	<50	<50	<50	54	<50	590	2130	2230	<50	<50	<50	<50	<50	88	<50	<50	<50
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1800	S	19,000	S	19,000	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	I	40	I	150	T	0.065	0.283	0.301	0.144	0.123	0.147	<0.050	0.254	0.236	0.076	0.066	0.213	0.083	0.391	0.284	0.065	0.065	0.065
10	G	40	G	40	G	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	4.4	26.0	26.4	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
100	G	500	G	500	G	21.8	14.7	51.8	16.7	22.4	19.5	59.8	270	217	14.1	10.5	45.5	8.6	36.6	25.7	17.8	17.6	18.1
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	G	10	G	10	G	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<3.0	<3.0
20	G	40	G	40	G	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.9	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7,000	S	100,000	S	100,000	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	S	300	S	300	S	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	44.6	172	223	5.5	<5.0	<5.0	<5.0	<5.0	13.1	<5.0	<5.0	<5.0
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
200	G					77.5	27.3	45.2	33.9	45.4	44.9	48.4	42.8	47.8	28.0	21.3	38.1	22.0	35.2	73.8	67	67.4	63.5
50-450	MW/T/pH	150-600	MW/T/pH	150-600	MW/T/pH	68.9	34.4	73.8	119	551	140	5300	1820	2260	143	538	148	81.9	62.6	131	59.3	60.2	57.5
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	1.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ed Sites Regulation (CSR), enacted in 1997, and updated May 31, 2011.

Land); RL (Residential); CL (Commercial); IL (Industrial).

r gram (ug/g) unless othwise indicated.

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Field duplicate.

Report on Supplemental Stage 1 Preliminary Site Investigation and Detailed Site Investigation Lot
Dated June 30, 2005.

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4. Elk Falles Forest Industries Limited Phase II Environmental Assessment Ladysmith Harbour
uary 1994.

2000a. Preliminary Site Investigation Stage 1 and Stage II Lot 4, Plan 45800, District Lot 8G,
5, Oyster Land District. Ladysmith, B.C. Dated August 25, 2000.

. 2000b. Detailed Site Investigation Lot 4, Plan 45800, District Lot 8G, District Lot 11G and Lot
Ladysmith, B.C. Dated October 25, 2000.

n for Chromium (CSR Protocol 4) is 90µg/g.

CSR Standards for CL (MW)	MCS	CSR Standards for IL (MW)	MCS	Stockpile B COMP 7-12 n/a 5/18/2005 Golder	CPT 1 - 1.55 9/18/1990 Hardy	CPT 4 - 2.5 9/18/1990 Hardy	CPT 5 - 0.7 9/18/1990 Hardy	CPT 9 - 2.1 9/18/1990 Hardy	CPT 10 - 2 9/18/1990 Hardy FDA	CPT 10 - 2 9/18/1990 Hardy FD	TP1 1 18-Jul-00 Levelton[a]	TP2 1 18-Jul-00 Levelton[a]	TP3 3 18-Jul-00 Levelton[a]	TP4 2 18-Jul-00 Levelton[a]	TP4 4 18-Jul-00 Levelton[a]	TP6 3 18-Jul-00 Levelton[a]	TP12 3 18-Jul-00 Levelton[a]	LOT 11G 009071-32 0.5 21-Sep-00 Levelton[b]	1 3 7-May-93 EBA	2 1.3 7-May-93 EBA	3 3 7-May-93 EBA	5 3 7-May-93 EBA	6 4.5 7-May-9 EBA
				6.53	4.87	7.2	6.52	8.37	7.77	-	6.2	6.5	-	6.8	6.3	8.0	-	6.4	-	-	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74700	65800	-	-	-
40	G	40	G	<10	-	-	-	-	-	-	<2	<2	-	3	<2	<2	-	<2	<1.5	<1.5	-	-	-
25	MW	25	MW	5.5	-	<25	<25	52	26	34.2	2.4	2.9	-	7.4	2.8	4.1	-	5.4	6.5	11	-	-	-
1,500	T/MW	1,500	G	99.1	-	65.6	59.2	6.80	171	123	94	78	-	72	79	508	-	67.6	367	319	-	-	-
8	G	8	G	<0.50	-	-	-	-	-	-	0.3	0.2	-	0.3	0.3	0.4	-	0.2	0.7	0.6	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<2	<2	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19400	10100	-	-	-
2-100	MW/I/pH	2-200	MW/pH	<0.50	-	<0.10	<0.10	0.17	1.06	0.6	<0.2	<0.2	-	<0.2	<0.2	0.4	-	<0.2	0.7	0.6	-	-	-
60 (90^{13})	V	60 (90^{13})	V	28.7	-	26.8	28.1	49.1	77.1	59.8	20	16	-	34	40	24	-	72	31.9	25.1	-	-	-
300	G	300	G	11.8	-	14.6	15.6	9.5	12.6	15.7	8.9	7.5	-	17	11	10	-	9.0	9.7	9.6	-	-	-
90-250	MW/T/pH	90-250	MW/T/pH	84.4	-	58.9	55.9	86.4	147	252	51	63	-	45	40	90	-	58.4	73.9	77.9	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16200	17700	-	-	-
150-1,000	MW/I/pH	150-2,000	MW/T/pH	<50	28.0	2.8	2.7	<2.0	83.4	55.8	14	28	45	6	6	41	7	72	16	29	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6130	5900	-	-	-
19,000	S	19,000	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	253	255	-	-	-
40	I	150	T	0.054	-	0.058	0.08	0.239	0.334	0.341	<0.05	<0.05	-	0.06	0.05	0.07	-	0.08	0.44	0.7	-	-	-
40	G	40	G	<4.0	-	<5.0	<5.0	<5.0	<5.0	<4.0	<0.4	0.6	-	<0.4	0.8	1	-	3.4	<0.4	0.5	-	-	-
500	G	500	G	22.6	-	20.1	25.5	44.4	113	108	19	16	-	<0.5	18	2.1	-	25.9	41.6	50.4	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	219	326	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8820	7050	-	-	-
10	G	10	G	<3.0	-	0.07	0.1	0.08	0.16	0.11	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	1.1	<1	<1	-	-	-
40	G	40	G	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<1	<1	-	<1	<1	<1	-	<1	<1	<1	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3970	822	-	-	-
100,000	S	100,000	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	121	105	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	<2	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<2	<2	-	-	-
300	S	300	S	<5.0	-	<30	<30	<30	<30	<30	<2	<2	-	<2	<2	<2	-	8	<2	<2	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1150	1030	-	-	-
				78.6	-	-	-	-	-	-	45	41	-	82	91	70	-	41.8	101	97.5	-	-	-
150-600	MW/T/pH	150-600	MW/T/pH	57.6	-	46.4	40.1	91.3	588	543	59	119	-	31	28	94	-	103	65.2	78.6	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.6	5.8	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2660	3030	1530	2900	2790

enacted in 1997, and updated May 31, 2011.
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intake of contaminated soil (I), toxicity to soil invertebrates and plants

sed (CrIV)

age 1 Preliminary Site Investigation and Detailed Site Investigation Lot

own of Ladysmith Waterfront Development Slag Point Area,

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rds RL)	MCS	CSR Standards for CL (MW)	MCS	CSR Standards for IL (MW)	MCS	BH05-1 0019-08 6.9 28-Mar-05 Golder	MW05-1 0020-05 0.15 28-Mar-05 Golder	MW05-2 0020-08 1.8 28-Mar-05 Golder	MW05-3 0021-01 0.15 28-Mar-05 Golder	MW05-3 0021-03 0.9 28-Mar-05 Golder	MW05-4 0022-01 1.7 29-Mar-05 Golder	MW05-4 0022-02 2.7 29-Mar-05 Golder	MW05-5 0022-10 2.7 29-Mar-05 Golder FDA	MW05-6 0023-08 0.15 29-Mar-05 Golder	MW05-6 0023-10 0.9 29-Mar-05 Golder FDA	MW5-6 0023-12 1.8 29-Mar-05 Golder	MW05-7 0024-04 0.15 29-Mar-05 Golder	MW05-7 0024-06 0.9 29-Mar-05 Golder	MW05-7 0024-09 2.7 29-Mar-05 Golder	MW05-8 0026-01 1 30-Mar-05 Golder	MW05-9 0026-07 0.47 30-Mar-05 Golder	BH05-10 0027-04 0.9 30-Mar-05 Golder	BH05-10 0027-07 3.7 30-Mar-05 Golder	BH05-13 8715-06 15.5 31-Mar-05 Golder
	MW	2.5	MW	2.5	MW	-	-	<0.50	-	<0.50	<0.50	-	-	-	-	-	<0.040	<0.040	-	-	-	-	-	-
	T	20	T	20	T	-	-	0.20	-	0.17	<0.10	-	-	-	-	-	0.066	<0.050	-	-	-	-	-	-
	S	700	S	700	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	50	G	50	G	-	-	-	-	-	-	-	-	-	-	-	<0.050	<0.050	-	-	-	-	-	-
	T	25	T	25	T	-	-	<0.20	-	0.30	<0.20	-	-	-	-	-	0.103	<0.050	-	-	-	-	-	-
						-	-	1.41	-	1.20	0.24	-	-	-	-	-	0.436	<0.050	-	-	-	-	-	-
						-	-	1.47	-	1.10	0.23	-	-	-	-	-	0.182	<0.050	-	-	-	-	-	-
	T	50	T	50	T	-	-	2.88	-	2.30	0.47	-	-	-	-	-	0.62	<0.10	-	-	-	-	-	-
						-	-	110	-	<100	<100	-	-	-	-	-	<100	<100	-	-	-	-	-	-
	G	200	G	200	G	-	-	100	-	<100	<100	-	-	-	-	-	<100	<100	-	-	-	-	-	-
						0.682	<0.20	<0.30	<0.30	<0.20	<0.20	0.598	<0.40	-	<0.080	-	0.140	0.123	<0.20	<0.090	0.047	0.232	<0.20	0.65
						0.619	0.292	0.328	0.269	0.191	0.220	<0.60	0.302	-	<0.10	-	0.130	<0.050	0.240	<0.15	<0.050	0.057	0.167	0.575
						1.05	0.346	0.492	0.459	0.287	0.325	0.476	0.482	-	0.10	-	0.102	0.162	0.359	0.202	0.103	0.421	0.228	0.936
	G	10	G	10	G	0.757	0.760	0.627	0.792	0.503	0.622	0.549	0.510	-	0.10	-	0.057	0.179	0.556	0.346	<0.15	0.323	0.346	0.680
	T	10	T	10	T	0.492	0.454	0.441	0.465	0.325	0.405	0.255	0.318	-	<0.10	-	0.101	0.084	0.369	0.135	0.067	0.176	0.203	0.467
	G	10	G	10	G	0.572	0.929	0.516	0.648	0.426	0.555	0.340	0.387	-	<0.10	-	0.125	0.137	0.531	0.207	0.079	0.281	0.250	0.611
						0.469	0.333	0.374	0.467	0.292	0.394	0.202	0.268	-	<0.10	-	0.105	<0.050	0.381	0.119	<0.050	0.098	0.157	0.448
	G	10	G	10	G	0.120	0.229	0.112	0.130	0.082	0.118	0.055	0.087	-	<0.10	-	<0.050	<0.050	0.108	0.053	<0.050	0.092	<0.050	0.125
						0.982	1.21	0.817	1.11	0.709	0.938	0.690	0.691	-	0.13	-	0.068	<0.25	0.827	0.442	0.107	0.380	0.492	0.991
	G	10	G	10	G	0.120	0.091	0.077	0.112	0.078	0.112	0.060	0.072	-	<0.10	-	<0.050	<0.050	0.094	<0.050	<0.050	<0.050	0.055	0.112
						0.649	1.30	0.486	0.615	0.378	0.460	0.391	0.420	-	0.23	-	0.057	<0.40	0.420	0.214	0.181	1.08	0.283	0.592
						1.65	0.169	0.267	0.294	0.195	0.281	0.889	0.618	-	<0.10	-	0.275	0.216	0.265	0.120	0.090	0.330	0.184	1.46
	G	10	G	10	G	0.106	0.197	0.109	0.129	0.072	0.098	<0.050	0.063	-	<0.10	-	0.108	<0.050	0.096	<0.050	<0.050	0.101	<0.050	0.115
						9.95	5.06	9.04	8.12	6.28	5.56	9.90	8.24	-	0.67	-	4.54	0.976	5.58	3.16	0.752	0.630	4.26	10.1
	G	50	G	50	G	4.88	2.52	4.79	4.14	3.02	2.37	3.83	3.71	-	0.32	-	1.18	0.443	2.48	1.04	0.323	4.00	1.78	**5.12**
	G	50	G	50	G	**9.47**	4.07	**5.36**	**6.36**	4.31	**5.84**	4.61	**5.24**	-	0.68	-	0.973	1.22	4.93	2.50	0.670	0.910	2.74	**8.31**
	G	100	G	100	G	0.813	1.37	0.616	0.825	0.516	0.636	0.524	0.580	-	0.19	-	0.267	0.324	0.581	0.305	0.177	0.828	0.370	0.788
	G	2,000	G	2,000	G	**1440**	760	**1360**	**1320**	930	**1050**	**1110**	980	<200	360	**1510**	**1300**	410	**1080**	650	440	450	550	**1350**
	G	5,000	G	5,000	G	**1710**	**1280**	**1980**	**1920**	**1300**	**1560**	**1340**	**1230**	410	**2650**	**2420**	**1870**	**3390**	**1540**	930	**4160**	**2010**	720	**1580**
	G	2,000	G	2,000	G	**1420**	760	**1350**	**1310**	930	**1050**	**1100**	970	-	360	-	**1300**	410	**1070**	640	440	450	550	**1330**
	G	5,000	G	5,000	G	**1710**	**1280**	**1970**	**1920**	**1300**	**1560**	**1340**	**1220**	-	**2650**	-	**1870**	**3390**	**1540**	930	**4160**	**2010**	720	**1580**
	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	I/T	15	I	50	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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ds RL	MCS	CSR Standards for CL (MW)	MCS	CSR Standards for IL (MW)	MCS	MW05-18 0031-10 12.1 4-Apr-05 Golder	MW05-19 0131-02 0.47 11-Apr-05 Golder	MW05-19 0131-09 6 11-Apr-05 Golder FDA	MW05-19 0131-10 7.5 11-Apr-05 Golder	BH05-21 0130-10 3.1 11-Apr-05 Golder	MW05-22 0132-05 0.15 11-Apr-05 Golder	BH05-23 0133-03 0.47 11-Apr-05 Golder	BH05-23 0134-06 14.9 11-Apr-05 Golder	MW05-24 0047-01 0.15 21-Apr-05 Golder	TP05-1 0032-06 0.67 6-Apr-05 Golder	TP05-2 0032-07 0.9 6-Apr-05 Golder	TP05-4 0033-04 1 6-Apr-05 Golder	TP05-8 0034-03 0.4 6-Apr-05 Golder	TP05-9 0034-05 0.6 6-Apr-05 Golder	TP05-10 0034-07 0.6 6-Apr-05 Golder	TP05-11 0034-09 0.3 6-Apr-05 Golder	TP05-11 0034-11 1.6 6-Apr-05 Golder	TP05-12 0035-02 2.5 6-Apr-05 Golder	TP05-13 0035-04 0.4 6-Apr-05 Golder	TP0 00 6-A Go
	MW	2.5	MW	2.5	MW	-	<0.50	-	-	-	<0.040	<0.040	-	-	-	-	-	-	-	-	-	-	-	-	
	T	20	T	20	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	S	700	S	700	S	-	<0.10	-	-	-	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	
	G	50	G	50	G	-	<0.10	-	-	-	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	
	T	25	T	25	T	-	0.20	-	-	-	0.082	0.076	-	-	-	-	-	-	-	-	-	-	-	-	
						-	0.92	-	-	-	0.306	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	
						-	0.84	-	-	-	0.199	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	
	T	50	T	50	T	-	1.76	-	-	-	0.50	<0.10	-	-	-	-	-	-	-	-	-	-	-	-	
						-	<100	-	-	-	<100	<100	-	-	-	-	-	-	-	-	-	-	-	-	
	G	200	G	200	G	-	<100	-	-	-	<100	<100	-	-	-	-	-	-	-	-	-	-	-	-	
						0.446	<0.10	<0.040	0.295	<0.25	0.132	<0.040	0.695	<0.20	<0.60	<0.040	0.074	<0.040	-	-	-	0.046	-	<0.050	
						<0.50	<0.20	<0.050	0.182	<0.25	0.237	<0.050	<0.40	<0.30	0.092	<0.070	0.060	<0.050	-	-	-	<0.050	-	<0.050	
						0.668	0.185	<0.050	0.464	0.257	0.245	<0.050	1.01	0.364	0.237	0.123	0.151	<0.050	-	-	-	0.057	-	<0.050	
	G	10	G	10	G	0.577	0.400	0.051	0.424	0.322	0.445	0.056	0.738	0.620	0.306	0.255	0.180	<0.050	-	-	-	0.080	-	0.072	
	T	10	T	10	T	0.339	0.264	<0.050	0.163	0.188	0.173	0.064	0.454	0.389	0.155	0.147	0.117	<0.050	-	-	-	<0.050	-	<0.050	
	G	10	G	10	G	0.368	0.362	<0.050	0.193	0.243	0.274	0.083	0.534	0.575	<0.30	0.275	0.157	0.102	-	-	-	0.079	-	<0.050	
						0.217	0.307	0.059	0.145	0.249	0.197	0.070	0.558	0.340	0.178	0.167	0.101	0.052	-	-	-	<0.050	-	<0.050	
	G	10	G	10	G	0.085	0.055	<0.050	<0.050	<0.050	0.056	<0.050	0.094	0.103	<0.050	0.069	<0.050	<0.050	-	-	-	<0.050	-	<0.050	
						0.711	0.593	0.075	0.476	0.471	0.537	0.067	0.998	0.887	0.445	0.338	0.223	0.088	-	-	-	0.111	-	0.098	
	G	10	G	10	G	<0.050	0.074	<0.050	<0.050	0.057	0.059	<0.050	<0.15	0.097	<0.050	<0.050	<0.050	<0.050	-	-	-	<0.050	-	<0.050	
						0.506	0.328	0.067	0.290	0.279	0.304	0.094	0.677	0.535	0.361	0.211	0.145	0.068	-	-	-	0.166	-	0.136	
						<0.60	0.151	<0.050	0.674	0.320	0.187	<0.050	1.43	0.308	0.153	<0.060	0.125	<0.050	-	-	-	0.084	-	0.054	
	G	10	G	10	G	0.051	0.075	<0.050	<0.050	0.054	0.054	0.053	0.123	0.090	0.059	0.088	0.052	0.052	-	-	-	<0.050	-	<0.050	
						16.9	4.87	0.285	5.46	8.80	5.58	0.082	9.27	9.15	2.85	1.36	1.93	0.130	-	-	-	0.513	-	0.695	
	G	50	G	50	G	**6.89**	1.95	0.140	2.45	4.10	2.39	<0.050	3.48	3.70	1.63	0.689	1.11	0.127	-	-	-	0.251	-	0.328	
	G	50	G	50	G	**7.32**	3.55	0.295	3.75	3.29	3.68	0.106	**7.85**	**5.17**	2.38	1.31	1.42	0.163	-	-	-	0.567	-	0.442	
	G	100	G	100	G	0.572	0.440	0.104	0.392	0.356	0.405	0.116	0.831	0.638	0.387	0.267	0.189	0.054	-	-	-	0.162	-	0.136	
	G	2,000	G	2,000	G	**1740**	970	270	750	790	940	<200	**1340**	**1270**	860	780	580	<200	340	430	480	630	710	440	8
	G	5,000	G	5,000	G	**1950**	**1450**	720	810	970	**1210**	<200	**1640**	**1560**	**3700**	**3910**	**2260**	230	830	990	**3710**	**5940**	**1540**	**2910**	**1**
	G	2,000	G	2,000	G	**1730**	960	270	750	790	940	<200	**1330**	**1260**	860	780	570	<200	-	-	-	620	-	440	
	G	5,000	G	5,000	G	**1950**	**1450**	720	810	970	**1210**	<200	**1640**	**1560**	**3700**	**3910**	**2260**	230	-	-	-	**5940**	-	**2910**	
	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	I/T	15	I	50	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

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rds RL)	MCS	CSR Standards for CL (MW)	MCS	CSR Standards for IL (MW)	MCS	Stockpile A COMP 1-6 n/a 5/18/2005 Golder	Stockpile B 0094-09 n/a 5/18/2005 Golder	Stockpile B 0094-12 n/a 5/18/2005 Golder	Stockpile B COMP 7-12 n/a 5/18/2005 Golder	CPT 1 - 1.55 18-Sep-90 Hardy	CPT 2 - 1.8 18-Sep-90 Hardy	CPT 3 - 1 18-Sep-90 Hardy	CPT 3 - 1.8 18-Sep-90 Hardy	CPT 10 - 2 18-Sep-90 Hardy FDA	CPT 10 - 2 18-Sep-90 Hardy FD	TP2 - 1 18-Jul-00 Levelton[a]	TP3 - 3 18-Jul-00 Levelton[a]	TP4 - 2 18-Jul-00 Levelton[a]	TP4 - 4 18-Jul-00 Levelton[a]	TP6 - 3 18-Jul-00 Levelton[a]	TP7 - 3 18-Jul-00 Levelton[a]	TP8 - 18-Jul-00 Levelton[a]	TP10 - 2 18-Jul-00 Levelton[a] FDA	TP10 - 2 18-Jul-00 Levelton[a] FD
	MW	2.5	MW	2.5	MW	-	-	-	-	1.02	-	-	-	-	-	-	<0.04	-	-	-	-	-	<0.04	<0.04
	T	20	T	20	T	-	-	-	-	**11.3**	-	-	-	-	-	-	<0.04	-	-	-	-	-	<0.04	<0.04
	S	700	S	700	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	50	G	50	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	T	25	T	25	T	-	-	-	-	**24**	-	-	-	-	-	-	<0.04	-	-	-	-	-	<0.04	<0.04
						-	-	-	-	74.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	30.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	T	50	T	50	T	-	-	-	-	**104.7**	-	-	-	-	-	-	<0.04	-	-	-	-	-	<0.04	<0.04
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	200	G	200	G	-	-	-	-	-	-	-	-	-	-	-	<10	-	-	-	-	-	<10	<10
						<0.040	<0.040	<0.040	<0.040	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						0.068	0.251	<0.050	0.084	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						0.055	0.115	<0.050	0.077	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	10	G	10	G	0.135	0.399	<0.050	0.185	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	T	10	T	10	T	0.172	0.669	<0.050	0.217	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	10	G	10	G	0.221	0.741	<0.050	0.263	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						0.137	0.591	<0.050	0.169	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	10	G	10	G	0.097	0.27	<0.050	0.108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						0.169	0.44	<0.050	0.205	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	10	G	10	G	<0.050	0.124	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						0.251	0.731	<0.050	0.406	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						<0.050	<0.050	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	10	G	10	G	0.142	0.555	<0.050	0.164	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						0.125	<0.050	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	50	G	50	G	0.082	0.1	<0.050	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	50	G	50	G	0.18	0.215	<0.050	0.244	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	100	G	100	G	0.244	0.695	<0.050	0.357	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
																-	-	-	-	-	-	-	-	-
	G	2,000	G	2,000	G	<200	<200	<200	<200	-	-	-	-	-	-	<100	<100	**4,760**	**2,230**	<100	560	-	<100	<100
	G	5,000	G	5,000	G	<200	<200	<200	<200	-	-	-	-	-	-	<100	<100	550	350	<100	<100	-	<100	<100
	G	2,000	G	2,000	G	<200	<200	<200	<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	5,000	G	5,000	G	<200	<200	<200	<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	2,000	G	2,000	G	-	-	-	-	475	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	2,000	G	2,000	G	-	-	-	-	-	317	**2,740**	**3,130**	**2,000**	**2,050**	-	-	-	-	-	-	-	-	-
	G	2,000	G	2,000	G	-	-	-	-	-	439	-	2440	-	-	-	-	-	-	-	-	-	-	-
	I/T	15	I	50	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	< detection	-	-

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5	MW	2.5	MW	2.5	MW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.04	-	-
	T	20	T	20	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.04	-	-
0	S	700	S	700	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	50	G	50	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	T	25	T	25	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.04	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	T	50	T	50	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.04	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0	G	200	G	200	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	10	G	10	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	T	10	T	10	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	10	G	10	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	10	G	10	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	10	G	10	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	G	10	G	10	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	G	50	G	50	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	G	50	G	50	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0	G	100	G	100	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
00	G	2,000	G	2,000	G	430	1,350	875	<250	<250	<250	770	<250	2,350	<250	<250	<250	<250	<250	<250	-	<250	<2
00	G	5,000	G	5,000	G	480	1,450	680	<250	<250	<250	270	<250	750	<250	<250	<250	<250	<250	<250	-	<250	<2
00	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
00	G	5,000	G	5,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
00	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
00	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
00	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
00	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	I/T	15	I	50	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ion (CSR), enacted in 1997, and updated May 31, 2011.
dential); CL (Commercial); IL (Industrial).
nless othwise indicated.
eneric (G), intake of contaminated soil (I), toxicity to soil invertebrates and schedule 10 (S).

EPH10-19 and EPH19-32, respectively.
phatic Hydrocarbons, Mineral Oil and Grease, Oil and Grease, and Total

tractable Hydrocarbons.

lemental Stage 1 Preliminary Site Investigation and Detailed Site Investigation 30, 2005.
eview for Town of Ladysmith Waterfront Development Slag Point Area,

orest Industries Limited Phase II Environmental Assessment Ladysmith Harbou

orest Industries Limited Supplemental Information Ladysmith Harbour Leases

nary Site Investigation Stage 1 and Stage II Lot 4, Plan 45800, District Lot 8G, ed August 25, 2000.Plan VIP64405, Oyster Land

ed Site Investigation Lot 4, Plan 45800, District Lot 8G, District Lot 11G and

Location	CSR Standards for PL/RL (MW)	MCS	CSR Standards for CL (MW)	MCS	CSR Standards for IL (MW)	MCS	3	4	6	7	10	11	14	15	16	17	17	17	18	18	19	19
SCN							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depth (m)							3	3	4.5	3.5	2	0.8	0.6	0.6	0.6	1	1	1.5	1	1.5	1	1.5
Date Sampled							7-May-93	7-May-93	7-May-93	7-May-93	7-May-93	27-Jun-93	16-Jul-93	10-Aug-93	10-Aug-93	28-Jan-94	28-Jan-94	28-Jan-94	28-Jan-94	28-Jan-94	28-Jan-94	28-Jan
Source							EBA[a]	EBA[a]	EBA[a]	EBA[a]	EBA[a]	EBA[a]	EBA[a]	EBA[a]	EBA[a]	EBA[b]	EBA[b]	EBA[b]	EBA[b]	EBA[b]	EBA[b]	EBA
QA/QC																FDA	FD					
n-Halogenated Volatiles																						
zene	2.5	MW	2.5	MW	2.5	MW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ylbenzene	1	T	20	T	20	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
thyl t-butyl ether (MTBE)	320	S	700	S	700	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
rene	5	G	50	G	50	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
uene	1.5	T	25	T	25	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
a- & para-Xylene							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylene							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
al Xylene	5	T	50	T	50	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
atile Hydrocarbons (VH6-10)							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H	200	G	200	G	200	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ycyclic Aromatic Hydrocarbons																						
naphthene							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
naphthylene							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
hracene							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
z(a)anthracene	1	G	10	G	10	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
zo(a)pyrene	1	T	10	T	10	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
zo(b)fluoranthene	1	G	10	G	10	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
zo(g,h,i)perylene							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
zo(k)fluoranthene	1	G	10	G	10	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ysene							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
enz(a,h)anthracene	1	G	10	G	10	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
oranthene							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
orene							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
eno(1,2,3-c,d)pyrene	1	G	10	G	10	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
lethylnaphthalene							-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phthalene	5	G	50	G	50	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
nanthrene	5	G	50	G	50	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ene	10	G	100	G	100	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
al PAH TEQ (Calc.)																						
ractable Hydrocarbons																						
H10-19[c]	1,000	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H19-32[4]	1,000	G	5,000	G	5,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PH	1,000	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PH	1,000	G	5,000	G	5,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
neral																						
nt Aliphatic Hydrocarbons[5]	1,000	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
neral Oil and Grease[5]	1,000	G	2,000	G	2,000	G	3,200	2,400	2,500	2,300	2,400	16,000	1,100	470	960	<10	<10	<10	<10	<10	<10	<10
and Grease[5]	1,000	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
al Extractable Hydrocarbons[5]	1,000	G	2,000	G	2,000	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
al PCBs	5	I/T	15	I	50	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

s:

dards shown are from the Contaminated Sites Regulation (CSR), enacted in 1997, and updated May 31, 2011.

. Use abbreviations: PL (Urban Park Land); RL (Residential); CL (Commercial); IL (Industrial).

esults are expressed in micrograms per gram (ug/g) unless othwise indicated.

SR Standards reflect the most conservative value of generic (G), intake of contaminated soil (I), toxicity to soil invertebrates and s (T), marine and/or estuarine aquatic life (MW) and schedule 10 (S).

CS= Most Conservative Standard.

EPH/HEPH criteria used as a conservative screen for EPH10-19 and EPH19-32, respectively.

EPH criteria used as a conservate screen for Light Aliphatic Hydrocarbons, Mineral Oil and Grease, Oil and Grease, and Total actable Hydrocarbons.

PH criteria used as a conservative screen for Total Extractable Hydrocarbons.

DA = Field duplicate available; FD = Field duplicate.

older = Golder Associates Ltd. 2005. Report on Supplemental Stage 1 Preliminary Site Investigation and Detailed Site Investigation 6G Ladysmith Harbour Ladysmith, BC. Dated June 30, 2005.

ardy = Hardy BBT Limited. 1990. Environmental Review for Town of Ladysmith Waterfront Development Slag Point Area, smith, B.C. Dated October 1990.

EBA = EBA Environmental Ltd. 1994. Elk Falles Forest Industries Limited Phase II Environmental Assessment Ladysmith Harbou es Project Ladysmith, B.C. Dated January 1994.

EBA[b] = EBA Environmental Ltd. 1994b. Elk Falles Forest Industries Limited Supplemental Information Ladysmith Harbour Leases ct Ladysmith, BC. Dated February 4, 1994.

evelton[a] = Levelton Engineering Ltd. 2000a. Preliminary Site Investigation Stage 1 and Stage II Lot 4, Plan 45800, District Lot 8G, ict Lot 11G and Lot 1, District. Ladysmith, B.C. Dated August 25, 2000.Plan VIP64405, Oyster Land

evelton[b] = Levelton Engineering Ltd. 2000b. Detailed Site Investigation Lot 4, Plan 45800, District Lot 8G, District Lot 11G and

TABLE 3c
Historic Soil Sampling Results - VOCs
Ladysmith Harbour, Ladysmith, BC

Location	CSR Standards for PL/RL (MW)	MCS	CSR Standards for CL (MW)	MCS	CSR Standards for IL (MW)	MCS	MW05-2	MW05-3	MW05-4
SCN							0020-08	0021-03	0022-01
Depth (m)							1.8	0.9	1.7
Date Sampled							28-Mar-05	28-Mar-05	29-Mar-05
Source							Golder	Golder	Golder
QA/QC									
Chlorinated Aliphatics									
Carbon Tetrachloride	5	G	50	G	50	G	<0.10	<0.10	<0.10
Monochlorobenzene	1	G	10	G	10	G	<0.10	<0.10	<0.10
Chloroethane	30	S	65	S	65	S	<0.10	<0.10	<0.10
Chloromethane	47	S	160	S	160	S	-	-	-
1,2-Dichlorobenzene	1	G	10	G	10	G	<0.10	<0.10	<0.10
1,3-Dichlorobenzene	1	G	10	G	10	G	<0.10	<0.10	<0.10
1,4-Dichlorobenzene	1	G	10	G	10	G	<0.10	<0.10	<0.10
1,1-Dichloroethane	5	S	50	S	50	S	<0.10	<0.10	<0.10
1,2-Dichloroethane	5	G	50	G	50	G	<0.10	<0.10	<0.10
1,2-Dichloroethene	5	G	50	G	50	G	-	-	-
cis-1,2-Dichloroethylene	5	S	50	S	50	S	<0.10	<0.10	<0.10
trans-1,2-Dichloroethylene	5	S	50	S	50	S	<0.10	<0.10	<0.10
1,1-Dichloroethene	5	G	50	G	50	G	<0.10	<0.10	<0.10
Dichloromethane	5	G	50	G	50	G	-	-	-
1,2-dichloropropane	5	S	50	S	50	S	<0.10	<0.10	<0.10
cis 1,3-dichloropropene	5	S	50	S	50	S	<0.10	<0.10	<0.10
trans 1,3-dichloropropene	5	S	50	S	50	S	<0.10	<0.10	<0.10
1,1,1,2-tetrachloroethane	32	S	73	S	73	S	<0.10	<0.10	<0.10
1,1,2,2-tetrachloroethane	4.1	S	9.3	S	9.3	S	<0.10	<0.10	<0.10
tetrachloroethylene (Perc)	5	AW	5	AW	5	AW	<0.10	<0.10	<0.10
1,1,1-trichloroethane	5	S	50	S	50	S	<0.10	<0.10	<0.10
1,1,2-trichloroethane	5	S	50	S	50	S	<0.10	<0.10	<0.10
Trichloroethylene (TCE)	0.65	AW	0.65	AW	0.65	AW	<0.10	<0.10	<0.10
Trichlorofluoromethane	390	S	2000	S	2000	S	<0.10	<0.10	<0.10
Vinyl Chloride	0.79	S	7.5	S	7.5	S	<0.10	<0.10	<0.10
Trihalomethanes									
Bromodichloromethane	8.2	S	18	S	18	S	<0.10	<0.10	<0.10
Bromoform	620	S	2200	S	2200	S	<0.10	<0.10	<0.10
Chloroform	5	G	50	G	50	G	<0.10	<0.10	<0.10
Dibromochloromethane	11	S	26	S	26	S	<0.10	<0.10	<0.10

Notes:

Standards shown are from the Contaminated Sites Regulation (CSR), enacted in 1997, and updated May 31, 2011.

Land Use abbreviations: PL (Urban Park Land); RL (Residential); CL (Commercial); IL (Industrial).

1. Results are expressed in micrograms per gram (ug/g).
2. CSR Standards reflect the most conservative value of generic (G), intake of contaminated soil (I), toxicity to soil invertebrates and plants (T), marine and/or estuarine aquatic life (MW). where no MW standard is present, the freshwater aquatic life (AW) is used.
3. MCS= Most Conservative Standard
4. S = Schedule 10.
5. Golder = Golder Associates Ltd. 2005. Report on Supplemental Stage 1 Preliminary Site Investigation and Detailed Site Investigation Lot 16G Ladysmith Harbour Ladysmith, BC. Dated June 30, 2005.

TABLE 3d
Historic Soil Sampling Results - Chlorinated Phenols
Ladysmith Harbour, Ladysmith, BC

Location		CSR Standards for PL/RL (MW)	MCS	CSR Standards for CL (MW)	MCS	CSR Standards for IL (MW)	MCS	9
SCN								2
Depth (m)								7-May-93
Date Sampled								EBA
Source								
QA/QC								
Chlorinated Phenols								
Pentachlorophenol		**0.15 - 20**	MW/T/pH	**0.15 - 50**	MW/T/pH	**0.15 - 50**	MW/T/pH	<0.005
Tetracholorophenols		**0.5**	G	**5**	G	**5**	G	<0.005
Trichlorophenols		**0.5**	G	**5**	G	**5**	G	<0.005

Notes:

Standards shown are from the Contaminated Sites Regulation (CSR), enacted in 1997, and updated May 31, 2011.

Land Use abbreviations: PL (Urban Park Land); RL (Residential); CL (Commercial); IL (Industrial).

1. Results are expressed in micrograms per gram (ug/g).
2. CSR Standards reflect the most conservative value of generic (G),
   intake of contaminated soil (I), toxicity to soil invertebrates and
   plants (T), marine and/or estuarine aquatic life (MW) .
   where no MW standard is present, the freshwater aquatic life (AW) is used.
3. MCS= Most Conservative Standard
4. pH = Standard is pH dependant.
5. EBA = EBA Environmental Ltd. 1994. Elk Falles Forest Industries Limited Phase II
   Environmental Assessment Ladysmith Harbour Leases Project Ladysmith, B.C. Dated January 1994.

ndards Marine	Notes	MW05-2 0045-02 13-Apr-2005 Golder	MW05-3 0045-01 13-Apr-2005 Golder	MW05-4 0045-05 13-Apr-2005 Golder	MW05-5 0036-02 14-Apr-2005 Golder	MW05-6 0045-08 13-Apr-2005 Golder	MW05-7 0036-01 14-Apr-2005 Golder	MW05-8 0045-07 13-Apr-2005 Golder	MW05-9 0046-10 14-Apr-2005 Golder	MW05-11 0045-06 13-Apr-2005 Golder	MW05-12 0046-02 14-Apr-2005 Golder	MW05-16 0045-03 13-Apr-2005 Golder FDA	MW05-17 0039-01 14-Apr-2005 Golder	MW05-18 0039-02 14-Apr-2005 Golder FDA	MW05-19 0046-08 14-Apr-2005 Golder	MW05 0046 14-Apr Gold
		345	1470	146	2510	566	3430	519	463	394	791	590	4290	4640	323	87.
		7.18	6.51	7.58	7.77	7.45	7.75	7.31	7.37	7.11	6.60	6.79	7.73	7.79	7.29	8.5
		<0.020	<0.10	<0.050	<1.0	<0.10	<1.0	0.031	<0.020	<0.020	<0.10	<0.020	<0.10	<0.20	<0.010	<0.0
2		<0.0010	<0.0050	<0.0025	<0.050	<0.0050	<0.050	<0.0010	<0.0010	<0.0010	<0.0050	<0.0010	<0.0050	<0.010	<0.00050	<0.00
25		<0.0020	<0.020	<0.0050	<0.10	<0.010	<0.10	0.0053	<0.0060	<0.0020	<0.010	<0.0020	<0.040	<0.060	<0.0010	<0.0
5		0.124	<0.20	0.074	<0.20	0.075	<0.20	0.132	<0.20	0.244	<0.20	0.071	0.29	0.34	<0.20	<0.2
		<0.0050	<0.050	<0.0050	<0.050	<0.010	<0.050	<0.0050	<0.050	<0.0050	<0.050	<0.0050	<0.050	<0.050	<0.050	<0.0
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0		0.37	2.1	1.11	<1.0	1.23	3.0	0.51	1.5	0.21	1.1	0.29	2.2	2.0	<1.0	<1.
01		<0.00010	<0.00050	<0.00025	*<0.0050*	<0.00050	*<0.0050*	<0.00010	<0.00010	<0.00010	<0.00050	0.00011	<0.00050	<0.0010	0.000061	<0.000
		88.0	101	22.8	244	72.3	237	157	67.2	135	225	181	262	297	99.4	15.
0.56[III]	V	<0.0010	<0.0050	0.0028	<0.050	<0.0050	<0.050	<0.0050	<0.0010	<0.0010	<0.0050	<0.0050	<0.0050	<0.010	<0.00050	<0.00
04		0.0041	<0.0050	0.0050	*<0.050*	<0.0050	*<0.050*	0.0022	0.0050	0.0089	0.0115	0.0011	<0.0050	<0.010	0.00523	0.004
02		<0.0020	<0.010	<0.0050	*<0.10*	<0.010	*<0.10*	0.0029	0.0046	<0.0020	<0.010	<0.0020	<0.010	<0.020	<0.0010	0.00
		0.359	<0.30	<0.030	<0.30	<0.060	<0.30	1.15	<0.30	0.162	0.48	<0.030	<0.30	<0.30	<0.30	<0.3
02		<0.0020	<0.010	<0.0050	*<0.10*	<0.010	*<0.10*	<0.0020	<0.0020	<0.0020	<0.010	<0.0020	<0.010	<0.020	<0.0010	<0.00
		<0.050	<0.50	<0.050	<0.50	<0.10	<0.50	<0.050	<0.50	<0.050	<0.50	<0.050	<0.50	<0.50	<0.50	<0.5
		30.4	295	21.5	461	93.6	690	31.0	71.7	13.5	55.7	33.4	884	946	18.3	12.
		0.092	<0.10	0.021	0.33	<0.020	0.28	0.272	<0.10	1.58	0.73	0.053	0.77	0.86	0.13	<0.1
01		<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00
0		<0.0020	<0.010	0.0063	<0.10	<0.010	<0.10	<0.0020	0.0027	0.0022	<0.010	<0.0020	<0.010	<0.020	<0.0010	<0.00
83		<0.010	<0.050	<0.025	*<0.50*	<0.050	*<0.50*	<0.010	<0.010	0.012	<0.050	<0.010	<0.050	*<0.10*	<0.0050	<0.00
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
54		<0.0020	<0.060	<0.0050	<0.10	<0.010	<0.10	<0.0020	<0.014	<0.0020	<0.010	0.0035	<0.12	<0.14	<0.0010	<0.00
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15		<0.00010	<0.00050	<0.00025	<0.0050	<0.00050	<0.0050	<0.00010	<0.00010	<0.00010	<0.00050	<0.00010	<0.00050	<0.0010	<0.000050	<0.000
		67.6	3240	532	4000	1050	5790	30.4	1060	15.1	33	10.4	6620	5420	31	50
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03		<0.00040	<0.0020	<0.0010	*<0.020*	<0.0020	*<0.020*	<0.00040	<0.00040	<0.00040	<0.0020	<0.00040	<0.0020	*<0.0040*	<0.00020	<0.00
		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		<0.050	<0.50	<0.050	<0.50	<0.10	<0.50	<0.050	<0.50	<0.050	<0.50	<0.050	<0.50	<0.50	<0.50	<0.5
		<0.00040	<0.0020	<0.0010	<0.020	<0.0020	<0.020	<0.00040	0.00081	0.00258	<0.0020	0.00061	<0.0020	<0.0040	0.00052	<0.00
		<0.030	<0.30	<0.030	<0.30	<0.060	<0.30	<0.030	<0.30	<0.030	<0.30	<0.030	<0.30	<0.30	<0.30	<0.3
1		<0.0050	<0.050	<0.0050	<0.050	<0.010	<0.050	<0.0050	<0.050	<0.0050	<0.050	<0.0050	<0.050	<0.050	<0.050	<0.0

lation (CSR), its associated Schedules (Schedules 6 and 10) and Technical Guidance Documents, enacted in 1997, and updated from time to time (includes May 31, 2011 updates).

M = Marine.

)/Cr(III)]

eeds standard.

ld Duplicate.

port on Supplemental Stage 1 Preliminary Site

Historic Groundwater Results - Total Metals and Other Parameters
Ladysmith Harbour, Ladysmith, BC

Location	CSR Standards for AW Marine[5]	Notes	4	4	17	17	18	19
SCN			93011006	93015229	467-16-1	467-16-1	467-16-2	467-16-3
Date			4-Jun-1993	16-Jul-1993	28-Jan-1994	28-Jan-1994	28-Jan-1994	28-Jan-1994
Source			EBA[a]	EBA[a]	EBA[b]	EBA[b]	EBA[b]	EBA[b]
QA/QC					FDA	FD		
Physical								
Hardness (as $CaCO_3$)			591	-	-	-	-	-
pH			-	-	-	-	-	-
Salinity			-	-	20100	16610	4290	14890
Total Metals								
Aluminum			9.18	-	-	-	-	-
Antimony	**0.2**		<0.02	-	-	-	-	-
Arsenic	**0.125**		0.004	-	0.060	-	0.080	**0.130**
Barium	**5**		0.184	-	0.715	-	0.713	2.287
Beryllium	**1**		<0.001	-	-	-	-	-
Bismuth			<0.02	-	-	-	-	-
Boron	**50**		0.36	-	-	-	-	-
Cadmium	**0.001**		*<0.002*	-	**0.006**	-	**0.005**	**0.042**
Calcium			175	-	-	-	-	-
Chromium	**0.15[VI], 0.56[III]**	V	0.027	-	0.035	-	0.043	**0.159**
Cobalt	**0.04**		0.009	-	**0.062**	-	**0.100**	**0.167**
Copper	**0.02**		**0.110**	-	**0.584**	-	**0.705**	**1.529**
Iron			10.8	-	-	-	-	-
Lead	**0.02**		**0.03**	-	**0.21**	-	**0.170**	**2.060**
Lithium			-	-	-	-	-	-
Magnesium			37.4	-	-	-	-	-
Manganese			0.457	-	-	-	-	-
Mercury	**0.001**		0.00065	-	**0.002**	-	**0.003**	**0.009**
Molybdenum	**10**		<0.004	-	0.045	-	0.020	0.043
Nickel	**0.083**		0.04	-	**0.149**	-	**0.150**	**0.342**
Phosphorus			0.21	-	-	-	-	-
Potassium			12.4	-	-	-	-	-
Selenium	**0.54**		<0.005	-	<0.005	-	<0.005	<0.005
Silicon			3.8	-	-	-	-	-
Silver	**0.015**		<0.03	-	<0.003	-	<0.003	0.006
Sodium			66.8	68	-	-	-	-
Strontium			1.13	-	-	-	-	-
Tellurium			<0.02	-	-	-	-	-
Thallium	**0.003**		*<0.03*	-	-	-	-	-
Tin			<0.02	-	<0.010	-	<0.010	<0.010
Titanium	**1**		0.066	-	-	-	-	-
Uranium	**1**		-	-	-	-	-	-
Vanadium			0.033	-	-	-	-	-
Zinc	**0.1**		0.08	-	**0.440**	-	**0.400**	**1.360**
Zirconium			<0.003	-	-	-	-	-
Other Parameters								
Sulphur			32.6	-	-	-	-	-
Sulfate	**1000**		-	103	-	-	-	-
Chloride			-	36.9	-	-	-	-

Notes:
Standards from the Contaminated Sites Regulation (CSR), its associated Schedules (Schedules 6 and 10) and Technical Guidance Documents, enacted in 1997, and updated from time to time (includes May 31, 2011 updates).

Land Use abbreviations: AW (Aquatic Life), M = Marine.

1. All concentrations in mg/L.
2. V= Standard is valence dependent [CR(VI)/Cr(III)]
3. Italic indicates method detection limit exceeds standard.
4. FDA = Field duplicate available; FD = Field Duplicate.
5. CSR standards are for dissolved metals.
6. EBA[a] = EBA Environmental Ltd. 1994a. Elk Falles Forest Industries Limited Phase II Environmental Assessment Ladysmith Harbour Leases Project Ladysmith, B.C. Dated January 1994.
7. EBA[b] = EBA Environmental Ltd. 1994b. Elk Falles Forest Industries Limited Supplemental Information Ladysmith Harbour Leases Project Ladysmith, BC. Dated February 4, 1994.

MW05-4 0045-05 -Apr-2005 Golder	MW05-5 0036-02 14-Apr-2005 Golder	MW05-6 0045-08 13-Apr-2005 Golder	MW05-7 0036-01 14-Apr-2005 Golder	MW05-8 0045-07 13-Apr-2005 Golder	MW05-9 0046-10 14-Apr-2005 Golder	MW05-16 0045-03 13-Apr-2005 Golder FDA	MW05-17 0039-01 14-Apr-2005 Golder	MW05-18 0039-02 14-Apr-2005 Golder FDA	MW05-22 0048-01 21-Apr-2005 Golder	MW05-24 0049-01 25-Apr-2005 Golder	MW00-02 009079-02 25-Sep-2000 Levelton	MW00-04 009079-01 25-Sep-2000 Levelton	MW00-06 009079-03 25-Sep-2000 Levelton	MW00-09 009079-04 25-Sep-2000 Levelton	4 93011006 4-Jun-1993 EBA[a]	4 9301 25-Jun EB
<0.00050	-	<0.00050	-	-	<0.00050	-	-	-	<0.00050	<0.00050	-	-	-	-	-	
<0.00050	-	<0.00050	-	-	<0.00050	-	-	-	<0.00050	<0.00050	-	-	-	-	-	
<0.0010	-	<0.0010	-	-	<0.0010	-	-	-	<0.0010	<0.0010	-	-	-	-	-	
<0.0010	-	<0.0010	-	-	<0.0010	-	-	-	<0.0010	<0.0010	-	-	-	-	-	
<0.00050	-	<0.00050	-	-	<0.00050	-	-	-	<0.00050	<0.00050	-	-	-	-	-	
<0.00050	-	<0.00050	-	-	<0.00050	-	-	-	<0.00050	<0.00050	-	-	-	-	-	
<0.0010	-	<0.0010	-	-	<0.0010	-	-	-	<0.0010	<0.0010	-	-	-	-	-	
<0.10	-	<0.10	-	-	<0.10	-	-	-	<0.10	<0.10	-	-	-	-	-	
<0.10	-	<0.10	-	-	<0.10	-	-	-	<0.10	<0.10	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	0.000066	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	0.000126	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	
<0.30	-	<0.30	-	<0.30	<0.30	<0.30	-	-	<0.30	<0.30	**0.910**	<0.100	0.105	0.285	-	
<1.0	-	<1.0	-	<1.0	<1.0	<1.0	-	-	<1.0	<1.0	1.400	<0.100	0.260	0.590	-	
<0.30	-	<0.30	-	<0.30	<0.30	<0.30	-	-	<0.30	<0.30	-	-	-	-	-	
<1.0	-	<1.0	-	<1.0	<1.0	<1.0	-	-	<1.0	<1.0	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**7**	<

ociated Schedules (Schedules 6 and 10) and Technical Guidance Documents, enacted in 1997, and updated from time to time (includes May 31, 2011 updates).

l Grease and EHw10-19.
al Stage 1 Preliminary Site
Harbour Ladysmith, BC.

TABLE 4d
Historical Groundwater Results - Phenols
Ladysmith Harbour, Ladysmith, BC

Location	CSR Standards for AW Marine	Notes	MW05-4	MW05-5	MW05-6	MW05-7	MW05-8	MW05-9	MW05-16	MW05-17	MW05-18	MW05-22	MW05-24
SCN			0045-05	0036-02	0045-08	0036-01	0045-07	0046-10	0045-03	0039-01	0039-02	0048-01	0049-01
Date Sampled			13-Apr-2005	14-Apr-2005	13-Apr-2005	14-Apr-2005	13-Apr-2005	14-Apr-2005	13-Apr-2005	14-Apr-2005	14-Apr-2005	21-Apr-2005	25-Apr-2005
Source			Golder	Golder	Golder	Golder	Golder	Golder	Golder	Golder	Golder	Golder	Golder
QA/QC									FDA		FDA		
Physical													
pH			7.58	7.77	7.45	7.75	7.31	7.37	6.79	7.73	7.79	6.90	6.70
Phenolic Compounds													
2,3,4-trichlorophenol	**0.001-0.27**	pH	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
2,3,5-trichlorophenol	**0.001-0.27**	pH	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
2,3,6-trichlorophenol	**0.001-0.27**	pH	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
2,4,5-trichlorophenol	**0.001-0.27**	pH	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
2,4,6-trichlorophenol	**0.001-0.27**	pH	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
3,4,5-trichlorophenol	**0.001-0.27**	pH	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
2,3,4,5-tetrachlorophenol	**0.002-0.18**	pH	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
2,3,4,6-tetrachlorophenol	**0.002-0.18**	pH	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
2,3,5,6-tetrachlorophenol	**0.002-0.18**	pH	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
pentachlorophenol	**0.001-0.0275**	pH	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020

Notes:

Standards from the Contaminated Sites Regulation (CSR), its associated Schedules (Schedules 6 and 10) and Technical Guidance Documents, enacted in 1997, and updated from time to time (includes May 31, 2011 updates).

Land Use abbreviations: AW (Aquatic Life), M = Marine.

1. All concentrations in mg/L.
2. pH = standard is pH dependant
3. Italic indicates method detection limit exceeds standard
4. FDA Field duplicate available.
5. Golder = Golder Associates Ltd. 2005. Report on Supplemental Stage 1 Preliminary Site Investigation and Detailed Site Investigation Lot 16G Ladysmith Harbour Ladysmith, BC. Dated June 30, 2005.

APEC							AEC 10				APEC 15			
Location							MW09-1	MW09-3	TP09-01	TP09-04	MW09-5	MW09-5	MW09-16	
SCN	CSR Standards for		CSR Standards for		CSR Standards for		21360-02	21360-07	21381-01	21381-11	21361-08	21361-09	21366-07	
Depth (m bgs)							0.6 - 0.76	0.6 - 0.76	0.6-0.8	1.0-1.2	0.6 - 0.8	1.4 - 1.6	1.2 - 1.37	3
Date Sampled (mm/dd/yyyy)							10/11/2009	10/11/2009	12/15/2009	12/15/2009	11/11/2009	11/11/2009	11/14/2009	1
QA/QC	RL/PL (AW-M)	MCS	CL (AW-M)	MCS	IL (AW-M)	MCS								
							0	10	20	22	30	15	16	
							18.5	10.6	-	17	16.8	-	10.3	
							5.7	7.3	5.9	7.2	5.9	6.2	6.3	
							20900	11900	13600	19100	23800	19800	20500	
	20	G	40	G	40	G	< 10	< 10	< 10	< 10	< 10	< 10	< 10	
	25	M	25	M	25	M	< 10	< 10	< 10	11	< 10	< 10	< 10	
	1,000	T	1,500	T/M	1,500	T/M	135	42	116	153	122	71	91	
	4	G	8	G	8	G	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
							17	13	< 1	3	18	21	18	
	2 - 35	M/I/pH	2 - 100	M/I/pH	2 - 200	pH/M	0.8	< 0.5	< 0.5	1.8	< 0.5	< 0.5	< 0.5	
							4860	4470	3650	7800	3170	4420	3970	
	60 ^{VI} / 95 ^{III}	M/V	60 ^{VI} / 95 ^{III}	M/V	60 ^{VI} / 95 ^{III}	M/V	40	30	27	35	33	25	29	
	50	G	300	G	300	G	11	8	12	16	12	12	10	
	90 - 150	M/T/pH	90 - 250	M/T/pH	90 - 250	M/T/pH	89	49	82	119	44	52	39	
							24900	18800	20500	28100	24900	22000	22200	
	150 - 500	M/I/pH	150 - 1,000	M/I/pH	150 - 2,000	M/T/pH	89	23	75	52	10	< 5	13	
							4220	5430	5190	3890	6680	6580	5110	
	1,800	S	19,000	S	19,000	S	558	274	493	1070	337	323	418	
	15	I	40	I	150	T	0.06	0.02	0.07	0.06	0.05	0.04	0.04	
	10	G	40	G	40	G	< 4	< 4	< 4	< 4	< 4	< 4	< 4	
	100	G	500	G	500	G	21	17	24	25	21	17	23	
							447	440	582	915	493	470	538	
							348	741	450	411	401	607	552	
	3	G	10	G	10	G	< 2	< 2	< 2	< 2	< 2	< 2	< 2	
	20	G	40	G	40	G	< 2	< 2	< 2	< 2	< 2	< 2	< 2	
							246	408	172	168	162	364	176	
	47,000	S	100,000	S	100,000	S	38	19	25	106	25	28	21	
	50	S	300	S	300	S	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
							953	939	964	1280	1300	1270	1230	
	200	G					102	42	67	92	82	67	65	
	150 - 450	M/T/pH	150 - 600	M/T/pH	150 - 600	M/T/pH	71	49	81	143	51	33	47	
							4	3	3	5	6	6	8	

ograms per gram (ug/g), unless otherwise indicated.
surface
r

e Contaminated Sites Regulation (CSR), enacted in 1997, and updated May 31, 2011.
Urban Park Land); RL (Residential); CL (Commercial); IL (Industrial)
dard based on applicable site-specific standards
rs include: I = Intake of Contaminated Soil; T = Toxicity to Invertebrates and Plants; AW = Groundwater Flow to Surface Water used by
e Aquatic Life.
); pH = standard is pH dependant
ble

uality control
dard. If land used for agriculture (human consumption), standard = 3 , otherwise 35.
ndant: III - trivalent chromium (Cr^{3+}); VI - hexa-valent chromium (Cr^{6+})

APEC							AEC 12							
Location							MW09-9	MW09-10	MW09-10	MW09-11	KE SA1	KE SA2	KE SA4	TP09-05
SCN	CSR Standards for	MCS	CSR Standards for	MCS	CSR Standards for	MCS	21364-02	21364-05	21364-07	21364-09	21370-01	21370-02	21370-04	21383-01
Depth (m bgs)							1.5 - 1.7	0.6 - 0.76	1.5 - 1.7	0.3 - 0.4	0.2 - 0.3	0.2 - 0.3	0.2 - 0.3	0.3-0.5
pled (mm/dd/yyyy)							11/13/2009	11/13/2009	11/13/2009	11/13/2009	11/25/2009	11/25/2009	11/25/2009	12/15/2009
QA/QC	RL/PL (AW-M)		CL (AW-M)		IL (AW-M)									
							16	10	22	5	-	-	-	20
							12.6	8.5	15.4	21.2	9	10.8	6.9	-
							8.1	7.6	7.7	6.6	6.2	6	6.1	7.9
							10400	16000	11700	21800	10800	11100	11300	12600
	20	G	40	G	40	G	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
	25	M	25	M	25	M	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
	1,000	T	1,500	T/M	1,500	T/M	40	189	46	103	43	61	65	273
	4	G	8	G	8	G	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
							16	24	15	22	8	37	10	21
	2 - 35	M/I/pH	2 - 100	M/I/pH	2 - 200	pH/M	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	1.1
							7070	7730	7290	4820	2920	3380	3000	11200
	60 ^{VI} / 95 ^{III}	M/V	60 ^{VI} / 95 ^{III}	M/V	60 ^{VI} / 95 ^{III}	M/V	16	25	20	39	13	17	13	27
	50	G	300	G	300	G	7	10	9	13	7	10	9	11
	90 - 150	M/T/pH	90 - 250	M/T/pH	90 - 250	M/T/pH	31	62	39	42	52	138	47	140
							20100	20700	19200	26900	13800	16800	14900	20500
	150 - 500	M/I/pH	150 - 1,000	M/I/pH	150 - 2,000	M/T/pH	< 5	45	< 5	19	15	80	12	175
							4500	5700	5510	5150	4460	5060	4680	5260
	1,800	S	19,000	S	19,000	S	482	335	220	747	190	265	237	335
	15	I	40	I	150	T	0.04	0.08	0.04	0.06	0.05	0.05	0.02	0.16
	10	G	40	G	40	G	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4
	100	G	500	G	500	G	13	25	16	21	12	14	11	32
							461	683	478	263	546	605	509	750
							413	630	504	380	330	509	376	541
	3	G	10	G	10	G	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
	20	G	40	G	40	G	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
							504	402	524	208	201	205	204	289
	47,000	S	100,000	S	100,000	S	41	111	35	47	16	18	20	166
	50	S	300	S	300	S	< 5	< 5	< 5	< 5	< 5	9	< 5	8
							828	773	969	1160	396	478	478	786
	200	G					59	60	63	96	33	40	35	57
	150 - 450	M/T/pH	150 - 600	M/T/pH	150 - 600	M/T/pH	25	61	30	210	34	77	66	133
							4	6	5	8	3	2	3	4

(ug/g), unless otherwise indicated.

ites Regulation (CSR), enacted in 1997, and updated May 31, 2011.
); RL (Residential); CL (Commercial); IL (Industrial)
plicable site-specific standards
take of Contaminated Soil; T = Toxicity to Invertebrates and Plants; AW = Groundwater Flow to Surface Water used by

s pH dependant

for agriculture (human consumption), standard = 3 , otherwise 35.
ent chromium (Cr^{3+}); VI - hexa-valent chromium (Cr^{6+})

APEC						APEC 20					APEC 8			
Location						BH09-13	BH09-14	MW09-7	MW09-8	MW09-8	TP09-10	TP09-10	TP09-11	T
SCN	**CSR Standards for**		CSR Standards for		CSR Standards for	21365-05	21365-11	21362-11	21363-07	21363-08	21581-03	21581-04	21581-06	2
Depth (m bgs)						3.8 - 4.0	4.1 - 4.3	0.5 - 0.7	2.9 - 3.0	2.9 - 3.0	0.3-0.6	1.6-1.8	0.2-0.4	
mpled (mm/dd/yyyy)						11/14/2009	11/14/2009	12/11/2009	11/13/2009	11/13/2009	12/15/2009	12/15/2009	12/15/2009	12
QA/QC	**RL/PL (AW-M)**	**MCS**	CL (AW-M)	**MCS**	IL (AW-M)	**MCS**				FDA	FD			
							460	210	5	440	440	15	20	30
							19.3	9.5	-	20	24.3	9	7.2	13.2
							7.4	8.1	6.3	8	7.9	7.5	6.9	6.7
							23200	11600	14500	12100	11000	13200	12500	14300
	20	G	40	G	40	G	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
	25	M	25	M	25	M	16	< 10	< 10	< 10	< 10	< 10	< 10	< 10
	1,000	T	1,500	T/M	1,500	T/M	95	55	45	55	52	94	108	91
	4	G	8	G	8	G	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
							38	19	8	19	18	< 1	< 1	< 1
	2 - 35	M/I/pH	2 - 100	M/I/pH	2 - 200	pH/M	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
							1920	9380	3810	14800	33000	5690	3940	5020
	60 ^{VI} / 95 ^{III}	M/V	60 ^{VI} / 95 ^{III}	M/V	60 ^{VI} / 95 ^{III}	M/V	39	20	17	20	19	26	24	25
	50	G	300	G	300	G	28	7	8	9	8	11	12	13
	90 - 150	M/T/pH	90 - 250	M/T/pH	90 - 250	M/T/pH	50	21	40	64	56	46	26	57
							36300	18700	19500	18400	18200	22100	23800	21700
	150 - 500	M/I/pH	150 - 1,000	M/I/pH	150 - 2,000	M/T/pH	30	19	5	36	54	16	5	23
							11500	6530	4900	6000	5890	5870	5560	5660
	1,800	S	19,000	S	19,000	S	1190	329	236	425	427	510	734	694
	15	I	40	I	150	T	0.11	0.07	0.05	0.2	0.26	0.04	0.02	0.05
	10	G	40	G	40	G	7	< 4	< 4	5	< 4	< 4	< 4	< 4
	100	G	500	G	500	G	54	17	13	22	18	22	19	22
							441	373	570	492	469	635	1240	700
							3790	1420	412	815	796	647	347	384
	3	G	10	G	10	G	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
	20	G	40	G	40	G	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
							3560	1760	293	1470	1720	298	149	197
	47,000	S	100,000	S	100,000	S	34	70	20	117	266	45	19	36
	50	S	300	S	300	S	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
							186	809	868	597	677	1010	617	1240
	200	G					58	34	61	46	41	63	60	64
	150 - 450	M/T/pH	150 - 600	M/T/pH	150 - 600	M/T/pH	131	61	30	68	75	53	57	69
							5	3	4	3	3	3	2	3

n (ug/g), unless otherwise indicated.

Sites Regulation (CSR), enacted in 1997, and updated May 31, 2011.
d); RL (Residential); CL (Commercial); IL (Industrial)
pplicable site-specific standards
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is pH dependant

d for agriculture (human consumption), standard = 3 , otherwise 35.
lent chromium (Cr^{3+}); VI - hexa-valent chromium (Cr^{6+})

APEC							APEC 9								
Fill Samples									APEC 8	APEC 8					
Location	CSR Standards for	MCS	CSR Standards for	MCS	CSR Standards for	MCS	MW09-6	TP09-09	TP09-09	TP09-10	TP09-10	TP09-11	TP09-12	TP09-12	TP09-12
SCN							21362-06	21383-12	21581-01	21581-03	21581-04	21581-06	21581-08	21581-09	21581-10
Depth (m bgs)							2.0 - 2.2	0.4-0.6	1.0-1.2	0.3-0.6	1.6-1.8	0.2-0.4	0.1-0.3	0.1-0.3	1.3-1.5
Date Sampled (mm/dd/yyyy)							12/11/2009	12/15/2009	12/15/2009	12/15/2009	12/15/2009	12/15/2009	12/15/2009	12/15/2009	12/15/2009
QA/QC	PL/RL (AW-M)		CL (AW-M)		IL (AW-M)								FDA	FD	
arameters															
ours (ppm unless otherwise indicated)							10	10	15	15	20	30	30	30	25
l Parameters															
e (%)							-	15.9	16.3	9	7.2	13.2	15	18.4	12.4
units)							6.8	7.2	7.4	7.5	6.9	6.7	6.8	6.8	7.3
able Hydrocarbons															
19	*1,000*	G	*2,000*	G	*2,000*	G	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250
19 (sg)	*1,000*	G	*2,000*	G	*2,000*	G	-	-	-	-	-	-	-	-	-
32	*1,000*	G	*5,000*	G	*5,000*	G	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250
32 (sg)	*1,000*	G	*5,000*	G	*5,000*	G	-	-	-	-	-	-	-	-	-
	1,000	G	2,000	G	2,000	G	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250
	1,000	G	5,000	G	5,000	G	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250
lic Aromatic Hydrocarbons															
lnaphthalene							< 0.05	0.98	< 0.05	0.21	< 0.05	0.17	0.16	0.13	< 0.05
thene							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.11	< 0.05	< 0.05
thylene							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
ne							< 0.05	0.06	< 0.05	< 0.05	< 0.05	< 0.05	0.12	0.07	< 0.05
anthracene	**1**	G	10	G	10	G	< 0.05	0.13	< 0.05	< 0.05	< 0.05	0.11	0.26	0.34	< 0.05
pyrene	**1**	T	10	T	10	T	< 0.05	0.09	< 0.05	0.05	< 0.05	0.13	0.33	0.39	< 0.05
)fluoranthene	**1**	G	10	G	10	G	< 0.05	0.1	< 0.05	0.06	< 0.05	0.14	0.38	0.46	< 0.05
,h,i)perylene							< 0.05	0.07	< 0.05	< 0.05	< 0.05	0.07	0.22	0.26	< 0.05
)fluoranthene	**1**	G	10	G	10	G	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.08	0.19	0.16	< 0.05
e							< 0.05	0.15	< 0.05	0.05	< 0.05	0.12	0.32	0.45	< 0.05
,h)anthracene	**1**	G	10	G	10	G	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.08	< 0.05
hene							< 0.05	0.09	< 0.05	0.05	< 0.05	0.16	0.52	0.44	< 0.05
							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.11	< 0.05	< 0.05
,2,3-c,d)pyrene	**1**	G	10	G	10	G	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.06	0.18	0.21	< 0.05
lene	**5**	G	50	G	50	G	< 0.05	0.45	< 0.05	0.12	< 0.05	0.09	0.11	0.1	< 0.05
hrene	**5**	G	50	G	50	G	< 0.05	0.98	< 0.05	0.19	< 0.05	0.22	0.62	0.41	< 0.05
	10	G	100	G	100	G	< 0.05	0.15	< 0.05	0.07	< 0.05	0.18	0.56	0.58	< 0.05
logenated Volatiles															
	2.5	M	2.5	M	2.5	M	-	-	-	-	-	-	-	-	-
zene	**1**	T	20	T	20	T	-	-	-	-	-	-	-	-	-
	5	G	50	G	50	G	-	-	-	-	-	-	-	-	-
	1.5	T	25	T	25	T	-	-	-	-	-	-	-	-	-
ylene							-	-	-	-	-	-	-	-	-
para-Xylene							-	-	-	-	-	-	-	-	-
lene	**5**	T	50	T	50	T	-	-	-	-	-	-	-	-	-
-butyl ether (MTBE)	**320**	S	700	S	700	S	-	-	-	-	-	-	-	-	-
	200	G	200	G	200	G	-	-	-	-	-	-	-	-	-
							-	-	-	-	-	-	-	-	-
orinated Biphenyls															
r 1242	**5**	I/T	15	I	50	T	-	< 0.03	< 0.03	-	-	-	-	-	-
r 1248	**5**	I/T	15	I	50	T	-	< 0.03	< 0.03	-	-	-	-	-	-
r 1254	**5**	I/T	15	I	50	T	-	< 0.03	< 0.03	-	-	-	-	-	-
r 1260	**5**	I/T	15	I	50	T	-	< 0.03	< 0.03	-	-	-	-	-	-
orinated biphenyls (PCB-total)	**5**	I/T	15	I	50	T	-	< 0.03	< 0.03	-	-	-	-	-	-

APEC							APEC 10					
Fill Samples	APEC 8					APEC 8					APEC 8	APEC 8
Location	MW09-1	TP09-01	TP09-02	TP09-02	TP09-02	TP09-03	TP09-04	TP11-02	TP11-02	TP11-03	TP11-04	TP11-04
SCN	21360-02	21381-01	21381-04	21381-05	21381-06	21381-09	21381-11	0527-04	0527-05	0527-09	0528-02	0528-03
Depth (m bgs)	0.6 - 0.76	0.6-0.8	1.5-1.7	1.5-1.7	2.2-2.4	1.8-1.9	1.0-1.2	2-2.25	1.8-1.9	2.0-2.1	0.5-0.6	0.5-0.6
Date Sampled (mm/dd/yyyy)	10/11/2009	12/15/2009	12/15/2009	12/15/2009	12/15/2009	12/15/2009	12/15/2009	2/9/2011	2/9/2011	2/9/2011	2/9/2011	2/9/2011
QA/QC			FDA	FD							FDA	FD
arameters												
ours (ppm unless otherwise indicated)	0	20	580	580	810	5% LEL	22	0	0	0	0.6	0.6
l Parameters												
e (%)	18.5	-	16.1	18.5	20.8	10.9	17	18.9	11.1	21.4	33.6	52.0
units)	5.7	5.9	-	-	-	-	7.2	-	-	-	-	-
able Hydrocarbons												
19	< 250	-	270	300	430	< 250	< 250	<200	<200	<200	<200	<200
19 (sg)	-	-	-	-	-	-	-	-	-	-	-	-
32	< 250	-	830	980	400	< 250	< 250	<200	<200	<200	<200	<200
32 (sg)	-	-	-	-	-	-	-	-	-	-	-	-
	< 250	-	270	300	430	< 250	< 250	<200	<200	<200	<200	<200
	< 250	-	830	980	400	< 250	< 250	<200	<200	<200	<200	<200
lic Aromatic Hydrocarbons												
lnaphthalene	0.08	-	< 0.05	< 0.05	0.16	3.2	< 0.05	<0.050	0.250	<0.050	0.060	0.106
thene	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	<0.050	<0.050	<0.050	<0.050
thylene	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	<0.050	<0.050	<0.050	<0.050
ne	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	<0.050	<0.050	<0.050	<0.050
anthracene	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	0.068	<0.050	<0.050	<0.050
pyrene	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	<0.071	<0.050	<0.050	<0.050
)fluoranthene	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	0.095	<0.050	<0.050	<0.050
,h,i)perylene	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	<0.050	<0.050	<0.050	<0.050
)fluoranthene	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	<0.050	<0.050	<0.050	<0.050
e	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	0.087	<0.050	<0.050	<0.050
,h)anthracene	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	<0.050	<0.050	<0.050	<0.050
hene	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	0.103	<0.050	<0.050	<0.050
	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	<0.050	<0.050	<0.050	<0.050
,2,3-c,d)pyrene	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	<0.050	<0.050	<0.050	<0.050
lene	0.07	-	< 0.05	< 0.05	< 0.05	2.2	< 0.05	<0.050	0.136	<0.050	<0.050	0.060
hrene	< 0.05	-	< 0.05	< 0.05	0.09	< 0.05	< 0.05	<0.050	0.144	<0.050	0.069	0.127
	< 0.05	-	< 0.05	0.08	< 0.05	< 0.05	< 0.05	<0.050	0.106	<0.050	<0.050	<0.050
logenated Volatiles												
	< 0.04	-	< 0.04	-	< 0.04	< 0.04	< 0.04	<0.040	<0.040	<0.040	<0.040	<0.040
zene	< 0.5	-	< 0.5	-	< 0.5	< 0.5	< 0.5	<0.050	<0.050	<0.050	<0.050	<0.050
	< 0.1	-	< 0.5	-	< 0.1	< 0.1	< 0.1	<0.050	<0.050	<0.050	<0.050	<0.050
	< 0.5	-	< 0.1	-	< 0.5	< 0.5	< 0.5	<0.050	<0.050	<0.050	<0.050	<0.050
ylene	-	-	-	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050
para-Xylene	-	-	-	-	-	-	-	<0.050	0.060	<0.050	<0.050	<0.050
lene	< 0.1	-	< 0.1	-	< 0.1	< 0.1	0.2	<0.071	<0.071	<0.071	<0.071	<0.071
-butyl ether (MTBE)	-	-	-	-	-	-	-	<0.20	<0.20	<0.20	<0.20	<0.20
	< 100	-	118	< 100	**546**	**956**	< 100	<100	<100	<100	<100	<100
	< 100	-	118	< 100	546	843	< 100	<100	<100	<100	<100	<100
orinated Biphenyls												
r 1242	-	-	-	-	-	-	-	-	-	-	-	-
r 1248	-	-	-	-	-	-	-	-	-	-	-	-
r 1254	-	-	-	-	-	-	-	-	-	-	-	-
r 1260	-	-	-	-	-	-	-	-	-	-	-	-
orinated biphenyls (PCB-total)	-	-	-	-	-	-	-	-	-	-	-	-

are expressed in micrograms per gram (ug/g), unless otherwise indicated.
metres below ground surface
ample control number
Chain of Custody
ds shown are from the Contaminated Sites Regulation (CSR), enacted in 1997, and updated May 31, 2011.
e abbreviations: PL (Urban Park Land); RL (Residential); CL (Commercial); IL (Industrial)
ost conservative standard based on applicable site-specific standards
ced site-specific factors include: I = Intake of Contaminated Soil; T = Toxicity to Invertebrates and Plants; AW
dwater Flow to Surface Water used by Aquatic Life, F = Fresh Water Aquatic Life and M = Marine Aquatic

eric; S = Schedule 10; pH = standard is pH dependant
Field duplicate available
ld duplicate
= quality assurance/quality control
dard for EPH 10-19 is equivalent to LEPH, and the standard for EPH C19-32 is equivalent to HEPH when no
r HEPH analysis is undertaken and the equivalent standard is indicated by the use of italics.
o Standard
= not analysed

				APEC 8	APEC 8	APEC 8	APEC 8	APEC 8	AEC 13			APEC 17			APEC 15		AEC 12															
				TP09-07	TP09-08	(near TP-8) SA5	(near TP-8) SA6	(near TP-8) SA7	MW09-3	MW09-3	MW11-01	MW09-16	MW09-16	MW09-16	MW09-5	MW09-5	MW09-9	MW09-10	MW09-10	MW09-11	KE SA1	KE SA2	KE SA4	TP09-05	TP09-05	TP09-05	TP09-06	TP09-06
CSR		CSR		21383-08	21383-11	21370-05	21370-06	21370-07	21360-07	21360-08	0526-03	21366-07	21366-09	21366-10	21361-09	21362-02	21364-02	21364-05	21364-07	21364-09	21370-01	21370-02	21370-04	21383-01	21383-02	21383-03	21383-05	21383-06
andards		Standards		0.3-0.5	0.4-0.6	0.2 - 0.3	0.2 - 0.3	0.2 - 0.3	0.6 - 0.76	2.1 - 2.3	4 - 4.1	1.2 - 1.37	3.35 - 3.50	3.35 - 3.50	1.4 - 1.6	7.1-7.3	1.5 - 1.7	0.6 - 0.76	1.5 - 1.7	0.3 - 0.4	0.2 - 0.3	0.2 - 0.3	0.2 - 0.3	0.3-0.5	0.7-0.9	1.6-1.8	0.9-1.1	0.9-1.1
for		for		12/15/2009	12/15/2009	11/25/2009	11/25/2009	11/25/2009	10/11/2009	10/11/2009	2/8/2011	11/14/2009	11/14/2009	11/14/2009	11/11/2009	11/11/2009	11/13/2009	11/13/2009	11/13/2009	11/13/2009	11/25/2009	11/25/2009	11/25/2009	12/15/2009	12/15/2009	12/15/2009	12/15/2009	12/15/2009
(AW-M)	MCS	IL (AW-M)	MCS										FDA	FD													FDA	FD
				20	10	-	-	-	10	23	0.4	16	26	26	15	23	16	10	22	5	-	-	-	20	260	35	410	410
				6.1	11.9	20.2	7.4	19	10.6	8.4	7.88	10.3	18.7	18.1		12.9	12.6	8.5	15.4	21.2	9	10.8	6.9	-	22.4	17.9	19.5	19.8
				-	-	-	-	-	7.3	-	-	6.3	7.3	7.5	6.2	-	8.1	7.6	7.7	6.6	6.2	6	6.1	7.9	-	-	-	-
2,000	*G*	*2,000*	*G*	< 250	< 250	< 250	< 250	1,000	< 250	< 250	<200	< 250	< 250	< 250	-	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	-	< 250	< 250	5,100	6,600
2,000	*G*	*2,000*	*G*	-	-	-	-	-	-	-	<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5,000	*G*	*5,000*	*G*	< 250	830	< 250	1,600	14,000	< 250	< 250	<200	< 250	< 250	< 250	-	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	-	< 250	< 250	1500	2000
5,000	*G*	*5,000*	*G*	-	-	-	-	-	-	-	<200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,000	G	2,000	G	< 250	< 250	< 250	< 250	1,000	< 250	< 250	<200	< 250	< 250	< 250	-	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	-	< 250	< 250	**5,100**	**6,600**
5,000	G	5,000	G	< 250	830	< 250	**1,600**	**14,000**	< 250	< 250	<200	< 250	< 250	< 250	-	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	-	< 250	< 250	**1500**	**2000**
				< 0.05	0.06	< 0.05	0.08	0.29	< 0.05	< 0.05	0.093	< 0.05	< 0.05	< 0.05	-	0.2	< 0.05	0.28	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.5	< 0.5
				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	< 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	< 0.5	0.57
				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	< 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	< 0.5	< 0.5
				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	< 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	< 0.5	< 0.5
10	G	10	G	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.107	< 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	< 0.5	< 0.5
10	T	10	T	< 0.05	< 0.05	< 0.05	< 0.05	0.1	< 0.05	< 0.05	0.107	< 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	< 0.5	< 0.5
10	G	10	G	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.122	< 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	< 0.5	< 0.5
				< 0.05	< 0.05	< 0.05	0.12	0.47	< 0.05	< 0.05	0.072	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	0.06	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.5	< 0.5
10	G	10	G	< 0.05	< 0.05	< 0.05	< 0.05	0.08	< 0.05	< 0.05	<0.050	< 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	< 0.5	< 0.5
				< 0.05	< 0.05	< 0.05	< 0.05	0.11	< 0.05	< 0.05	0.116	< 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	< 0.5	< 0.5
10	G	10	G	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	< 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	< 0.5	< 0.5
				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.283	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	0.06	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.5	< 0.5
				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.050	< 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	0.6	1.1
10	G	10	G	< 0.05	< 0.05	< 0.05	0.1	0.31	< 0.05	< 0.05	0.074	< 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	< 0.5	< 0.5
50	G	50	G	< 0.05	< 0.05	< 0.05	0.07	0.27	< 0.05	< 0.05	0.051	< 0.05	< 0.05	< 0.05	-	0.1	< 0.05	0.14	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.5	< 0.5
50	G	50	G	< 0.05	0.06	< 0.05	0.13	0.32	< 0.05	0.05	0.156	< 0.05	< 0.05	< 0.05	-	0.11	< 0.05	0.3	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.5	< 0.5
100	G	100	G	< 0.05	< 0.05	< 0.05	0.07	0.23	< 0.05	< 0.05	0.263	< 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	< 0.5	< 0.5
2.5	M	2.5	M	-	-	-	-	-	< 0.04	< 0.04	<0.040	-	-	-	-	0.12	< 0.03	-	< 0.03	-	< 0.03	0.06	< 0.03	< 0.04	< 0.04	-	< 0.04	-
20	T	20	T	-	-	-	-	-	< 0.5	< 0.5	<0.050	-	-	-	-	0.07	< 0.03	-	< 0.03	-	< 0.03	0.45	< 0.03	**17**	< 0.5	-	< 0.5	-
50	G	50	G	-	-	-	-	-	< 0.1	< 0.1	<0.050	-	-	-	-	< 0.03	< 0.03	-	< 0.03	-	0.07	**29**	0.24	< 0.1	< 0.1	-	< 0.1	-
25	T	25	T	-	-	-	-	-	< 0.5	< 0.5	<0.050	-	-	-	-	0.24	< 0.03	-	< 0.03	-	< 0.03	0.17	< 0.03	< 0.5	< 0.5	-	< 0.5	-
				-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				-	-	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	T	50	T	-	-	-	-	-	< 0.1	< 0.1	<0.071	-	-	-	-	0.3	< 0.03	-	< 0.03	-	< 0.03	2.9	0.05	**96**	0.3	-	< 0.1	-
700	S	700	S	-	-	-	-	-	-	-	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
200	G	200	G	-	-	-	-	-	< 100	< 100	<100	-	-	-	-	< 100	< 100	-	< 100	-	< 100	100	< 100	-	< 100	-	-	-
				-	-	-	-	-	< 100	< 100	<100	-	-	-	-	< 100	< 100	-	< 100	-	< 100	< 100	< 100	-	< 100	-	-	-
15	I	50	T	-	-	< 0.03	< 0.03	< 0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	I	50	T	-	-	< 0.03	< 0.03	< 0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	I	50	T	-	-	< 0.03	< 0.03	< 0.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	I	50	T	-	-	< 0.03	< 0.03	0.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	I	50	T	-	-	< 0.03	< 0.03	0.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ted.

in 1997, and updated May 31, 2011.
nercial); IL (Industrial)

Toxicity to Invertebrates and Plants; AW
Aquatic Life and M = Marine Aquatic

C19-32 is equivalent to HEPH when no
d by the use of italics.

APEC					APEC 15	APEC 19 and 20									
Fill Samples															
Location					MW09-5	MW09-7	MW09-7	MW09-7	MW09-8	MW09-8	MW09-8	BH09-13	BH09-14	BH09-15	BH09-15
SCN	CSR Standards for		CSR Standards for		21361-08	21362-11	21363-02	21363-04	21363-07	21363-08	21363-10	21365-05	21365-11	21366-03	21366-04
Depth (m bgs)					0.6 - 0.8	0.5 - 0.7	2.1 - 2.3	3.9 - 4.1	2.9 - 3.0	2.9 - 3.0	3.9 - 5.0	3.8 - 4.0	4.1 - 4.3	3.65 - 3.8	3.65 - 3.8
Date Sampled (mm/dd/yyyy)					11/11/2009	12/11/2009	12/11/2009	12/11/2009	11/13/2009	11/13/2009	11/13/2009	11/14/2009	11/14/2009	11/14/2009	11/14/2009
QA/QC	PL/RL (AW-M)	MCS	CL (AW-M)	MCS	IL (AW-M)	MCS				FDA	FD				FDA	FD
Field Parameters															
Soil Vapours (ppm unless otherwise indicated)						30	5	10	5	440	440	60	460	210	340	340
Physical Parameters															
moisture (%)						16.8	-	16.3	15.7	20	24.3	11.4	19.3	9.5	14.5	11.7
pH (pH units)						5.9	6.3	-	-	8	7.9	-	7.4	8.1	-	-
Extractable Hydrocarbons															
EPH $_{C10-19}$	***1,000***	*G*	*2,000*	*G*	*2,000*	*G*	< 250	-	< 250	< 250	1,900	7,500	< 250	5,200	3,500	2,100	2,500
EPH $_{C10-19}$ (sg)	***1,000***	*G*	*2,000*	*G*	*2,000*	*G*	-	-	-	-	-	-	-	-	-	-	-
EPH $_{C19-32}$	***1,000***	*G*	*5,000*	*G*	*5,000*	*G*	< 250	-	330	< 250	2,000	7,700	< 250	9,800	1,800	3,100	3,300
EPH $_{C19-32}$ (sg)	***1,000***	*G*	*5,000*	*G*	*5,000*	*G*	-	-	-	-	-	-	-	-	-	-	-
LEPH	**1,000**	G	2,000	G	2,000	G	< 250	-	< 250	< 250	**1,900**	**7,500**	< 250	**5,200**	**3,500**	**2,100**	**2,500**
HEPH	**1,000**	G	5,000	G	5,000	G	< 250	-	330	< 250	**2,000**	**7,700**	< 250	**9,800**	**1,800**	**3,100**	**3,300**
Polycyclic Aromatic Hydrocarbons															
2-methylnaphthalene						0.2	-	0.22	0.09	0.74	0.66	< 0.05	1.5	< 0.05	< 0.05	< 0.05
acenaphthene						0.82	-	< 0.05	< 0.05	3	1.7	< 0.05	1.7	< 0.05	< 0.05	< 0.05
acenaphthylene						< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
anthracene						1.5	-	0.06	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
benzo(a)anthracene	**1**	G	10	G	10	G	0.4	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
benzo(a)pyrene	**1**	T	10	T	10	T	0.13	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
benzo(b)fluoranthene	**1**	G	10	G	10	G	0.19	-	0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
benzo(g,h,i)perylene						< 0.05	-	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
benzo(k)fluoranthene	**1**	G	10	G	10	G	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
chrysene						0.3	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
dibenz(a,h)anthracene	**1**	G	10	G	10	G	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
fluoranthene						1.9	-	0.07	< 0.05	< 0.05	0.84	< 0.05	0.71	< 0.05	< 0.05	< 0.05
fluorene						0.87	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	1.3	< 0.05	< 0.05	< 0.05
indeno(1,2,3-c,d)pyrene	**1**	G	10	G	10	G	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
naphthalene	**5**	G	50	G	50	G	0.42	-	0.15	0.09	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
phenanthrene	**5**	G	50	G	50	G	4	-	0.27	< 0.05	< 0.05	0.05	4.2	< 0.05	< 0.05	< 0.05
pyrene	**10**	G	100	G	100	G	1.2	-	0.07	< 0.05	5.2	3	0.09	3	0.05	0.77	0.66
Non-Halogenated Volatiles															
benzene	**2.5**	M	2.5	M	2.5	M	< 0.03	-	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	0.13	< 0.04	< 0.04	< 0.04
ethylbenzene	**1**	T	20	T	20	T	< 0.03	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
styrene	**5**	G	50	G	50	G	< 0.03	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
toluene	**1.5**	T	25	T	25	T	< 0.03	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
ortho-Xylene						-	-	-	-	-	-	-	-	-	-	-	-
meta- & para-Xylene						-	-	-	-	-	-	-	-	-	-	-	-
Total xylene	**5**	T	50	T	50	T	< 0.03	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1
Methyl t-butyl ether (MTBE)	**320**	S	700	S	700	S	-	-	-	-	-	-	-	-	-	-	-
VPH	**200**	G	200	G	200	G	< 100	-	< 100	< 100	**250**	140	< 100	< 100	< 100	< 100	< 100
VH6-10						< 100	-	< 100	< 100	250	140	< 100	< 100	< 100	< 100	< 100	< 100
Polychlorinated Biphenyls															
Arochlor 1242	**5**	I/T	15	I	50	T	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	**5**	I/T	15	I	50	T	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	**5**	I/T	15	I	50	T	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	**5**	I/T	15	I	50	T	-	-	-	-	-	-	-	-	-	-	-
polychlorinated biphenyls (PCB-total)	**5**	I/T	15	I	50	T	-	-	-	-	-	-	-	-	-	-	-

Notes:
Results are expressed in micrograms per gram (ug/g), unless otherwise indicated.
m bgs = metres below ground surface
SCN = sample control number
COC = Chain of Custody
Standards shown are from the Contaminated Sites Regulation (CSR), enacted in 1997, and updated May 31, 2011.
Land Use abbreviations: PL (Urban Park Land); RL (Residential); CL (Commercial); IL (Industrial)
MCS: most conservative standard based on applicable site-specific standards
Referenced site-specific factors include: I = Intake of Contaminated Soil; T = Toxicity to Invertebrates and Plants; AW = Groundwater Flow to Surface Water used by Aquatic Life, F = Fresh Water Aquatic Life and M = Marine Aquatic Life;
G = Generic; S = Schedule 10; pH = standard is pH dependant
FDA = field duplicate available
FD = field duplicate
QA/QC = quality assurance/quality control
The standard for EPH 10-19 is equivalent to LEPH, and the standard for EPH C19-32 is equivalent to HEPH when no LEPH or HEPH analysis is undertaken and the equivalent standard is indicated by the use of italics.
NS = No Standard
- or NA = not analysed

Location							MW09-5	MW09-5	MW09-9	MW09-10	KE SA1	KE SA2	KE SA
SCN	CSR Standards for	MCS	CSR Standards for	MCS	CSR Standards for	MCS	21361-08	21362-02	21364-02	21364-07	21370-01	21370-02	21370-
Depth (m bgs)							0.6 - 0.8	7.1-7.3	1.5 - 1.7	1.5 - 1.7	0.2 - 0.3	0.2 - 0.3	0.2 - 0
Date Sampled (mm/dd/yyyy)							11/11/2009	11/11/2009	11/13/2009	11/13/2009	11/25/2009	11/25/2009	11/25/2
QA/QC	PL/RL (AW-M)		CL (AW-M)		IL (AW-M)								
Parameters													
apours (ppm)							30	23	16	22	-	-	-
cal Parameters													
re (%)							16.8	12.9	12.6	15.4	9	10.8	6.9
H units)							5.9	-	8.1	7.7	6.2	6	6.1
enated Hydrocarbons													
dichloromethane (BDCM)	**8.2**	S	18	S	18	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
form (tribromomethane)	**620**	S	2,200	S	2,200	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
methane (methyl bromide)	**3.9**	S	13	S	13	S	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.1
l ethyl ketone (2-Butanone)	**22000**	S	110000	S	110000	S	<1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
tetrachloride	**5**	G	50	G	50	G	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
benzene	**1**	G	10	G	10	G	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
ethane	**30**	S	65	S	65	S	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.0
form	**5**	G	50	G	50	G	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
methane (methyl chloride)	**47**	S	160	S	160	S	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.12	< 0.1
mochloromethane (DBCM)	**11**	S	26	S	26	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
bromoethane (ethylene dibromide) (EDB)	**0.32**	S	0.73	S	0.73	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
momethane (methylene bromide)	**67**	S	230	S	230	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
chlorobenzene	**1**	G	10	G	10	G	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
chlorobenzene	**1**	G	10	G	10	G	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
chlorobenzene	**1**	G	10	G	10	G	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
rodifluoromethane (freon 12)	**94**	S	310	S	310	S	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.0
chloroethane	**5**	S	50	S	50	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
chloroethane	**5**	G	50	G	50	G	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.0
chloroethene	**5**	G	50	G	50	G	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
chloroethylene (cis) (1,2-dichloroethene) (cis)	**5**	S	50	S	50	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
chloroethylene (trans) (1,2-dichloroethene) (trans)	**5**	S	50	S	50	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
chloropropane (propylene dichloride)	**5**	S	50	S	50	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
chloropropene (cis)	**5**	S	50	S	50	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
chloropropene (trans)	**5**	S	50	S	50	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
anone							<1.5	< 1.5	<1.5	<1.5	< 1.5	< 1.5	< 1.5
l isobutyl ketone (4-Methyl-2-pentanone)	**5300**	S	47000	S	47000	S	<0.6	< 0.6	<0.6	<0.6	< 0.6	< 0.6	< 0.6
romethane (methylene chloride)	**5**	G	50	G	50	G	< 0.1	< 0.1	<0.1	<0.1	< 0.1	< 0.1	< 0.1
2-tetrachloroethane	**4.1**	S	9.3	S	9.3	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
hloroethylene (PERC)	**5**	M/T	5	M	5	M	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
trichloroethane	**5**	S	50	S	50	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
trichloroethane	**5**	S	50	S	50	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
roethylene (TCE)	**0.65**	M	0.65	M	0.65	M	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.0
rofluoromethane (freon 11)	**390**	S	2000	S	2,000	S	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.0
chloride (chloroethene)	**0.79**	S	7.5	S	7.5	S	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.0

s are expressed in micrograms per gram (ug/g), unless otherwise indicated.
= metres below ground surface
= sample control number
= Chain of Custody
ards shown are from the Contaminated Sites Regulation (CSR), enacted in 1997, and updated May 31, 2011.
Use abbreviations: PL (Urban Park Land); RL (Residential); CL (Commercial); IL (Industrial)
most conservative standard based on applicable site-specific standards
enced site-specific factors include: I = Intake of Contaminated Soil; T = Toxicity to Invertebrates and Plants;
Groundwater Flow to Surface Water used by Aquatic Life, F = Fresh Water Aquatic Life and M = Marine Aquatic Life;
eneric; S = Schedule 10; pH = standard is pH dependant
= field duplicate available

SCN Location QA/QC Date (dd/mm/yyyy)	Aquatic Life CSR-AW (marine)	Notes	21367-04 MW00-2 18-Nov-09	21382-03 MW00-04 11-Dec-09	21382-02 MW00-09 11-Dec-09	21382-01 MW00-11 11-Dec-09	21369-04 MW05-02 24-Nov-09	21369-05 MW05-04 24-Nov-09	21369-02 MW05-08 24-Nov-09	21369-03 MW05-09 24-Nov-09	21369-08 MW05-12 24-Nov-09	21369-01 MW05-17 24-Nov-09	21369-07 MW05-20 24-Nov-09	21369-06 MW05-22 24-Nov-09	21367-01 MW09-1 18-Nov-09	21367-02 MW09-2 18-Nov-09	21367-03 MW09-3 18-Nov-09	21382-04 MW09-03 11-Dec-09	21367-07 MW09-4 19-Nov-09	21367-08 MW09-5 19-Nov-09
Field Parameters																				
pH (pH units)			7.55	6.66	6.33	7.33	7.04	7.06	6.74	7.23	6.6	7.51	8.4	6.59	7.97	7.36	7.69	7.31	7.64	7.6
Temperature (°C)			10.8	8.69	9.21	10.4	9.4	10.62	10.9	13.61	12.61	11.32	9.4	11.12	10.29	10.44	10.44	11.7	12.8	10.33
Conductivity (µS/cm)			242	230	96	386	531	510	1054	9547	1331	33734	900	1032	301	370	390	355	460	410
Redox (mV)			31.6	-62.7	144.2	18.7	-15.9	-34	-39.2	17.3	110.9	-219.6	-121.6	-61.6	-130.6	-80	-121.6	-116.9	45.3	-50.4
Dissolved Oxygen (%)			11.7	2.91	4.41	2.67	10.9	9.4	13.9	18.6	21.1	14.4	60.2	9.6	36	23.6	14.3	1.56	8.9	11
Laboratory Parameters																				
pH (lab)			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity (µS/cm_)			-	-	-	-	464	639	775	12000	1100	14900	209	1060	-	-	-	-	-	-
Salinity (Low Level) (g/L)	10-40		-	-	-	-	0.22	0.31	0.38	6.89	0.55	8.7	< 0.2	0.53	-	-	-	-	-	-
Hardness $CaCO_3$			125	101	56	198	233	307	435	944	790	1570	86	688	106	151	144	-	206	175
Bicarbonate Alkalinity HCO_3			-	-	-	-	262	393	449	709	752	181	78.9	645	-	-	-	-	-	-
Carbonate Alkalinity CO_3			-	-	-	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	-	-	-	-	-	-
Hydroxide Alkalinity OH			-	-	-	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	-	-	-	-	-	-
Total Alkalinity $CaCO_3$			-	-	-	-	215	322	368	581	617	148	64.7	528	-	-	-	-	-	-
Dissolved Bromide Br			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Chloride Cl			-	-	-	-	12	14.2	21.6	2700	10.9	4010	17.4	6.1	-	-	-	-	-	-
Dissolved Fluoride F	15		-	-	-	-	< 0.25	< 0.1	< 0.25	< 0.5	< 0.1	< 0.5	< 0.05	< 0.1	-	-	-	-	-	-
Dissolved Nitrate N	400		-	-	-	-	< 0.25	< 0.1	< 0.25	< 0.5	1.15	< 0.5	1.91	0.15	-	-	-	-	-	-
Nitrite N	0.2-2	Cl	-	-	-	-	< 0.002	< 0.002	< 0.002	< 0.002	0.023	< 0.002	< 0.002	< 0.002	-	-	-	-	-	-
Nitrate and Nitrite N	400		-	-	-	-	< 0.25	< 0.1	< 0.25	< 0.5	1.13	< 0.5	1.91	0.15	-	-	-	-	-	-
Dissolved Sulphate SO_4	1000		-	-	-	-	14.6	15.1	23.8	561	103	466	5.72	85.2	-	-	-	-	-	-
Dissolved Metals																				
aluminum			0.017	0.086	0.071	0.005	0.015	0.013	0.093	0.023	0.014	0.019	0.014	0.01	0.079	0.013	0.036	-	0.011	0.026
antimony	0.2		< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0018	< 0.0005	0.0009	-	< 0.0005	< 0.0005
arsenic	0.125		0.009	0.001	< 0.001	< 0.001	< 0.001	0.001	< 0.001	0.003	0.002	0.004	< 0.001	< 0.001	0.005	0.003	0.004	-	< 0.001	0.003
barium	5		0.026	0.044	0.059	0.032	0.05	0.034	0.091	0.043	0.051	0.1	0.036	0.14	0.042	0.024	0.04	-	0.043	0.16
beryllium	1		< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-	< 0.0005	< 0.0005
bismuth			< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0007	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0005	-	< 0.0005	< 0.0005
boron	50		0.04	0.12	0.03	0.13	0.15	0.23	0.59	1.9	1.13	0.79	0.04	0.32	0.04	0.07	0.08	-	0.12	0.05
cadmium	0.001		< 0.00005	0.00066	0.00024	< 0.00005	< 0.00005	< 0.00005	< 0.00005	0.00012	< 0.00005	< 0.00005	< 0.00005	0.00009	< 0.00005	< 0.00005	< 0.00005	-	0.00014	< 0.00005
calcium			36.8	31.6	16.6	54.1	71.7	74.6	142	143	227	110	30.5	215	31.3	41.9	42.3	-	58.4	49.5
cesium			<0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005
chromium	0.15[VI], 0.56[III]	V	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001
cobalt	0.04		< 0.0005	0.014	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.001	< 0.0005	0.0007	0.0014	0.0049	0.0029	-	0.0035	0.001
copper	0.02		0.0009	0.0036	0.0021	0.0009	0.0012	0.0047	0.016	0.013	0.0027	0.0011	0.0045	0.003	0.0038	0.0025	0.0005	-	0.0014	0.0007
iron			1.69	4.25	0.08	0.49	0.72	< 0.05	0.18	< 0.05	0.08	< 0.05	< 0.05	0.14	0.36	0.18	0.75	-	0.09	0.7
lanthanum			<0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005
lead	0.02		< 0.00025	0.0003	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	0.0046	< 0.00025	< 0.00025	-	< 0.00025	< 0.00025
lithium			< 0.0005	0.0006	0.0009	0.0079	0.012	0.0099	0.016	0.059	0.029	0.068	0.0011	0.028	< 0.0005	< 0.0005	0.0017	-	< 0.0005	0.001
magnesium			8.04	5.42	3.5	15.1	13	29.3	19.7	143	53.6	314	2.26	36.5	6.61	11.2	9.38	-	14.5	12.3
manganese			0.689	1.31	0.353	0.934	0.059	0.127	0.01	0.0036	0.185	0.205	< 0.0005	0.092	1.05	2.37	1.29	-	1.11	0.572
mercury	0.001		< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	0.00005	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	-	< 0.00002	< 0.00002
molybdenum	10		0.0007	0.0006	< 0.0005	< 0.0005	0.0008	0.001	< 0.0005	0.0037	0.0006	0.0023	< 0.0005	< 0.0005	0.018	0.0023	0.0095	-	0.0027	0.001
nickel	0.083		0.001	0.007	< 0.001	< 0.001	< 0.001	0.001	0.003	0.002	0.002	0.003	< 0.001	< 0.001	0.003	0.003	0.004	-	0.006	0.001
phosphorus			< 0.075	< 0.075	< 0.075	< 0.075	< 0.075	< 0.075	< 0.075	< 0.075	< 0.075	0.26	< 0.075	< 0.075	< 0.075	< 0.075	< 0.075	-	< 0.075	< 0.075
potassium			1.19	1.51	0.91	1.01	6.39	14	5.49	67.2	6.65	80.5	0.72	4.35	4.42	1.22	3.54	-	1.64	0.88
rhenium			<0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	<0.0005	<0.0005	<0.0005	-	<0.0005	<0.0005
rubidium			0.0007	0.0008	0.0011	0.0005	0.0027	0.0043	0.0018	0.021	0.0026	0.0064	< 0.0005	0.0022	0.004	0.001	0.0023	-	0.0013	0.001
selenium	0.54		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001
silicon			12.5	4.9	6.8	10.8	3.9	2.8	4.9	4	4.4	4	2.1	3.7	7	12	7.2	-	12.7	12.9
silver	0.015		< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	-	< 0.0002	< 0.0002
sodium			12.5	11	7.25	23.6	15.9	24.4	26.4	1820	20.7	2170	7.58	4.59	29.2	11.9	28.8	-	26.4	12
strontium			0.207	0.23	0.18	0.668	1.1	0.657	1.07	1.49	2.68	2.37	0.191	3.23	0.187	0.252	0.198	-	0.441	0.287
sulphur			<5	< 5	< 5	< 5	5	< 5	10	209	44	168	< 5	34	10	<5	13	-	<5	<5
tellurium			<0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
thallium	0.003		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	-	< 0.0001	< 0.0001
thorium			0.0004	< 0.00025	< 0.00025	< 0.00025	0.0003	0.0004	0.0006	0.0008	0.0004	0.0019	0.0003	0.0004	0.0006	0.0004	0.0005	-	0.0003	0.0003
tin			<0.0006	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0037	< 0.0005	< 0.0005	<0.0006	<0.0006	<0.0006	-	<0.0006	<0.0006
titanium	1		< 0.001	0.002	0.001	< 0.001	< 0.001	< 0.001	0.002	0.002	< 0.001	0.004	< 0.001	< 0.001	0.003	< 0.001	0.002	-	< 0.001	< 0.001
tungsten			0.005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.007	0.005	0.005	-	0.005	0.005
uranium	1		< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	0.0003	< 0.00025	0.001	0.0007	0.0008	< 0.00025	0.0008	< 0.00025	< 0.00025	0.0005	-	0.0004	< 0.00025
vanadium			0.0007	0.005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0006	0.0008	0.0007	0.0006	< 0.0005	< 0.0005	0.0016	0.0007	0.001	-	0.001	< 0.0005
zinc	0.1		0.008	**0.19**	0.008	< 0.005	< 0.005	0.009	< 0.005	0.005	< 0.005	< 0.005	0.005	0.006	0.016	0.008	< 0.005	-	< 0.005	0.006
zirconium			< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	-	< 0.0005	< 0.0005

Notes:
All concentrations in milligrams per litre (mg/L), unless otherwise noted.
Standards from the Contaminated Sites Regulation (CSR), its associated Schedules (Schedules 6 and 10) and Technical Guidance Documents, enacted in 1997, and updated from time to time (includes May 31, 2011 updates).
Land Use abbreviations: AW (Aquatic Life), M = Marine.
H = standard is Hardness dependent
Cl = standard is chloride dependent
V= Standard is valence dependent VI refers to chromium VI and III refers to chromium III
FDA = field duplicate available; FD = field duplicate; SCN = sample control number
italics indicate the concentration exceeds the laboratory detection limit.

SCN	Aquatic Life CSR-AW (marine)	Notes	0531-01	21368-07	0532-01	0531-02	0531-03	0532-02	21368-05	21368-06	21369-09	21369-10	21367-05	21367-06	21368-02	0531-04	0532-03	0531-05	0532-04	21368-01	0532-05
Location			MW09-07	MW09-7	MW09-07	MW09-08	MW09-08	MW09-08	MW09-8	MW09-8	MW09-9	MW09-9	MW09-10	MW09-11	MW09-16	MW11-01	MW11-01	MW11-02	MW11-02	Sea Water	WHARF
QA/QC						FDA	FD		FDA	FD	FDA	FD									
Date (dd/mm/yyyy)			16-Feb-11	20-Nov-09	22-Feb-11	16-Feb-11	16-Feb-11	22-Feb-11	20-Nov-09	20-Nov-09	25-Nov-09	25-Nov-09	19-Nov-09	19-Nov-09	20-Nov-09	16-Feb-11	22-Feb-11	16-Feb-11	22-Feb-11	20-Nov-09	22-Feb-11
Field Parameters																					
pH (pH units)			6.34	7.22	6.49	6.99	6.99	6.68	6.92	6.92	6.75	6.75	8.13	7.88	7.62	7.69	6.76	8.05	7.87	-	-
Temperature (°C)			6.6	11.33	6.2	7.77	7.77	6.84	9.66	9.66	10.3	10.3	11.49	11.31	10.51	6.6	5.1	10.2	10.03	-	-
Conductivity (µS/cm)			2960	1420	4100	8360	8360	33841	14210	14210	402	402	401	410	347	4223	41100	402	437	-	-
Redox (mV)			-	13	-	-95.9	-95.9	65.9	45.1	45.1	-54.8	-54.8	6.7	12.6	24.7	192.9	-	158.7	51.3	-	-
Dissolved Oxygen (%)			-	8.91	-	-	-	2.325	6.7	6.7	7.87	7.87	10.9	7.1	10.7	-	-	-	-	-	-
Laboratory Parameters																					
pH (lab)			7.15	-	7.11	7.50	7.55	7.53	-	-	-	-	-	-	-	7.78	7.57	7.95	8.27	-	7.70
Conductivity (µS/cm_)				-					18900	22400	-	-	-	-	436					13100	
Salinity (Low Level) (g/L)	10-40			-					11.3	13.5	-	-	-	-	0.21					7.57	
Hardness $CaCO_3$			185	102	1010	694	684	3850	1480	1890	149	149	149	145	32	425	4330	83.5	73.2	1030	4710
Bicarbonate Alkalinity HCO_3			187	-	153	133	129	119	112	123	-	-	-	-	105	106	116	107	140	43.1	123
Carbonate Alkalinity CO_3			<2.0	-	<2.0	<2.0	<2.0	<2.0	< 0.5	< 0.5	-	-	-	-	< 0.5	<2.0	<2.0	<2.0	<2.0	< 0.5	<2.0
Hydroxide Alkalinity OH			<2.0	-	<2.0	<2.0	<2.0	<2.0	< 0.5	< 0.5	-	-	-	-	< 0.5	<2.0	<2.0	<2.0	<2.0	< 0.5	<2.0
Total Alkalinity $CaCO_3$			187	-	153	133	129	119	91.7	100	-	-	-	-	86.3	106	116	107	140	35.3	123
Dissolved Bromide Br			<1.0	-	5.5	5.9	5.2	28.8	-	-	-	-	-	-	-	5.0	35.6	<0.050	<0.050	-	39.0
Dissolved Chloride Cl			384	-	2170	2340	2150	10800	5410	6480	-	-	-	-	76.4	2000	12800	9.04	18.1	3470	14500
Dissolved Fluoride F	15		<0.40	-	<0.40	<0.40	<0.40	0.404	< 1.25	< 2.5	-	-	-	-	< 0.25	<0.40	0.513	0.122	0.261	< 1.25	0.714
Dissolved Nitrate N	400		<0.10	-	<0.10	<0.10	<0.10	<0.50	< 1.25	< 2.5	-	-	-	-	< 0.25	<0.10	<0.50	0.0871	<0.0050	< 1.25	<0.50
Nitrite N	0.2-2	Cl	<0.020	-	<0.020	<0.020	<0.020	<0.10	< 0.002	< 0.002	-	-	-	-	0.005	0.025	<0.10	0.0026	<0.0010	< 0.002	<0.10
Nitrate and Nitrite N	400		-	-	-	-	-	-	< 1.25	< 2.5	-	-	-	-	< 0.25	-	-	-	-	< 1.25	-
Dissolved Sulphate SO_4	1000		59	-	314	290	264	**1510**	686	843	-	-	-	-	20.5	279	**1790**	25.8	48.7	476	**2030**
Dissolved Metals																					
aluminum			<0.050	0.017	<0.20	<0.20	<0.20	<1.0	0.012	0.014	0.011	0.016	0.014	0.012	0.046	<0.10	<1.0	0.021	0.013	0.059	<1.0
antimony	0.2		<0.0025	< 0.0005	<0.010	<0.010	<0.010	<0.050	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	<0.0050	<0.050	0.00555	0.00993	< 0.0005	<0.050
arsenic	0.125		<0.0050	0.002	<0.020	<0.020	<0.020	<0.10	0.011	0.014	0.001	0.001	0.002	0.01	0.003	<0.010	<0.10	0.0109	0.0304	0.009	<0.10
barium	5		0.138	0.12	0.751	<0.040	<0.040	<0.20	0.18	0.21	0.012	0.012	0.034	0.041	0.014	0.027	<0.20	<0.020	<0.020	0.017	<0.20
beryllium	1		<0.0050	< 0.0005	<0.010	<0.010	<0.010	<0.050	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	<0.0050	<0.050	<0.0050	<0.0050	< 0.0005	<0.050
bismuth			<0.20	< 0.0005	<0.40	<0.40	<0.40	<2.0	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	<0.20	<2.0	<0.20	<0.20	< 0.0005	<2.0
boron	50		0.28	0.13	0.52	0.66	0.65	2.5	0.91	1.06	0.07	0.06	0.06	0.05	0.12	0.44	2.9	<0.10	<0.10	0.72	3.4
cadmium	0.001		<0.00025	0.0001	<0.0010	*<0.0010*	<0.0010	*<0.0050*	< 0.00005	< 0.00005	6.00E-05	0.00007	< 0.00005	< 0.00005	< 0.00005	<0.00050	*<0.0050*	0.000055	<0.000050	0.00018	*<0.0050*
calcium			17.8	15	90.3	50.0	49.1	262	136	169	41.4	41.5	39.2	42.6	5.25	35.6	305	26.1	20.0	78	323
cesium				< 0.0005					< 0.0005	< 0.0005	< 0.0005	< 0.0005	<0.0005	<0.0005	< 0.0005					< 0.0005	
chromium	0.15[VI], 0.56[III]	V	<0.0025	< 0.001	<0.010	<0.010	<0.010	<0.050	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.0050	<0.050	<0.00050	<0.0010	< 0.001	<0.050
cobalt	0.04		<0.0025	0.0035	<0.010	<0.010	<0.010	*<0.050*	0.0014	0.0016	0.0035	0.0035	0.0028	0.0026	0.0011	<0.0050	*<0.050*	<0.00050	<0.00050	< 0.0005	*<0.050*
copper	0.02		<0.0050	0.0025	<0.020	<0.020	<0.020	*<0.10*	0.0018	0.0019	0.0014	0.0012	0.0011	0.0024	0.0019	<0.010	*<0.10*	0.0047	<0.0010	0.0018	*<0.10*
iron			2.97	0.35	7.68	0.087	0.088	<0.30	0.35	0.64	< 0.05	< 0.05	1.64	0.94	0.46	<0.030	<0.30	<0.030	<0.030	0.06	<0.30
lanthanum				< 0.0005					< 0.0005	< 0.0005	< 0.0005	< 0.0005	<0.0005	<0.0005	< 0.0005					< 0.0005	
lead	0.02		<0.0050	0.0003	<0.020	<0.020	<0.020	*<0.10*	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	< 0.00025	<0.010	*<0.10*	<0.0010	<0.0010	< 0.00025	*<0.10*
lithium			<0.050	0.0021	<0.10	<0.10	<0.10	<0.50	0.035	0.039	0.0008	0.0012	< 0.0005	0.0006	0.0021	<0.050	<0.50	<0.050	<0.050	0.026	<0.50
magnesium			34.1	15.7	191	138	136	775	277	357	11.1	10.9	12.4	9.25	4.57	81.6	866	4.46	5.66	202	948
manganese			0.506	0.731	1.48	0.295	0.289	<0.10	1.04	1.4	2.45	2.47	1.32	3.77	0.271	0.751	1.01	0.224	0.070	0.0091	<0.10
mercury	0.001		<0.00020	< 0.00002	<0.00020	<0.00020	<0.00020	<0.00020	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	<0.00020	<0.00020	<0.00020	<0.00020	< 0.00002	<0.00020
molybdenum	10		<0.0050	0.0007	<0.020	<0.020	<0.020	<0.10	0.0054	0.0064	0.0061	0.006	0.0009	0.0033	0.0018	<0.010	<0.10	0.0031	0.0045	0.0028	<0.10
nickel	0.083		<0.025	0.005	*<0.10*	*<0.10*	*<0.10*	<0.50	0.006	0.006	0.005	0.004	0.003	0.003	0.002	<0.050	*<0.50*	<0.0050	<0.0050	0.002	*<0.50*
phosphorus			0.40	< 0.075	<0.60	<0.60	<0.60	<3.0	< 0.075	< 0.075	< 0.075	< 0.075	< 0.075	< 0.075	< 0.075	<0.30	<3.0	<0.30	<0.30	< 0.075	<3.0
potassium			15.7	8.42	42.6	54.2	53.3	221	85.7	104	0.79	0.78	0.88	1.2	3.91	35.4	254	<2.0	<2.0	66.4	301
rhenium			-	< 0.0005	-	-	-	-	< 0.0005	< 0.0005	< 0.0005	< 0.0005	<0.0005	<0.0005	< 0.0005	-	-	-	-	< 0.0005	-
rubidium			-	0.0029	-	-	-	-	0.03	0.034	0.0005	0.0005	0.0007	0.001	0.0012	-	-	-	-	0.024	-
selenium	0.54		<0.0050	< 0.001	<0.040	<0.040	<0.040	<0.20	< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.020	<0.20	<0.0010	<0.0010	< 0.001	<0.20
silicon			7.72	5.2	6.60	4.88	4.77	2.71	2.6	2.4	10.9	10.9	12.5	13.7	5.6	5.20	2.23	5.04	6.62	2.3	1.82
silver	0.015		<0.00025	< 0.0002	<0.0010	<0.0010	<0.0010	<0.0050	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	<0.00050	<0.0050	<0.000050	<0.000050	< 0.0002	<0.0050
sodium			287	97.8	1210	1270	1250	6310	2800	3450	12.5	12.9	11	18.1	73.4	869	7520	33.6	70.1	1910	8590
strontium			0.299	0.209	1.50	0.839	0.827	4.79	2.8	3.43	0.248	0.256	0.304	0.35	0.051	0.524	5.37	0.209	0.289	1.71	5.75
sulphur			-	10	-	-	-	-	249	310	< 5	< 5	<5	<5	< 5	-	-	-	-	166	-
tellurium			-	< 0.001	-	-	-	-	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	< 0.001	-	-	-	-	< 0.001	-
thallium	0.003		<0.0010	< 0.0001	*<0.0040*	*<0.0040*	*<0.0040*	<0.020	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0020	*<0.020*	<0.00020	<0.00020	< 0.0001	*<0.020*
thorium			-	0.0005	-	-	-	-	0.0012	0.0013	0.0003	0.0003	0.0004	0.0004	0.0005	-	-	-	-	0.0011	-
tin			<0.030	< 0.0005	<0.060	<0.060	<0.060	<0.30	< 0.0005	< 0.0005	< 0.0005	< 0.0005	<0.0006	<0.0006	< 0.0005	<0.030	<0.30	<0.030	<0.030	< 0.0005	<0.30
titanium	1		<0.050	0.001	<0.10	<0.10	<0.10	<0.50	0.004	0.005	< 0.001	< 0.001	< 0.001	< 0.001	0.002	<0.050	<0.50	<0.050	<0.050	0.003	<0.50
tungsten			-	< 0.0005	-	-	-	-	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.005	0.005	< 0.0005	-	-	-	-	< 0.0005	-
uranium	1		<0.0010	< 0.00025	<0.0040	<0.0040	<0.0040	<0.020	0.001	0.0012	0.0003	0.0003	< 0.00025	0.0003	< 0.00025	<0.0020	<0.020	0.00190	0.00252	0.0006	<0.020
vanadium			<0.030	< 0.0005	<0.060	<0.060	<0.060	<0.30	< 0.0005	< 0.0005	0.0009	0.0008	0.0007	0.0015	0.0015	<0.030	<0.30	<0.030	<0.030	< 0.0005	<0.30
zinc	0.1		0.0081	0.011	0.013	<0.010	<0.010	<0.050	< 0.005	< 0.005	0.005	0.005	< 0.005	0.01	0.005	<0.0050	<0.050	<0.0050	<0.0050	< 0.005	<0.050
zirconium				< 0.0005					< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005					< 0.0005	

Notes:
All concentrations in milligrams per litre (mg/L), unless otherwise noted.
Standards from the Contaminated Sites Regulation (CSR), its associated Schedules (Schedules 6 and 10) and Technical Guidance Documents, enacted in 1997, and updated from time to time (includes May 31, 2011 updates).
Land Use abbreviations: AW (Aquatic Life), M = Marine.
H = standard is Hardness dependent
Cl = standard is chloride dependent
V= Standard is valence dependent VI refers to chromium VI and III refers to chromium III
FDA = field duplicate available; FD = field duplicate; SCN = sample control number
italics indicate the concentration exceeds the laboratory detection limit.

SCN			21367-04	21382-03	21382-02	21382-01	21369-04	21369-05	21369-02	21369-03	21369-08	21369-01	21369-07	21369-06	21367-01	21367-02	21367-03	21382-04
Location			MW00-2	MW00-04	MW00-09	MW00-11	MW05-02	MW05-04	MW05-08	MW05-09	MW05-12	MW05-17	MW05-20	MW05-22	MW09-1	MW09-2	MW09-3	MW09-03
QA/QC																		
Date	Aquatic Life CSR-AW (marine)	Note	18-Nov-09	10-Dec-09	10-Dec-09	10-Dec-09	25-Nov-09	25-Nov-09	25-Nov-09	25-Nov-09	25-Nov-09	25-Nov-09	25-Nov-09	25-Nov-09	18-Nov-09	18-Nov-09	18-Nov-09	10-Dec-09
			7.55	6.66	6.33	7.33	7.04	7.06	6.74	7.23	6.6	7.51	8.4	6.59	7.97	7.36	7.69	7.31
			10.8	8.69	9.21	10.4	9.4	10.62	10.9	13.61	12.61	11.32	9.4	11.12	10.29	10.44	10.44	11.7
			242	230	96	386	531	510	1054	9547	1331	33734	900	1032	301	370	390	355
			31.6	-62.7	144.2	18.7	-15.9	-34	-39.2	17.3	110.9	-219.6	-121.6	-61.6	-130.6	-80	-121.6	-116.9
			11.7	2.91	4.41	2.67	10.9	9.4	13.9	18.6	21.1	14.4	60.2	9.6	36	23.6	14.3	1.56
			125	101	56	198	233	307	435	944	790	1570	86	688	106	151	144	-
	1,000		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	56	< 0.1	< 0.1	-
	2,500		0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	87	0.3	< 0.1	-
	720		< 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	-
	3,300		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	198	0.2	< 0.1	-
			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			1.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	1200	2.1	0.4	-
	4,400		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	15,000		< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	5,300	< 100	< 100	-
	1,500		< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	**3,800**	< 100	< 100	-
	60		< 0.1	< 0.1	< 0.1	< 0.1	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1	< 0.1	-
			< 0.1	< 0.1	< 0.1	< 0.1	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.1	< 0.1	< 0.1	-
	0.5		< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	-
	1		< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.01	< 0.01	< 0.01	-
	1		< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.01	< 0.01	-
	0.1		< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.01	< 0.01	-
			< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.01	< 0.01	-
			< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.01	< 0.01	< 0.01	-
			< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.01	< 0.01	-
	1		< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.01	< 0.01	-
			< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.01	< 0.01	-
	2		< 0.04	< 0.04	< 0.04	< 0.04	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.04	< 0.04	< 0.04	-
	120		< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	0.06	-
			< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.01	< 0.01	< 0.01	-
	10		< 0.3	< 0.3	< 0.3	< 0.3	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	8.9	0.4	0.4	-
	3		< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.06	< 0.05	0.06	-
	0.2		< 0.02	< 0.02	< 0.02	< 0.02	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.02	< 0.02	< 0.02	-
	34		< 0.5	< 0.5	< 0.5	< 0.5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 0.5	< 0.5	< 0.5	-
	5,000		< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	370	< 250	< 250	-
			600	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	-
	500		< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	360	< 250	< 250	-
			600	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	< 250	-

tre (µg/L), unless otherwise noted.
Regulation (CSR), its associated
Guidance Documents, enacted in 1997, and

Life), M = marine.

	SCN			0531-01	0532-01	21368-07	0531-02	0531-03	21368-05	21368-06	0532-02	21369-09	21369-10	21367-05	21367-06	21368-02	0531-04	0532-03	05
	Location	Aquatic Life		MW09-07	MW09-07	MW09-7	MW09-08	MW09-08	MW09-8	MW09-8	MW09-08	MW09-9	MW09-9	MW09-10	MW09-11	MW09-16	MW11-01	MW11-01	MW
	QA/QC	CSR-AW					FDA	FD	FDA	FD		FDA	FD						
	Date	(marine)	Note	16-Feb-11	22-Feb-11	20-Nov-09	16-Feb-11	16-Feb-11	20-Nov-09	20-Nov-09	22-Feb-11	25-Nov-09	25-Nov-09	19-Nov-09	19-Nov-09	20-Nov-09	16-Feb-11	22-Feb-11	16-
				6.34	6.49	7.22	6.99	6.99	6.92	6.92	6.68	6.75	6.75	8.13	7.88	7.62	7.69	6.76	
				6.6	6.2	11.33	7.77	7.77	9.66	9.66	6.84	10.3	10.3	11.49	11.31	10.51	6.6	5.1	
)				2960	4100	1420	8360	8360	14210	14210	33841	402	402	401	410	347	4223	41100	
				-	-	13	-95.9	-95.9	45.1	45.1	65.9	-54.8	-54.8	6.7	12.6	24.7	192.9	-	
%)				-	-	8.91	-	-	6.7	6.7	2.325	7.87	7.87	10.9	7.1	10.7	-	-	
				185	-	102	694	684	1480	1890	-	149	149	149	145	32	425	-	
ocarbons																			
		1,000		1.07	1.45	1	<0.50	<0.50	< 0.1	< 0.1	<0.50	< 0.1	< 0.1	< 0.1	< 0.1	-	<0.50	<0.50	<
		2,500		0.59	<0.50	2.3	<0.50	<0.50	< 0.1	< 0.1	<0.50	< 0.1	< 0.1	< 0.1	< 0.1	-	<0.50	<0.50	<
		720		<0.50	<0.50	< 0.1	<0.50	<0.50	< 0.1	< 0.1	<0.50	< 0.1	< 0.1	< 0.1	< 0.1	-	<0.50	<0.50	<
		3,300		<1.0	<1.0	< 0.1	<1.0	<1.0	< 0.1	< 0.1	<1.0	< 0.1	< 0.1	< 0.1	< 0.1	-	<1.0	<1.0	
				<0.50	<0.50	-	<0.50	<0.50	-	-	<0.50	-	-	-	-	-	<0.50	<0.50	<
e				<0.50	<0.50	-	<0.50	<0.50	-	-	<0.50	-	-	-	-	-	<0.50	<0.50	<
				<0.71	<0.71	0.5	<0.71	<0.71	< 0.1	< 0.1	<0.71	< 0.1	< 0.1	< 0.1	< 0.1	-	<0.71	<0.71	<
(MTBE)		**4,400**		<1.0	<1.0	-	<1.0	<1.0	-	-	<1.0	-	-	-	-	-	<1.0	<1.0	
		15,000		140	240	170	<100	<100	< 100	< 100	<100	< 100	< 100	< 100	< 100	-	<100	<100	<
		1,500		140	240	170	<100	<100	< 100	< 100	<100	< 100	< 100	< 100	< 100	-	<100	<100	<
Hydrocarbons																			
		60		0.252	0.257	< 0.1	0.898	0.931	< 0.1	< 0.1	0.128	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.098	<0.050	<
				<0.050	<0.050	< 0.1	<0.050	<0.050	< 0.1	< 0.1	<0.050	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.084	<0.050	<
		0.5		<0.070	<0.050	< 0.05	<0.13	<0.13	< 0.05	< 0.05	<0.050	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.060	<0.050	<
		1		<0.050	<0.050	< 0.01	<0.10	<0.10	0.06	0.05	<0.050	0.05	0.04	< 0.01	< 0.01	< 0.01	0.145	<0.050	<
		1		<0.050	<0.050	< 0.01	<0.050	<0.050	0.05	0.04	<0.050	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.369	<0.050	<
		0.1		<0.020	<0.010	< 0.01	<0.030	<0.010	0.03	0.03	<0.020	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**0.399**	<0.020	<
e				<0.050	<0.050	< 0.01	<0.050	<0.050	0.09	0.07	<0.050	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.467	<0.050	<
				<0.050	<0.050	< 0.01	<0.050	<0.050	0.03	0.04	<0.050	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.267	<0.050	<
e				<0.050	<0.050	< 0.01	<0.050	<0.050	0.03	0.03	<0.050	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.184	<0.050	<
		1		<0.050	<0.050	< 0.01	<0.050	<0.050	0.1	0.08	<0.050	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.446	<0.050	<
ne				<0.050	<0.050	< 0.01	<0.050	<0.050	0.01	< 0.01	<0.050	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.054	<0.050	<
		2		<0.050	<0.050	< 0.04	<0.050	<0.050	0.22	0.2	<0.050	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	0.929	<0.050	<
		120		0.279	0.235	0.05	<0.050	<0.050	< 0.05	< 0.05	<0.050	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.081	<0.050	<
ene				<0.050	<0.050	< 0.01	<0.050	<0.050	0.03	0.03	<0.050	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.292	<0.050	<
		10		<0.82	<0.37	< 0.3	<0.64	<0.29	< 0.3	< 0.3	<0.050	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	<0.96	<0.050	<
		3		0.193	<0.050	< 0.05	<0.050	<0.050	0.12	0.12	<0.050	0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.399	<0.050	<
		0.2		<0.050	<0.050	0.02	0.054	0.056	**0.23**	**0.23**	<0.050	0.03	0.03	< 0.02	< 0.02	< 0.02	**0.854**	<0.050	<
		34		0.138	<0.31	< 0.5	<0.050	<0.050	< 0.5	< 0.5	<0.050	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	<0.050	<0.050	<
		5,000		<430	<250	< 250	<340	<280	< 250	< 250	<250	< 250	< 250	< 250	< 250	< 250	<250	<250	<
				<380	<250	< 250	<510	<250	300	260	<250	< 250	< 250	< 250	< 250	280	1280	<250	<
		500		<430	<250	< 250	<340	<280	< 250	< 250	<250	< 250	< 250	< 250	< 250	< 250	<250	<250	<
				<380	<250	< 250	<510	<250	300	260	<250	< 250	< 250	< 250	< 250	280	1280	<250	<

micrograms per litre (µg/L), unless otherwise noted.
Contaminated Sites Regulation (CSR), its associated
6) and Technical Guidance Documents, enacted in 1997, and
1.

ons: AW (Aquatic Life), M = marine.

SCN			21367-08	0531-01	0532-01	0531-02	0531-03	21368-05	0532-02	21369-09	21369-10	0531-04	0532-03	0531-05	
Location	Aquatic Life CSR-AW (marine)	Note	MW09-5	MW09-07	MW09-07	MW09-08	MW09-08	MW09-8	MW09-08	MW09-9	MW09-9	MW11-01	MW11-01	MW11-02	M
QA/QC						FDA	FD	FDA		FDA	FD				
Date			19-Nov-09	16-Feb-11	22-Feb-11	16-Feb-11	16-Feb-11	20-Nov-09	22-Feb-11	25-Nov-09	25-Nov-09	16-Feb-11	22-Feb-11	16-Feb-11	2
rs															
(pH units)			7.6	6.34	6.49	6.99	6.99	6.92	6.68	6.75	6.75	7.69	6.76	8.05	
ure (°C)			10.33	6.6	6.2	7.77	7.77	9.66	6.84	10.3	10.3	6.6	5.1	10.2	
vity (µS/cm)			410	2960	4100	8360	8360	14210	33841	402	402	4223	41100	402	
V)			-50.4	-	-	-95.9	-95.9	45.1	65.9	-54.8	-54.8	192.9	-	158.7	
Oxygen (%)			11	-	-	-	-	6.7	2.325	7.87	7.87	-	-	-	
(mg/L)			175	185	-	694	684	1480	-	149	149	425	-	83.5	
ated Hydrocarbons															
hloroethane			< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
etrachloroethane			< 0.2	<1.0	<1.0	<1.0	<1.0	< 0.2	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
hloroethane			< 0.1	<2.0	<4.0	<1.0	<1.0	< 0.1	<1.0	< 0.2	< 0.2	<1.0	<1.0	<1.0	
oroethane			< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
oroethene			< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
moethane			< 0.1	-	-	-	-	< 0.1	-	< 0.1	< 0.1	-	-	-	
orobenzene	420		< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
oroethane	1000		< 0.4	<1.0	<1.0	<1.0	<1.0	< 0.4	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
oropropane			< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.4	< 0.4	<1.0	<1.0	<1.0	
orobenzene	1,500		< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
orobenzene	260		< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
ne			< 5	-	-	-	-	< 5	-	< 0.1	< 0.1	-	-	-	
ne			< 20	-	-	-	-	< 20	-	< 5	< 5	-	-	-	
-2-pentanone			< 2	-	-	-	-	< 2	-	< 2	< 2	-	-	-	
hloromethane			< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
m			< 0.2	<1.0	<1.0	<1.0	<1.0	< 0.2	<1.0	< 0.2	< 0.2	<1.0	<1.0	<1.0	
thane			< 0.8	-	-	-	-	< 0.8	-	< 0.8	< 0.8	-	-	-	
etrachloride	130		< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
nzene	120		< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
ane			< 0.4	<1.0	<1.0	<1.0	<1.0	< 0.4	<1.0	< 0.4	< 0.4	<1.0	<1.0	<1.0	
m	20		< 0.3	<1.0	<1.0	<1.0	<1.0	< 0.3	<1.0	< 0.3	< 0.3	<1.0	<1.0	**24.1**	
thane			< 0.4	<5.0	<5.0	<5.0	<5.0	< 0.4	<5.0	< 0.4	< 0.4	<5.0	<5.0	<5.0	
ichloroethene			< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
ichloropropene			< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
chloromethane			< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
methane			< 0.2	<5.0	<5.0	<5.0	<5.0	< 0.2	<5.0	< 0.2	< 0.2	<5.0	<5.0	<5.0	
difluoromethane			< 0.2	-	-	-	-	< 0.2	-	< 0.2	< 0.2	-	-	-	
e Chloride	980		< 6	-	-	-	-	< 6	-	< 6	< 6	-	-	-	
roethene	1,100		< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
Dichloroethene			< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
Dichloropropene			< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
ethene	200		< 0.1	<1.0	<1.0	<1.0	<1.0	< 0.1	<1.0	< 0.1	< 0.1	<1.0	<1.0	<1.0	
fluoromethane			< 0.2	<1.0	<1.0	<1.0	<1.0	< 0.2	<1.0	< 0.2	< 0.2	<1.0	<1.0	<1.0	
oride			< 0.2	<1.0	<1.0	<1.0	<1.0	< 0.2	<1.0	< 0.2	< 0.2	<1.0	<1.0	<1.0	

ntrations in micrograms per litre (µg/L), unless otherwise noted.
from the Contaminated Sites Regulation (CSR), its associated
s (Schedule 6) and Technical Guidance Documents, enacted in 1997,
ed May 31, 2011.

Table 16d
Results of Groundwater Monitoring Analyses
Ladysmith Harbour, Ladysmith, BC
Hydrocarbons, Phenols, PCBs

SCN				21369-04	21369-05	21369-02	21369-03	21369-08	21369-01	21369-07	21369-06	21382-04	21368-03	21368-04
Location	Aquatic Life CSR-AW (marine)		Note	MW05-02	MW05-04	MW05-08	MW05-09	MW05-12	MW05-17	MW05-20	MW05-22	MW09-03	MW09-6 FDA	MW09-6 FD
QA/QC														
Date				25-Nov-09	25-Nov-09	25-Nov-09	25-Nov-09	25-Nov-09	25-Nov-09	25-Nov-09	25-Nov-09	10-Dec-09	20-Nov-09	20-Nov-09
Parameters														
pH (field) (pH units)				7.04	7.06	6.74	7.23	6.6	7.51	8.4	6.59	7.31	6.76	6.76
Temperature (°C)				9.4	10.62	10.9	13.61	12.61	11.32	9.4	11.12	11.7	11.2	11.2
Conductivity (µS/cm)				531	510	1054	9547	1331	33734	900	1032	355	411	411
Redox (mV)				-15.9	-34	-39.2	17.3	110.9	-219.6	-121.6	-61.6	-116.9	31	31
Dissolved Oxygen (%)				10.9	9.4	13.9	18.6	21.1	14.4	60.2	9.6	1.56	-	-
hardness (mg/L)				233	307	435	944	790	1570	86	688	-	-	-
Polychlorinated Biphenyls														
Arochlor 1242				-	-	-	-	-	-	-	-	< 0.1	< 0.1	< 0.1
Arochlor 1248				-	-	-	-	-	-	-	-	< 0.1	< 0.1	< 0.1
Arochlor 1254				-	-	-	-	-	-	-	-	< 0.1	< 0.1	< 0.1
Arochlor 1260				-	-	-	-	-	-	-	-	< 0.1	< 0.1	< 0.1
Total PCB				-	-	-	-	-	-	-	-	< 0.4	< 0.4	< 0.4
Chlorinated Phenols														
Total Trichlorophenols				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-
Total Tetrachlorophenols				0.06	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-
Total Chlorinated Phenols				0.51	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.15	< 0.05	-	-	-
2,3,4-Trichlorophenol	1-270	pH/T/I		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-
2,3,5-Trichlorophenol	1-270	pH/T/I		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-
2,3,6-Trichlorophenol	1-270	pH/T/I		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-
2,4,5-Trichlorophenol	1-270	pH/T/I		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-
2,4,6-Trichlorophenol	1-270	pH/T/I		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-
3,4,5-Trichlorophenol	1-270	pH/T/I		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-
2,3,4,5-Tetrachlorophenol	2-180	pH/T/I		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-
2,3,4,6-Tetrachlorophenol	2-180	pH/T/I		0.06	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-
2,3,5,6-Tetrachlorophenol	2-180	pH/T/I		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-
Pentachlorophenol	1-27.5	pH/T/I		0.45	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.15	< 0.05	-	-	-

Notes:
All concentrations in micrograms per litre (µg/L), unless otherwise noted.
Standards from the Contaminated Sites Regulation (CSR), its associated Schedules (Schedule 6) and Technical Guidance Documents, enacted in 1997, and updated May 31, 2011.

Land Use abbreviations: AW (Aquatic Life), M = marine.
For chlorophenol standards, refer to Technical Guidance Document #9
pH/T/I = The standards varies as a function of pH, Temperature and Chlorophenol Isomer

BH09-15 21366-04 3.65 - 3.8 1/14/2009 FD	Method Detection Limit	Mean	Relative Percent Difference	Difference Factor (DF)	MW09-8 21363-07 2.9 - 3.0 11/13/2009 FDA	MW09-8 21363-08 2.9 - 3.0 11/13/2009 FD	Method Detection Limit	Mean	Relative Percent Difference	Difference Factor (DF)	MW09-16 21366-09 3.35 - 3.50 11/14/2009 FDA	MW09-16 21366-10 3.35 - 3.50 11/14/2009 FD	Method Detection Limit	Mean	Relative Percent Difference	Difference Factor (DF)	TP09-02 21381-04 1.5-1.7 12/15/2009 FDA	TP09-02 21381-05 1.5-1.7 12/15/2009 FD	Method Detection Limit
-	10	NC	NC	NC	12100	11000	10	11550	9.52%	NA	11400	10900	10	11150	4.48%	NA	-	-	-
-	10	NC	NC	NC	< 10	< 10	10	NC	NC	NC	< 10	< 10	10	NC	NC	NC	-	-	-
-	10	NC	NC	NC	< 10	< 10	10	NC	NC	NC	< 10	< 10	10	NC	NC	NC	-	-	-
-	1	NC	NC	NC	55	52	1	53.5	5.61%	NA	117	109	1	113	7.08%	NA	-	-	-
-	1	NC	NC	NC	< 1	< 1	1	NC	NC	NC	< 1	< 1	1	NC	NC	NC	-	-	-
-	1	NC	NC	NC	19	18	1	18.5	5.41%	NA	14	14	1	14	0.00%	NA	-	-	-
-	0.5	NC	NC	NC	< 0.5	< 0.5	0.5	NC	NC	NC	< 0.5	< 0.5	0.5	NC	NC	NC	-	-	-
-	1	NC	NC	NC	14800	33000	1	23900	76.15%	NA	4940	4860	1	4900	1.63%	NA	-	-	-
-	2	NC	NC	NC	20	19	2	19.5	5.13%	NA	15	15	2	15	0.00%	NA	-	-	-
-	1	NC	NC	NC	9	8	1	8.5	11.76%	NA	7	7	1	7	0.00%	NA	-	-	-
-	1	NC	NC	NC	64	56	1	60	13.33%	NA	29	29	1	29	0.00%	NA	-	-	-
-	2	NC	NC	NC	18400	18200	2	18300	1.09%	NA	16600	16600	2	16600	0.00%	NA	-	-	-
-	5	NC	NC	NC	36	54	5	45	**40.00%**	NA	< 5	< 5	5	NC	NC	NC	-	-	-
-	0.1	NC	NC	NC	6000	5890	0.1	5945	1.85%	NA	5140	5030	0.1	5085	2.16%	NA	-	-	-
-	1	NC	NC	NC	425	427	1	426	0.47%	NA	242	235	1	238.5	2.94%	NA	-	-	-
-	0.01	NC	NC	NC	0.2	0.26	0.01	0.23	26.09%	NA	0.02	0.03	0.01	0.025	NA	1.00	-	-	-
-	4	NC	NC	NC	5	< 4	4	NC	NC	NC	< 4	< 4	4	NC	NC	NC	-	-	-
-	2	NC	NC	NC	22	18	2	20	20.00%	NA	16	15	2	15.5	6.45%	NA	-	-	-
-	20	NC	NC	NC	492	469	20	480.5	4.79%	NA	440	432	20	436	1.83%	NA	-	-	-
-	10	NC	NC	NC	815	796	10	805.5	2.36%	NA	630	593	10	611.5	6.05%	NA	-	-	-
-	0.2	NC	NC	NC	< 2	< 2	0.2	NC	NC	NC	< 2	< 2	0.2	NC	NC	NC	-	-	-
-	2	NC	NC	NC	< 2	< 2	2	NC	NC	NC	< 2	< 2	2	NC	NC	NC	-	-	-
-	5	NC	NC	NC	1470	1720	5	1595	15.67%	NA	557	525	5	541	5.91%	NA	-	-	-
-	1	NC	NC	NC	117	266	1	191.5	**77.81%**	NA	29	26	1	27.5	10.91%	NA	-	-	-
-	5	NC	NC	NC	< 5	< 5	5	NC	NC	NC	< 5	< 5	5	NC	NC	NC	-	-	-
-	1	NC	NC	NC	597	677	1	637	12.56%	NA	913	902	1	907.5	1.21%	NA	-	-	-
-	1	NC	NC	NC	46	41	1	43.5	11.49%	NA	45	46	1	45.5	2.20%	NA	-	-	-
-	1	NC	NC	NC	68	75	1	71.5	9.79%	NA	29	28	1	28.5	3.51%	NA	-	-	-
-	1	NC	NC	NC	3	3	1	3	NA	0.00	4	5	1	4.5	NA	1.00	-	-	-
2500	250	2300	17.39%	NA	1900	7500	250	4700	**119.15%**	NA	< 250	< 250	250	NC	NC	NC	270	300	250
3300	250	3200	6.25%	NA	2000	7700	250	4850	**117.53%**	NA	< 250	< 250	250	NC	NC	NC	830	980	250
2500	250	2300	17.39%	NA	1900	7500	250	4700	**119.15%**	NA	< 250	< 250	250	NC	NC	NC	270	300	250
3300	250	3200	6.25%	NA	2000	7700	250	4850	**117.53%**	NA	< 250	< 250	250	NC	NC	NC	830	980	250
< 0.05	0.05	NC	NC	NC	0.74	0.66	0.05	0.7	11.43%	NA	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	3	1.7	0.05	2.35	**55.32%**	NA	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	0.84	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05
0.66	0.05	0.715	15.38%	NA	5.2	3	0.05	4.1	**53.66%**	NA	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	0.08	0.05
< 0.04	0.04	NC	NC	NC	< 0.04	< 0.04	0.04	NC	NC	NC	-	-	-	NC	NC	NC	< 0.04	-	0.04
< 0.5	0.5	NC	NC	NC	< 0.5	< 0.5	0.5	NC	NC	NC	-	-	-	NC	NC	NC	< 0.5	-	0.5
< 0.1	0.1	NC	NC	NC	< 0.1	< 0.1	0.1	NC	NC	NC	-	-	-	NC	NC	NC	< 0.5	-	0.1
< 0.5	0.5	NC	NC	NC	< 0.5	< 0.5	0.5	NC	NC	NC	-	-	-	NC	NC	NC	< 0.1	-	0.5
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
< 0.1	0.1	NC	NC	NC	< 0.1	< 0.1	0.1	NC	NC	NC	-	-	-	NC	NC	NC	< 0.1	-	0.1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
< 100	100	NC	NC	NC	250	140	100	195	NA	1.10	-	-	-	NC	NC	NC	118	< 100	100
< 100	100	NC	NC	NC	250	140	100	195	NA	1.10	-	-	-	NC	NC	NC	118	< 100	100

ndicated.

by the mean of the two values.
he method detection limit.
mes the detection limit.

e of less than 0.35 (or 35 percent) for soil)

Location	TP09-06	TP09-06					TP09-12	TP09-12					TP11-07	TP11-07				
SCN	21383-05	21383-06	Method Detection Limit	Mean	Relative Percent Difference	Difference Factor (DF)	21581-08	21581-09	Method Detection Limit	Mean	Relative Percent Difference	Difference Factor (DF)	0529-07	0529-10	Method Detection Limit	Mean	Relative Percent Difference	D
Depth (m bgs)	0.9-1.1	0.9-1.1					0.1-0.3	0.1-0.3					2.8-3.0	2.8-3.0				
Date Sampled (dd/mm/yyyy)	12/15/2009	12/15/2009					12/15/2009	12/15/2009					2/9/2011	2/9/2011				
QA/QC	FDA	FD					FDA	FD					FDA	FD				
	-	-	-	NC	NC	NC	14000	15400	10	14700	9.52%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	< 10	< 10	10	NC	NC	NC	-	-	-	-	-	
	-	-	-	NC	NC	NC	< 10	< 10	10	NC	NC	NC	-	-	-	-	-	
	-	-	-	NC	NC	NC	130	131	1	130.5	0.77%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	< 1	< 1	1	NC	NC	NC	-	-	-	-	-	
r soluble)	-	-	-	NC	NC	NC	1	< 1	1	NC	NC	NC	-	-	-	-	-	
	-	-	-	NC	NC	NC	< 0.5	< 0.5	0.5	NC	NC	NC	-	-	-	-	-	
	-	-	-	NC	NC	NC	6280	5820	1	6050	7.60%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	27	29	2	28	7.14%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	11	12	1	11.5	8.70%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	63	64	1	63.5	1.57%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	20800	22900	2	21850	9.61%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	58	60	5	59	3.39%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	5390	5610	0.1	5500	4.00%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	464	608	1	536	26.87%	NA	-	-	-	-	-	
nic)	-	-	-	NC	NC	NC	0.09	0.09	0.01	0.09	0.00%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	< 4	< 4	4	NC	NC	NC	-	-	-	-	-	
	-	-	-	NC	NC	NC	21	22	2	21.5	4.65%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	766	801	20	783.5	4.47%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	422	442	10	432	4.63%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	< 2	< 2	0.2	NC	NC	NC	-	-	-	-	-	
	-	-	-	NC	NC	NC	< 2	< 2	2	NC	NC	NC	-	-	-	-	-	
	-	-	-	NC	NC	NC	366	406	5	386	10.36%	NA	-	-	-	-	-	
e)	-	-	-	NC	NC	NC	65	56	1	60.5	14.88%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	< 5	< 5	5	NC	NC	NC	-	-	-	-	-	
	-	-	-	NC	NC	NC	1060	1140	1	1100	7.27%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	67	71	1	69	5.80%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	108	123	1	115.5	12.99%	NA	-	-	-	-	-	
	-	-	-	NC	NC	NC	3	3	1	3	NA	0.00	-	-	-	-	-	
drocarbons																		
	5100	6600	250	5850	25.64%	NA	< 250	< 250	250	NC	NC	NC	<200	<200	200	NC	NC	
	1500	2000	250	1750	28.57%	NA	< 250	< 250	250	NC	NC	NC	<200	<200	200	NC	NC	
	5100	6600	250	5850	25.64%	NA	< 250	< 250	250	NC	NC	NC	<200	<200	200	NC	NC	
	1500	2000	250	1750	28.57%	NA	< 250	< 250	250	NC	NC	NC	<200	<200	200	NC	NC	
matic Hydrocarbons																		
alene	< 0.5	< 0.5	0.05	NC	NC	NC	0.16	0.13	0.05	0.145	NA	0.60	<0.050	<0.050	0.05	NC	NC	
	< 0.5	0.57	0.05	NC	NC	NC	0.11	< 0.05	0.05	NC	NC	NC	<0.050	<0.050	0.05	NC	NC	
	< 0.5	< 0.5	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC	<0.050	<0.050	0.05	NC	NC	
	< 0.5	< 0.5	0.05	NC	NC	NC	0.12	0.07	0.05	0.095	NA	1.00	<0.050	<0.050	0.05	NC	NC	
ene	< 0.5	< 0.5	0.05	NC	NC	NC	0.26	0.34	0.05	0.3	26.67%	NA	<0.050	<0.050	0.05	NC	NC	
	< 0.5	< 0.5	0.05	NC	NC	NC	0.33	0.39	0.05	0.36	16.67%	NA	<0.050	<0.050	0.05	NC	NC	
thene	< 0.5	< 0.5	0.05	NC	NC	NC	0.38	0.46	0.05	0.42	19.05%	NA	<0.050	<0.050	0.05	NC	NC	
ylene	< 0.5	< 0.5	0.05	NC	NC	NC	0.22	0.26	0.05	0.24	NA	0.80	<0.050	<0.050	0.05	NC	NC	
thene	< 0.5	< 0.5	0.05	NC	NC	NC	0.19	0.16	0.05	0.175	NA	0.60	<0.050	<0.050	0.05	NC	NC	
	< 0.5	< 0.5	0.05	NC	NC	NC	0.32	0.45	0.05	0.385	33.77%	NA	<0.050	<0.050	0.05	NC	NC	
racene	< 0.5	< 0.5	0.05	NC	NC	NC	< 0.05	0.08	0.05	NC	NC	NC	<0.050	<0.050	0.05	NC	NC	
	< 0.5	< 0.5	0.05	NC	NC	NC	0.52	0.44	0.05	0.48	16.67%	NA	<0.050	<0.050	0.05	NC	NC	
	0.6	1.1	0.05	0.85	**58.82%**	NA	0.11	< 0.05	0.05	NC	NC	NC	<0.050	<0.050	0.05	NC	NC	
d)pyrene	< 0.5	< 0.5	0.05	NC	NC	NC	0.18	0.21	0.05	0.195	NA	0.60	<0.050	<0.050	0.05	NC	NC	
	< 0.5	< 0.5	0.05	NC	NC	NC	0.11	0.1	0.05	0.105	NA	0.20	<0.050	<0.050	0.05	NC	NC	
	< 0.5	< 0.5	0.05	NC	NC	NC	0.62	0.41	0.05	0.515	**40.78%**	NA	<0.050	<0.050	0.05	NC	NC	
	< 0.5	< 0.5	0.05	NC	NC	NA	0.56	0.58	0.05	0.57	3.51%	NA	<0.050	<0.050	0.05	NC	NC	
ed Volatiles																		
	< 0.04	-	0.04	NC	NC	NC	-	-	-	-	-	-	<0.040	<0.040	0.04	NC	NC	
	< 0.5	-	0.5	NC	NC	NC	-	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	
	< 0.1	-	0.1	NC	NC	NC	-	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	
	< 0.5	-	0.5	NC	NC	NC	-	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	
	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	
ylene	-	-	-	-	-	-	-	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	
	< 0.1	-	0.1	NC	NC	NC	-	-	-	-	-	-	<0.071	<0.071	0.071	NC	NC	
ther (MTBE)	-	-	-	-	-	-	-	-	-	-	-	-	<0.20	<0.20	0.2	NC	NC	
	-	-	-	NC	NC	NC	-	-	-	-	-	-	<100	<100	100	NC	NC	
	-	-	-	NC	NC	NC	-	-	-	-	-	-	<100	<100	100	NC	NC	

essed in micrograms per gram (ug/g), unl
of two values.
difference = the difference between two
r = absolute difference between two valu
r is calculated when the concentration is
lable
cable
plicate Available
licate
difference more than acceptable variablity

18900	22400	1	20650	16.95%	NA	-	-	-	-	-	-			-	
11.3	13.5	0.2	12.4	17.74%	NA	-	-	-	-	-	-			-	
1480	1890	1	1685	**24.33%**	NA	149	149	1	149	0.00%	NA	694	684	0.96	
112	123	0.5	117.5	9.36%	NA	-	-	-	-	-	-	133	129	2.0	
< 0.5	< 0.5	0.5	NC	NC	NC	-	-	-	-	-	-	<2.0	<2.0	2.0	
< 0.5	< 0.5	0.5	NC	NC	NC	-	-	-	-	-	-	<2.0	<2.0	2.0	
91.7	100	0.5	95.85	8.66%	NA	-	-	-	-	-	-	133	129	2.0	
												5.9	5.2	1.0	
5410	6480	1	5945	18.00%	NA	-	-	-	-	-	-	2340	2150	10	
< 1.25	< 2.5	0.25	NC	NC	NC	-	-	-	-	-	-	<0.40	<0.40	0.40	
< 1.25	< 2.5	0.25	NC	NC	NC	-	-	-	-	-	-	<0.10	<0.10	0.10	
< 0.002	< 0.002	0.002	NC	NC	NC	-	-	-	-	-	-	<0.020	<0.020	0.020	
< 1.25	< 2.5	0.25	NC	NC	NC	-	-	-	-	-	-	-	-	-	
686	843	2.5	764.5	**20.54%**	NA	-	-	-	-	-	-	290	264	10	
0.012	0.014	0.005	0.013	NA	0.40	0.011	0.016	0.005	0.0135	NA	1.00	<0.20	<0.20	0.20	
< 0.0005	< 0.0005	0.0005	NC	NC	NC	< 0.0005	< 0.0005	0.0005	NC	NC	NC	<0.010	<0.010	0.010	
0.011	0.014	0.001	0.0125	**24.00%**	NA	0.001	0.001	0.001	0.001	NA	0.00	<0.020	<0.020	0.020	
0.18	0.21	0.001	0.195	15.38%	NA	0.012	0.012	0.001	0.012	0.00%	NA	<0.040	<0.040	0.040	
< 0.0005	< 0.0005	0.0005	NC	NC	NC	< 0.0005	< 0.0005	0.0005	NC	NC	NC	<0.010	<0.010	0.010	
< 0.0005	< 0.0005	0.0005	NC	NC	NC	< 0.0005	< 0.0005	0.0005	NC	NC	NC	<0.40	<0.40	0.40	
0.91	1.06	0.25	0.985	NA	0.60	0.07	0.06	0.25	0.065	NA	0.04	0.66	0.65	0.20	
< 0.00005	< 0.00005	0.00005	NC	NC	NC	6.00E-05	0.00007	0.00005	0.000065	NA	0.20	<0.0010	<0.0010	0.0010	
136	169	0.05	152.5	**21.64%**	NA	41.4	41.5	0.05	41.45	0.24%	NA	50.0	49.1	0.20	
< 0.0005	< 0.0005	0.0005	NC	NC	NC	< 0.0005	< 0.0005	0.0005	NC	NC	NC	-	-	-	
< 0.001	< 0.001	0.001	NC	NC	NC	< 0.001	< 0.001	0.001	NC	NC	NC	<0.010	<0.010	0.010	
0.0014	0.0016	0.0005	0.0015	NA	0.40	0.0035	0.0035	0.0005	0.0035	0.00%	NA	<0.010	<0.010	0.010	
0.0018	0.0019	0.0005	0.00185	NA	0.20	0.0014	0.0012	0.0005	0.0013	NA	0.40	<0.020	<0.020	0.020	
0.35	0.64	0.05	0.495	**58.59%**	NA	< 0.05	< 0.05	0.05	NC	NC	NC	0.87	0.88	0.06	
< 0.0005	< 0.0005	0.0005	NC	NC	NC	< 0.0005	< 0.0005	0.0005	NC	NC	NC	-	-	-	
< 0.00025	< 0.00025	0.00025	NC	NC	NC	< 0.00025	< 0.00025	0.00025	NC	NC	NC	<0.020	<0.020	0.020	
0.035	0.039	0.0005	0.037	10.81%	NA	0.0008	0.0012	0.0005	0.001	NA	0.80	<0.10	<0.10	0.10	
277	357	0.025	317	**25.24%**	NA	11.1	10.9	0.025	11	1.82%	NA	138	136	0.20	
1.04	1.4	0.0005	1.22	**29.51%**	NA	2.45	2.47	0.0005	2.46	0.81%	NA	0.295	0.289	0.020	
< 0.00002	< 0.00002	0.00002	NC	NC	NC	< 0.00002	< 0.00002	0.00002	NC	NC	NC	<0.00020	<0.00020	0.00020	
0.0054	0.0064	0.0005	0.0059	16.95%	NA	0.0061	0.006	0.0005	0.00605	1.65%	NA	<0.020	<0.020	0.020	
0.006	0.006	0.001	0.006	0.00%	NA	0.005	0.004	0.001	0.0045	NA	1.00	<0.10	<0.10	0.10	
< 0.075	< 0.075	0.075	NC	NC	NC	< 0.075	< 0.075	0.075	NC	NC	NC	<0.60	<0.60	0.60	
85.7	104	0.05	94.85	19.29%	NA	0.79	0.78	0.05	0.785	1.27%	NA	54.2	53.3	4.0	
< 0.0005	< 0.0005	0.0005	NC	NC	NC	< 0.0005	< 0.0005	0.0005	NC	NC	NC	-	-	-	
0.03	0.034	0.0005	0.032	12.50%	NA	0.0005	0.0005	0.0005	0.0005	NA	0.00	-	-	-	
< 0.001	0.001	0.001	NC	NC	NC	< 0.001	< 0.001	0.001	NC	NC	NC	<0.040	<0.040	0.040	
2.6	2.4	0.25	2.5	8.00%	NA	10.9	10.9	0.25	10.9	0.00%	NA	4.88	4.77	0.10	
< 0.0002	< 0.0002	0.0002	NC	NC	NC	< 0.0002	< 0.0002	0.0002	NC	NC	NC	<0.0010	<0.0010	0.0010	
2800	3450	0.025	3125	**20.80%**	NA	12.5	12.9	0.025	12.7	3.15%	NA	1270	1250	4.0	
2.8	3.43	0.0005	3.115	**20.22%**	NA	0.248	0.256	0.0005	0.252	3.17%	NA	0.839	0.827	0.010	
249	310	0.5	279.5	**21.82%**	NA	< 5	< 5	0.5	NC	NC	NC	-	-	-	
< 0.001	< 0.001	0.001	NC	NC	NC	< 0.001	< 0.001	0.001	NC	NC	NC	-	-	-	
< 0.0001	< 0.0001	0.0001	NC	NC	NC	< 0.0001	< 0.0001	0.0001	NC	NC	NC	<0.0040	<0.0040	0.0040	
0.0012	0.0013	0.00025	0.00125	8.00%	NA	0.0003	0.0003	0.00025	0.0003	NA	0.00	-	-		
< 0.0005	< 0.0005	0.0005	NC	NC	NC	< 0.0005	< 0.0005	0.0005	NC	NC	NC	<0.060	<0.060	0.060	
0.004	0.005	0.001	0.0045	NA	1.00	< 0.001	< 0.001	0.001	NC	NC	NC	<0.10	<0.10	0.10	
< 0.0005	< 0.0005	0.0005	NC	NC	NC	< 0.0005	< 0.0005	0.0005	NC	NC	NC	-	-	-	
0.001	0.0012	0.00025	0.0011	NA	0.80	0.0003	0.0003	0.00025	0.0003	NA	0.00	<0.0040	<0.0040	0.0040	
< 0.0005	< 0.0005	0.0005	NC	NC	NC	0.0009	0.0008	0.0005	0.00085	NA	0.20	<0.060	<0.060	0.060	
< 0.005	< 0.005	0.005	NC	NC	NC	0.005	0.005	0.005	0.005	NA	0.00	<0.010	<0.010	0.010	
< 0.0005	< 0.0005	0.0005	NC	NC	NC	< 0.0005	< 0.0005	0.0005	NC	NC	NC	-	-	-	

SCN	21368-05	21368-06					21369-09	21369-10				
Location	MW09-8	MW09-8	Method Detection Limit	Mean	Relative Percent Difference	Difference Factor (DF)	MW09-9	MW09-9	Method Detection Limit	Mean	Relative Percent Difference	Difference Factor (DF)
QA/QC	FDA	FD					FDA	FD				
Date (dd/mm/yyyy)	20-Nov-09	20-Nov-09					24-Nov-09	24-Nov-09				
Monoaromatic Hydrocarbons												
benzene	< 0.1	< 0.1	0.1	NC	NC	NC	< 0.1	< 0.1		NC	NC	NC
ethylbenzene	< 0.1	< 0.1	0.1	NC	NC	NC	< 0.1	< 0.1		NC	NC	NC
styrene	< 0.1	< 0.1	0.1	NC	NC	NC	< 0.1	< 0.1		NC	NC	NC
toluene	< 0.1	< 0.1	0.1	NC	NC	NC	< 0.1	< 0.1		NC	NC	NC
ortho-Xylene												
meta- & para-Xylene												
total xylene	< 0.1	< 0.1	0.1	NC	NC	NC	< 0.1	< 0.1		NC	NC	NC
Methyl t-butyl ether (MTBE)												
VH_{w6-10}	< 100	< 100	100	NC	NC	NC	< 100	< 100		NC	NC	NC
VPH_w	< 100	< 100	100	NC	NC	NC	< 100	< 100		NC	NC	NC
Polycyclic Aromatic Hydrocarbons												
acenaphthene	< 0.1	< 0.1	0.1	NC	NC	NC	< 0.1	< 0.1	0.1	NC	NC	NC
acenaphthylene	< 0.1	< 0.1	0.1	NC	NC	NC	< 0.1	< 0.1	0.1	NC	NC	NC
acridine	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC
anthracene	0.06	0.05	0.01	0.055	18.18%	NA	0.05	0.04	0.01	0.045	NA	1.00
benzo(a)anthracene	0.05	0.04	0.01	0.045	NA	1.00	< 0.01	< 0.01	0.01	NC	NC	NC
benzo(a)pyrene	0.03	0.03	0.01	0.03	NA	0.00	< 0.01	< 0.01	0.01	NC	NC	NC
benzo(b)fluoranthene	0.09	0.07	0.01	0.08	**25.00%**	NA	< 0.01	< 0.01	0.01	NC	NC	NC
benzo(g,h,i)perylene	0.03	0.04	0.01	0.035	NA	1.00	< 0.01	< 0.01	0.01	NC	NC	NC
benzo(k)fluoranthene	0.03	0.03	0.01	0.03	NA	0.00	< 0.01	< 0.01	0.01	NC	NC	NC
chrysene	0.1	0.08	0.01	0.09	**22.22%**	NA	< 0.01	< 0.01	0.01	NC	NC	NC
dibenzo(a,h)anthracene	0.01	< 0.01	0.01	NC	NC	NC	< 0.01	< 0.01	0.01	NC	NC	NC
fluoranthene	0.22	0.2	0.04	0.21	9.52%	NA	< 0.04	< 0.04	0.04	NC	NC	NC
fluorene	< 0.05	< 0.05	0.05	NC	NC	NC	< 0.05	< 0.05	0.05	NC	NC	NC
indeno(1,2,3-c,d)pyrene	0.03	0.03	0.01	0.03	NA	0.00	< 0.01	< 0.01	0.01	NC	NC	NC
naphthalene	< 0.3	< 0.3	0.3	NC	NC	NC	< 0.3	< 0.3	0.3	NC	NC	NC
phenanthrene	0.12	0.12	0.05	0.12	NA	0.00	0.05	< 0.05	0.05	NC	NC	NC
pyrene	0.23	0.23	0.02	0.23	0.00%	NA	0.03	0.03	0.02	0.03	NA	0.00
quinoline	< 0.5	< 0.5	0.5	NC	NC	NC	< 0.5	< 0.5	0.5	NC	NC	NC
Other Hydrocarbons												
$EPHw_{10-19}$	< 250	< 250	250	NC	NC	NC	< 250	< 250	250	NC	NC	NC
$EPHw_{19-32}$	300	260	250	280	NA	0.16	< 250	< 250	250	NC	NC	NC
LEPHw	< 250	< 250	250	NC	NC	NC	< 250	< 250	250	NC	NC	NC
HEPH	300	260	250	280	NA	0.16	< 250	< 250	250	NC	NC	NC
non-aqueous phase liquid (NAPL)												
Polychlorinated Biphenyls												
Arochlor 1242	-	-		-	-	-	-	-		-	-	-
Arochlor 1248	-	-		-	-	-	-	-		-	-	-
Arochlor 1254	-	-		-	-	-	-	-		-	-	-
Arochlor 1260	-	-		-	-	-	-	-		-	-	-
Total PCB	-	-		-	-	-	-	-		-	-	-
Chlorinated Hydrocarbons												
1,1,1-Trichloroethane	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
1,1,2,2-Tetrachloroethane	< 0.2	-	-	-	-	-	< 0.1	< 0.1	0.2	NC	NC	NC
1,1,2-Trichloroethane	< 0.1	-	-	-	-	-	< 0.2	< 0.2	0.1	NC	NC	NC
1,1-Dichloroethane	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
1,1-Dichloroethene	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
1,2-Dibromoethane	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
1,2-Dichlorobenzene	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
1,2-Dichloroethane	< 0.4	-	-	-	-	-	< 0.1	< 0.1	0.4	NC	NC	NC
1,2-Dichloropropane	< 0.1	-	-	-	-	-	< 0.4	< 0.4	0.1	NC	NC	NC
1,3-Dichlorobenzene	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
1,4-Dichlorobenzene	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
2-Butanone	< 5	-	-	-	-	-	< 0.1	< 0.1	5	NC	NC	NC
2-Hexanone	< 20	-	-	-	-	-	< 5	< 5	20	NC	NC	NC
4-Methyl-2-pentanone	< 2	-	-	-	-	-	< 2	< 2	2	NC	NC	NC
Bromodichloromethane	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
Bromoform	< 0.2	-	-	-	-	-	< 0.2	< 0.2	0.2	NC	NC	NC
Bromomethane	< 0.8	-	-	-	-	-	< 0.8	< 0.8	0.8	NC	NC	NC
Carbon Tetrachloride	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
Chlorobenzene	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
Chloroethane	< 0.4	-	-	-	-	-	< 0.4	< 0.4	0.4	NC	NC	NC
Chloroform	< 0.3	-	-	-	-	-	< 0.3	< 0.3	0.3	NC	NC	NC
Chloromethane	< 0.4	-	-	-	-	-	< 0.4	< 0.4	0.4	NC	NC	NC
cis-1,2-Dichloroethene	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
cis-1,3-Dichloropropene	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
Dibromochloromethane	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
Dibromomethane	< 0.2	-	-	-	-	-	< 0.2	< 0.2	0.2	NC	NC	NC
Dichlorodifluoromethane	< 0.2	-	-	-	-	-	< 0.2	< 0.2	0.2	NC	NC	NC
Methylene Chloride	< 6	-	-	-	-	-	< 6	< 6	6	NC	NC	NC
Tetrachloroethene	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
trans-1,2-Dichloroethene	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
trans-1,3-Dichloropropene	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
Trichloroethene	< 0.1	-	-	-	-	-	< 0.1	< 0.1	0.1	NC	NC	NC
Trichlorofluoromethane	< 0.2	-	-	-	-	-	< 0.2	< 0.2	0.1	NC	NC	NC
Vinyl Chloride	< 0.2	-	-	-	-	-	< 0.2	< 0.2	0.1	NC	NC	NC

Notes:
All concentrations in micrograms per litre (µg/L), unless otherwise noted.
Mean = average of two values.

Relative percent difference = the difference between two values divided by the mean of the two values.

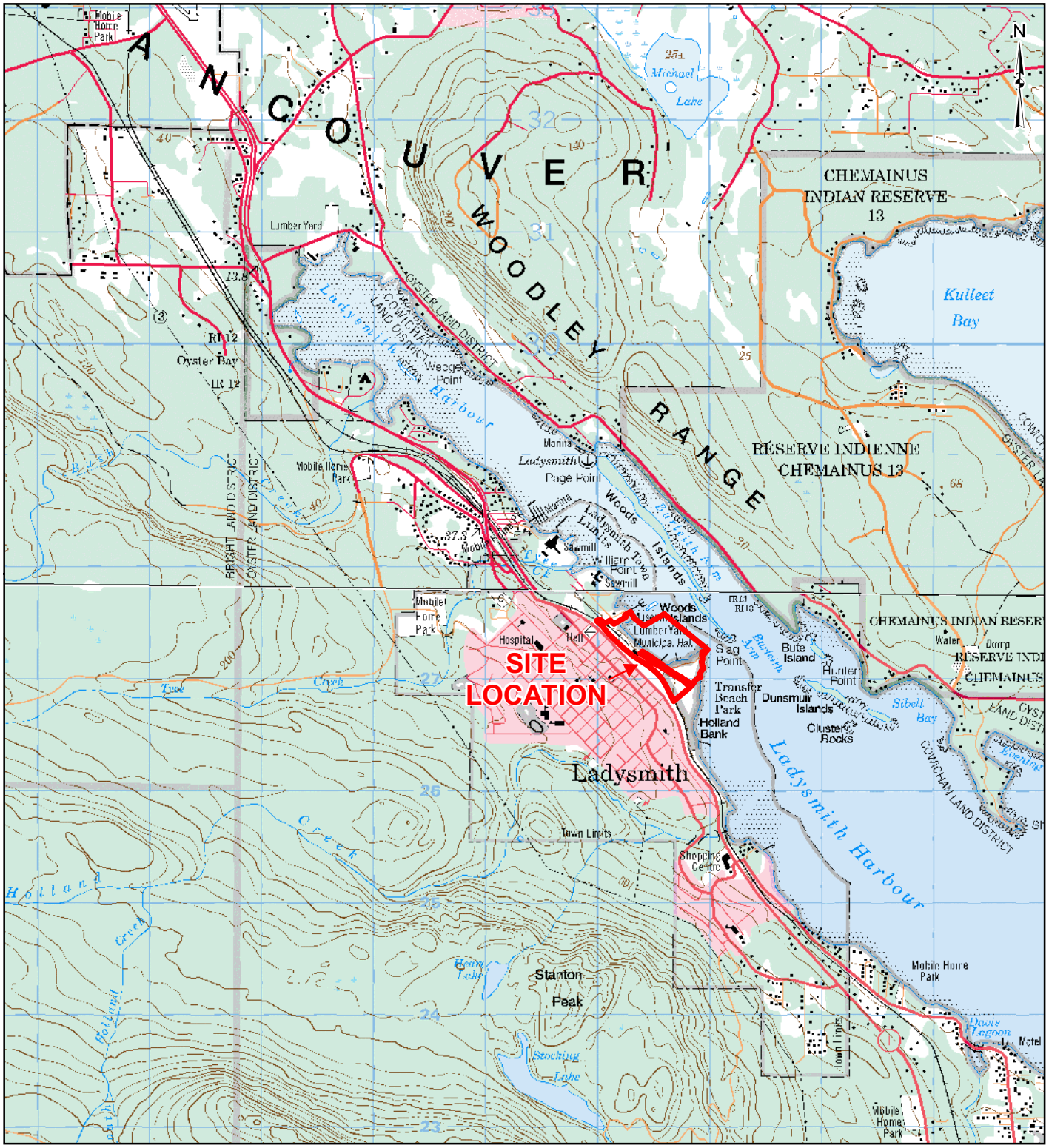
Difference factor = absolute difference between two values divided by the method detection limit. Difference factor is calculated when the concentration is less than five times the detection limit.
NC = Not Calculable
NA = Not Applicable
FDA = Field Duplicate Available
FD = Field Duplicate
Bold = percent difference more than acceptable

SCN	21368-03	21368-04					0531-02	0531-03				
Location	MW09-06	MW09-06	Method Detection Limit	Mean	Relative Percent Difference	Difference Factor (DF)	MW09-08	MW09-08	Method Detection Limit	Mean	Relative Percent Difference	Difference Factor (DF)
QA/QC	FDA	FD					FDA	FD				
Date (dd/mm/yyyy)	20-Nov-09	20-Nov-09					16-Feb-11	16-Feb-11				
Monoaromatic Hydrocarbons												
benzene	-	-		-	-	-	<0.50	<0.50	0.5	NC	NC	NC
ethylbenzene	-	-		-	-	-	<0.50	<0.50	0.5	NC	NC	NC
styrene	-	-		-	-	-	<0.50	<0.50	0.5	NC	NC	NC
toluene	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
ortho-Xylene							<0.50	<0.50	0.5	NC	NC	NC
meta- & para-Xylene							<0.50	<0.50	0.5	NC	NC	NC
total xylene	-	-		-	-	-	<0.71	<0.71	0.71	NC	NC	NC
Methyl t-butyl ether (MTBE)							<1.0	<1.0	1	NC	NC	NC
VH_{w6-10}	-	-		-	-	-	<100	<100	100	NC	NC	NC
VPH_w	-	-					<100	<100	100	NC	NC	NC
Polycyclic Aromatic Hydrocarbons												
acenaphthene	< 0.1	-	-	-	-	-	0.898	0.931	0.050	0.9145	3.61%	NA
acenaphthylene	< 0.1	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	NC
acridine	< 0.05	-	-	-	-	-	<0.13	<0.13	0.13	NC	NC	NC
anthracene	< 0.01	-	-	-	-	-	<0.10	<0.10	0.1	NC	NC	NC
benzo(a)anthracene	< 0.01	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	NC
benzo(a)pyrene	< 0.01	-	-	-	-	-	<0.030	<0.010	0.03	NC	NC	NC
benzo(b)fluoranthene	< 0.01	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	NC
benzo(g,h,i)perylene	< 0.01	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	NC
benzo(k)fluoranthene	< 0.01	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	NC
chrysene	< 0.01	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	NC
dibenzo(a,h)anthracene	< 0.01	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	NC
fluoranthene	< 0.04	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	NC
fluorene	< 0.05	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	NC
indeno(1,2,3-c,d)pyrene	< 0.01	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	NC
naphthalene	< 0.3	-	-	-	-	-	<0.64	<0.29	0.64	NC	NC	NC
phenanthrene	< 0.05	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	NC
pyrene	0.03	-	-	-	-	-	0.054	0.056	0.050	0.055	NA	0.04
quinoline	< 0.5	-	-	-	-	-	<0.050	<0.050	0.05	NC	NC	NC
Other Hydrocarbons												
$EPHw_{10-19}$	< 250	-		-	-	-	<340	<280	340	NC	NC	NC
$EPHw_{19-32}$	< 250	-		-	-	-	<510	<250	510	NC	NC	NC
LEPHw	< 250	-		-	-	-	<340	<280	340	NC	NC	NC
HEPH	< 250	-		-	-	-	<510	<250	510	NC	NC	NC
non-aqueous phase liquid (NAPL)									-			
									-			
Polychlorinated Biphenyls												
Arochlor 1242	< 0.1	< 0.1	0.1	NC	NC	NC	-	-	-	-	-	-
Arochlor 1248	< 0.1	< 0.1	0.1	NC	NC	NC	-	-	-	-	-	-
Arochlor 1254	< 0.1	< 0.1	0.1	NC	NC	NC	-	-	-	-	-	-
Arochlor 1260	< 0.1	< 0.1	0.1	NC	NC	NC	-	-	-	-	-	-
Total PCB	< 0.4	< 0.4	0.4	NC	NC	NC	-	-	-	-	-	-
												-
Chlorinated Hydrocarbons												
1,1,1-Trichloroethane	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
1,1,2,2-Tetrachloroethane	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
1,1,2-Trichloroethane	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
1,1-Dichloroethane	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
1,1-Dichloroethene	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
1,2-Dibromoethane	-	-		-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
1,2-Dichloroethane	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
1,2-Dichloropropane	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
1,3-Dichlorobenzene	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
1,4-Dichlorobenzene	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
2-Butanone	-	-		-	-	-	-	-	-	-	-	-
2-Hexanone	-	-		-	-	-	-	-	-	-	-	-
4-Methyl-2-pentanone	-	-		-	-	-	-	-	-	-	-	-
Bromodichloromethane	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
Bromoform	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
Bromomethane	-	-		-	-	-	-	-	-	-	-	-
Carbon Tetrachloride	-	-		-	-	-	<1.0	<1.0	1	-	-	-
Chlorobenzene	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
Chloroethane	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
Chloroform	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
Chloromethane	-	-		-	-	-	<5.0	<5.0	5	NC	NC	NC
cis-1,2-Dichloroethene	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
cis-1,3-Dichloropropene	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
Dibromochloromethane	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
Dibromomethane	-	-		-	-	-	<5.0	<5.0	5	NC	NC	NC
Dichlorodifluoromethane	-	-		-	-	-	-	-	-	-	-	-
Methylene Chloride	-	-		-	-	-	-	-	-	-	-	-
Tetrachloroethene	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
trans-1,2-Dichloroethene	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
trans-1,3-Dichloropropene	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
Trichloroethene	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
Trichlorofluoromethane	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC
Vinyl Chloride	-	-		-	-	-	<1.0	<1.0	1	NC	NC	NC

Notes:
All concentrations in micrograms per litre (µg/L), unless otherwise noted.
Mean = average of two values.

Relative percent difference = the difference between two values divided by the mean of the two values.

Difference factor = absolute difference between two values divided by the method detection limit. Difference factor is calculated when the concentration is less than five times the detection limit.
NC = Not Calculable
NA = Not Applicable
FDA = Field Duplicate Available
FD = Field Duplicate
Bold = percent difference more than acceptable



LEGEND

Site Boundary

1,000 0 1,000

SCALE 1:50,000 METRES

REFERENCE

NTS Mapsheet 092G04/092B13 obtained from Natural Resources Canada.
Projection: UTM Zone 10 Datum: NAD 83

PROJECT	CROWN CONTAMINATED SITES PROGRAM, CROWN LAND OPPORTUNITIES AND RESTORATION BRANCH B.C. MINISTRY OF FORESTS, LANDS AND NATURAL RESOURCE OPERATIONS LADYSMITH HARBOUR, LADYSMITH, B.C.
TITLE	**KEY PLAN**

Golder Associates
Greater Vancouver Office, B.C.

PROJECT No. 09-1436-5008				
DESIGN	LK	02SEP10	SCALE AS SHOWN	REV. 0
GIS	MH	02SEP10	**FIGURE 1**	
CHECK				
REVIEW				

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LEGEND

- Site Boundary
- Filled Foreshore
- Uplands
- Water Lot

* Lot sizes derived from Baker & Osland Appraisals Ltd. (2002)

REFERENCE

Image ' 2009 TerraMetrics: Captured from Google Earth Pro ' 2009.
Other basedata obtained from WMS in the Province of British Columbia.
Projection: UTM Zone 10 Datum: NAD 83

PROJECT: CROWN CONTAMINATED SITES PROGRAM, CROWN LAND OPPORTUNITIES AND RESTORATION BRANCH
B.C. MINISTRY OF FORESTS, LANDS AND NATURAL RESOURCE OPERATIONS
LADYSMITH HARBOUR, LADYSMITH, B.C.

TITLE

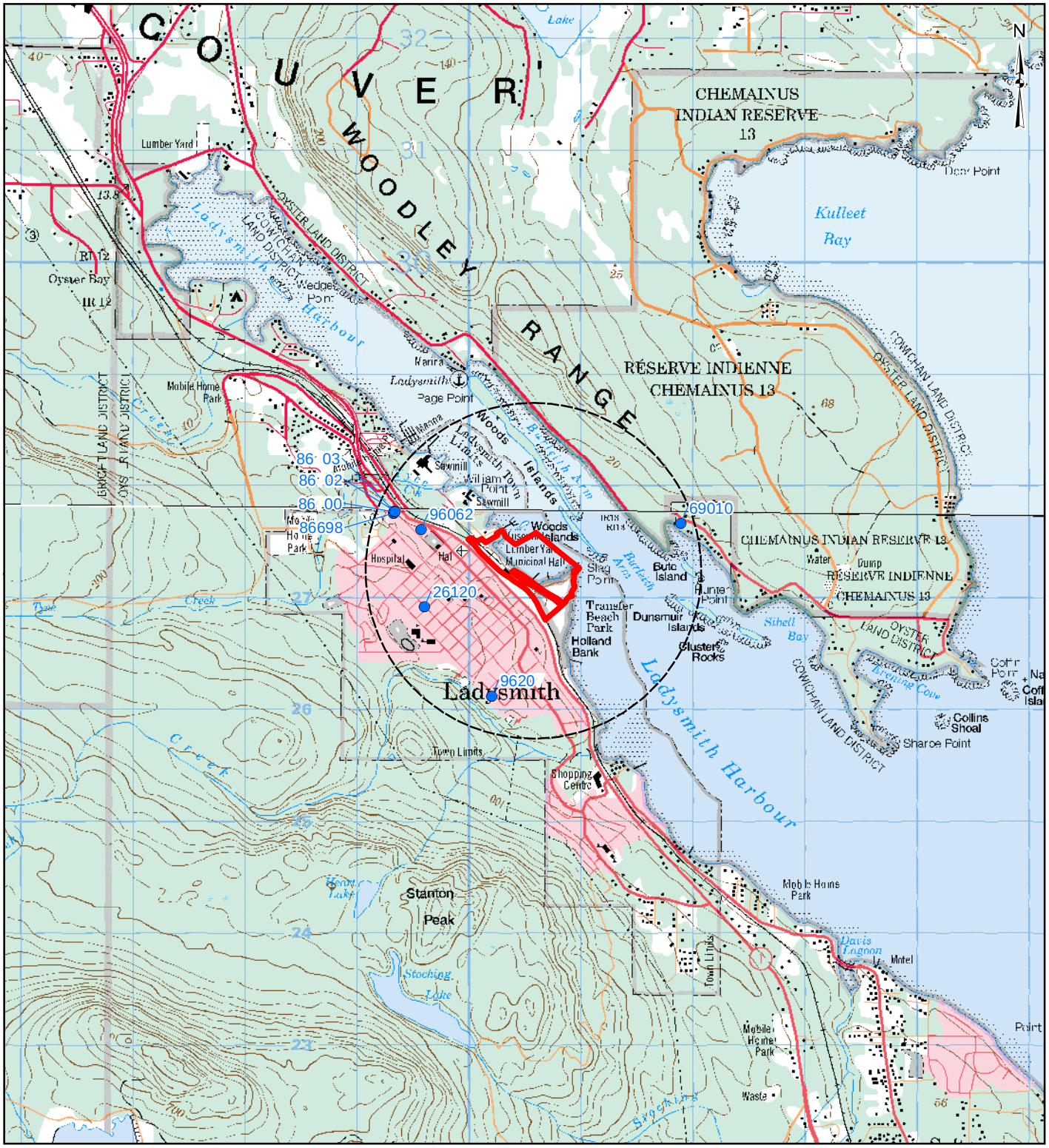
SITE PLAN SHOWING LEGAL LOTS

Golder Associates
Greater Vancouver Office, B.C.

PROJECT No.09-1436-5008				
DESIGN	LK	02SEP10	SCALE AS SHOWN	REV. 1
GIS	MH	02SEP10		
CHECK				
REVIEW				

FIGURE 2

N:\Bur-Graphics\Projects\2009\1436\09-1436-5008\GIS\projects\3000\figure-02_siteplan.mxd



LEGEND

- ater ell Location
- Site Boundary
- Buffer 1.5 km

1,000 0 1,000

SCALE 1:50,000 METRES

REFERENCE

NTS Mapsheet 092G04/092B13 obtained from Natural Resources Canada.
ater ell Locations obtained from the BC Land and Resource Data arehouse LRD .
Projection: UTM Zone 10 Datum: NAD 83

PROJECT CROWN CONTAMINATED SITES PROGRAM, CROWN LAND OPPORTUNITIES AND RESTORATION BRANCH
B.C. MINISTRY OF FORESTS, LANDS AND NATURAL RESOURCE OPERATIONS
LADYSMITH HARBOUR, LADYSMITH, B.C.

TITLE

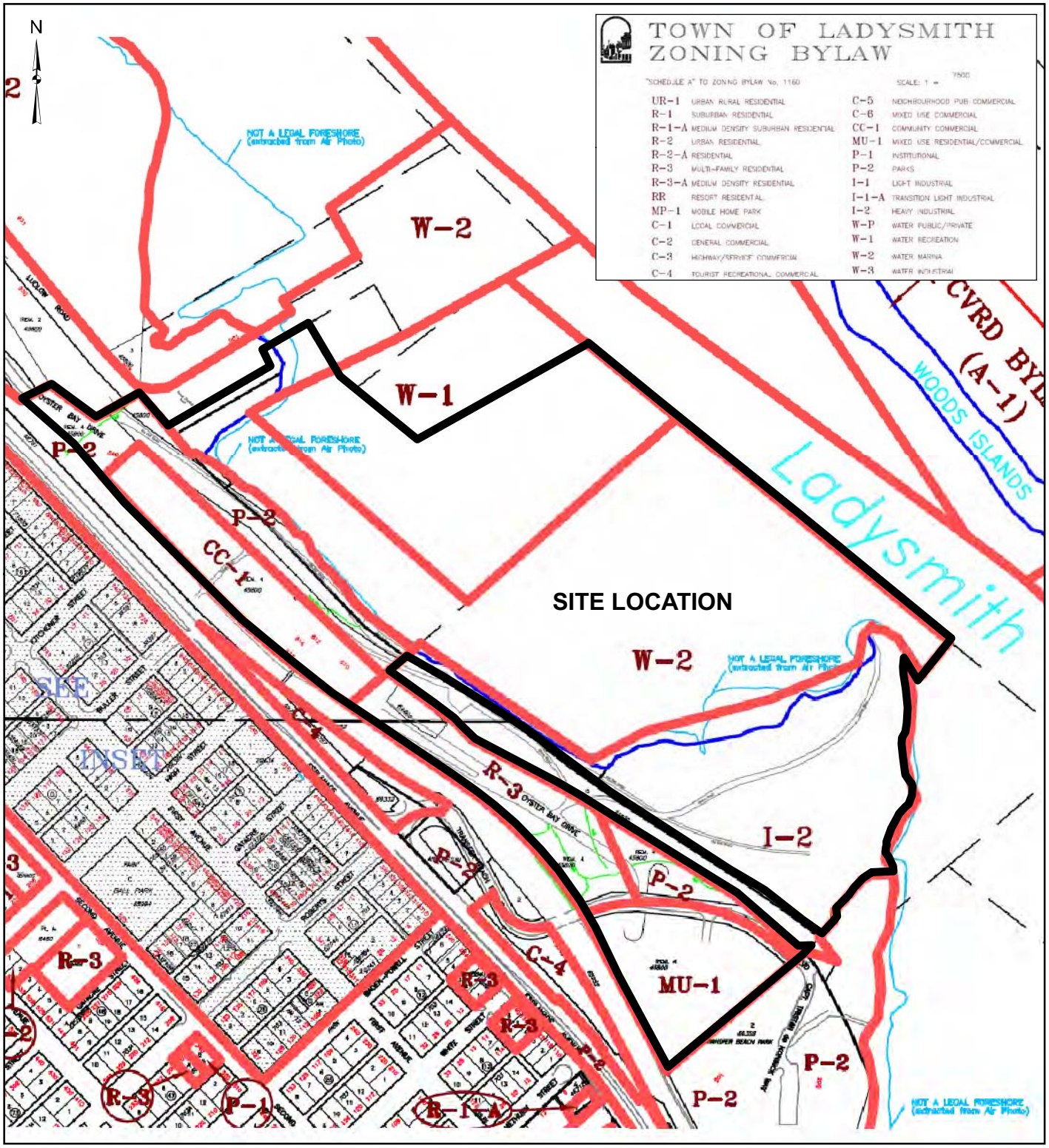
WATER WELL LOCATIONS

Golder Associates
Greater Vancouver Office, B.C.

PROJECT No.09-1436-5008				
DESIGN	LK	02SEP10	SCALE AS SHOWN	REV. 0
GIS	MH	02SEP10		
CHECK				
REVIEW				

FIGURE 3

N:\Bur-Graphics\Projects\2009\1436\09-1436-5008\GIS\projects\3000\figure-03_ ter- ells.mxd



LEGEND

- Site Boundary
- Zoning Boundary

150 0 150

SCALE 1:6,000 METRES

REFERENCE

Image obtained from the Town of Ladysmith Zoning Bylaw.
Projection: UTM Zone 10 Datum: NAD 83

PROJECT	CROWN CONTAMINATED SITES PROGRAM, CROWN LAND OPPORTUNITIES AND RESTORATION BRANCH B.C. MINISTRY OF FORESTS, LANDS AND NATURAL RESOURCE OPERATIONS LADYSMITH HARBOUR, LADYSMITH, B.C.
TITLE	**SURROUNDING LAND USE**

Golder Associates
Greater Vancouver Office, B.C.

PROJECT No.09-1436-5008				
DESIGN	LK	02SEP10	SCALE AS SHOWN	REV. 0
GIS	MH	02SEP10		
CHECK				
REVIEW				

FIGURE 4

N:\Bur-Graphics\Projects\2009\1436\09-1436-5008\GIS\projects\3000\figure-04_site_location_surrounding_landuse.mxd