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## Installation and Start-Up of In-Situ Air Sparge / Soil Vapour Extraction (Biosparging/Bioventing) Remediation System Beneath Mall

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## Outline

- Site Description and History
- Previous Work by Others
- SLR Remediation Plan
- Delineation challenges/logistics
- System Installation challenges/logistics
- System Start-Up challenges
- System O&M



## Site Description

- The site is a shopping mall in the Lower Mainland (commercial)
- Burrard Inlet to south of site (marine aquatic receptor)
- Creek to east of site (freshwater aquatic receptor)
- Applicable BC CSR standards:
  - Soil: CL
  - Groundwater: AWM and AWF







## Site History





## Previous Work By Others

- IAS/SVE remediation system installed under building and operated from 1997 to 2008
- Vertical and horizontal extent of plume in soil and groundwater was not delineated
- Soil vapour extraction lines were not deep enough
- Some air sparge wells did not target optimal depth
- Pressures, flow rates and vacuum at sparge compressors and extraction blower too low
- Some success in reducing petroleum hydrocarbon concentrations in groundwater but was not able to significantly reduce the overall plume size



### SLR Remediation Plan

- Delineate extent of soil and groundwater contamination in both areas
- Assess soil vapour (inside building and parking lot)
- Parking Lot contaminant sources relatively accessible, excavate
- Beneath Building contaminant sources more difficult to access, install IAS/SVE (biosparging/bioventing) system (target to remediate to numerical standards)
- Assess baseline groundwater quality







## Delineation Drilling - challenges/logistics



 For north end of plume beneath building used a mini odex rig (inside wine shop)



## Parking Lot - Excavation



 Excavated approximately 1,000 tonnes of soil, dewatered excavation, collected confirmatory samples



## Parking Lot - Excavation



- Backfilled, paved, painted parking stall lines
- Installed and sampled post remedial groundwater and soil vapour wells
- Confirmed this area remediated







## System Installation - Proposed



## Soil Vapour Extraction/Bioventing Line Installation - challenges/logistics



- Directional drilling to install 4 horizontal lines under building
- Depth critical (above the water table but still in sand and gravel below a silt and sand layer)



## Soil Vapour Extraction/Bioventing Line Installation





## Soil Vapour Extraction/Bioventing Line Installation





## Soil Vapour Extraction/Bioventing Line Installation





## Sparge Well Installation

- 10 new sparge wells installed:
  - 7 vertical
  - 3 angled under building (approximately 35 degrees from vertical)
- 9 of existing sparge wells also reused for new system



# Sparge Well Installation - challenges/logistics





## Sparge Well Installation - challenges/logistics













## Remediation System Equipment

- sparge compressor (rotary claw compressor with 40 HP, 208-230/460 V/3P motor) = 300 scfm at 28 psig
- SVE/biovent blower (5L rotary lobe blower with 15 HP, 230/460V/3P motor) = 400 scfm at 80 inches H<sub>2</sub>O
- heat exchanger
- liquid / vapour separator
- water holding tank
- carbon vessels
- fans, instrumentation, gauges etc.
- control panel, telemetry



#### SPARGE COMPRESSOR

100

SVE BLOWER

CARBON VESSELS

HOLDING TANK

#### LIQUID / VAPOUR SEPARATOR



### **Remediation System After Installation**





## System Start-Up - challenges

- Primary:
  - elevated sound levels (complaint from tenant)
- Minor Issues:
  - required replacement of PVC piping in some areas of steel piping due to high temperatures
  - pressure build up in carbon vessels
  - water build up in carbon vessels



### **Elevated Sound Levels**

- Sought advice from equipment vendor, contractor, colleagues
- Hired acoustics consultants to assess sound levels at various locations around equipment and provide recommendations for reducing sound levels
  - Sound levels measured at various locations in proximity to the equipment ranged from 50 dbs to 78 dbs
- Local bylaw sound level:
  - Activity Zone during the day = 60 dbs
  - Activity Zone during the night = 55 dbs



## Managing and Reducing Sound Levels

- lined the inside of the heat exchanger and equipment enclosure with liner board/insulation
- replaced latticed area with solid plywood
- placed rubber foam on stack covers
- wrapped piping with insulation/added foam
- covered inlet and outlet of heat exchanger with custom made downward facing covers
- added a silencer and dampener at the outlet of compressor (~15 db reduction each)











![](_page_35_Picture_1.jpeg)

![](_page_35_Picture_2.jpeg)

![](_page_36_Picture_0.jpeg)

![](_page_36_Picture_1.jpeg)

![](_page_36_Picture_2.jpeg)

## Managing and Reducing Sound Levels

#### INSTALL SILENCER -HERE

#### INSTALL DAMPENER ~ HERE

sparge global environmental solutions **COMPRESSOR** 

![](_page_37_Picture_4.jpeg)

## Managing and **Reducing Sound** Levels

#### **INSTALLED SILENCER HERE**

#### **INSTALLED** DAMPENER HERE

**SPARGE** global environmental solutions **COMPRESSOR** 

## Managing and Reducing Sound Levels

- received authorization from client and property manager to run system
- equipment no longer audible inside building
- no more complaints from tenants
- lower frequency sound

![](_page_39_Picture_5.jpeg)

## System O&M/Optimization & Effectiveness

- Baseline groundwater and subslab vapour sampling completed (summer and winter)
- Regular groundwater and subslab vapour sampling to assess changes in groundwater quality/system effectiveness (approximately every 3 months)
- Regular monitoring of system (approx. every 2 weeks):
  - Sparge compressor pressure, temperature, flow rate
  - Extraction blower vacuum, pressure, temperature, vapour levels (Gastech), velocity

![](_page_40_Picture_6.jpeg)

### Thanks:

- SLR Staff:
  - Kevin Pendreigh senior review
  - Steve Hammer design
  - Stef Lee, Geoff Rousseau, Joey Tsao, Mark White fieldwork
- Directional Mining and Drilling
- Quantum Murray
- Maple Leaf Equipment

![](_page_41_Picture_8.jpeg)

![](_page_42_Picture_0.jpeg)

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## Thank You

## SLR Consulting (Canada) Ltd.

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