



**Keystone  
Environmental**  
Knowledge-Driven Results



# On-Site Remediation Approach for a Former Petrochemical Plant

Former Chatterton Petrochemical Plant  
7927 Huston Road, Delta, BC

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October 20, 2011 11am

Environmental  
Consulting

Engineering  
Solutions

Assessment &  
Protection

KeystoneEnviro.com



## Overview

- Location and History
- Site Characterization
- Remediation
  - Challenges
  - Solutions
  - Results



**Keystone Environmental**

Knowledge-Driven Results



Fraser River

Sunbury

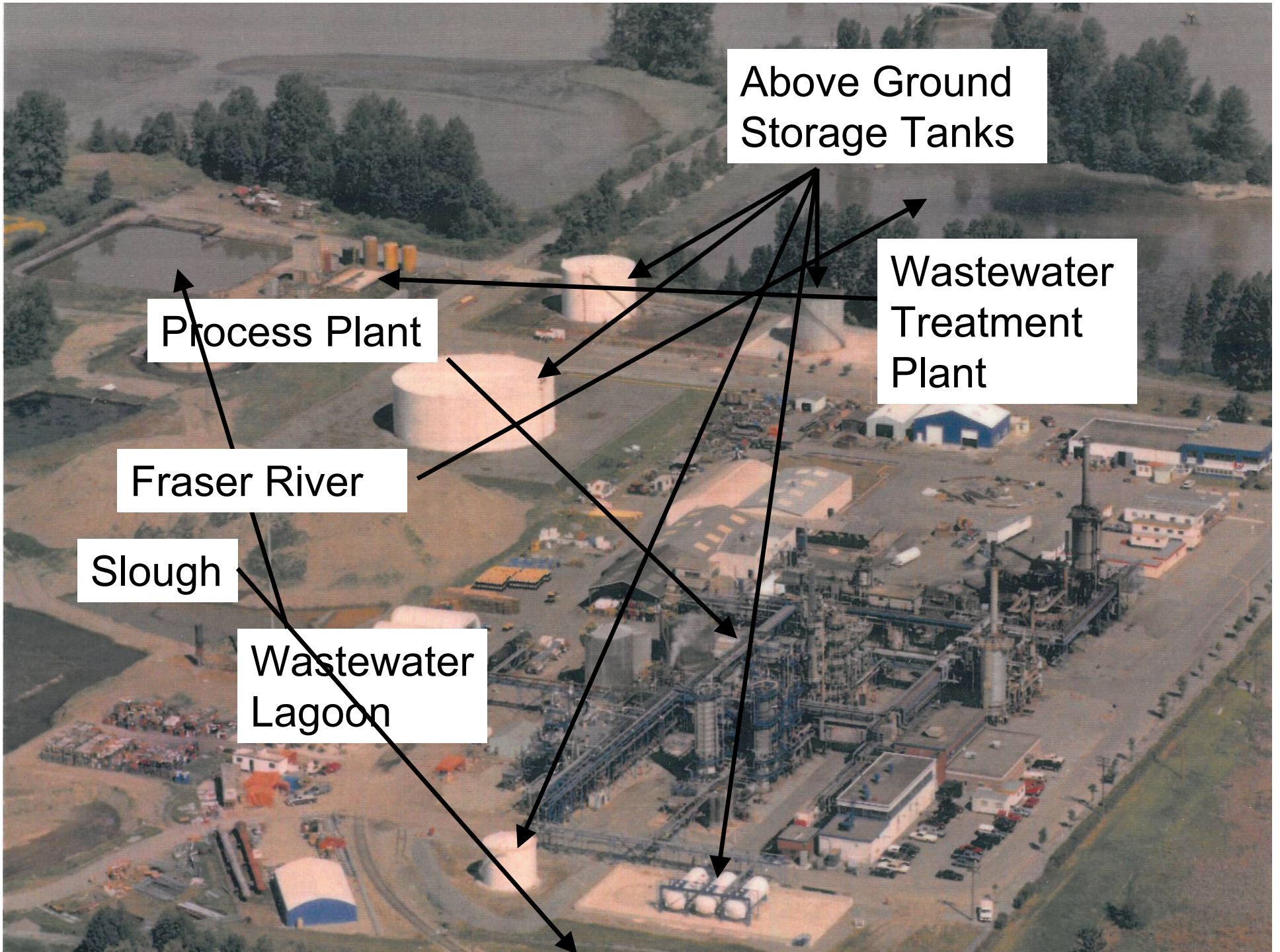
Site

# History

- Agricultural prior to 1960s
- Plant constructed circa 1960
- Dow Chemical, 1961-84
- Chatterton Petrochemical, 1984-92
  - Mainly benzoic acid, phenol, meta-toluic acid
- The waste products and by-products include:
  - Benzene and tar residues from various reactor vessels
  - By-product tars were incinerated on-Site from 1961 to 1992
- Process waste water was treated on-Site in the Biox plant which consisted of an equalization lagoon

A toluene spill of approximately 220,000 lbs in the process plant area in 1982





Above Ground  
Storage Tanks

Wastewater  
Treatment  
Plant

Process Plant

Fraser River

Slough

Wastewater  
Lagoon

# Background

Chemical Plant decommissioned in 1992.

The Client acquired the site as part of a larger purchase.

Management objective is to redevelop the site as an industrial park.

The Client requested Keystone provide strategic oversight to the existing consultant. Within a year, Keystone was requested to take project to completion.



# Timeline Objectives

Keystone committed to obtain a Certificate of Compliance within three years.

Methodologies included:

- Consolidation of previous investigations to plan a go forward strategy
- Direct MOE liaison to ensure MOE on board with remedial actions
- Remediation strategy sensitive to timelines, costs and sustainability



# Identification of Areas of Potential Environmental Concern

- 14 APECs identified
- Remediation approach for:
  - APEC 1 Process Plant
  - APEC 4 Lagoon
- Risk assessment selected for remaining APECs





# Contamination Summary

## On-Site:

- Hazardous waste soils in former equalization lagoon
- Petroleum free product on top of groundwater in Process Plant Area
- Groundwater analytical results indicated toluene at concentrations of up to 250,000  $\mu\text{g/L}$

## Off-Site:

- Toluene and xylene contaminated groundwater to the south
- Groundwater analytical results indicated toluene at concentrations of up to 90,000  $\mu\text{g/L}$



# Remediation Challenges

Large volume of waste and hazardous waste soils

- Off-Site dig and dump too expensive
- In-situ remediation too slow

Concerns for Groundwater migration to the south  
off-site under railway to slough

The presence of an endangered plant species – a  
Lupine colony in remediation area.

- Access to this area was initially refused by  
Ministry of Environment



# Remediation Challenges

- High concentrations of contaminants
- Health and safety measures
  - During and after construction
- Groundwater treatment
  - Options for dewatering
- Close proximity to river and slough
- Active railway over off-Site contamination
- Permitting
- Timeline
- Site size, access, and location



# Remediation Strategy

## Site Future Use:

- Industrial Park

## Goals:

- Follow an aggressive timeline
- Lower cost than dig and dump

## Approach:

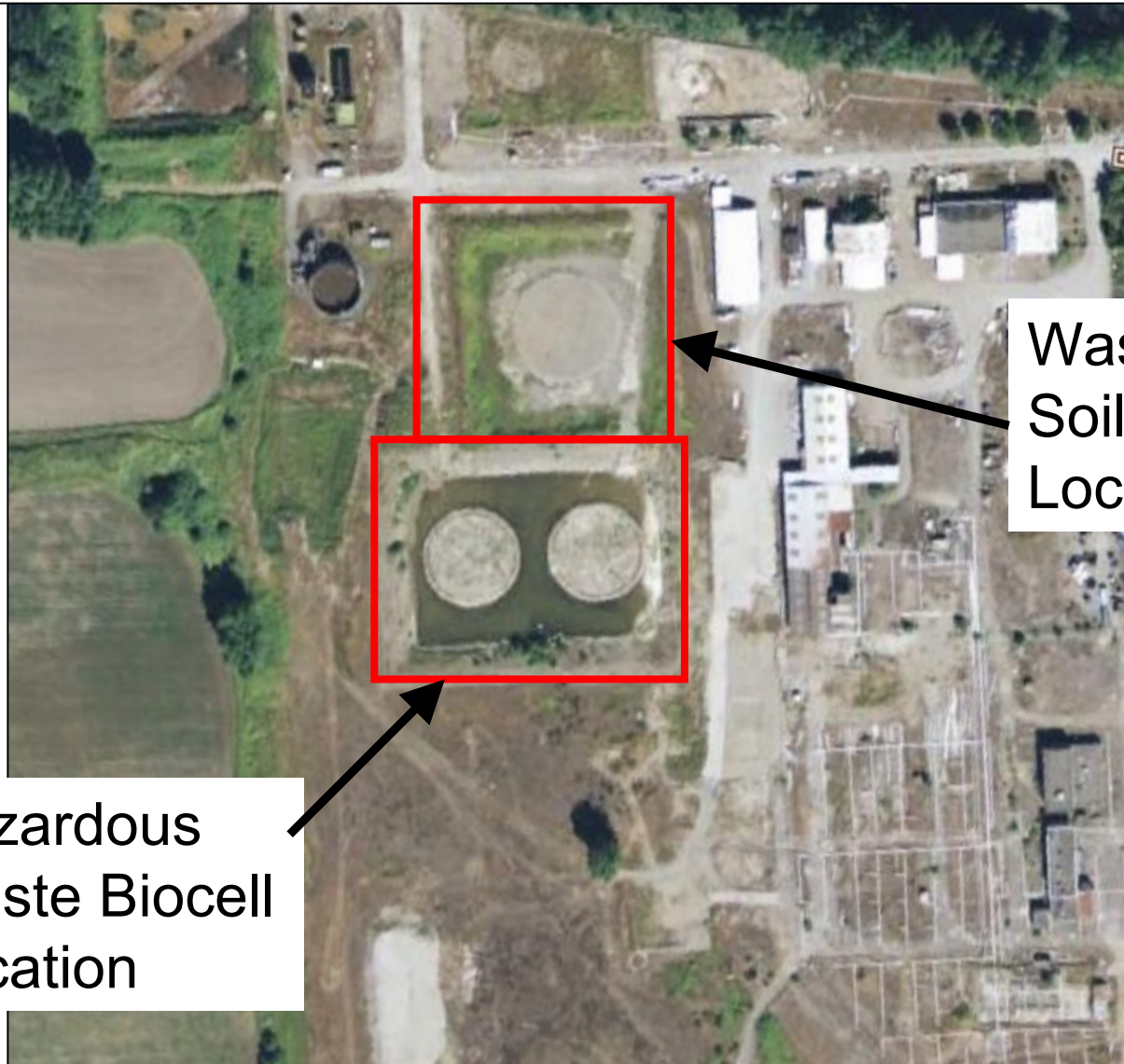
- Risk-based Certificate of Compliance
- Remediate areas that cannot be risk assessed
- Risk assessment included fate/transport modeling and toxicity testing



# Solutions

- **Biocell Construction**
  - Treating soil on-site
  - Lowering costs (vs. trucking to treatment facility)
  - Obtaining hazardous waste storage approval
  - The treated soil could be used as backfill
- **Excavation**
  - Excavated and segregated contaminated soils into appropriate biocell
  - Utilized existing water treatment plant and permit for dewatering
  - Obtained Metro-Vancouver air discharge approval
  - Air monitoring during excavation
- **Chemical Injection**
  - Injecting chemicals at both low and high pressures
  - Returning for several rounds of injection
  - Protecting streambank lupine

# Biocell Construction



Waste Quality  
Soil Biocell  
Location

Hazardous  
Waste Biocell  
Location

# Biocell Construction

- Treating Hazardous Waste and Waste Quality soil on-site
- Using double liner and monitoring system for hazardous waste containment
- Constructed within former tank nest containment compounds



# Biocell Construction

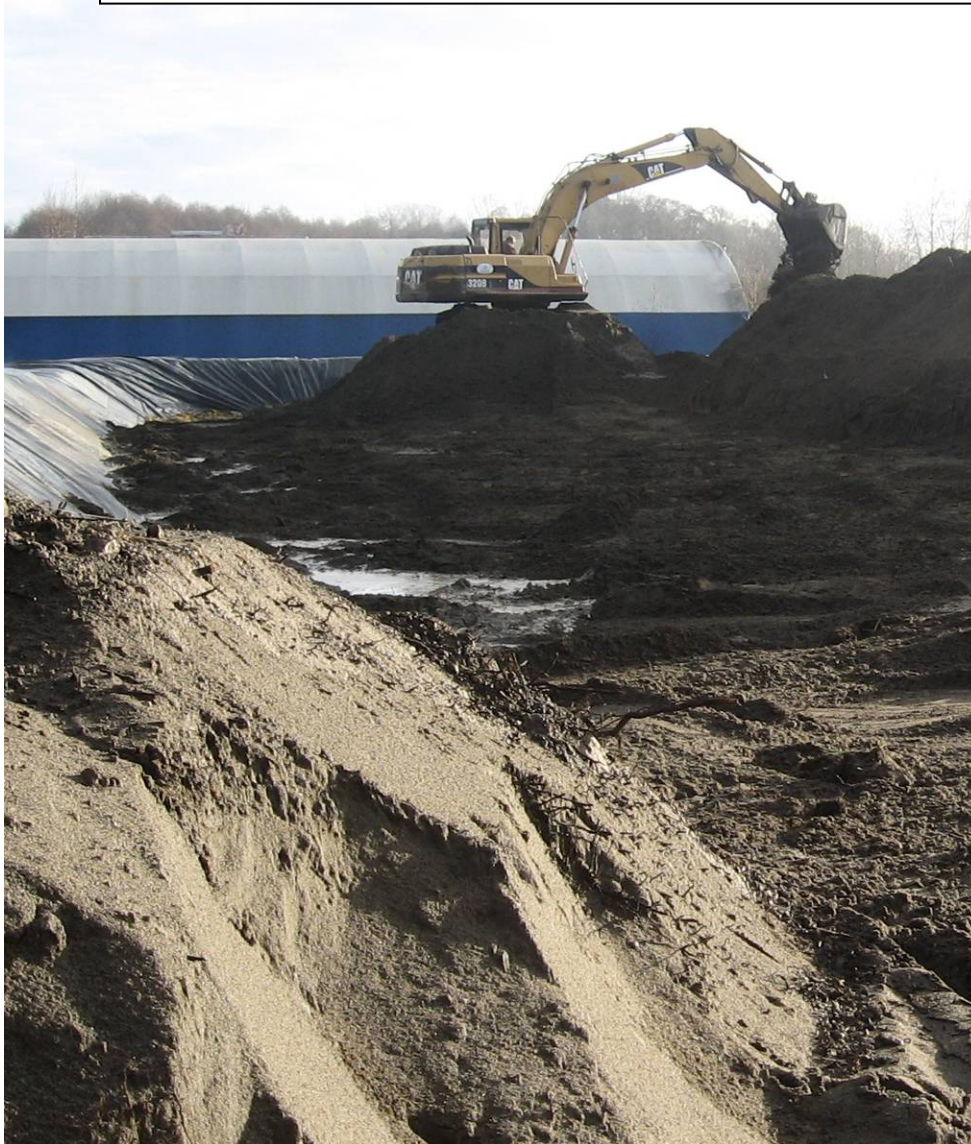




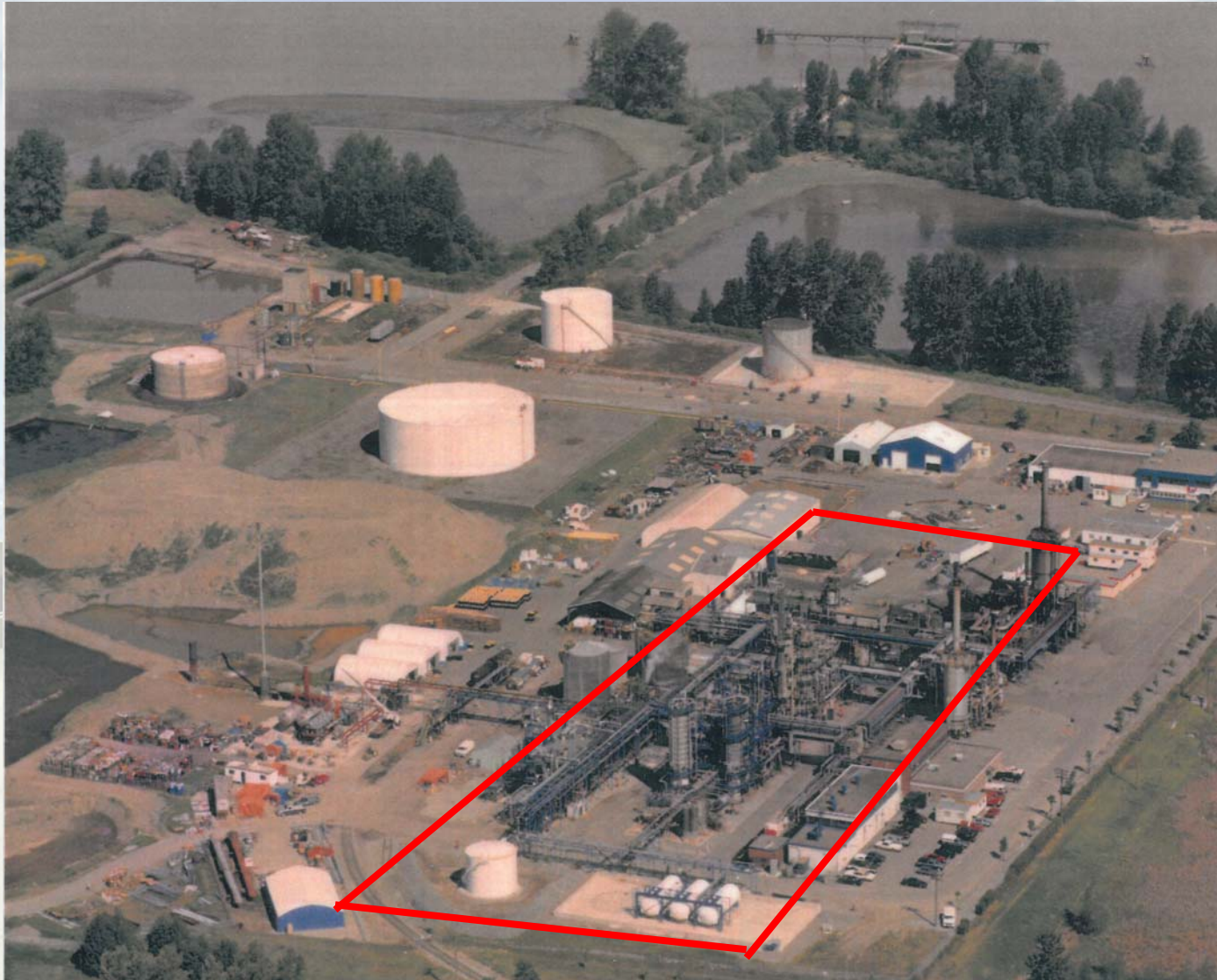
# Biocell Construction



# Biocell Construction



# Remediation of Former Process Area



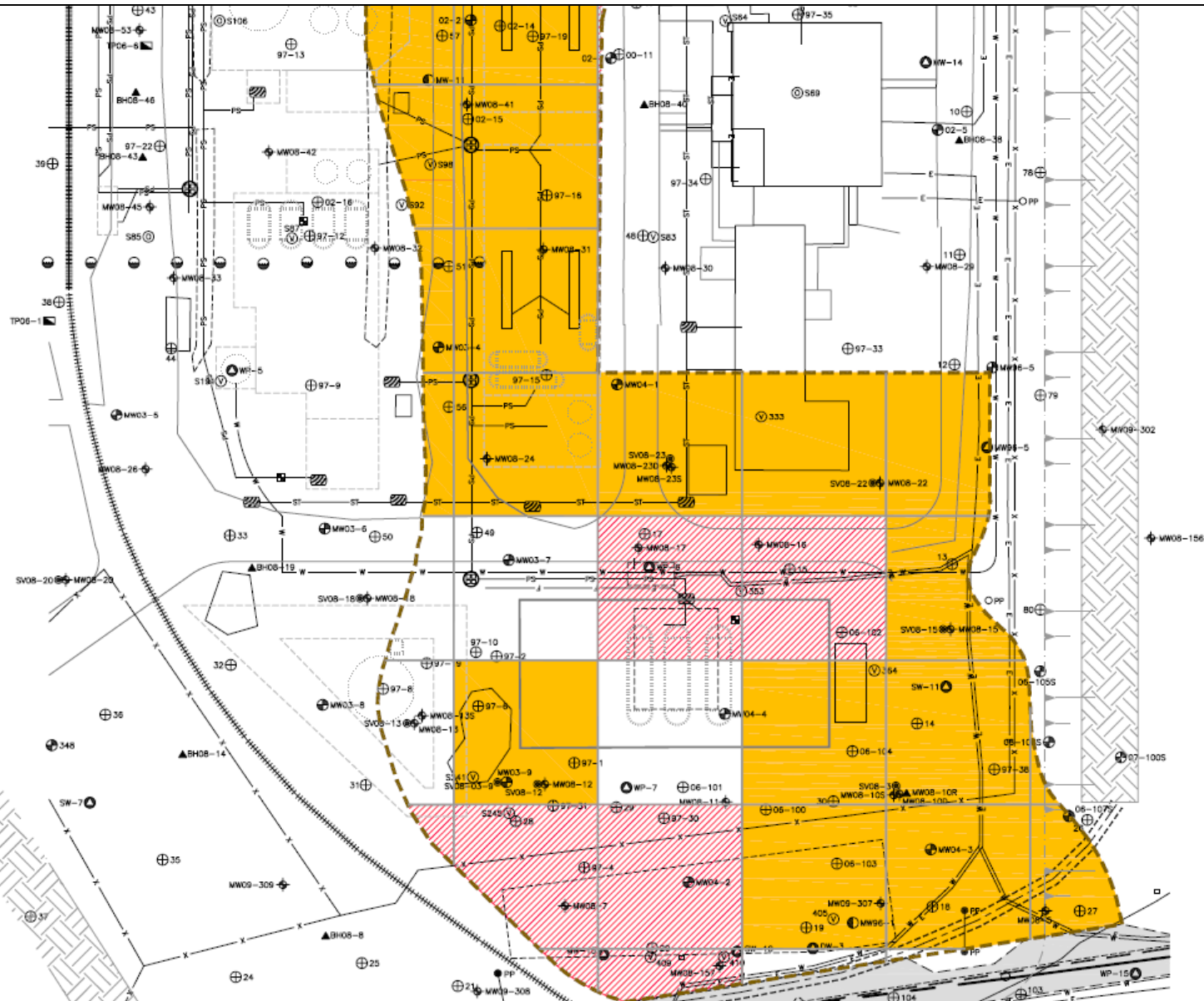
# Remediation of Former Process Area

- Characterized soil within former process area
- Excavated clean overburden soil and set aside on poly
- Excavated contaminated soil
- Removed free product on top of groundwater with Vacuum Truck
- Pumped groundwater within excavation to existing on-Site treatment plant to remediate groundwater
- Collected confirmatory samples
- Backfilled excavation with clean overburden
- Treated contaminated soil on-site
- Treated soil remains on-site as fill



# Soil Characterization

20x20m grid done at 0.5m depth intervals



# Excavation Prep Work



# Health and Safety

- Use of respirators
- Continuous monitoring of atmosphere and comparing to Work Safe values
- Communication with contractors and equipment operators



# Excavation Process





# Excavation Size



# NAPL within the Excavation



# Slope Stability



# On Site Water Treatment Plant



# Remediation of Lagoon



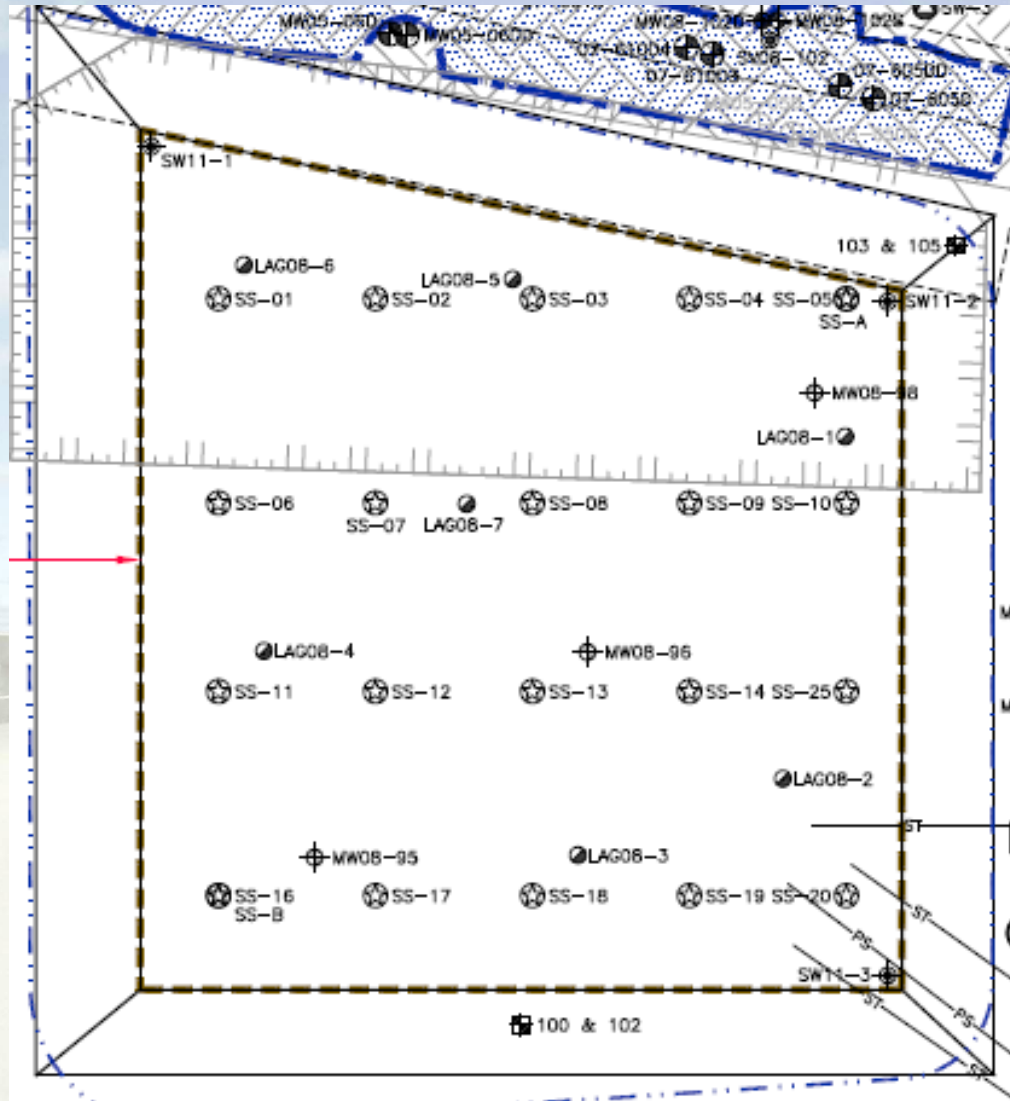
# Remediation of Lagoon

- Base of the Lagoon was excavated 2 m
- Treated contaminated soil on-site within the biocells



# Excavation Size

Excavation Area



# Lagoon Remediation





# Streambank Lupine

- Rare, endangered plant species on site
- Worked with *Streambank Lupine Society* to minimize damage to the vegetation
- Botanist on site while injection took place



# Chemical Injection

- Objectives to reduce the concentrations of BTEX and VPH in groundwater to less than risk based target concentrations.
- First round of chemical injection between October and November 2010
- Second round between January and February 2011
- Third round in June 2011



# Chemical Injection



# Chemical Injection



# Chemical Injection

- Used RegenOX and ORC
- Treated Dissolved Toluene Concentration from 90,000  $\mu\text{g/L}$
- These chemicals were used due to the close proximity to the receiving environment and lower H&S risk

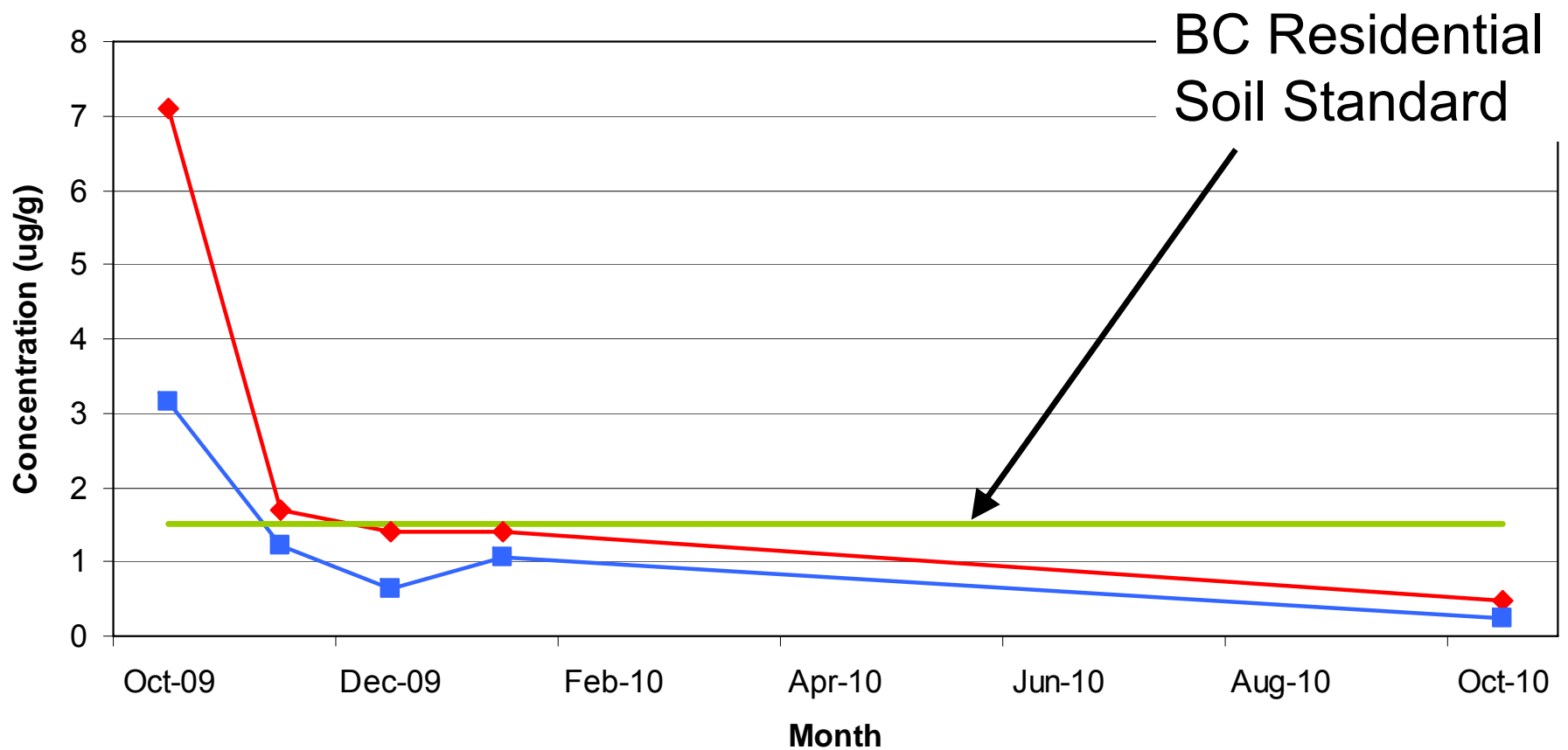


# Results

- Soil concentrations within both the Hazardous Waste and Waste cells were reduced to less than Residential Quality
- Groundwater concentrations within process area were reduced to concentrations acceptable for risk assessment
- Off-Site chemical injection appears to have reduced concentrations adequately for risk assessment



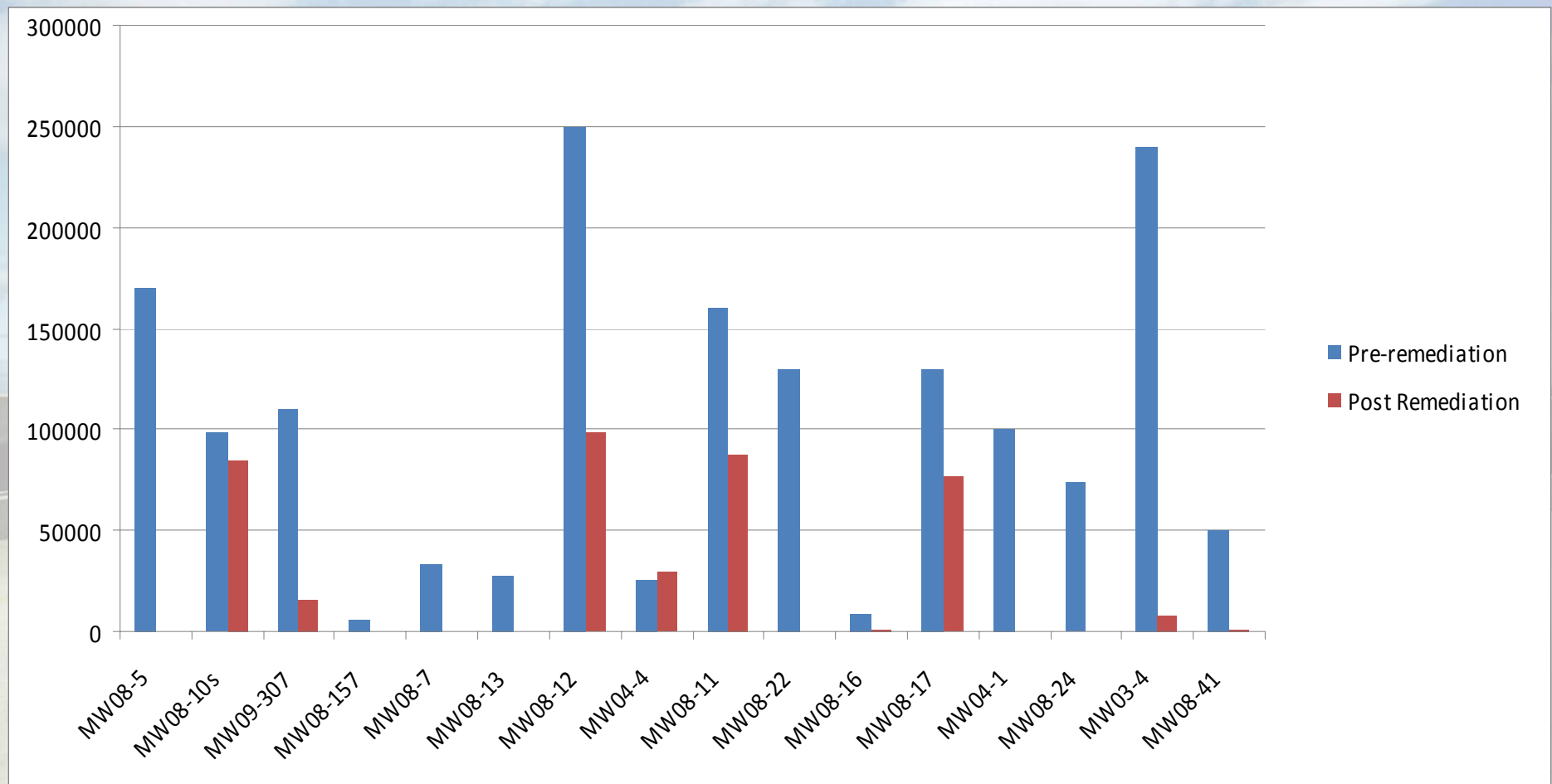
# Biocell Concentrations



◆ Highest Concentration ■ Average Concentration — CSR RL Standard — CSR CL Standard

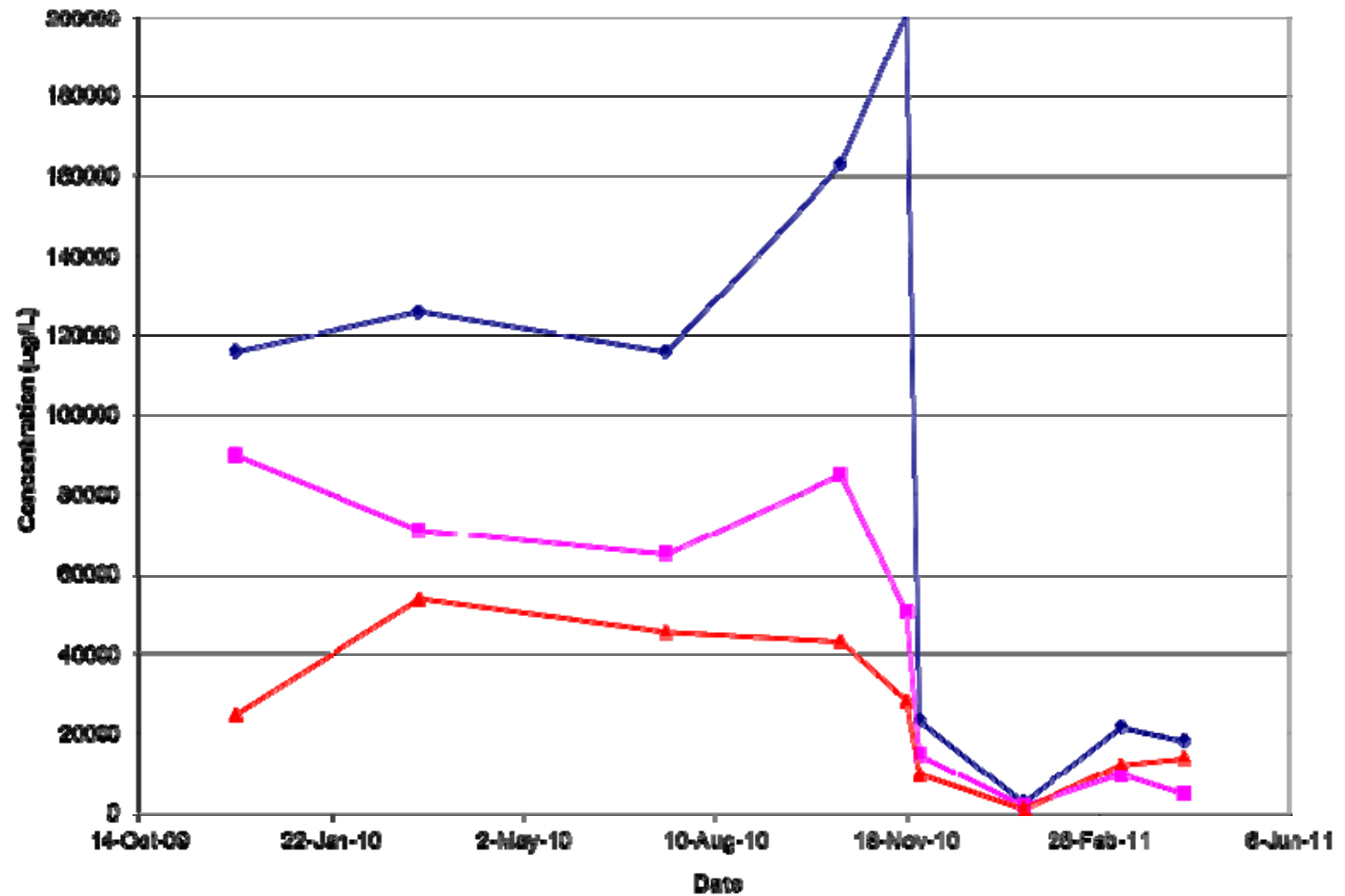
# Confirmatory Groundwater Samples

## VPH Results Pre- and Post-Remediation





# Chemical Injection



# Conclusions

- Saved >\$1 M in transport and disposal by using an onsite Biocell to treat the waste and hazardous waste soils
- Saved >\$145 K from completing biocell remediation under budget and ahead of schedule
- Saved >\$250 K from using existing plant water treatment facility to treat contaminated groundwater



# Conclusions

- Application for on-site Certificate of Compliance submitted to MOE in January 2011 - expected by end of 2011
- Off-site Remediation on track under an AIP
- Off-site Certificate of Compliance expected by end of 2013

**Project was on time and under budget**



# Questions?

## **Remediation Project Overview** Former Chatterton Petrochemical Plant

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October 20, 2011

