RemTech 2007

The Application of In-Situ Chemical Oxidation to Remediate Chlorinated Ethenes at a Former Dry Cleaning Facility in Alberta

by

Charlotte Clark, B.Eng., EIT

Tom Williams, B.A.Sc., P.Eng.

XCG Consultants Ltd.

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XCG

Outline

- Terms and Definitions
- History
- Site Assessment
- Remedial Approach
- Remediation
- Results
- Summary and Conclusions

Terms and Definitions

- PCE – perchloroethylene, tetrachloroethylene, tetrachloroethene
- ISCO – in-situ chemical oxidation
- CCME – Canadian Council of Ministers of the Environment. CCME commercial soil guidelines were used to assess the soil impacts

History

- Former tenant (dry cleaner) operated at the site until 1985.
- Two USTs containing PCE were discovered and removed in May 1993.
- Approximately 550 tonnes of impacted soil was excavated and removed from the site for landfill disposal.
- Remedial excavation was halted due to the risk of structural failure of an adjacent building.

Site Assessment

- Phase II ESA (September 2005) identified soil impacted with PCE in all ten boreholes advanced at the site. Groundwater PCE and TCE impacts were also found at the site.
- Phase II ESA (December 2005) used to delineate identified PCE impacts to soil and PCE and TCE impacts to groundwater.

Narrow 3-Channel CMT with Numbered Wellhead

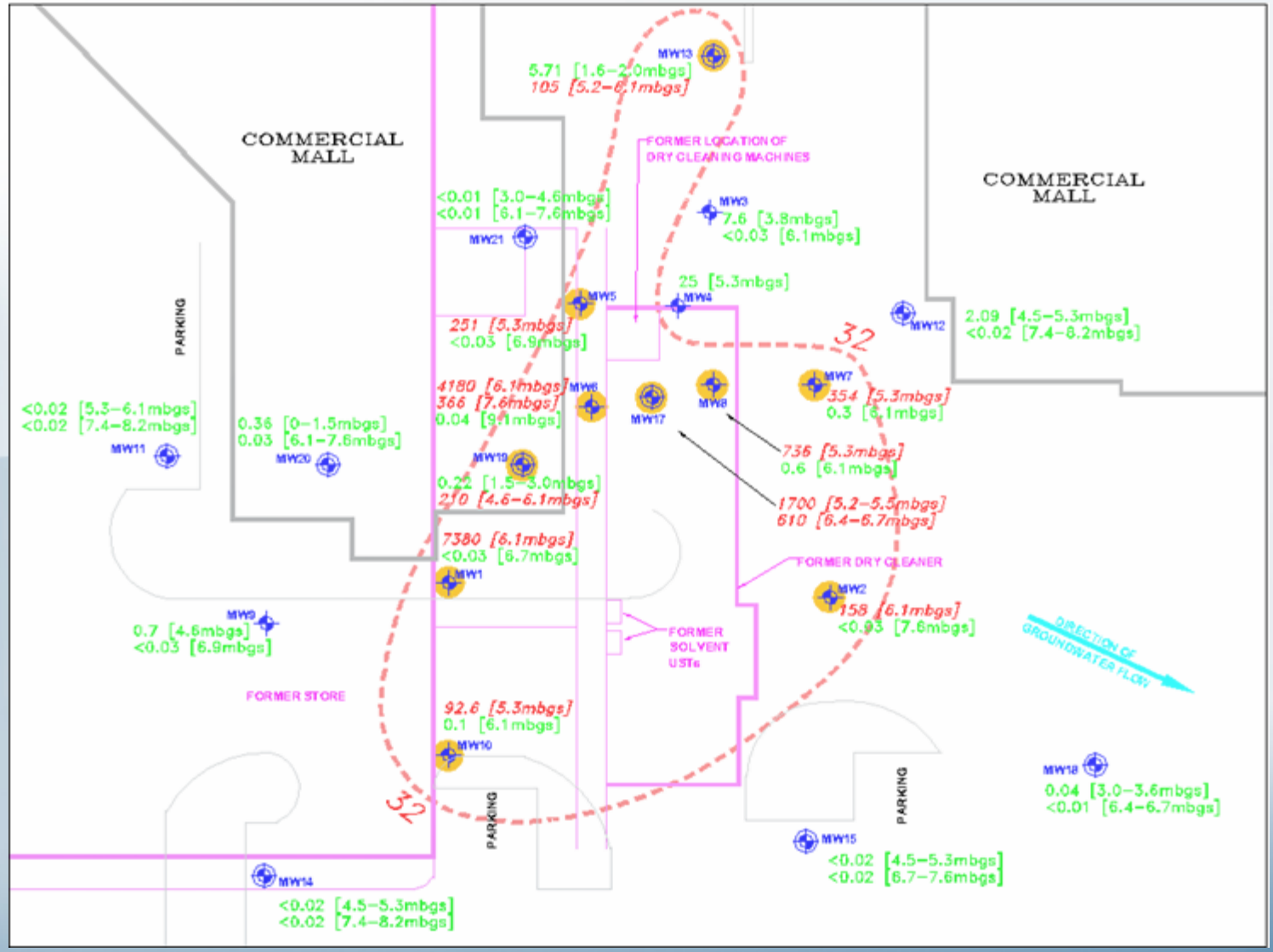
Risk Assessment

- Objective of Risk Assessment to develop Property-Specific Risk Assessment Standards for soil and groundwater.
- Both human health and ecological risk assessments were completed for the site based on conservation assumptions.
- Assuming no remediation effort at the site, calculated health risks to on-site indoor long-term workers, on-site visitors, and remediation/construction worker receptors are unacceptable.
- XCG recommended a Risk Management Plan.

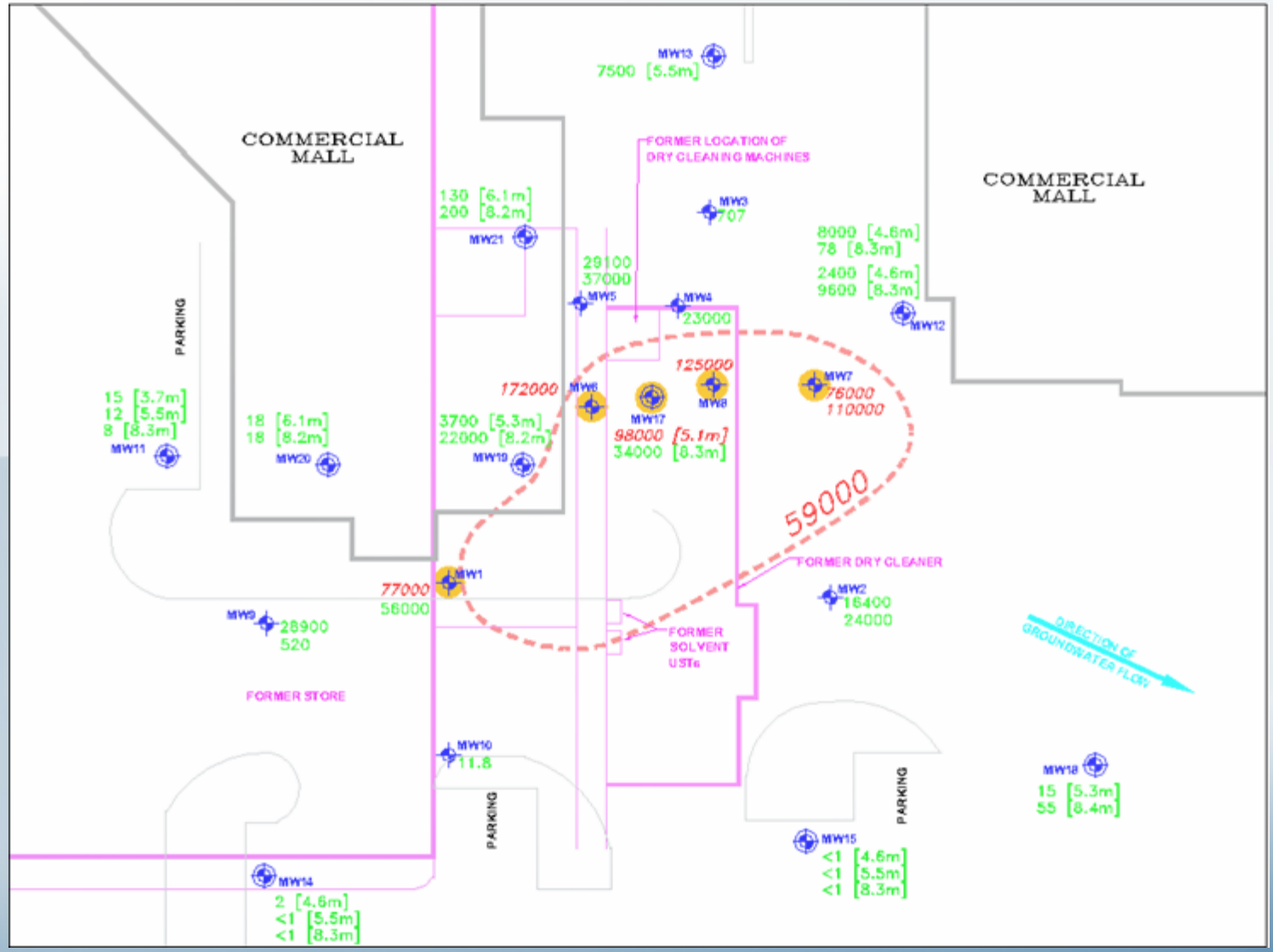
Additional Site Assessments

- Supplemental Phase II ESA (February 2006)
- Remedial Action Plan
- Supplemental Phase II ESA (July 2006)

Soil Impacts – Pre-ISCO



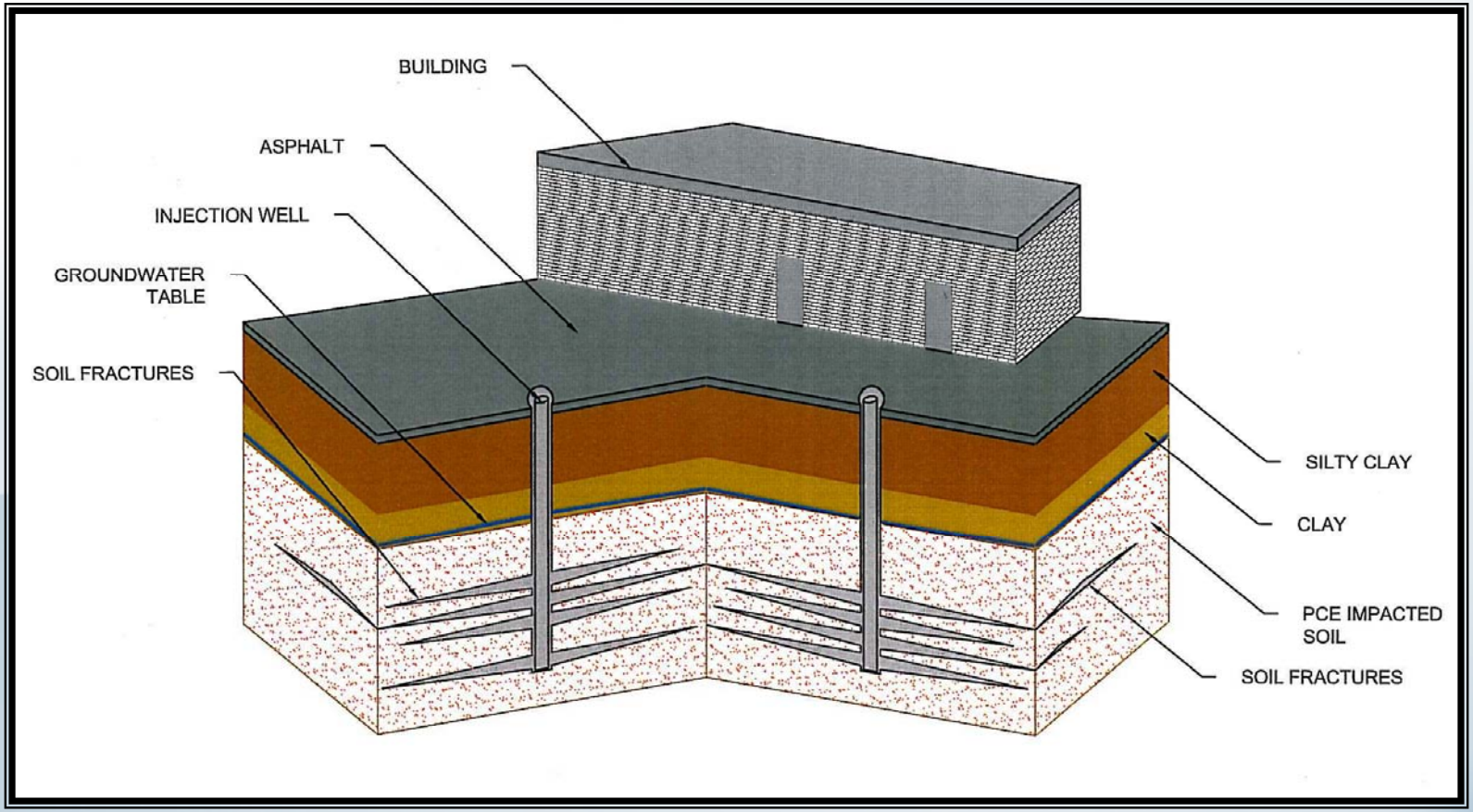
Groundwater Impacts – Pre-ISCO



Remedial Action Plan

- Soil Fracturing to increase clay permeability
- Creation of Injection Wells through the specifically placed screens

Soil Fracturing



Schematic of Fracturing at Site Using the Frac Rite Process

Remedial Action Plan

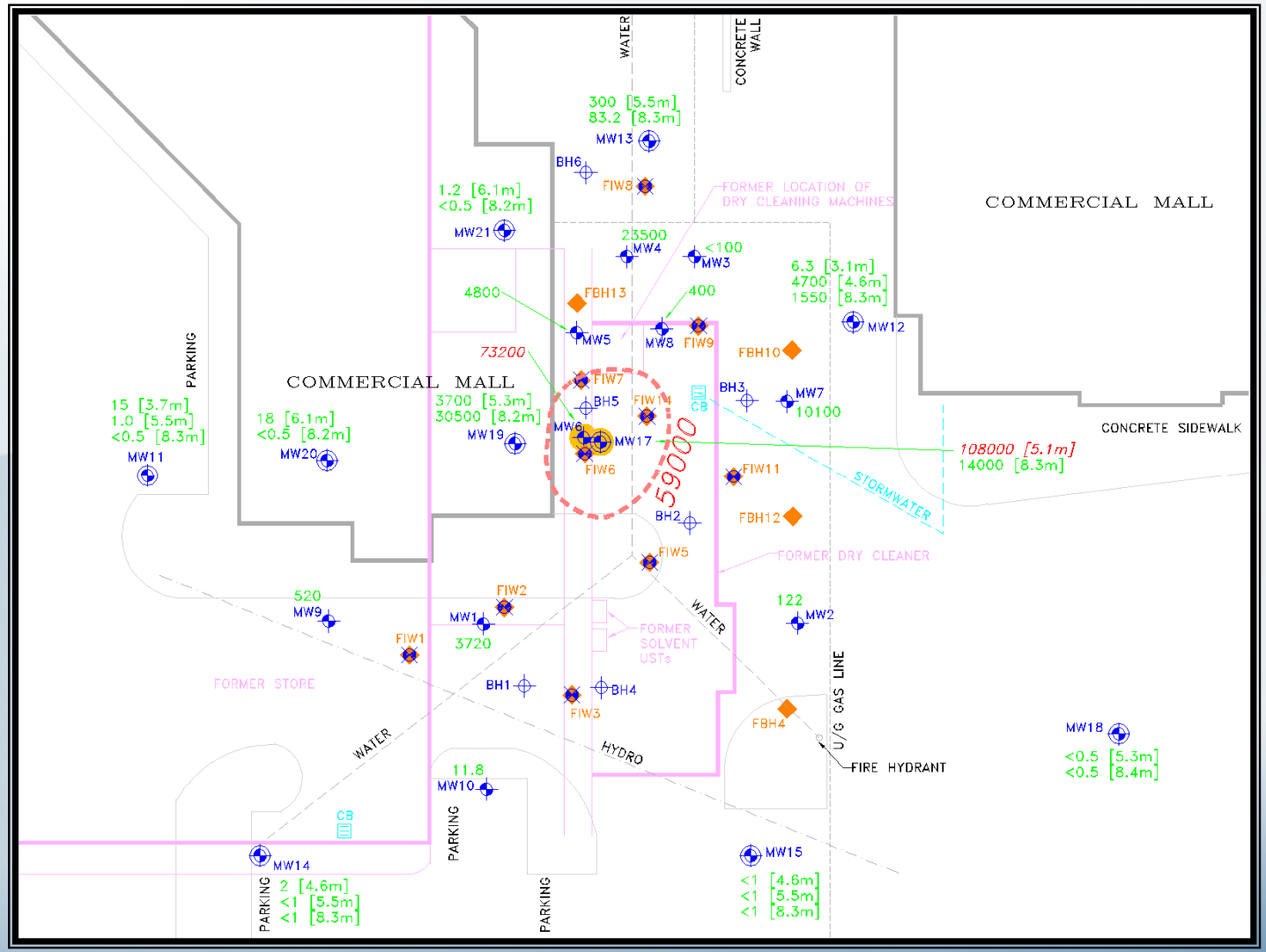
- ISCO using Peroxidant

Benefits of Peroxidant	
■ Low treatment cost	■ Controlled oxidation reaction
■ Proven effectiveness	■ Fast remediation time
■ Not exothermic	■ Safe/controls for air emissions
■ No vinyl chloride is produced in Chlorinated compound reactions	■ No health or safety issues
■ Easy to apply by push injection	■ Regulator supported technology

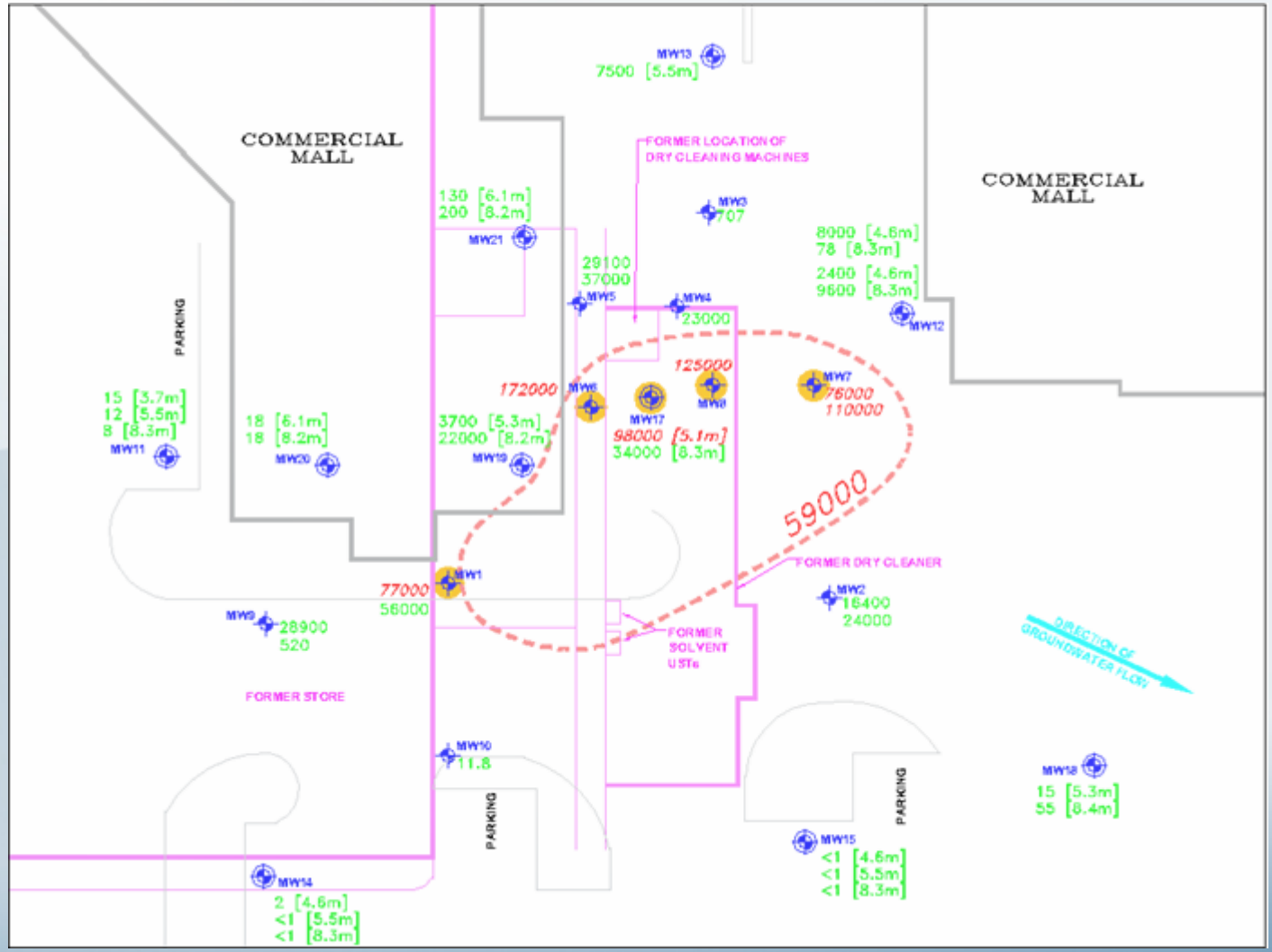
Injection Schedule

Date	Injection	Injection Wells	Volume
November 2, 2006	Oxytek™	8	2,485 L
November 30, 2006	Oxytek™	6	1,230 L
February 1, 2007	$KMnO_4$	6	1,460 L
March 8, 2006	$KMnO_4$	8	1,620 L
May 7, 2007	$KMnO_4$	9	1,760 L
June 18, 2007	$KMnO_4$	8	1,375 L
August 13, 2007	$KMnO_4$	7	1,410 L
October 2, 2007	$KMnO_4$	6	1,200 L

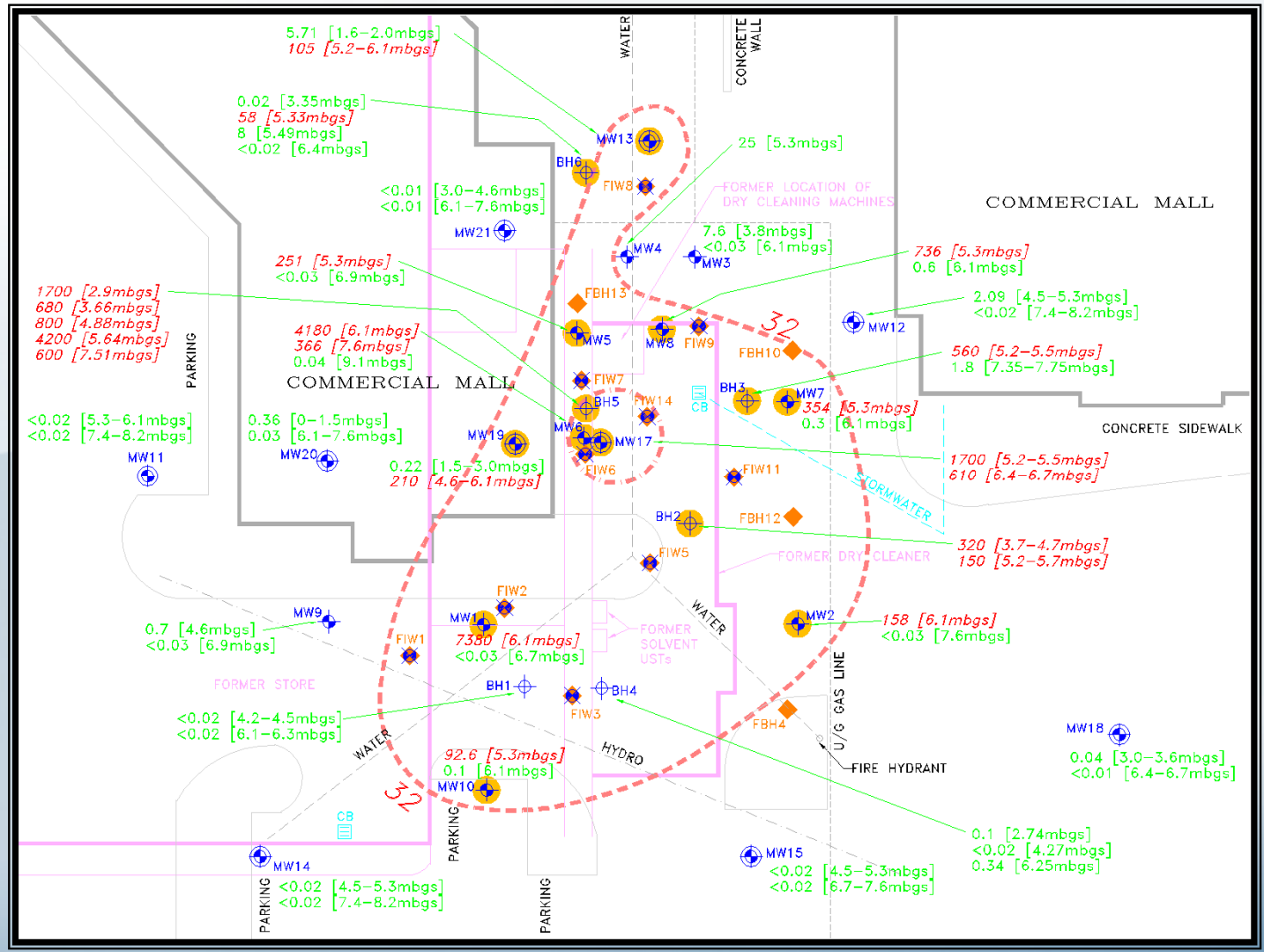
Current Groundwater Impacts



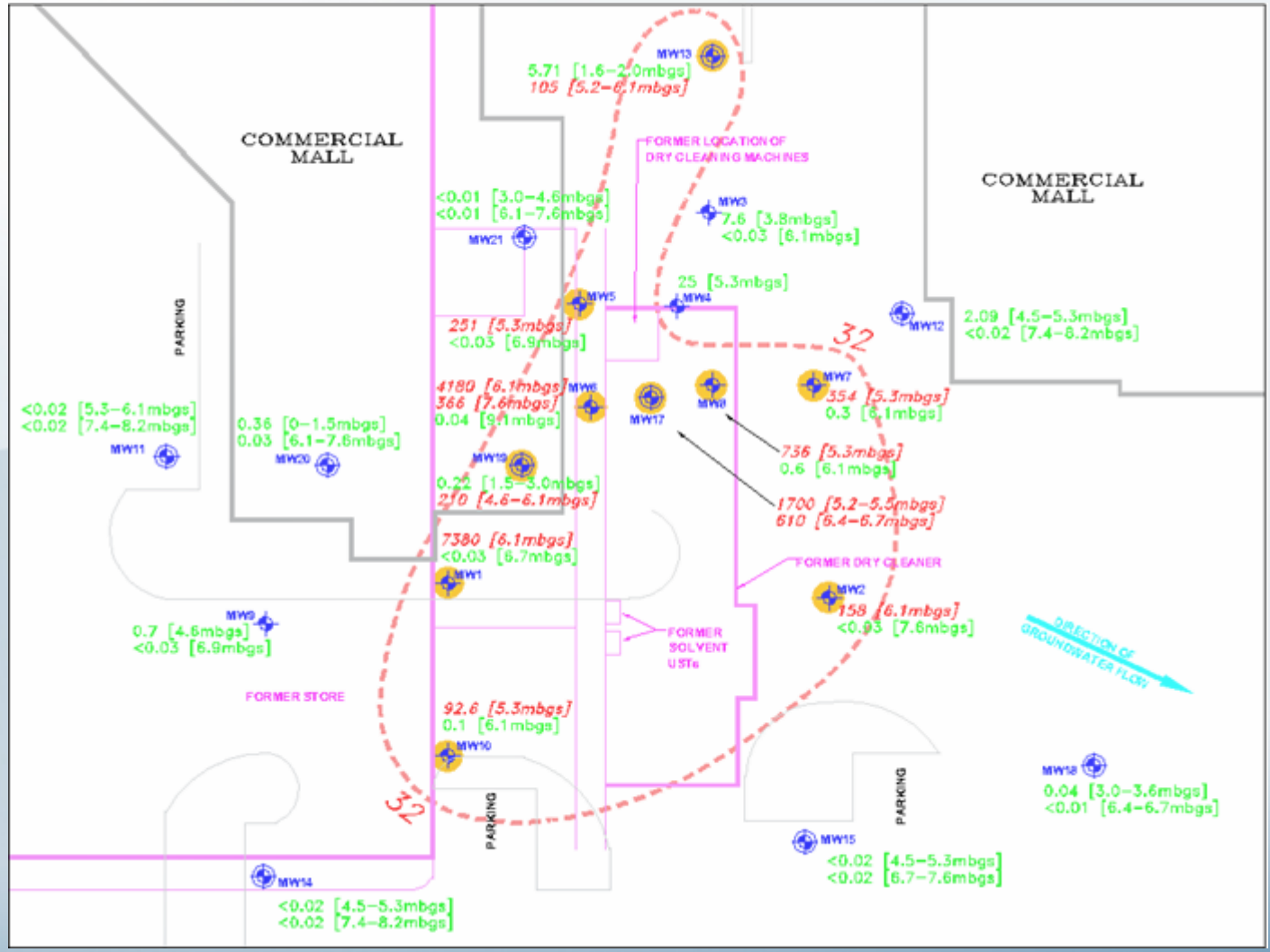
Groundwater Impacts – Pre-ISCO



Current Soil Impacts



Soil Impacts – Pre-ISCO



Problems Encountered

- Silt found in injection wells
- Injected solution through annulus to ground surface
- Riser disconnection
- Cold weather

Solutions

- Installed new injection wells
  - Installation at optimum locations
  - Collection of soil analytical data
- Injection Schedule
  - April to October
  - Six injections per year
  - Two soil sampling events
  - Three groundwater sampling events

Picture of Oxidation

Groundwater Analytical Results

- General decrease of PCE concentrations in groundwater at core and fringe monitoring wells
  - 87% decrease at fringe wells
  - 11% decrease at core wells
- PCE concentrations in centre core monitoring well increased
  - Soil leaching

Soil Analytical Results

- Soil analytical results from July 2007 show a general decrease in PCE concentrations in soil at the site.
- PCE concentrations still above site-specific clean-up criteria in core of plume.
- Reduction in the quantity of hazardous-classed soil.

Actions

- Treatment Program using ISCO.
- Continued groundwater and soil monitoring.

Summary and Conclusions

- Conventional dig and haul approach was expensive and disruptive to business.
- Emerging in-situ technologies can be more cost-effective.
- In-situ technologies allow business to continue during remediation activities.
- Cash flow for in-situ remediation can be better for operating business.

Acknowledgements

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  - Hazco
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Questions?