

Site Evaluation and Design Considerations for In-Situ Remediation Success!

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Outline

■ Site Evaluation

- Is your site a good candidate for a sustainable In-situ remediation program?

■ Design Considerations

- Mass Balance Calculations
- Amendment Options
- Delivery Methods



Site Evaluation

■ Phase I/II ESA

□ Contaminant of Concern

- Petroleum Hydrocarbons, Chlorinated Solvents, Metals, Pesticides, Salt, etc.

□ Plume Characterization

- Area of Impact (size of plume)
- Depth and Thickness of Impacts
- Contaminant Concentration
 - Source Area vs Plume



Site Evaluation

■ Phase II ESA

□ Sub Soil Conditions

■ Soil Type – Lithology

- Fine or Coarse Grained Soils, Porosity, Density
- Homogenous or Heterogeneous Soils

■ Hydrogeology

- Groundwater Depth, Hydraulic Conductivity/Gradient

■ Geochemistry

- Current Site Conditions (ORP, pH, DO, Temp)
- Available Nutrients & Electron Donors/Acceptors
- Soil Oxidant Demand



Site Evaluation

- Site Operations

- Site Active or Vacant

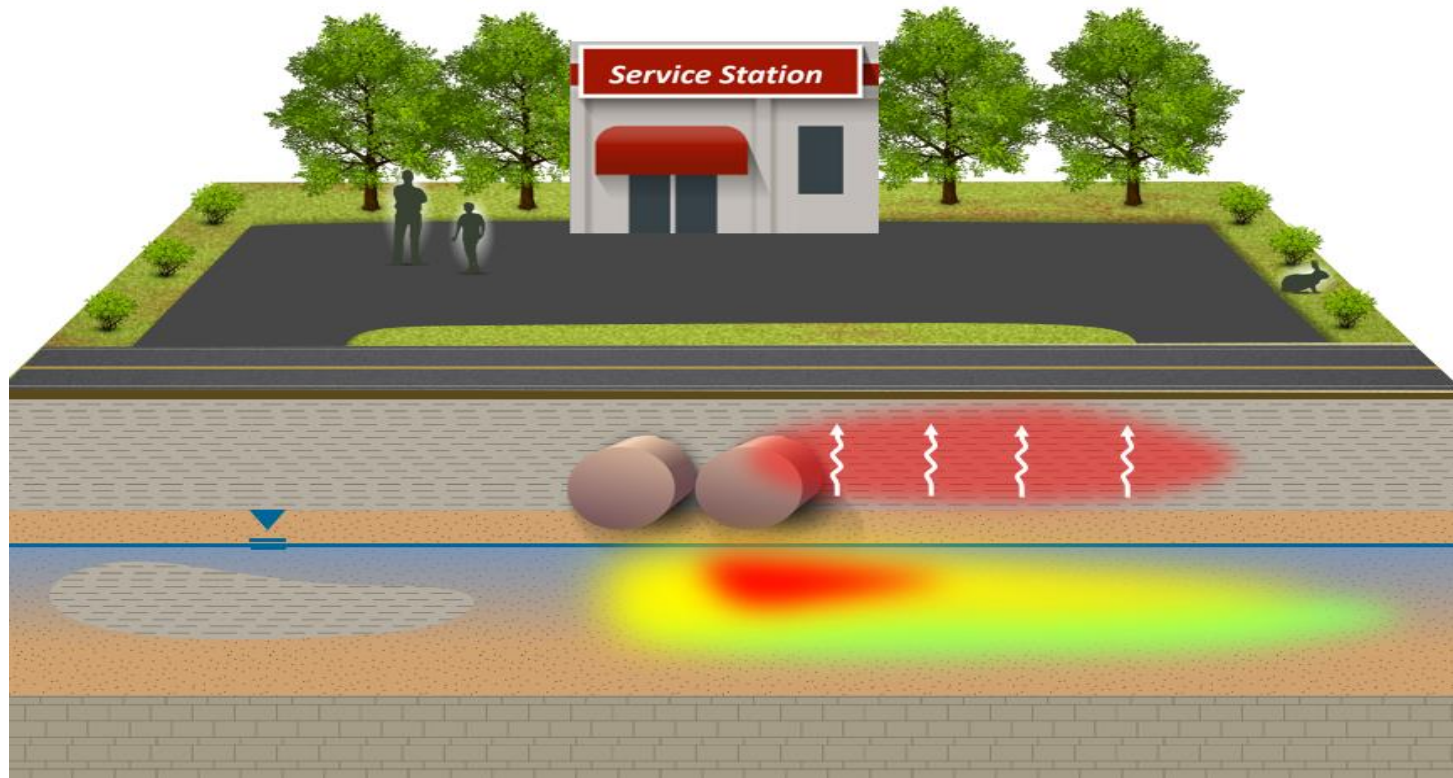
- Site Infrastructure

- Buildings, pump islands, potable wells
 - Surface materials (asphalt, gravel, concrete, grass)
 - Underground utilities



Site Evaluation

- Conceptual Site Model



Site Evaluation

■ Timeline

- Is your client able to wait for remediation to be achieved?

■ Site Criteria

- What are your remediation guidelines?
- Are they achievable via in situ?

■ Cost/Sustainability

- Are other remedial measures cost prohibitive (ie. Dig and Dump)?
- Sustainability Evaluation

Design Consideration

■ Production Selection

(Contact you consultants or chemical suppliers)

- Klozur SP, One, KP, CR
- Daramend Reagent
- Terramend Reagent
- EHC ISCR Reagent
- EHC Plus
- MetaFix Reagents
- Ferrous Sulphate
- Sodium Persulphate
- Sodium Metabisulphite
- Potassium Permanganate
- Plume Stop
- PetroFix
- S-MicroZVI
- Chemical Reducing Solution
- Micro Emulsion
- Hydrogen Release Compound
- Oxygen Releasing Compound
- PersulfOX
- RegenOX
- Hydrogen Peroxide

Design Considerations

- Bench Trial/Pilot Studies



Design Considerations

■ In-Situ Delivery Methods

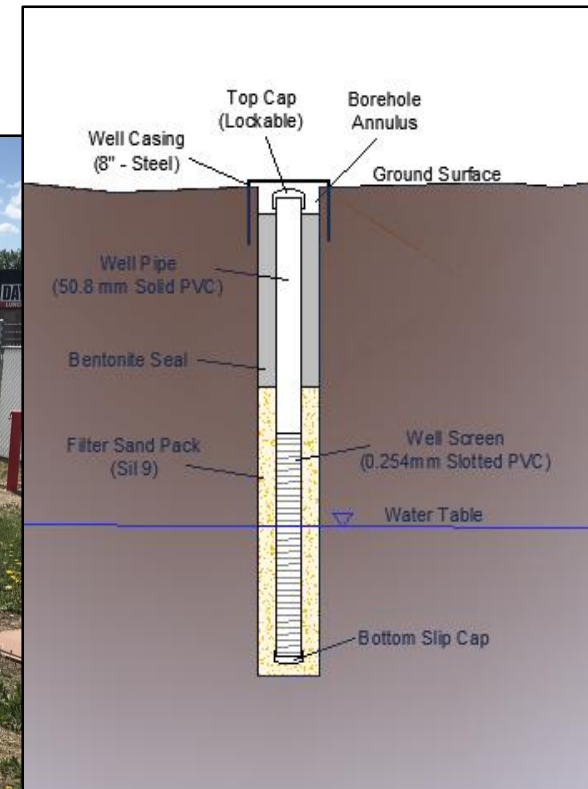
- Direct Push
- Dedicated Injection Wells
- Site / Excavation Flooding
- Hydraulic Fracturing
- High Pressure Injection
- Infiltration Galleries



Direct Push



Dedicated Injection Wells



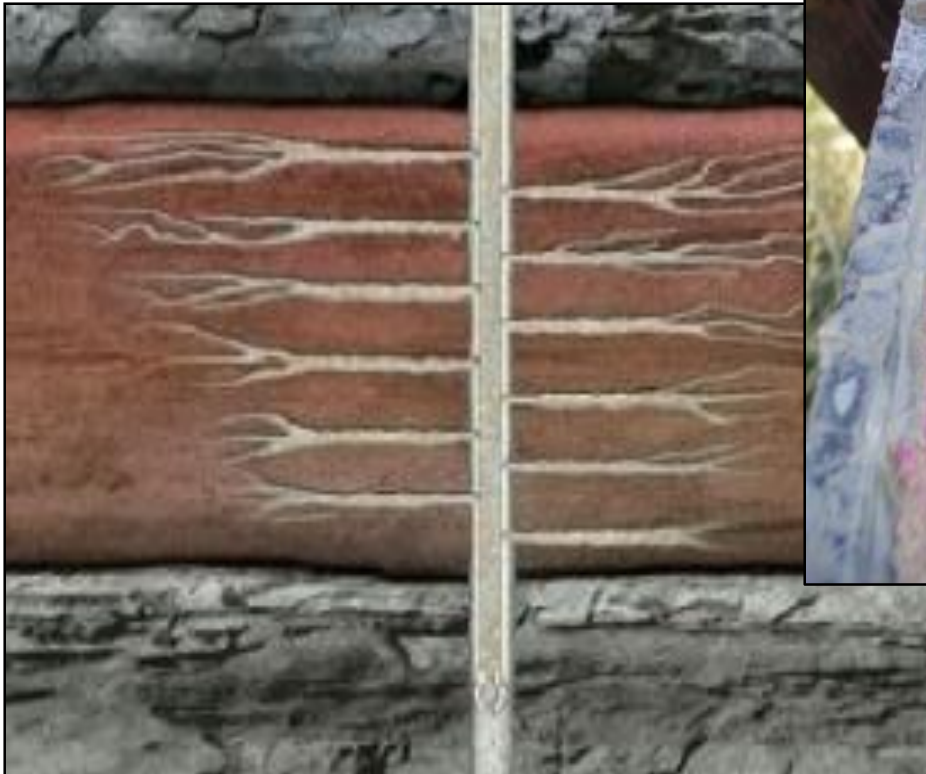
Dedicated Injection Wells



Excavation Flooding



Hydraulic Fracturing



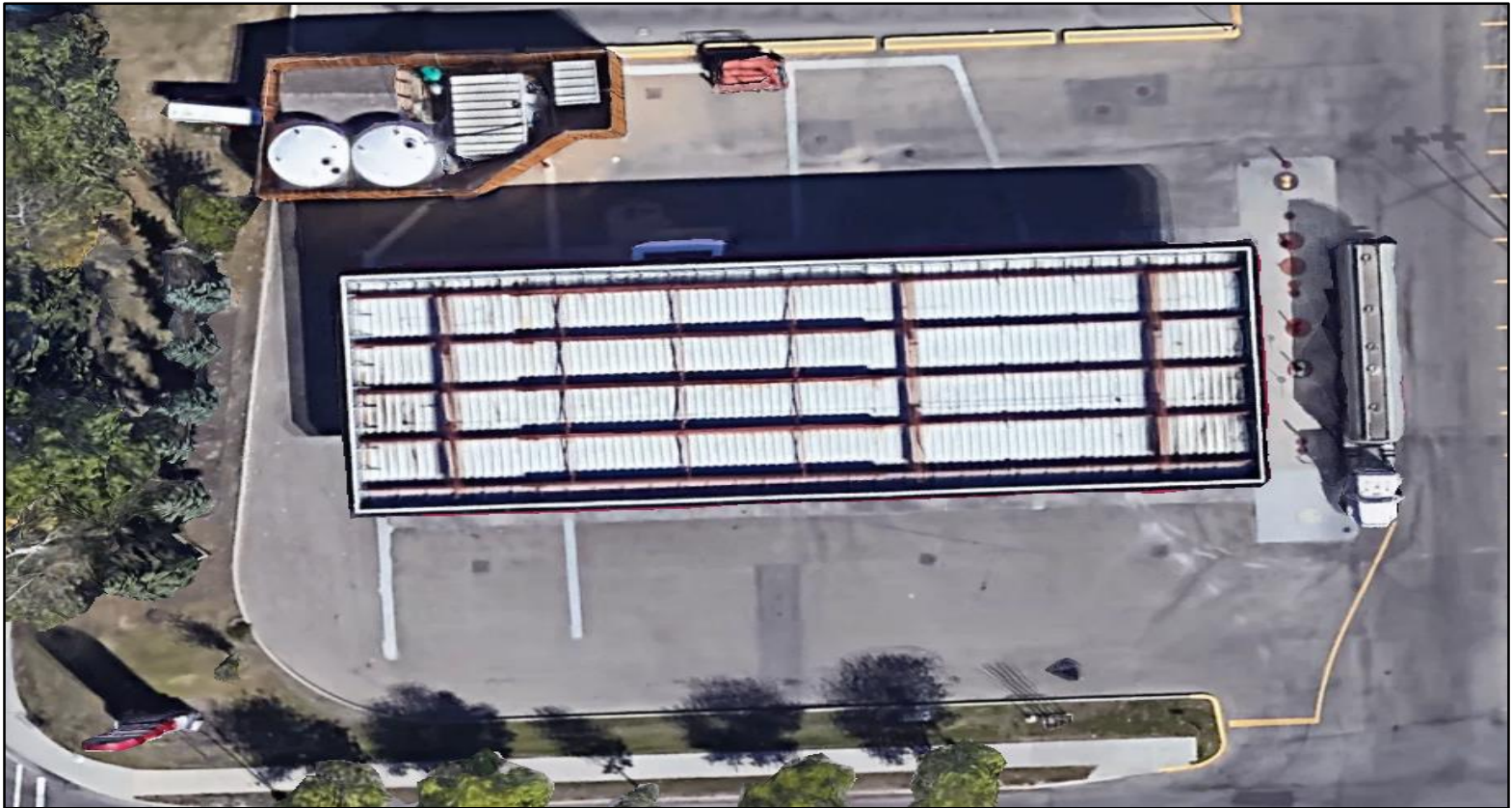
High Pressure Injections



Infiltration Galleries



Infiltration Galleries



Design Considerations

- Time of Year / Temperature
- Site Access / Location
- Public Safety & Perception
- Mixing / Solution Preparation
 - Water and power availability
- Health and Safety of Workers



Monitoring for Success

■ Real Time Field Monitoring

- Measure amendment delivery efficiency
- Determine radius of influence from injection points
- DO, pH, ORP, Temp, EC



Monitoring for Success

■ Post Injection Sampling

- Complete GW sampling 1 mth, 6 mths, 1 year, 2 years...
- Sample for COCs and other indicator parameters (EC, pH, routine parameters, macronutrients, etc...)
- Closure soil sampling once there is confidence in GW results

Conclusions

- Investigate, Investigate, Investigate
 - Know your plume and your Site
- Consider all treatment options available
 - Ask the experts for help
- Test the plan before jumping in head first
 - Be prepared to alter that plan

Conclusions

- Utilize multiple remedial methods or delivery options depending on your site characteristics
- Consider Real Time Monitoring and Post Injection Sampling
- Manage the expectations of your clients
- Set yourself up for the opportunity for success!!

Questions

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