The Use of Horizontal Sparge Wells for the Remediation of LNAPL

Presented by:
Bob Lunardini, PE

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Presentation Overview

- Horizontal Directional Drilling Overview
- Peairs Road Site
- Selma Terminal Site
- Lessons Learned
- Conclusions

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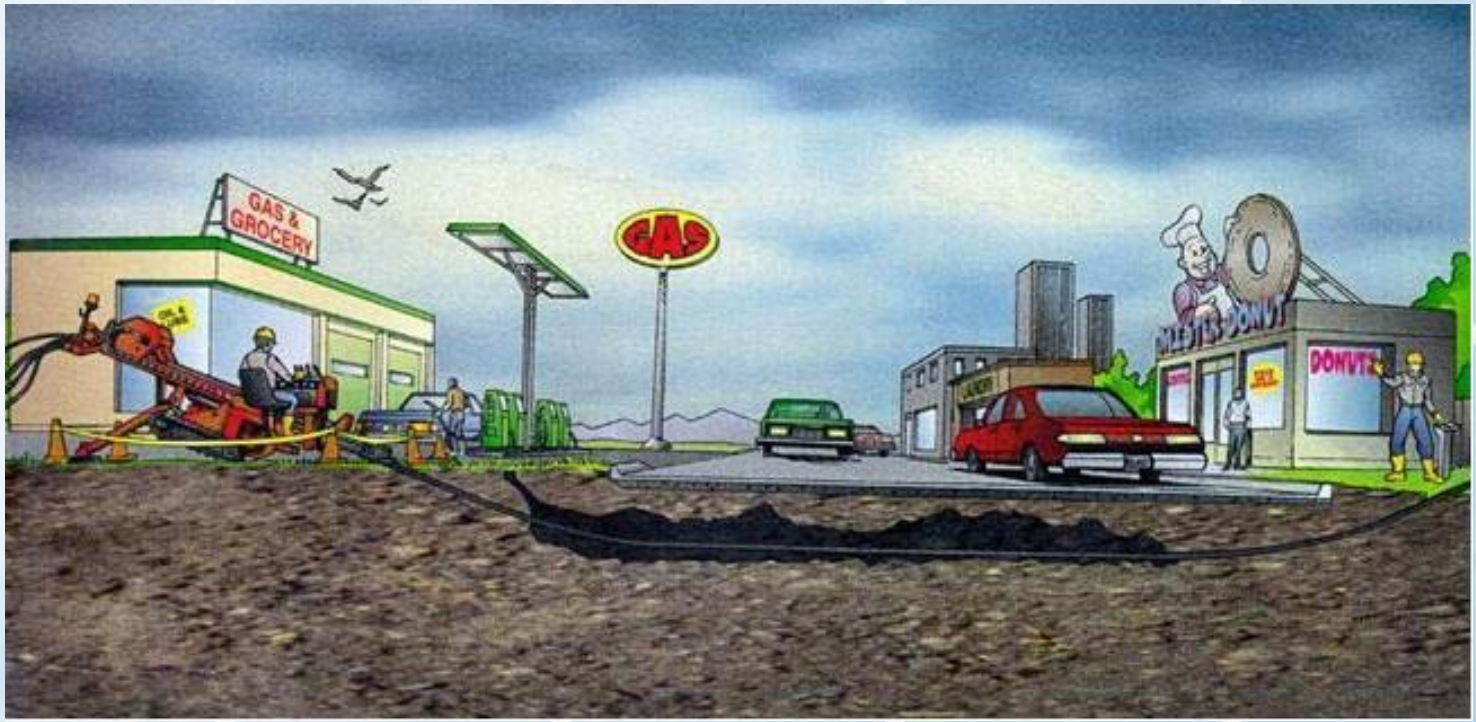
Horizontal Drilling Overview

- What is Horizontal Directional Drilling?



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Horizontal Drilling Benefits

- Allows minimal impacts to above-ground operations
- Can bore underneath shallow utilities
- Fewer number of wells to cover same surface area versus traditional vertical wells
- Larger ROI than vertical wells

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Slanted Paddle Drill Head

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Walkover Device

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Ported Reamer

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DANGER
TURNING SHAFT
will kill you or crush
arm or leg.
STAY AWAY.
WARNING
MOVING PARTS
could cut off
or foot
STAY AWAY.

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Air Sparge Screen

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Air Sparge Screen

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Well Seal

Peairs Road - Site Overview

- Located Near Zachary, East Baton Rouge Parish
- Southeast of Peairs Road, West of Wind Bayou
- Rural Wooded Area with Residents Along Peairs Road
- Nearest Water Well > One Mile
- 650 Feet from Surface Water Body
- One 12-inch and Two 18-inch Pipelines Transport Gasoline, Fuel and Diesel
- Pipelines Constructed in Early 1940's

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Peairs Road - Site History

- November 2, 2001 Release Occurred
- Initial Response Activities – Soil Excavation
- 2002 – 2004: Site Investigation
  - LNAPL discovered in 2004
- 2005: Remedial Planning and Design
- 2006: System Installation
- 2007-present: System operation

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Site Hydrogeology

- Surface Topography Relatively Flat
- Depth to Water Approximately 18 Feet
- Groundwater Flow Generally Eastward
- Hydraulic Conductivity of 2.7 Feet/Day
- Average Flow Velocity of 10 to 67 Feet/Year
- Estimated Sustainable Yield From 316 to 556 GPD

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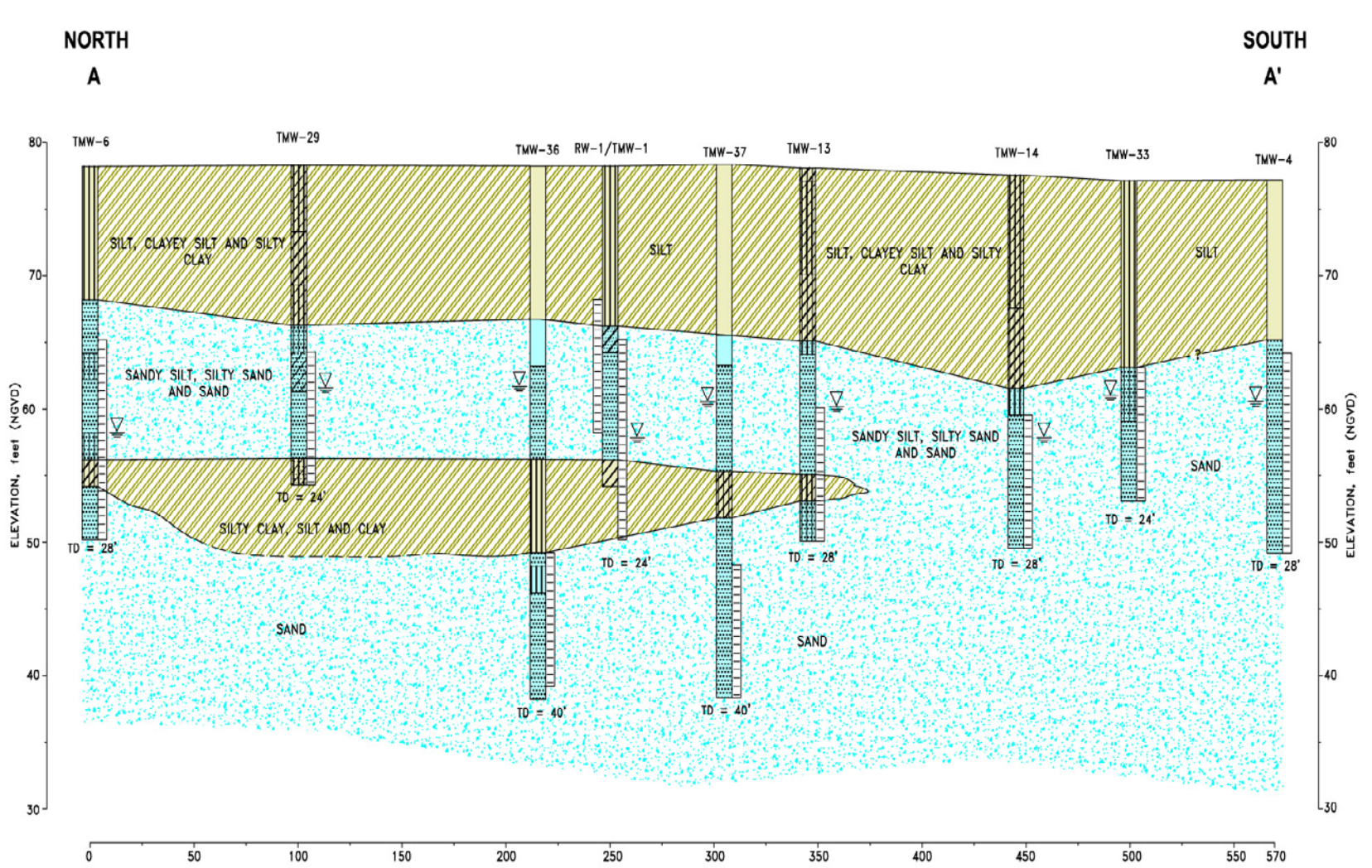
Peairs Road - Cross Section



Peairs Road – Site Map

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Peairs Road - Remediation System Overview

- Horizontal Wells
  - 12 wells replaced 150 proposed vertical wells
  - 6,084 feet of screen and casing
  - Radius of influence estimated at 7.5 feet
- AS Equipment
  - Kaeser compressor - 160 scfm at 15 psi
- SVE Equipment
  - 25 vertical SVE wells
  - Kaeser Omega 43, 7.5 hp, PD blower - 375 scfm at 60 in-H2O
- Electric Catalytic Oxidizer - 500 cfm

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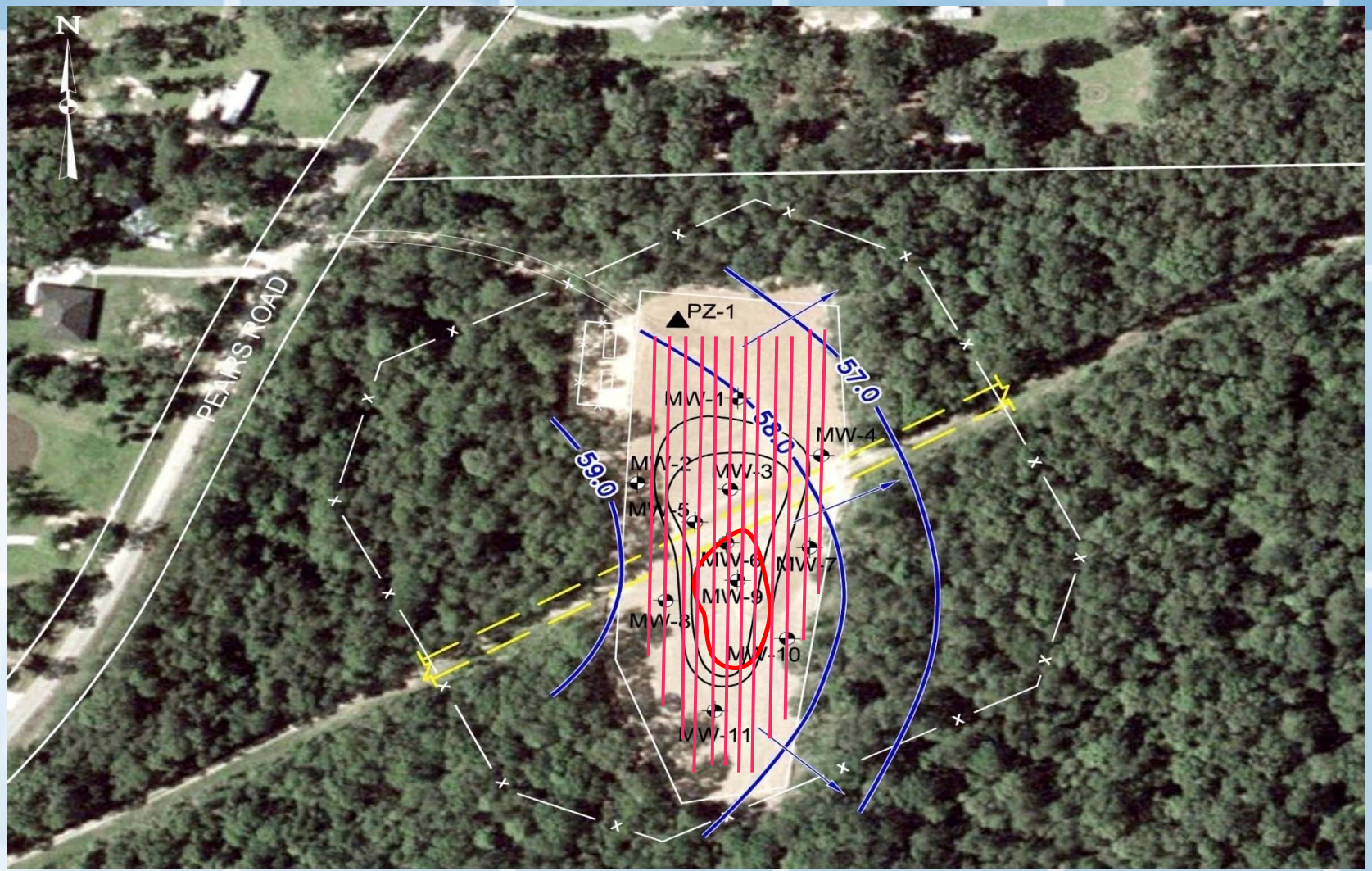
N
PEARS ROAD
PZ-1
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
MW-9
MW-10
MW-11
57.0
58.0
59.0

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Peairs Road – Results

- LNAPL chronology

Date	MW-3	MW-5	MW-9
August 2006	1.1 ft	1.2 ft	1.1 ft
April 2007	System Startup		
June 2007	0.3 ft	0.2 ft	0.1 ft
October 2008	No LNAPL in any site monitoring well		

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Selma Terminal - Site Layout

Selma Terminal - Release History

- Initial releases in 1990s near the fuel loading rack
- 2006: LNAPL detected in MW-44
- Pressure test of manifold revealed leak in an unused premium gasoline line
- Excavated soils around manifold to groundwater

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Selma Terminal – Investigation Summary

- Site Setting
  - Industrial area including terminals and trucking/transport companies
- Geology
  - Sand, silty sand to 20-25 feet
  - Underlain by weathered saprolite
- Hydrogeology
  - Depth to groundwater ranges from 2 to 7 feet bgs
  - Hydraulic conductivity – approx. 1.8 feet/day

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Selma Terminal - Remedial Objectives

- Remove LNAPL
- Control offsite migration of impacted groundwater
- Prevent impacts to drainage ditch south of the site
- Prevent impacts to utility trenches along Buffalo Road

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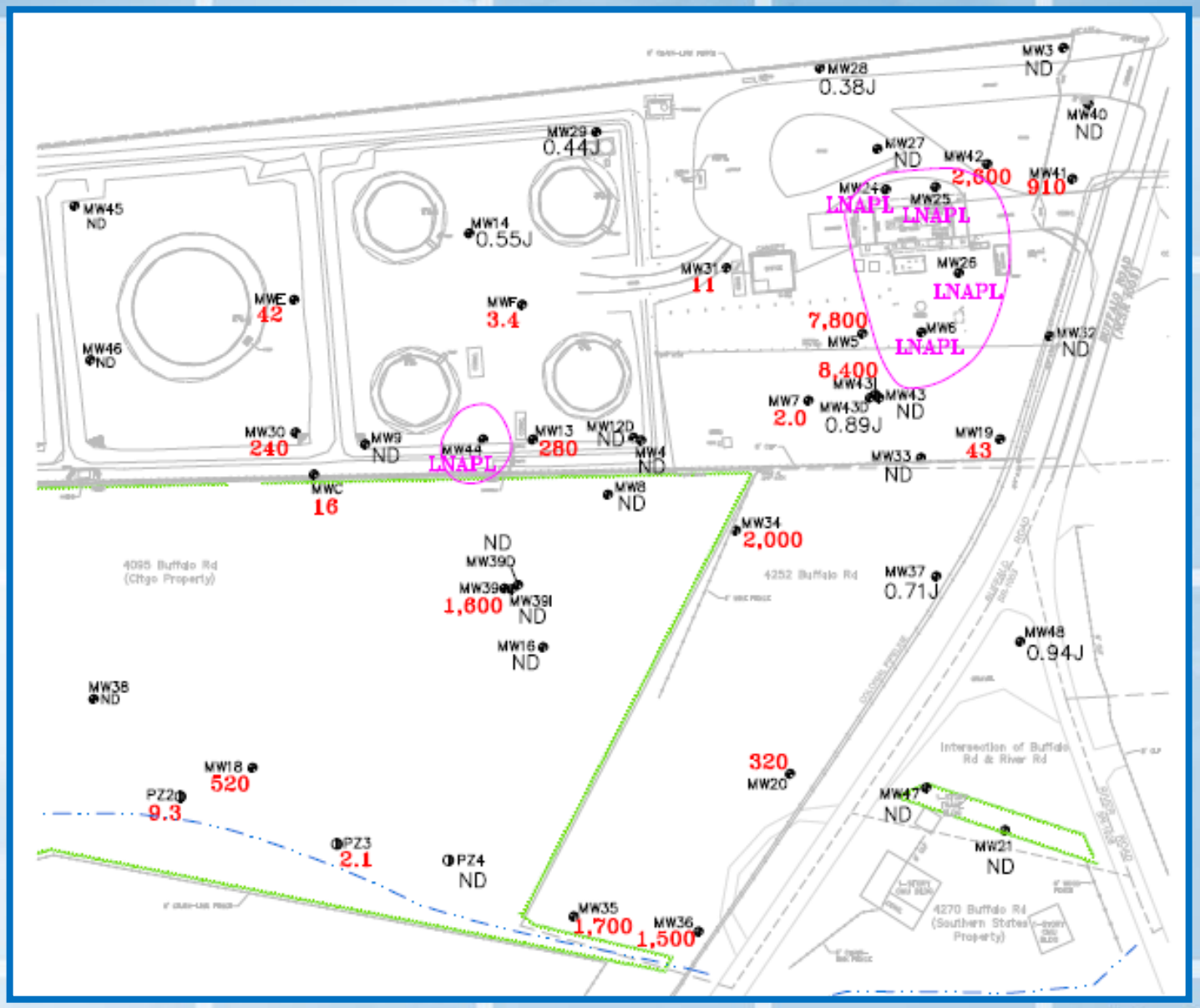
Selma Terminal – Baseline



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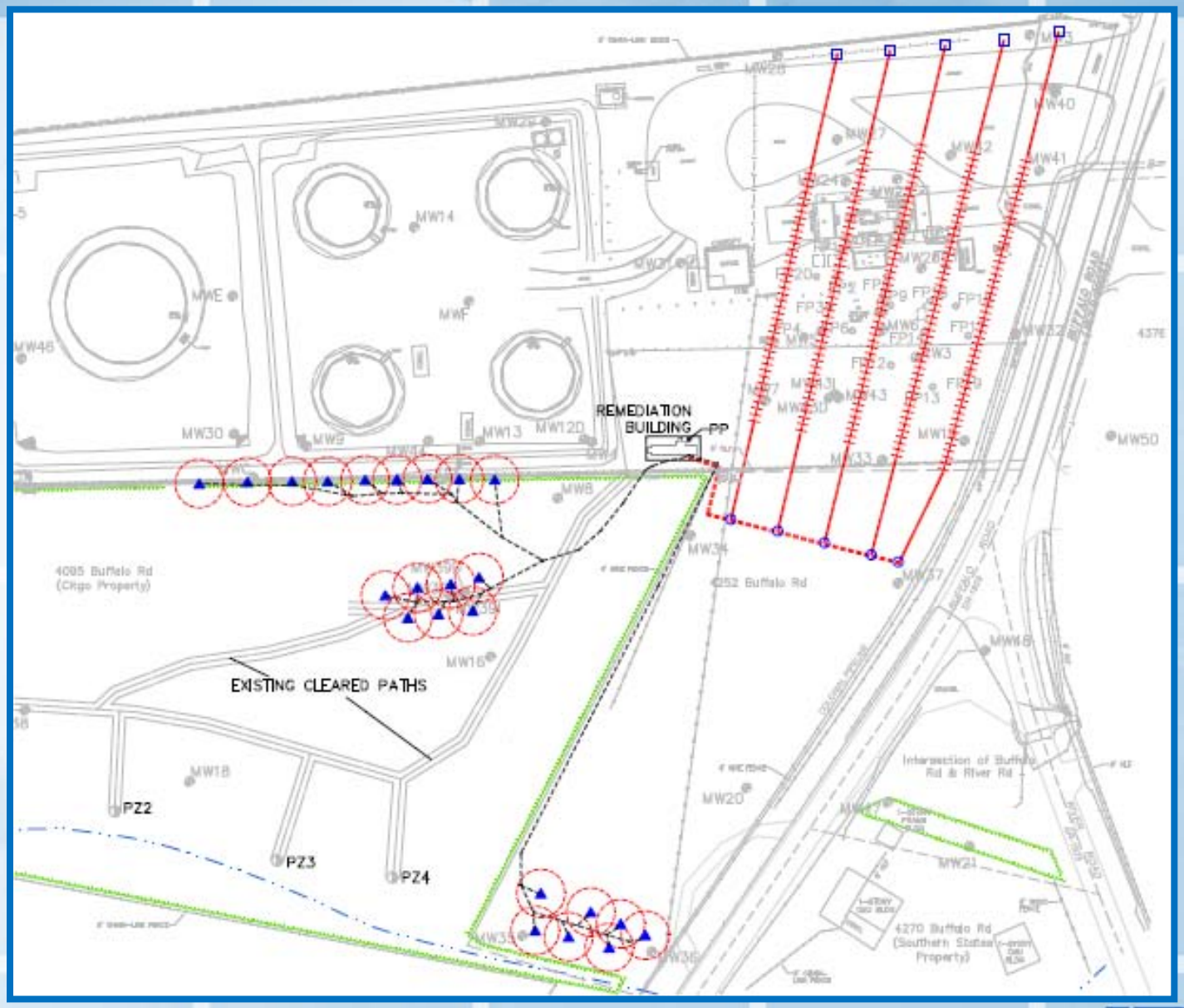
Selma Terminal –Biosparge Well Layout



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Selma Terminal - Remedial Overview

- 5 Horizontal biosparge wells
  - Average screen length of 250 feet with 200 feet of riser
  - Average depth of 20 feet bgs
- 23 vertical biosparge wells
  - Schumasoil screens
  - Depths ranging from 19-23 feet bgs
- Pre-fabricated building: 37 feet x 8.5 feet
- Kaeser ASD-40ST rotary screw compressor
- 400-gallon air receiver tank
- Direct Logic 205 PLC

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Selma Terminal - Site Photos

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Selma Terminal – Results

- LNAPL chronology

Date	MW-24	MW-25	MW-26
February 2009	4.08 ft	0.13 ft	3.37 ft
May 2010	System Startup		
September 2010	1.65 ft	ND	0.02 ft
May 2011	No LNAPL in any site monitoring well		

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Lessons Learned

- If freezing is possible put equipment inside
- Direct push soil borings along the well paths allow the driller to pinpoint target depths
- Drilling costs decreased from Peairs Road project (2007) to Selma project (2010)
  - Peairs ~ $90/ft
  - Selma ~ $55/ft

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Conclusions

- Horizontal sparge wells were beneficial due to:
  - Ability to bore underneath structures and utilities
  - Minor disruption to onsite operations
  - Cover large surface area with a smaller number of wells
- Horizontal sparge wells are an effective tool for remediating LNAPL:
  - Extent has been defined
  - Initial abatement activities have been implemented (i.e. excavation, vac truck)
  - Pulse Cycling Strategy

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Questions

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