# In-situ Chemical Oxidation Using Ozone

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Presented by:

Kevin Gomes

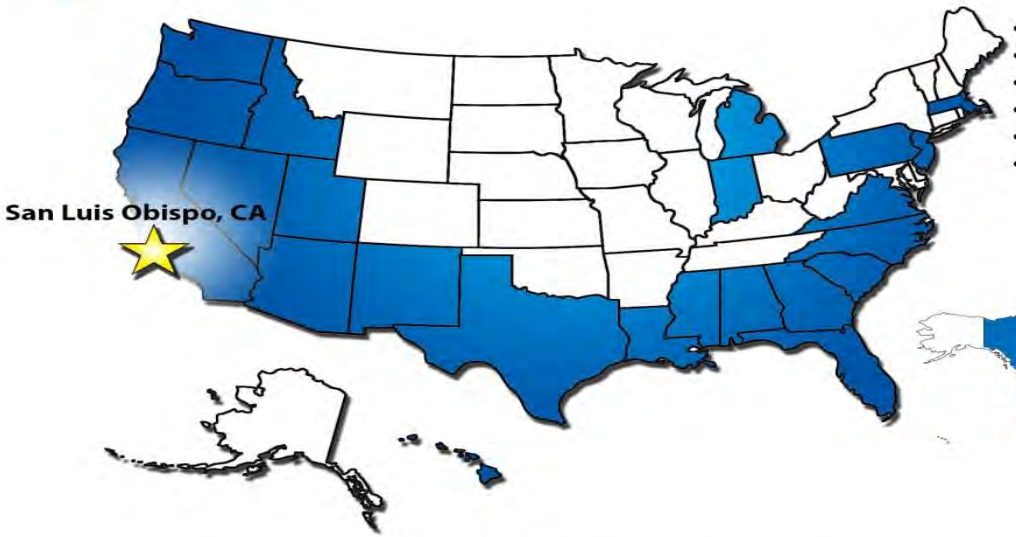
H2O Engineering Inc.

PURE WATER. CLEAN WORLD.

H2O ENGINEERING 15 Years of Service EST. 2000

# H2O Engineering Inc.

PURE WATER. CLEAN WORLD.®




**PRODUCTS**

- Ozone Remediation
- Ozone for Water Treatment: Self-Contained Systems and Large Scale Systems
- Membrane Filtration: Reverse Osmosis (RO), Nano Flitration (NF) and Ultra Filtration (UF)
- Electrodeionization (EDI/EDR)
- Liquid Chemical Injection
- Gas Sampling System
- Remote Monitoring
- Kaeser Compressors and Blowers
- Tonkaflo Pumps

**SERVICES**

- Design & Technical Support
- In-Field Support & Training
- Comprehensive Service Contracts
- Equipment Rentals & Lease Options
- System Automation & Controls
- Process Optimization & System Customization
- UL 508A Panel Fabrication

**Based out of San Luis Obispo, California**
**H2O Engineering Inc partners with environmental engineering consultants and project contractors having served customers Nation and Worldwide.**

**www.h2oengineering.com** **Ph: 1-866-987-0303**

MADE IN USA

# Today's Presentation

- Ozone Facts
- Alabama Case Studies
  - Case Study: Complex BTEX site
  - Case Study: Ozone polishing site

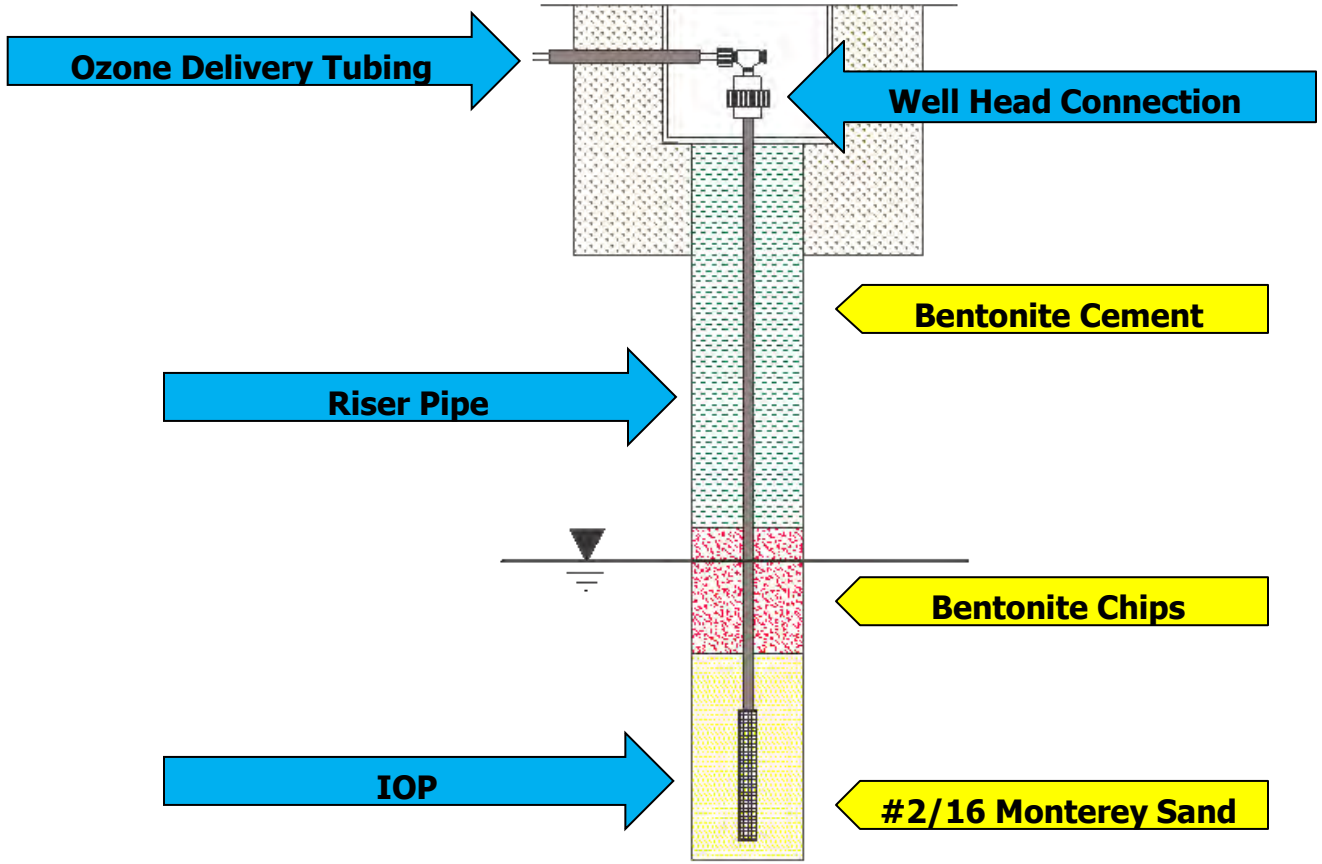
# Ozone

- Tri-atomic oxygen – powerful oxidant (2.08 eV)
- Fundamentally different
  - 24/7 injection
  - Extended time – 1 to 5 years

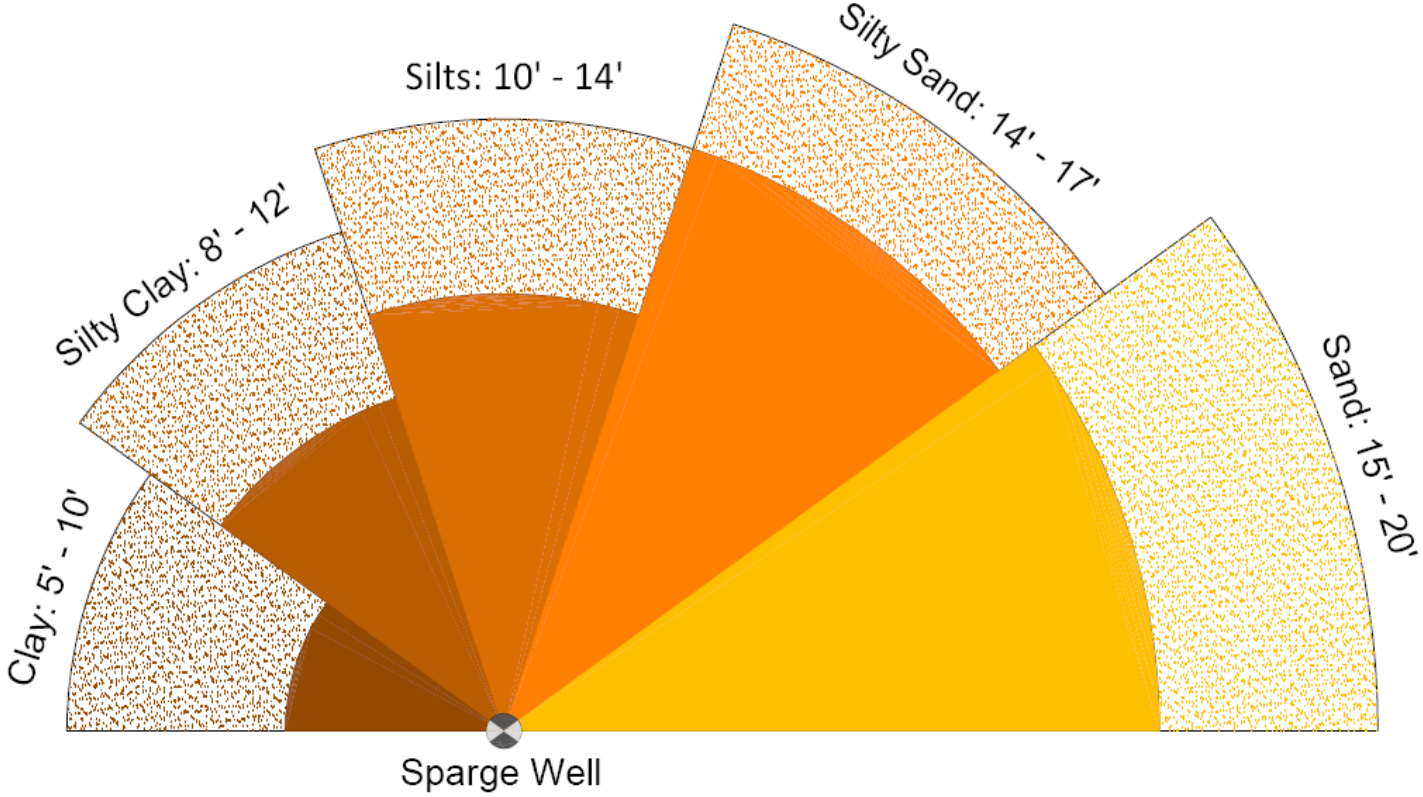
# Ozone

- Low cost – $50 to $150 a cubic yard
- ChemOx – fast reaction rates
- Minimal waste – $O_2$ and $CO_2$
- Enhances bioremediation
- Advanced oxidation process (ozone & peroxide
- Long term solution

# H2O: Sparge Well Installation

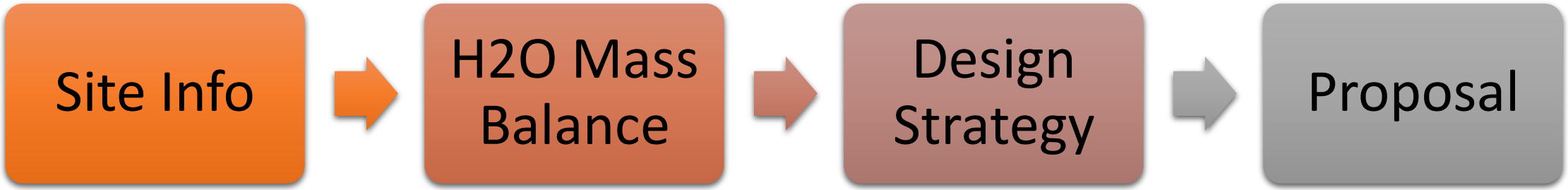


# Ozone: Radius of Influence



# Why H2O Engineering?

# H2O Process



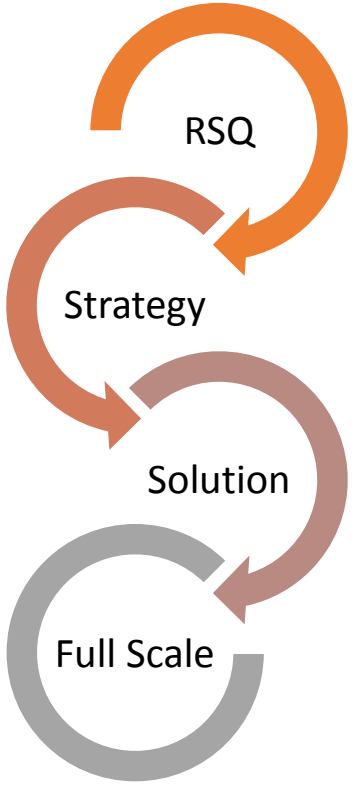
# H2O INTELO-ZONE® Control Logic, Series C

- Safety
- System configuration
- Regression strategy
- Operator  interface
- Telemetry-Smart phone/tablet

**MOSU40-520**

# H2O: Remote Monitoring

# Case Study #1
# Complex BTEX site in Alabama

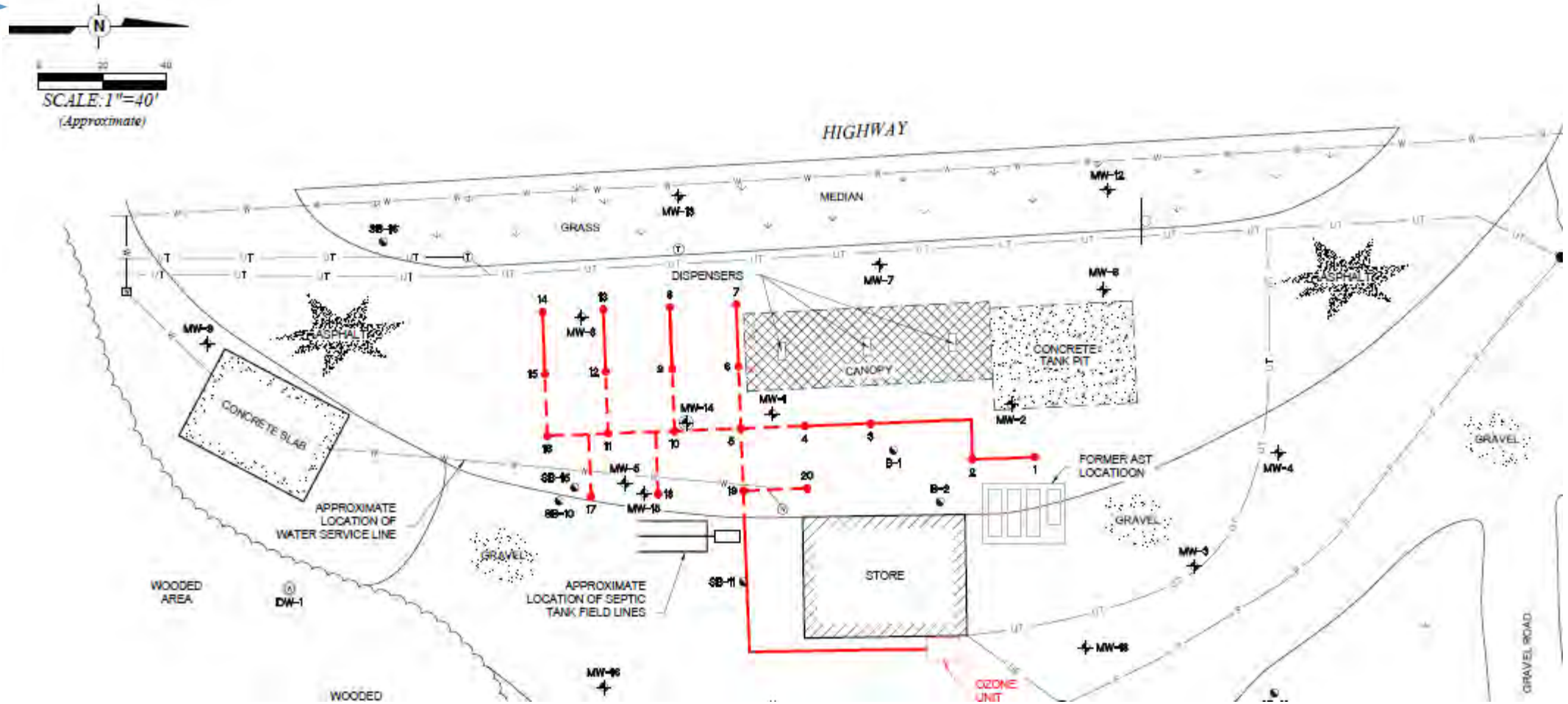


# Active Service Station – Tuscumbia, AL

Challenges

- Shallow GW table
- Clay to silty clay.  Bedrock at 10 to 12 feet BGS.
- High BTEX concentrations
- System start-up in Jan 2008

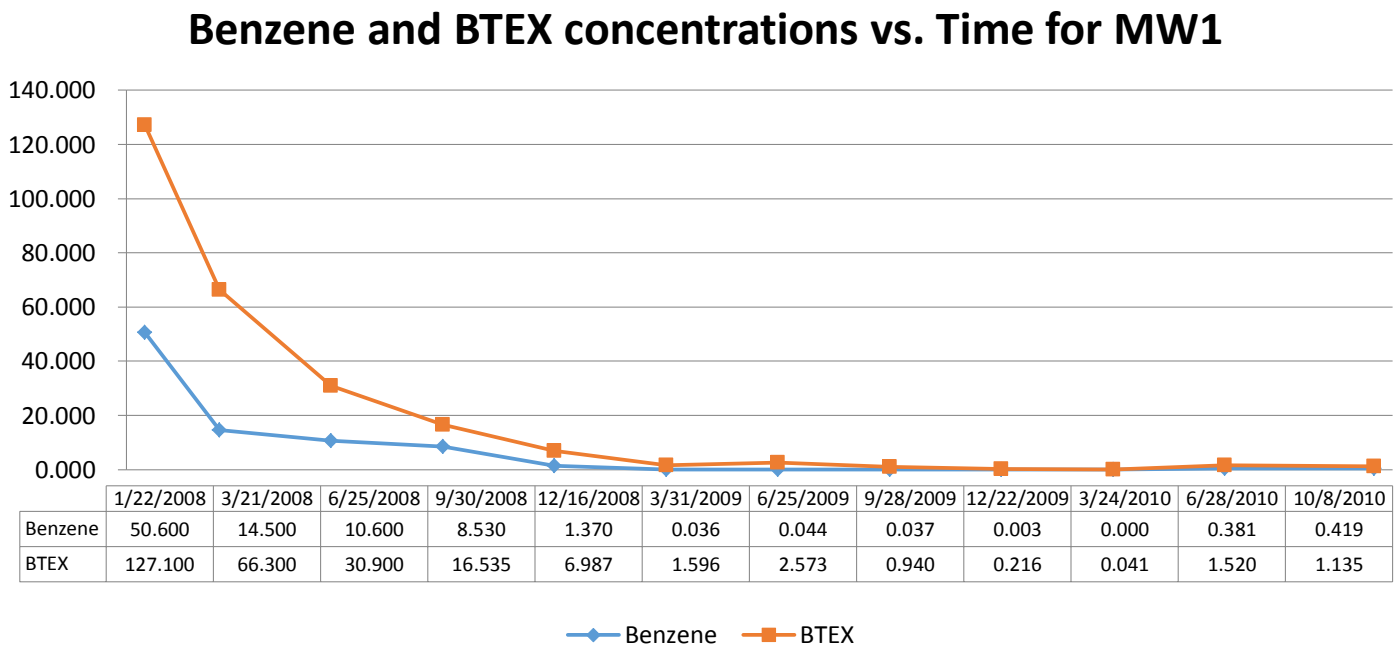
# Sparge Well Design



# Contaminant Levels:

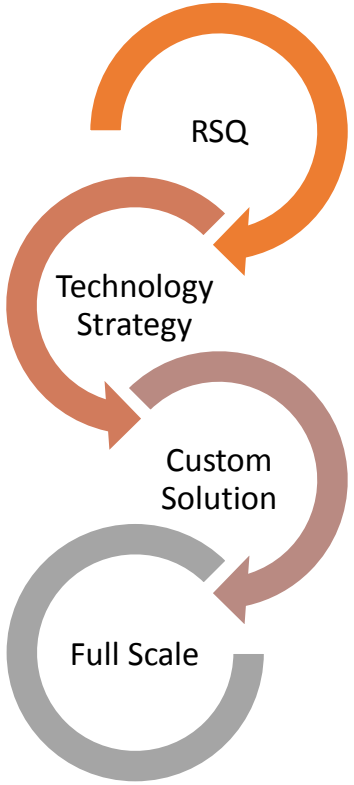
## Pre- and Post-Ozone Treatment

| Pre Ozone Treatment: As of January 22, 2008 | | |
|---|---|---|
| Contaminant | Groundwater (ppm) | SSCALS |
| Benzene | 50.6 | 0.654 |
| Touluene | 33.5 | 131 |
| Ethylbenzene | 5.7 | 91.5 |
| Xylene | 35.3 | 175 |
| MTBE | 2.35 | 2.62 |




| | 1/22/2008 | 3/21/2008 | 6/25/2008 | 9/30/2008 | 12/16/2008 | 3/31/2009 | 6/25/2009 | 9/28/2009 | 12/22/2009 | 3/24/2010 | 6/28/2010 | 10/8/2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Benzene | 50.600 | 14.500 | 10.600 | 8.530 | 1.370 | 0.036 | 0.044 | 0.037 | 0.003 | 0.000 | 0.381 | 0.419 |
| BTEX | 127.100 | 66.300 | 30.900 | 16.535 | 6.987 | 1.596 | 2.573 | 0.940 | 0.216 | 0.041 | 1.520 | 1.135 |

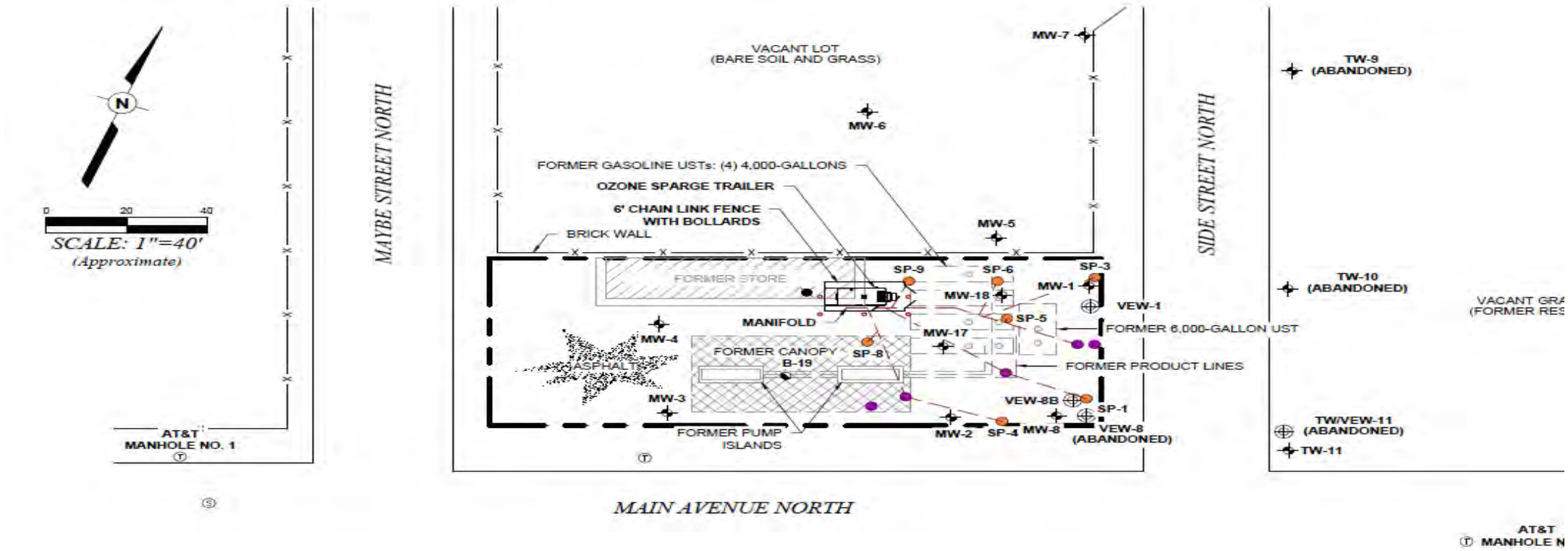
# Case Study #2
# Ozone Polishing Site



# Former UST Station – Birmingham, AL

- Shallow to moderate GW table
- Silty clay to sandy clay.  Bedrock at 10 to 20 feet BGS.
- Moderate BTEX concentrations in multiple wells
- Site in the UST program for some time
- System start-up in May 2013 / Shut-down in May 2014

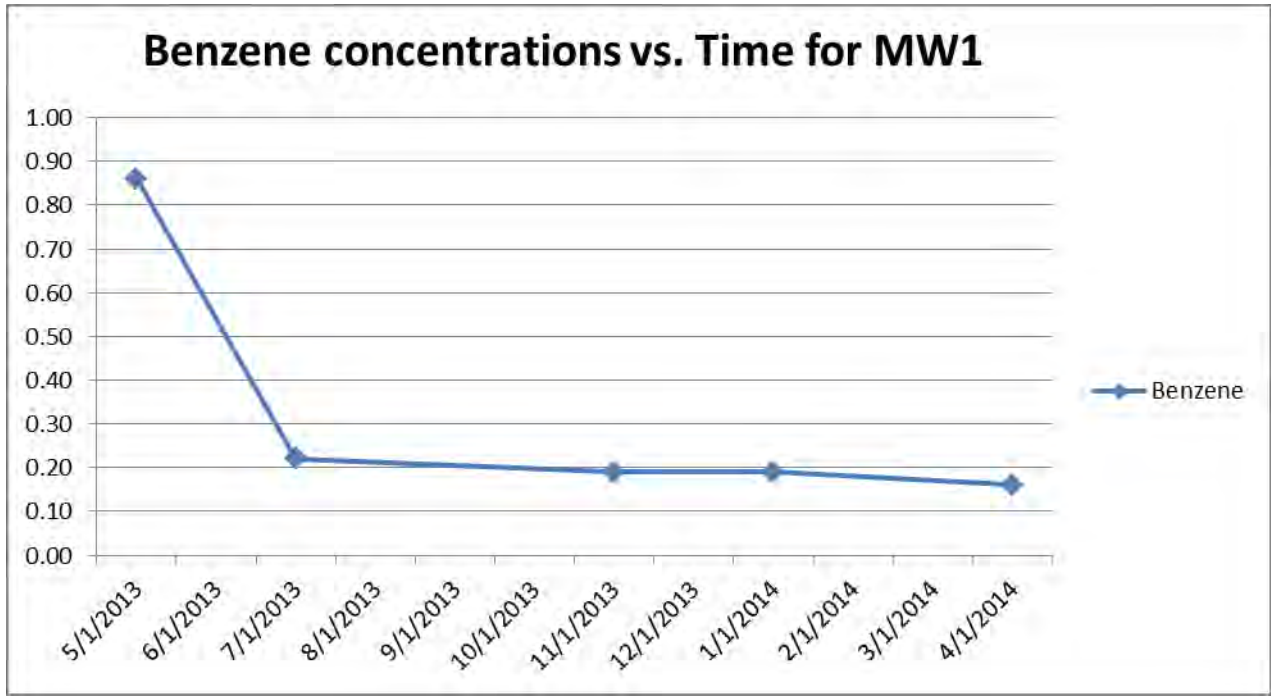
# Sparge Well Design



# Contaminant Levels:

## Pre- and Post-Ozone Treatment

| Pre Ozone Treatment: As of May 21st 2013 | | |
|---|---|---|
| Contaminant | Groundwater (ppm) | SSCALS |
| Benzene | 0.86 | 0.654 |
| Touluene | 0.1 | 131 |
| Ethylbenzene | 0.54 | 91.5 |
| Xylene | 1.4 | 175 |
| BTEX | 2.9 | |
| MTBE | 1.7 | 2.62 |



# Conclusions

- Safety - INTELO®-Zone control logic
- $50 to $150 per cubic yard
- Fast reaction rates
- 24/7 injection
- Long term solution

# Your partner for pure water and a clean world.

Thank you.

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