

Source Control & Extent and Magnitude of Groundwater Contaminant Plume

NDEP CEM Work Shop: Source Control & Extent and Magnitude of Groundwater Contaminant Plume

NAC 445A.2269 Assessment of conditions at site of facility after notification of release of certain substances. (NRS 445A.425)

1. Except as otherwise provided in this section, if the owner or operator of a facility, or his designated agent, is required to give notice of a release pursuant to [NAC 445A.345](#) to [445A.348](#), inclusive, the Division shall require the owner or operator to conduct an assessment of the conditions at the site of the facility, including an assessment of the condition of the soil or water, or both, to determine the extent and magnitude of the contamination.

NAC 445A.22725 Contamination of groundwater: Order by Director for corrective action; request for exemption; exception. (NRS 445A.425)

1. Except as otherwise provided in this section, the Director may require an owner or operator to take corrective action if the release of a hazardous substance, hazardous waste or a regulated substance contaminates groundwater and the level of contamination exceeds the action level established for the groundwater pursuant to NAC 445A.22735.

2. An owner or operator may, before initiating corrective action or after the termination of remediation pursuant to NAC 445A.22745, submit a written request to the Director for an exemption from the provisions of subsection 1. The request must be accompanied by such supporting information as the Director may require. The Director may grant the request if:

(a) The following conditions are satisfied:

(1) Each source of the contamination of the groundwater is identified and controlled or no source of the contamination remains based upon the age and nature of the release;

(2) The magnitude and extent of the contamination of the groundwater is known; and

(3) Data are available from at least 3 years of quarterly monitoring or another period specified by the Division based upon the magnitude of the contamination of the groundwater and the data do not show a trend of increasing concentrations of the contamination in the body of the plume of the contamination;

A. The Conceptual Site Model (CSM)

Overview

Conceptual Site Models (CSM) are essential elements of a systematic planning process. A CSM serves to conceptualize the relationship between contaminant sources and receptors through consideration of potential or actual migration and exposure pathways. It presents the current understanding of the site, helps to identify data gaps, and helps to focus the data collection efforts. The CSM should be maintained and updated as new information is collected throughout the life cycle of the project. Various styles of CSM are useful, from text explanations to a series of figures depicting current and assumed future site conditions in three dimensions. Some form of visualization aid (e.g., figures, graphs, charts, tables) that relates site conditions to receptors in a manner that lends itself to the explanation and use of incremental sampling methodologies (ISM) is suggested (Example 1). The sampling strategy should reflect the assumptions about the transport phenomena and exposure scenarios reflected in the CSM.

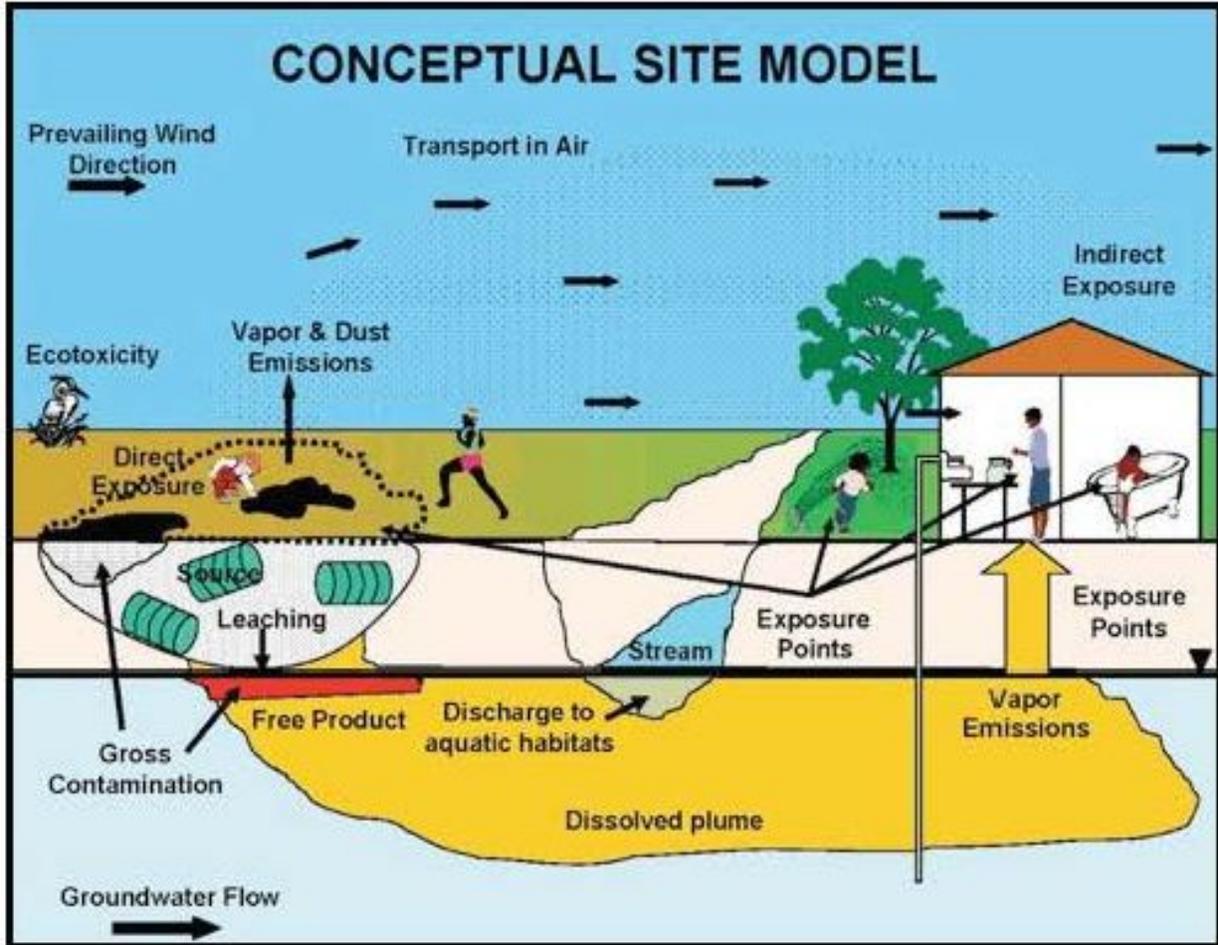
Topics

- 1) Definition of CSM
 - a) A model is a simplification of a real system; a device that represents an approximation of a field situation
 - b) A Concept level model is presented as a narrative, schematic, tabulated data, etc. (versus analytical or numerical Mathematic models)
- 2) Purpose of CSM
 - a) To provide a framework for assembling and organizing data
 - b) To develop an understanding of a specific environment or field situation
 - c) To gain insight into controlling parameters
 - d) To aid in identification of data gaps and plan further data acquisition
 - e) To aid in formulating ideas about system dynamics
 - f) To aid in predicting a future state
 - g) To facilitate selection of remedial alternatives
 - h) To evaluate the effectiveness of remedial actions
- 3) Nature of CSM
 - a) An iterative, "living document"
 - b) As data gaps are identified and filled, the CSM is updated, and used again to identify data gaps, if present.
- 4) Activities Involved in Preparing CSM
 - a) Identification of potential contaminants
 - b) Identification and characterization of source(s) of contaminants
 - c) Delineation of potential migration pathways through environmental media, including
 - i) Groundwater
 - ii) Surface water
 - iii) Soils
 - iv) Sediments
 - v) Biota
 - vi) Air
 - d) Establishment of background areas of contaminants for each contaminated medium
 - e) Sensitive Receptor Survey (human and ecological)

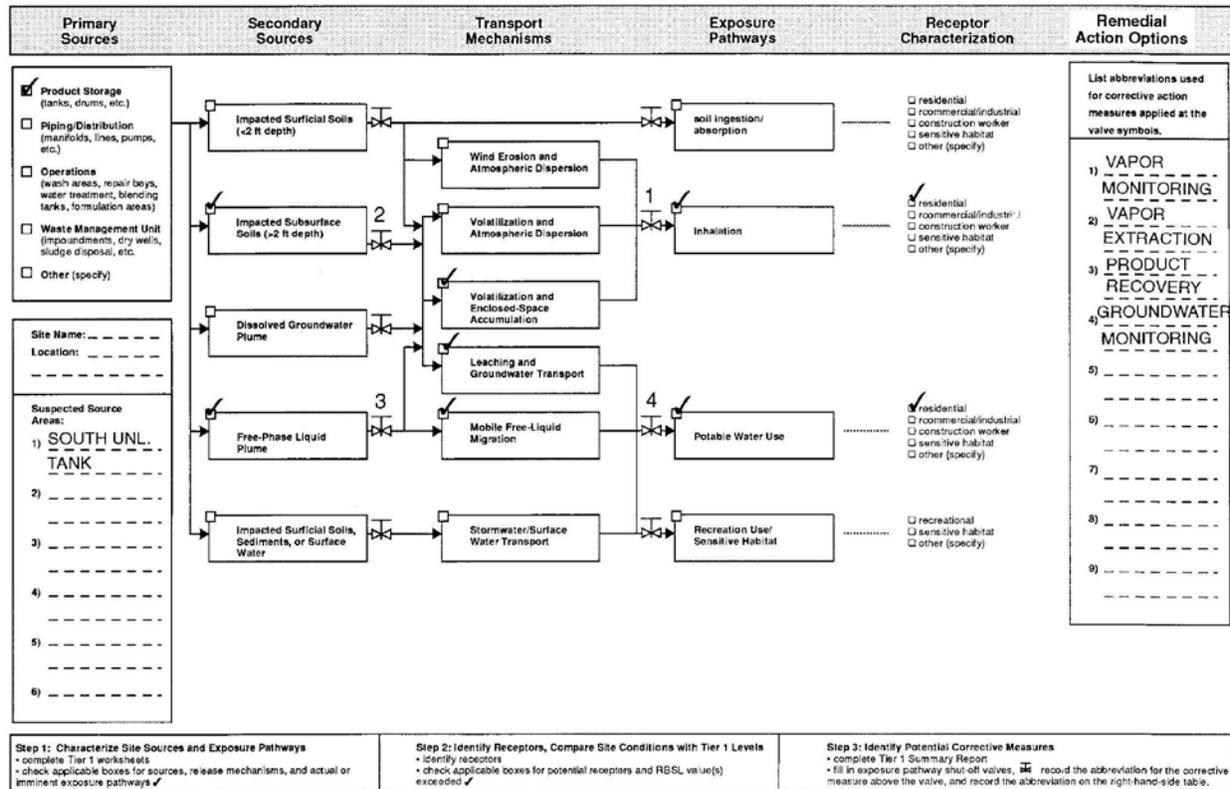
NOTE: *The following distances are promulgated in the NDEP "Oxygenated Fuel Corrective Action Guidance" October, 1998.*

- *water wells (receptors) are located in close proximity (within 1,000 feet) to any portion of the groundwater contaminant plume or facility boundary. As used herein, water wells are any well where water is extracted for: human consumption, bathing, swimming, or recreation; irrigation; application to crops; livestock; and/or industrial use;*
 - *surface water intakes for potable water supplies and/or other beneficial uses are located within one half mile (1/2 mile) of any portion of the groundwater contaminant plume; facility boundary; or spill location;*
- f) Determination of the limits of the study area or system boundaries
 - g) Identify and emphasize uncertainties

Example 1: Pictorial or Schematic CSM



Example 2: Exposure Evaluation Flow Chart from ASTM E1739 (RBCA Applied at Petroleum Release Sites)



Example 3: Table of Contents:

1. INTRODUCTION
2. OBJECTIVES
 - 3.1 Initial Petroleum Product Release(s)
 - 3.1.1 Free-Product Recovery
 - 3.1.2 Groundwater Investigation
 - 3.2 Gasoline Spill
 - 3.3 Limited Phase II Environmental Site Assessment (ESA)
 - 3.4 Additional Phase II ESA
 - 3.4.1 Installation of Wells MW-1 through MW-6
 - 3.4.2 Advancement of Soil Borings
 - 3.4.3 Field Pilot Testing and Installation of Additional Monitoring Wells
 - 3.5 Tracer Testing of UST Systems
 - 3.6 Closure of Tanks 1, 2, 3 and 4
4. RECENT ESA ACTIVITIES
 - 4.1 Scope of Work
 - 4.2 Pre-field Activities
 - 4.3 Traffic Control
 - 4.4 CPT/MIP Technology
 - 4.5 Advancement of CPT/MIP Borings

- 4.5.1 *Equipment Decontamination*
 - 4.5.2 *Advancement of Continuous Soil Borings*
 - 4.5.3 *Soil Sample Collection*
 - 4.5.4 *Groundwater Sample Collection*
 - 4.6 Sampling of Existing Groundwater Monitoring Wells
 - 4.6.1 *Gauging of Groundwater Levels*
 - 4.6.2 *Well Purging*
 - 4.6.3 *Groundwater Sample Collection*
 - 4.7 Analytical Testing
 - 5. SURVEY OF MONITORING WELLS AND CPT/MIP BORINGS
 - 6. DATA ASSIMILATION
 - 7. CPT AND MIP RESULTS
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 - 7.2 MIP Results
 - 8. GEOLOGIC CONDITIONS
 - 9. HYDROGEOLOGIC CONDITIONS
 - 10. ANALYTICAL RESULTS
 - 10.1 Soil Samples
 - 10.2 Groundwater Samples
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 - 10.2.2 *Monitoring Wells*
 - 11. SOURCE CHARACTERIZATION
 - 11.1 Primary Source
 - 11.2 Secondary Sources
 - 11.2.1 *Petroleum Product Impacted Soils*
 - 11.2.2 *Free-Phase Product*
 - 12. CONTAMINANT MIGRATION PATHWAYS
 - 13. EXPOSURE PATHWAY ASSESSMENT
 - 13.1 Inhalation
 - 13.2 Ingestion
 - 13.3 Dermal Contact
 - 14. DISTRIBUTION OF HYDROCARBON CONTAMINATION
 - 14.1 Soil
 - 14.2 Groundwater
 - 15. SUMMARY OF FIELD ACTIVITIES
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 - 17. CONCLUSIONS
 - 18. RECOMMENDATIONS
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Appendix L	Chain of Custody Documentation and Laboratory Analytical Results (Groundwater Samples)

B. Groundwater Elevation Contour Map & Plot of Historic Groundwater Flow Direction

See attached Figure

C. Analyte Isoconcentration Map

See attached Figure

D. LNAPL Isopleth Map

See attached Figure

Sources

ASTM Standard E1689-95(2014), 1995, "Standard Guide for Developing Conceptual Site Models for Contaminated Sites" ASTM International, West Conshohocken, PA, 2003, DOI: 10.1520/E1689, www.astm.org.

ASTM Standard E1739-95(2010)e1, 1995, " Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites" ASTM International, West Conshohocken, PA, 2003, DOI: 10.1520/E1689, www.astm.org.

Interstate Technology Regulatory Council (ITRC), Incremental Sampling Methodology [<http://www.itrcweb.org/ism-1/>]

NDEP, Oxygenated Fuel Corrective Action Guidance, October, 1998

LEGEND

- UST UNDERGROUND STORAGE TANK
- GROUNDWATER MONITORING WELL
- SCREENED INTERVAL
- FUEL DISPENSER
- GROUNDWATER SURFACE
- FEET ABOVE MEAN SEA LEVEL
- mg/kg MILLIGRAMS PER KILOGRAM
- LIMIT OF EXCAVATION

LITHOLOGIC SYMBOLS

- FILL
- CLAY/SILT-CLAY/SANDY-CLAY (CL)
- GRAVELLY-SAND/SILT (GM)
- SILTY-SAND/SANDY-SILT (ML/SP)

TPH CONCENTRATION (mg/kg)

- 100-1,000
- 1,000-2,000
- >2,000

* NOTE:
MW-1 ASPHALT PAVEMENT OVER WELL

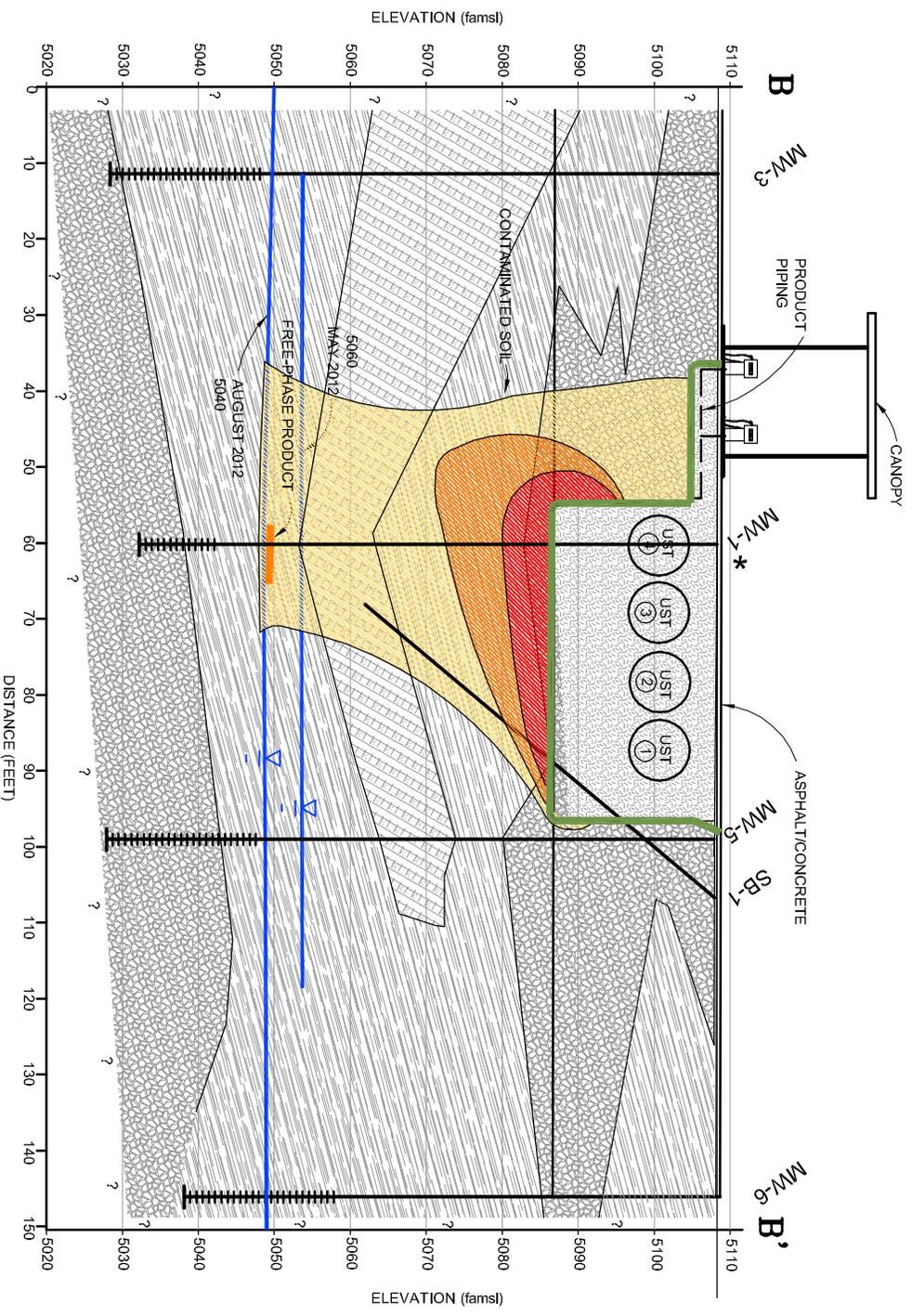
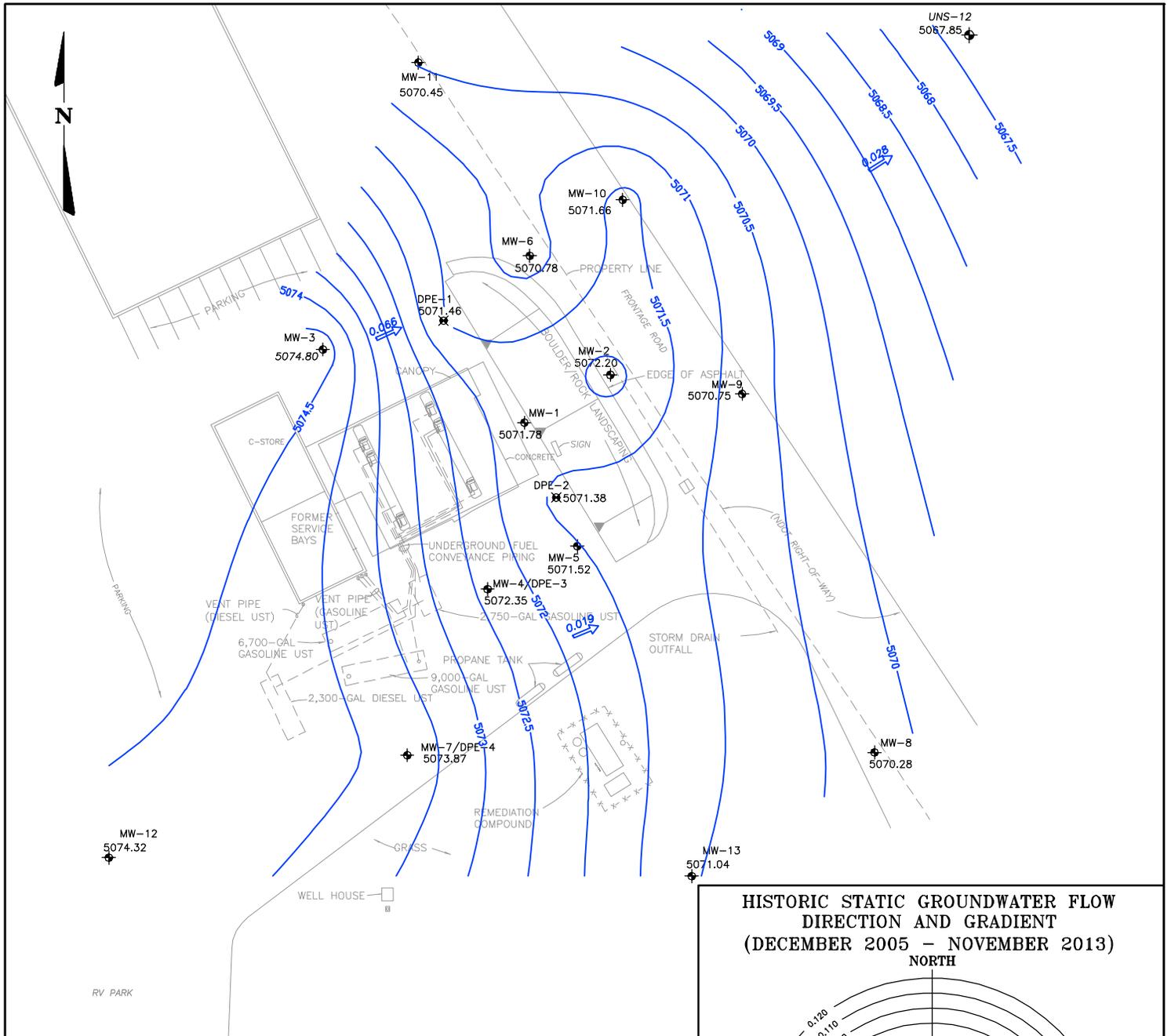


FIGURE 3
GEOLOGIC SECTION'

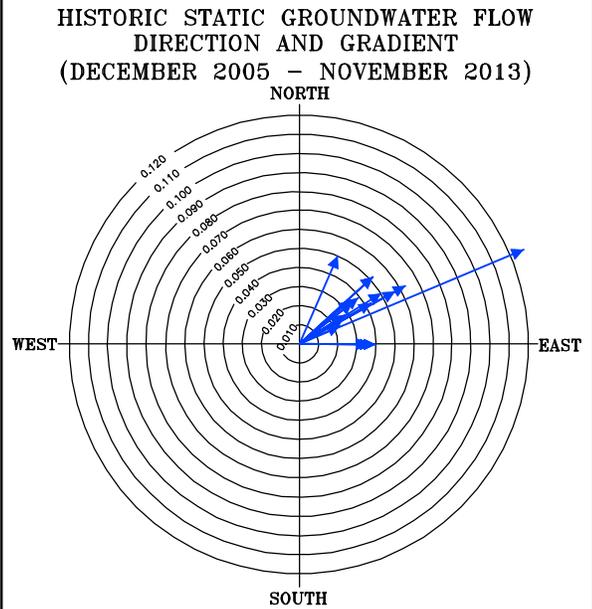
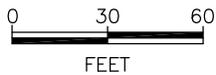
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LEGEND

- MW-1 5068.42 MONITORING WELL/
GROUNDWATER ELEVATION
- DPE-1 5072.30 FORMER DUAL-PHASE EXTRACTION WELL/
GROUNDWATER ELEVATION
- DISPENSER
- 5074 GROUNDWATER CONTOUR
- 0.143 APPROXIMATE HORIZONTAL
HYDRAULIC GRADIENT



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FIGURE 3

**WATER TABLE MAP
(NOVEMBER)**

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LEGEND

- UST UNDERGROUND STORAGE TANK
- MW-4 MONITORING WELL/ BENZENE CONCENTRATION (ug/L) 3,600
- MW-8 DIRECTIONAL GROUNDWATER MONITORING WELL
- ug/L MICROGRAMS PER LITER

BENZENE CONCENTRATION (ug/L)

- 5-100
- 1,000-5,000
- 100-1,000
- >5,000

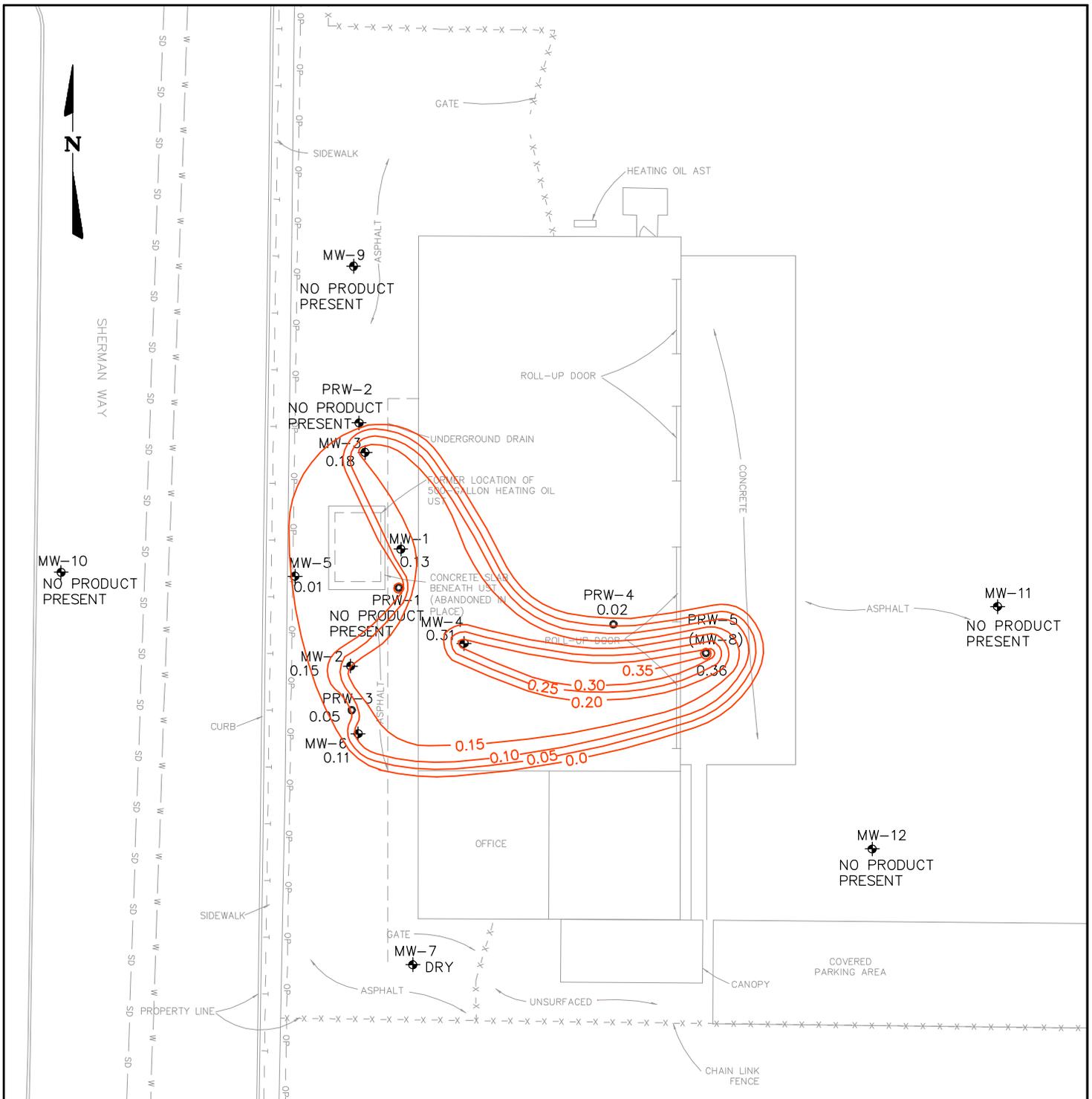


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FIGURE 4

**ISOPLETH MAP
-SHOWING-
INFERRED LATERAL
DISTRIBUTION OF BENZENE
EXCEEDING ACTION LEVEL
(FEBRUARY)**

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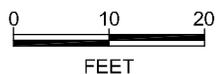
LEGEND

- MW-1
0.33

 PRW-1
0.27

 PRW-6

 0.25
- GROUNDWATER MONITORING WELL/
PRODUCT THICKNESS (FEET)
PRODUCT RECOVERY WELL/
PRODUCT THICKNESS (FEET)
PROPOSED LOCATION OF ADDITIONAL
PRODUCT RECOVERY WELL
AST ABOVEGROUND STORAGE TANK
UST UNDERGROUND STORAGE TANK
PRODUCT CONTOUR (FEET)
NM NOT MEASURED



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FIGURE 2
ISOPACH MAP
-SHOWING-
EXTENT AND
THICKNESS OF
FREE-PHASE PRODUCT
(MARCH)

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