3R - 440

WORK PLAN

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3R-440

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Groundwater Investigation Workplan
Enterprise Products Company
Lateral K-31 December 2011 Pipeline Release
SE¼ SW¼, Section 16, T25N, R6W
Rio Arriba County, New Mexico

July 30, 2012

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1.0 Introduction

Animas Environmental Services, LLC (AES), on behalf of Enterprise Products Company (Enterprise), has prepared a workplan to complete a groundwater investigation associated with a release of natural gas condensate, which occurred along the Enterprise 4-inch diameter Lateral K-31 pipeline in December 2011. Details of the initial release assessment and investigation were submitted in the AES *Pipeline Release Letter Report* dated December 30, 2011, and *Site Investigation Report* dated May 16, 2012.

1.1 Site Location and NMOCD Ranking

The release area is located on Federal land under jurisdiction of the Bureau of Land Management (BLM) within the SE¼ SW¼, Section 16, T25N, R6W, Rio Arriba County, New Mexico. Latitude and longitude of the release were recorded as N36.39373 and W107.47519, respectively. The release location is within the Largo Wash floodplain, and surface runoff drains northeast towards Largo Wash, which is 1,550 feet east of the release location. Based on measurements from the site investigation, depth to groundwater is approximately 14 feet below ground surface (bgs). A topographic site location map is included as Figure 1, and an aerial map showing the release location is included as Figure 2.

In accordance with the New Mexico Oil Conservation Division (NMOCD) *Guidelines for Remediation of Leaks, Spills, and Releases* (October 1993) the release location was assigned a ranking score. The ranking score was obtained in part by reviewing available records of nearby oil/gas wells using the NMOCD online database; however, no records were found to aid in the assessment. Additionally, the New Mexico Office of the State Engineer (NMOSE) database was reviewed for the presence of nearby water wells, and no registered water wells were reported to be located within 1,000 feet of the location. Google Earth and the New Mexico Tech Petroleum Recovery Research Center online mapping tool (http://ford.nmt.edu/react/pitrules_index.html) were accessed to aid in the identification of downgradient surface water. No surface waters were identified within 1,000 feet of the release location. Based on this information and the known depth to groundwater, the release location was assessed a ranking score of 20.

1.2 Release Information

A release was reported at the location on December 2, 2011, by Enterprise personnel, and on the same date Enterprise personnel were dispatched to locate and isolate the leak in the pipeline. The line repair was also completed on December 2, 2011. The cause of the release was identified as a corrosion hole on the underside of the line.

1.3 Initial Release Assessment and Investigation

On December 8, 2011, four test holes were each excavated to a total depth of 15.5 feet bgs, from which a total of six soil samples were collected for laboratory analysis. A groundwater sample from an existing monitor well labeled MW-4, which is located near the release area, was collected for laboratory analysis. Soil laboratory analytical results for total benzene, toluene, ethylbenzene, and xylenes (BTEX) and total petroleum hydrocarbons (TPH) exceeded applicable NMOCD action levels in two of the four test holes. Groundwater was not encountered in the test holes; however, depth to water was measured at 14 feet bgs in the nearby groundwater monitor well. The laboratory analytical results for the groundwater sample collected from this well showed reported benzene and total BTEX concentrations below laboratory detection limits. Details of the initial release assessment were submitted to Enterprise in a letter report dated January 20, 2012.

Based on the field screening readings, laboratory analytical results, and the shallow depth of groundwater, AES and Enterprise determined that a limited investigation of the release extents would be appropriate prior to implementing further mitigation measures.

On March 15 and 16, 2012, AES completed a site investigation in order to delineate the full extent of hydrocarbon impact on subsurface soils and groundwater resulting from the release. The investigation included the installation of 12 soil borings and the collection of soil and groundwater samples. Soil samples collected for laboratory analysis showed that contaminant concentrations exceeded NMOCD action levels for TPH in borings SB-1, SB-9, and SB-11. The highest TPH concentration was reported in SB-9 with 8,700 mg/kg. Soil boring locations are illustrated on Figure 3.

Dissolved phase analytical results indicated groundwater is impacted above the New Mexico Water Quality Control Commission (WQCC) standard for benzene in SB-1W through SB-4W, SB-7W, SB-9W, SB-11W, and SB-12W. The highest concentration for benzene was reported in SB-11W with 1,400 µg/L. Concentration contours of dissolved phase contaminants indicate that migration of the plume is primarily north along the pipeline corridor and to the northeast (following gradient) towards Largo Canyon Wash. The highest dissolved phase concentrations of BTEX were noted in SB-3W and SB-11W.

Based on the depth and lateral extent of contaminant impacted soil and groundwater, AES recommended installing permanent groundwater monitor wells and collecting additional monitoring and sampling data from which a corrective action plan can be developed.

2.0 Proposed Groundwater Investigation

The groundwater investigation is proposed in order to further delineate the extent of the dissolved phase hydrocarbon contaminants associated with the Lateral K-31 pipeline release. The investigation procedures are designed to be protective of both surface water and groundwater and are based upon protocols outlined in AES' Standard Operating Procedures (SOPs). AES' SOPs follow applicable NMOCD guidelines, BLM guidelines, ASTM standards, and applicable U.S. Environmental Protection Agency (USEPA) methods and guidelines for soil and groundwater sampling.

2.1 Pre-Field Permits and Coordination

2.1.1 Access Agreements

Prior to initiating the field work, AES will work with Enterprise and BLM for a Temporary Use Area (TUA) permit.

2.1.2 Archaeological Clearances

In the event that any evidence of artifacts and/or human remains are encountered, all work will be stopped immediately. The BLM Archaeologist and the State Historic Preservation Office (SHPO) will be contacted, and appropriate mitigation measures will be implemented.

2.1.3 Office of State Engineer Permits

Prior to initiating the groundwater investigation, AES will consult with the New Mexico Office of the State Engineer (NMOSE) to determine if groundwater monitor well permits are required.

2.1.4 Utilities Notification

AES will utilize the New Mexico One-Call system to identify and mark all underground utilities at the site before the start of any proposed field activities which could impact buried utilities. Any local utilities not participating in the New Mexico One-Call system will be contacted separately by AES for utility locations.

2.1.5 Health and Safety Plan

AES has a company health and safety plan in place, and all on-site personnel are 40-hour HazWoper trained in accordance with OSHA regulations outlined in 29 CFR 1910.120(e). Prior to the start of the site investigation, AES will prepare a comprehensive site-specific Job Safety Analysis (JSA) addressing the site investigation activities and associated soil and groundwater sampling. All employees and subcontractors are required to read and sign the JSA to acknowledge their understanding of the information contained within the JSA. The JSA will be implemented and enforced on site by the assigned Site Safety and Health Officer.

2.2 *Installation of Soil Borings*

AES proposes to install nine soil borings which will be completed as groundwater monitor wells within the release area to delineate the extent of the groundwater hydrocarbon contamination. Soil borings will be advanced to a total depth of 25 feet bgs with a CME-75 truck mounted drill rig equipped with hollow stem augers and 4-inch outer diameter (OD) core barrel. The drill rig will be operated by Kyvek Energy Services, Inc. of Aztec, New Mexico.

Drill cuttings from the soil borings will be contained in labeled and sealed 55-gallon drums. The drummed cuttings will be transported to Envirotech Landfarm for proper disposal. The locations of the proposed soil borings/monitor wells are shown on Figure 3.

2.3 *Soil Sampling and Analyses*

2.3.1 Sample Collection

Each soil boring will be continuously sampled using a core-barrel sampler. Soil samples collected will be field screened of volatile organic compounds (VOCs) with a photo-ionization detector (PID) organic vapor meter (OVM). A minimum of two soil samples will be collected from each boring for laboratory analysis. The samples will be collected from the vadose zone where the highest OVM-PID result is observed and from the capillary fringe just above groundwater. Additional soil samples will be collected and submitted for laboratory analyses if warranted by field observation. Therefore, based on nine proposed soil borings, a minimum of 18 soil samples will be submitted for laboratory analyses.

For each soil boring, a Soil Boring Log will be completed. These logs will record sample identification, depth collected, and method of collection, as well as observations of soil moisture, color, density, grain size, plasticity, contaminant presence, and overall stratigraphy.

2.3.2 Field Screening

Samples will be field-screened for VOC vapors utilizing a PID-OVM calibrated with isobutylene gas to obtain preliminary data regarding potential hydrocarbon impacted soil.

Once collected, the soil sample to be field-screened will be placed immediately in a clean 16 ounce glass jar, filled approximately half full, and sealed with a threaded ring lid and a sheet of aluminum foil. Approximately 10 minutes will be allowed for the soil to be heated and for any VOCs in the soil to accumulate in the head space of the jar. During the initial stages of headspace development, the sample will be gently shaken for one minute to promote vapor development and disaggregate the sample. Volatile gases will then be measured by piercing the aluminum foil with the sample probe of the PID-OVM. The highest (peak) measurement will be recorded. PID-OVM readings will be recorded onto the Soil Boring Logs.

2.3.3 Laboratory Analyses - Soil

Discrete samples for laboratory analysis will be collected and transferred to laboratory-supplied sample containers, labeled, and stored in an insulated cooler containing ice at less than 6°C. Samples will be submitted to Hall Environmental Analysis Laboratory (Hall), Albuquerque, New Mexico, via bus for analysis of the following parameters:

- BTEX per USEPA Method 8021B;
- TPH for gasoline range organics (GRO) and diesel range organics (DRO) per USEPA Method 8015B.

2.4 Groundwater Monitor Well Installation

2.4.1 Groundwater Monitor Well Installation and Construction

Groundwater monitor wells will be installed within all of the nine soil borings. Monitor well construction will consist of 2.375-inch outside diameter (OD) [2.067-inch inside diameter (ID)] Schedule 40 PVC screen and 2.0-inch blank riser casing. The screened interval will extend 15 feet across the water table. The wells will be constructed of a 2.375-inch OD PVC well screen (0.010-inch slot). Colorado silica sand (filter pack) will be placed from total depth to approximately 2 feet above the top of the well screen. A 2 foot bentonite seal will be placed above the sand pack, and concrete grout with approximately 5 percent bentonite will be poured from the top of the bentonite plug up to within 0.5 feet of ground surface. An above grade locking steel protective casing, enclosed with a shroud of concrete, will be installed on the well to prevent unauthorized access and damage. A proposed monitor well schematic is presented in Figure 4.

2.4.2 Professional Survey

The location and elevation of the top of each well casing will be surveyed to the nearest 0.01 foot with reference to mean sea level by a licensed surveyor in order to accurately determine the local groundwater depth and flow direction beneath the site. Each well will be tied to an existing USGS benchmark. AES will arrange with a New Mexico Licensed Professional Surveyor to complete the survey upon completion of the monitor well installation.

2.4.3 Groundwater Monitor Well Development

Following monitor well installation and completion, each well will be developed by a combination of surging and bailing techniques. Groundwater purged from the wells will be contained in labeled and sealed 55-gallon drums, and transported to Envirotech Landfarm for proper disposal.

2.4.4 Groundwater Monitor Well Monitor and Sampling

Upon completion and development, the monitor wells will be allowed to sit undisturbed for a minimum of one week. The monitor wells will then be gauged to determine water table elevation and direction of groundwater flow. The wells will then be purged of a minimum of three well volumes, and a groundwater sample will be collected from each well.

Groundwater samples will be collected from each well with a new disposable bailer equipped with a low-flow release valve. Purging data, including pH, temperature, conductivity, oxidation-reduction potential, and dissolved oxygen, will be measured with a YSI water quality meter and documented on a Water Sample Collection Form along with purged water volume and sample depth. All sampling equipment will be thoroughly decontaminated between uses. Purged water will be contained and labeled in a sealed 55-gallon drum and transported to the Envirotech Landfarm for proper disposal.

2.4.5 Laboratory Analyses - Groundwater

All groundwater analytical samples collected from the monitor wells will be submitted to Hall for analysis of the following parameters:

- BTEX per USEPA Method 8021B;

Once collected, sample containers will be packed per standard protocol with ice in insulated coolers and shipped via bus to the laboratory.

2.5 Equipment Decontamination

In order to prevent cross-contamination between sampling locations, strict decontamination procedures will be employed during the groundwater investigation. All drilling equipment will be decontaminated after completing each soil boring, and sampling equipment (i.e. hand auger, spoon sampler, and other hand tools) will be decontaminated following each use at an individual depth or location.

All decontamination of equipment will be completed within clean 5-gallon plastic buckets, which will contain the effluent. At least two tubs will be used, one designated for push rods and the other for small sampling equipment. On an as-needed basis, effluent from the tubs will be transferred by small pump or bucket into 55-gallon DOT approved drums, which will then be marked with identification labels and sealed. Decontamination procedures to be utilized are outlined below.

For small equipment such as hand augers, hand tools, and spoon samplers:

1. Physical removal of gross contamination and all debris with brushes
2. Hand wash with non-phosphate detergent

3. Hand wash with non-phosphate detergent and water using brush
4. Rinse with water
5. Second rinse with water
6. Air dry

All decontamination procedures will be completed in strict accordance with AES SOPs and applicable USEPA guidelines.

3.0 Deliverables

Following completion of the groundwater investigation activities, a Groundwater Investigation Report summarizing the investigation activities will be submitted to Enterprise. The report will include the following:

1. A summary of all work conducted in the implementation of the investigation;
2. Maps of all sampling locations, including soil and groundwater contaminant concentrations and contours;
3. Geologic cross-sections;
4. All laboratory data and quality assurance and quality control information;
5. Professional survey data; and
6. Recommendations for remediation will include further sampling.

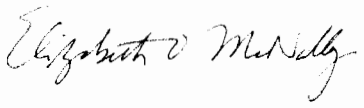
4.0 Implementation Schedule

AES proposes the following timeline to implement groundwater investigation activities once NMOCD approval has been received. This schedule assumes that no inclement weather occurs, which could result in a delay in implementing field activities.

Task	***Days from NMOCD Workplan Concurrence***
1. Pre-field permits and coordination	15
2. Complete installation of soil borings and groundwater monitor wells; collect and submit soil and groundwater samples for laboratory analysis. Schedule professional survey of wells.	30
3. Receive laboratory analytical reports for soil and groundwater samples. Receive professional survey data.	45
4. Prepare and submit Groundwater Investigation Report.	60

Respectfully submitted,

Ross Kennemer
Senior Project Manager



Elizabeth McNally, PE
Principal

5.0 References

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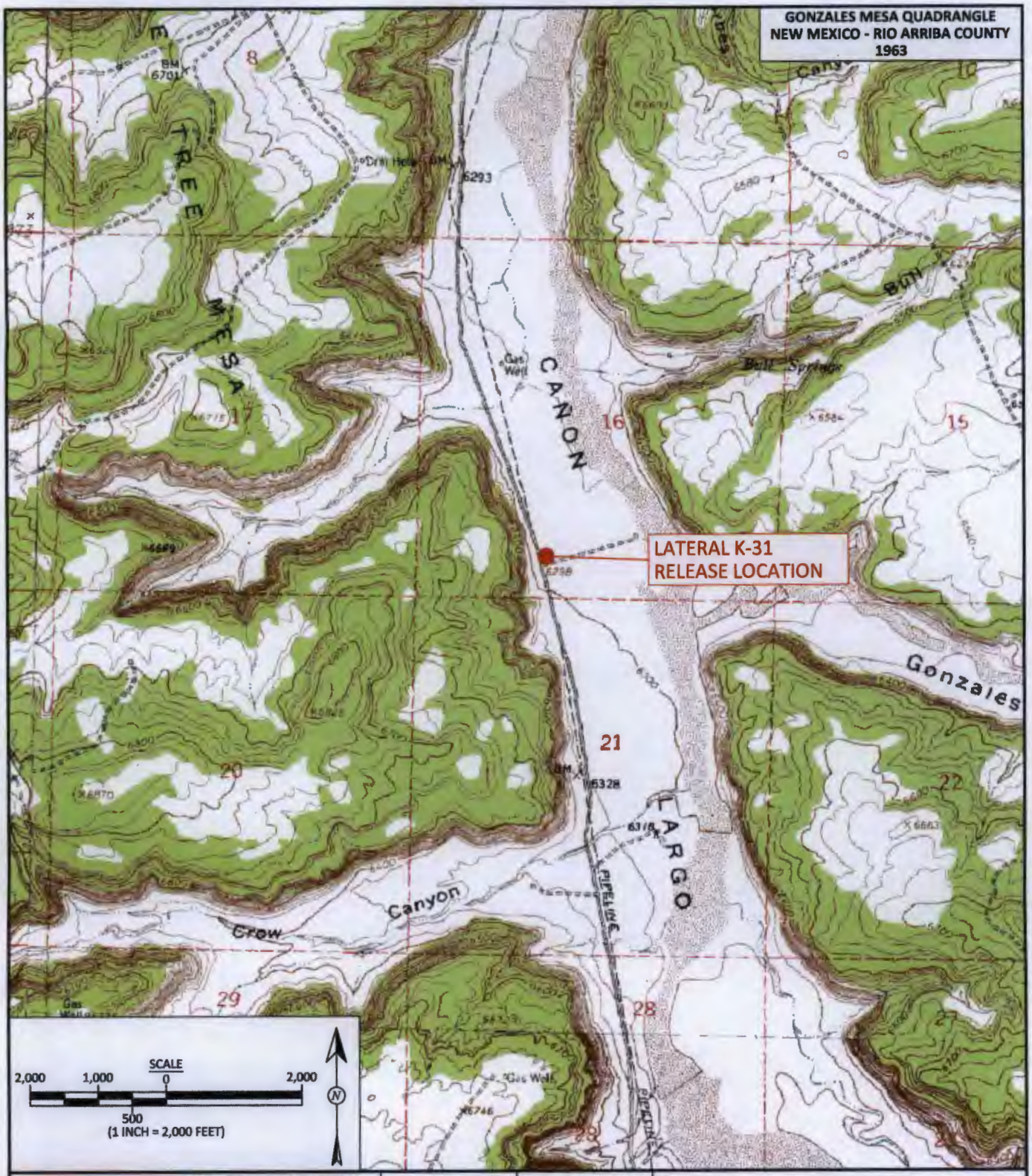

DRAWN BY: C. Lameman	**DATE DRAWN:** December 2, 2011	**FIGURE 1**
REVISIONS BY: C. Lameman	**DATE REVISED:** July 17, 2012	**TOPOGRAPHIC SITE LOCATION MAP**
CHECKED BY: T. Ross	**DATE CHECKED:** July 17, 2012	ENTERPRISE PRODUCTS COMPANY LATERAL K-31 DECEMBER 2011 RELEASE LOCATION RIO ARRIBA COUNTY, NEW MEXICO SE¼, SW¼, SECTION 16, T25N, R6W N36.39373, W107.47519
APPROVED BY: E. McNally	**DATE APPROVED:** July 17, 2012	

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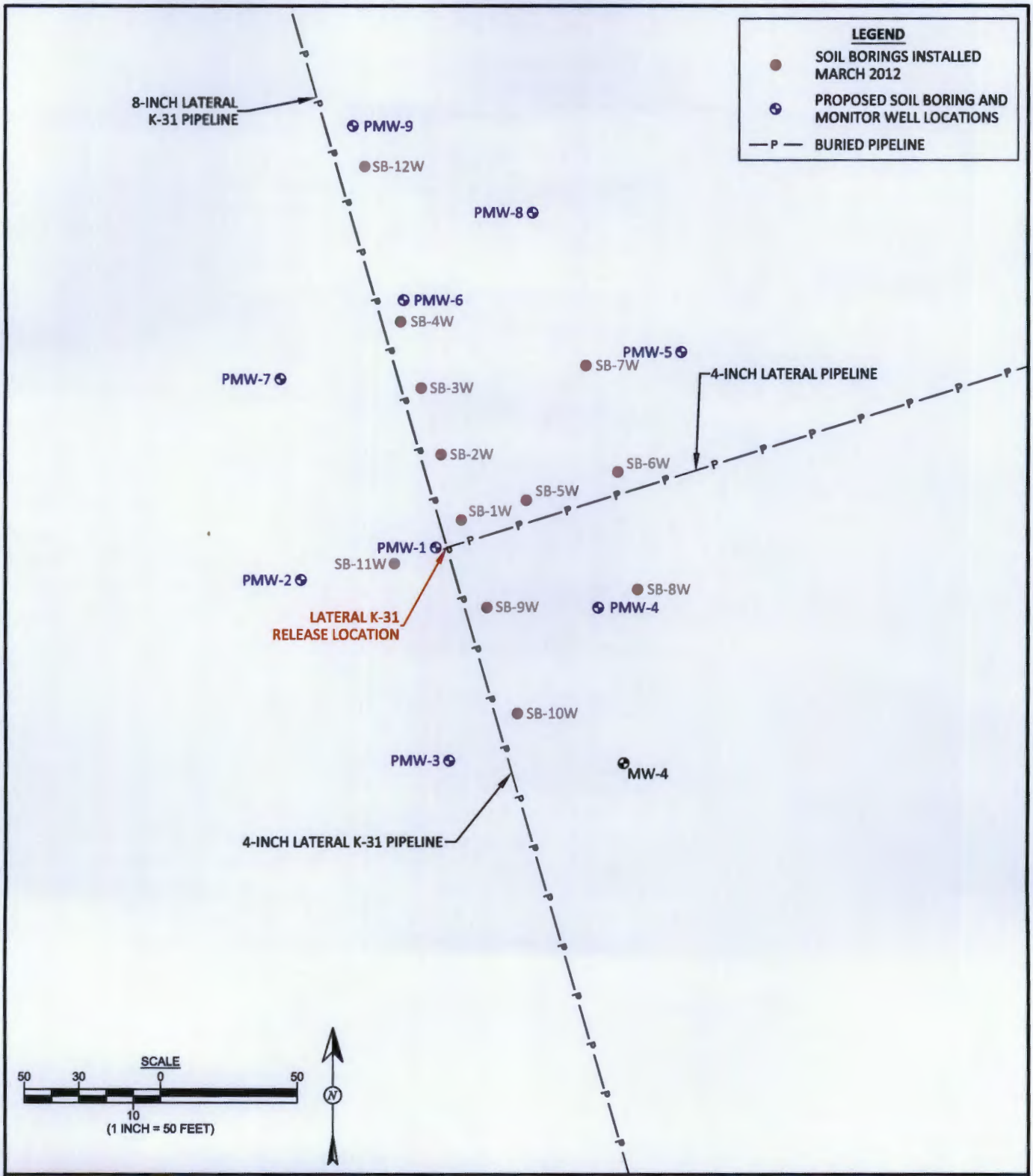
DRAWN BY: C. Lameman	**DATE DRAWN:** December 2, 2011
REVISIONS BY: C. Lameman	**DATE REVISED:** July 17, 2012
CHECKED BY: T. Ross	**DATE CHECKED:** July 17, 2012
APPROVED BY: E. McNally	**DATE APPROVED:** July 17, 2012

FIGURE 2

AERIAL SITE MAP
ENTERPRISE PRODUCTS COMPANY
LATERAL K-31 DECEMBER 2011 RELEASE LOCATION
RIO ARRIBA COUNTY, NEW MEXICO
SE¼, SW¼, SECTION 16, T25N, R6W
N36.39373, W107.47519



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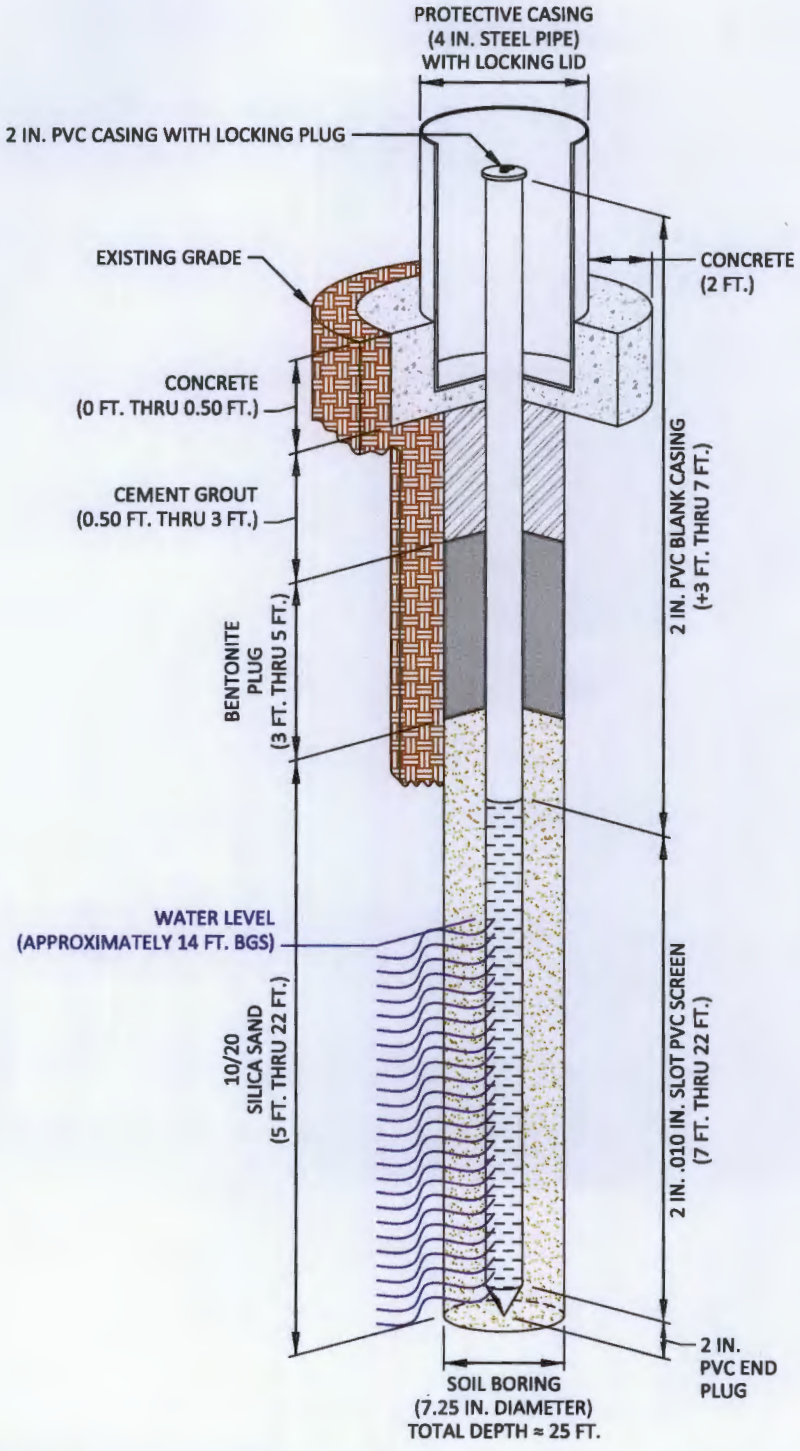
DRAWN BY: C. Lameman	DATE DRAWN: July 17, 2012	**FIGURE 3**
REVISIONS BY: C. Lameman	DATE REVISED: July 17, 2012	**PROPOSED SOIL BORINGS AND MONITOR WELL LOCATIONS**
CHECKED BY: T. Ross	DATE CHECKED: July 17, 2012	ENTERPRISE PRODUCTS COMPANY LATERAL K-31 DECEMBER 2011 RELEASE LOCATION RIO ARRIBA COUNTY, NEW MEXICO SE¼, SW¼, SECTION 16, T25N, R6W N36.39373, W107.47519
APPROVED BY: E. McNally	DATE APPROVED: July 17, 2012	



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DRAWN BY: N. Willis	**DATE DRAWN:** July 30, 2012	**FIGURE 4**
REVISIONS BY: N. Willis	**DATE REVISED:** July 30, 2012	**MONITOR WELL SCHEMATIC**
CHECKED BY: R. Kennemer	**DATE CHECKED:** January 5, 2011	ENTERPRISE PRODUCTS COMPANY LATERAL K-31 DECEMBER 2011 RELEASE LOCATION RIO ARRIBA COUNTY, NEW MEXICO
APPROVED BY: R. Kennemer	**DATE APPROVED:** January 5, 2011	SE¼, SW¼, SECTION 16, T25N, R6W N36.39373, W107.47519