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REPORTS

DATE:

7/2003

STAGE I ADDENDUM

Duke Energy
Field Services

370 17th Street, Suite 900
Denver, Colorado 80202
303-595-3331 – main
303-389-1957 – fax

July 18, 2003

Mr. Bill Olson
New Mexico Oil Conservation Division
1220 S. St. Francis Dr.
Santa Fe, NM 87505

RE: Stage 1 Abatement Plan Addendum for the Eldridge Ranch Study Area, Monument, New Mexico (Unit P, Section 21, Township 19 South, Range 37 East, Case #1R334)

Dear Mr. Olson:

Duke Energy Field Services, LP (DEFS) is pleased to submit for your review the Stage 1 Abatement Plan Addendum for the Eldridge Ranch Study Area, Monument, New Mexico (Case # 1R334).

If you have any questions regarding this report, please call me at 303-605-1718.

Sincerely

Duke Energy Field Services, LP

Stephen Weathers
Sr. Environmental Specialist

attachment

cc: Environmental Files

Remediacon Incorporated
Geological and Engineering Services
mstewart@remediacon.com

PO Box 302, Evergreen, Colorado 80437
Telephone: 303.674.4370
Facsimile: 720.528.8132

July 18, 2003

Mr. Stephen Weathers
Duke Energy Field Services, LP
370 17th Street, Suite 900
Denver, CO 80202

Re: Stage 1 Abatement Plan Addendum for the Eldridge Ranch Study Area, Monument, New Mexico (Unit P, Section 21, Township 19 South, Range 37 East, Case #1R334)

Dear Mr. Weathers:

Attached is an addendum to the Stage 1 Abatement Plan for the Eldridge Ranch Study Area that was submitted to the New Mexico Oil Conservation Division (OCD) on May 30, 2003. The addendum provides the additional information requested by OCD in its June 19, 2003 letter.

Each OCD request is addressed in a separate section. The responses were prepared to provide the information included in 19.15.1.19.E(3) NMAC

Do not hesitate to contact me if you have any questions or comments on this submittal.

Respectfully Submitted,
REMEDIACON INCORPORATED

Michael H. Stewart, P.E.
Principal Engineer

Attachment

STAGE 1 ABATEMENT PLAN ADDENDUM
FOR THE ELDRIDGE RANCH STUDY AREA
LEA COUNTY, NEW MEXICO

(Case #1R334)

Unit P, Section 21, Township 19 South, Range 37 East

Prepared For

Duke Energy Field Services, LP
370 17th Street, Suite 900
Denver, CO 80202

RECEIVED
JUL 21 2003
ENVIRONMENTAL BUREAU
OIL CONSERVATION DIVISION

Prepared By

Remediacon
P.O. Box 302
Evergreen, Colorado 80437
Telephone (303)674-4370
Facsimile (720)528-8132

July 18, 2003

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Appendix 1 – Sampling and Analysis Plan for the Eldridge Study Area

1 INTRODUCTION

Remediacon Incorporated (Remediacon) prepared a Stage 1 Abatement Plan that was submitted to the New Mexico Oil Conservation Division (OCD) on May 30, 2003. OCD responded in a June 19, 2003 letter requesting the following information to ensure compliance with 19.15.1.19.E(3) NMAC:

1. A plan to define the site geology and hydrogeology.

2. A plan to define the magnitude and extent of vadose zone and dissolved phase contamination.

3. An inventory of water wells inside and within one mile of the perimeter of the area where the standards are exceeded and the number of such wells actually or potentially affected by the pollution.

4. A quality assurance plan, consistent with the sampling and analytical techniques listed in 20.6.3107.B NMAC for all work to be conducted pursuant to the abatement plan.

This document responds to each of the above requests.

Each OCD request is addressed in a separate section. The responses were prepared to provide the information included in 19.15.1.19.E(3) NMAC.

2 PLAN TO DEFINE THE SITE GEOLOGY AND HYDROGEOLOGY

OCD requested that a specific plan be prepared to define the site geology and hydrogeology. Remediacon believes that the site geology has generally been characterized relative to the purpose of a Stage 1 abatement plan as defined in 19.15.1.19.E(3) NMAC:

> **The purpose of Stage 1 of the abatement plan shall be to design and conduct a site investigation that will adequately define site conditions, and provide the data necessary to select and design an effective abatement option.**

The following geologic summary is provided to verify general attainment of the purpose of the Stage 1 abatement plan. Supplemental geologic and hydrogeologic information will be collected as part of the characterization and monitoring program presented in Section 3 below. Geologic data will be collected as set forth in the Sampling and Analysis Plan (SAP) included as Appendix 1 to this report.

2.1 Summary of Geologic Setting

This section summarizes the geologic setting based upon the data collected by AMEC Earth and Environmental, Inc. (AMEC), consultant for the OCD through July 2002, and Remediacon over the duration of the project.

The information in this section primarily originates from the 28 wells that were installed as part of the OCD and the Duke Energy Field Services (DEFS) studies of this area. Their locations are shown on Figure 1. The approximate surface drainage boundaries as defined by inspection of aerial photographs are also shown on Figure 1. Well construction information is provided in Table 1.

2.2 Subsurface Material Distribution

Examination of the boring logs indicates that following four general material types are present:

- An extensive upper layer of caliche;
- An unconsolidated sand that contains varying percentages of fines (clays and silts);
- A cemented (indurated) sand; and
- Low plasticity silts and clays.

The distribution of the above materials is shown in Figure 2. Figures 3, 4 and 5 are cross sections depicting the vertical distribution. The alignment of each cross section is shown on Figure 1. Each material type is summarized below.

2.2.1 Caliche

Caliche is the uppermost extensive material beneath the entire area. The caliche is overlain by thin sands, silts and clays at some locations (Figures 2, 3, 4).

The depth of the base of the caliche logged at each boring is provided on Figure 2. The caliche is generally the thickest in the center of the study area based upon this figure, and it appears to thin in all directions. Some of the differences in caliche thickness may result from differences in field interpretations rather than actual material distributions. The best example is the difference between the boring logs for wells MW-1 and MW-1D. Well MW-1 was drilled and logged by AMEC personnel, and it has a described caliche depth of 26 feet. Well MW-1D was drilled and logged approximately 20 feet north of MW-1 by Trident for DEFS. Trident describes a caliche depth of 18 feet in their log, the same as the depth of saturation. The underlying materials are then described as a silty clay with a trace of weathered caliche to the base of the boring at 45 feet.

2.2.2 Materials Lying Beneath the Caliche

The materials beneath the caliche occur in three zones based upon the distribution shown in Figure 2. The materials in the far western part of the site are generally well-sorted very-fine grained sands that are overlain by between 4 and 16 feet of caliche. The cementation of these sands varies. In some areas, the sands are not cemented. Other areas contain alternating cemented and uncemented sands. The eastern boundary of this area appears to coincide with, and may be related to, the western boundary of the surface drainage.

Clayey-silty sand dominates the materials in the middle of the study area where the drainages are present. These materials are described as very fine grained with varying percentages of silt and clay. Again there were alternating cemented and uncemented intervals noted in the Trident logs that were prepared for the DEFS borings. Described caliche thicknesses vary between 15.5 and 30 feet.

A low-plasticity clay is the dominant material described beneath the eastern part of the study area (Figure 2). The logs for the borings in this area describe the clay as containing 20 percent silt and very-fine grained sand. These clay layers are also described as interlayered with the same type of cemented fine grained sands that are found throughout the study area.

The cross sections shown in Figures 3 through 5 graphically depict the vertical material descriptions described above. The cross section locations are shown on Figure 1. Figure 3 runs generally north sound longitudinally along the approximate middle of the study area. Figure 4 runs generally east west through the center of the study area. Figure 5 runs east west along in the boundary region between the Eldridge and Huston properties.

Figures 3 through 5 demonstrate the variation in caliche thickness throughout the study area. The borings describe by AMEC personnel are delineated by an asterisk, and they generally indicate a thicker caliche section than the Trident borings.

Figure 3 shows that a uniform groundwater gradient is present between the wells on the State land (NMGMW2, NMGMW3 and NMGMW4) and the adjoining wells on the Huston property. The groundwater gradient steepens between wells MW-8 and well MW-24 on the southern boundary of the study area.

Figure 3 also depicts the relationship between the water table and the saturated materials. The water table is generally at or below the caliche layer except beneath wells MW-8 and MW-10, both of which were logged by AMEC personnel. The groundwater is generally flowing in the sands until it passes beneath well MW-1 at the boundary between the Huston and Eldridge properties. The groundwater is flowing in silty clays below that location.

Figures 4 and 5 reveal the same trends discussed above except that Figure 5 shows the saturated materials consisting almost entirely of caliche. The groundwater is at or below the water table if the Trident boring for well MW-1D is substituted for AMEC boring MW-1.

The discrepancy between the caliche thicknesses in the AMEC and Trident boring is the only geological factor that needs to be clarified to adequately characterize the geological distribution. This discrepancy should be resolved by the geologic information collected during the free and dissolved phase characterization program described below in Section 3 .

3 PLAN TO DEFINE THE MAGNITUDE AND EXTENT OF VADOSE ZONE AND DISSOLVED PHASE CONTAMINATION

This section presents the plan to complete characterization of the free and dissolved phase hydrocarbons in the groundwater and vadose zone that are associated with the known releases to satisfy the purpose of a stage 1 abatement plan. The groundwater direction, velocity conductivity have been addressed in the historic documents that were already provided to OCD. The topic that requires further study is the potential for preferential groundwater flow to influence the migration of free and dissolved phase hydrocarbons away from the source areas. A substantial amount of additional hydrogeologic information will be collected during the free product and dissolved phase characterization program described in this section. If necessary, additional studies on preferential groundwater flow will be included as part of the design-specific Phase 2 abatement plan.

Section 3.1 reviews the current knowledge of site conditions. Section 3.2 presents the proposed work plan. Section 3.3 presents the projected schedule.

3.1 Existing Site Conditions

Four episodes of groundwater monitoring have been completed at the site. The February and June 2003 episodes included all of the site wells.

Six wells contained measurable thicknesses of free product in June 2003, including:

- MW-8: 0.30 feet
- MW-11: 1.36 feet
- MW-18: 0.40 feet
- MW-23: 0.59 feet
- MW-26: 0.84 feet
- MW-27: 1.26 feet

These wells are highlighted on Figure 6 along with the dissolved benzene isopleths based upon the June 2003 sampling episode. The benzene concentrations for all episodes are summarized in Table 2. Benzene was selected for evaluation because it is the most prevalent BTEX constituent in the study area. Interpretations that result from the examination of Figure 6 and Table 2 include:

1. The lateral limits of the composite dissolved phase plume for the entire study area have been delineated in all areas with the exception of the area of well MW-19.

2. The dissolved phase benzene distribution does not coincide with the locations of the free product. For instance, MW-13 had the highest measured benzene concentration but is not near to any of the locations containing free product. This discrepancy suggests that the dissolved phase BTEX may have other unidentified sources.

3. The high benzene concentration at MW-4 appears to be separated from the remainder of the plume by an area with lower concentrations. This distribution could originate from a discrete hydrocarbon release in the vicinity of MW-4. An alternative explanation is that preferential flow is routing the BTEX from another source around well MW-6 to the area of MW-4. The hydrocarbon distribution in the area of MW-4 will be evaluated as part of the proposed field program (Section 3.2.2.1).

4. The BTEX concentrations are decreasing in the wells adjacent to the Eldridge Property that were affected during the pumping of the Eldridge well. The benzene concentrations from each sampling episode for wells MW-1, MW-5 and MW-6 are graphed on Figure 7. The concentrations decreased substantially in all three wells between August 2001 and February 2003. The other BTEX constituents also exhibit the same trend with the exception of xylenes in MW-1. This pattern suggests that natural biodegradation is shrinking the composite plume back toward the north.

5. The benzene concentration in MW-4 is also decreasing over time (Table 2). The other three wells that contain benzene at concentrations in excess of 1 mg/l (MW-10, MW-12 and MW-13) have not exhibited a decreasing benzene pattern.

3.2 Proposed Plan Components

This section presents the plan to characterize the subsurface conditions to a level that fulfills the purpose of a Stage 1 abatement plan. Based upon the primary purpose of a stage 1 abatement plan, as stated in Section 2, and considering the above interpretations, the objectives of the characterization study include:

1. Delineating the extent of measurable free product at wells MW-8, MW-11, MW-18, MW-23, MW-26 and MW-27.

2. Defining the composite hydrocarbon plume boundary downgradient from MW-19.

3. Separating the discrete dissolved phase plumes associated with the wells that either contain free phase hydrocarbons or individual BTEX constituents at concentrations higher than 1 mg/l.

4. Identifying areas of lower hydraulic conductivity.

5. Completing further characterization of the deeper saturated zone.

The proposed field program includes five components to satisfy the above objectives. The components include:

- Free product delineation;
- Dissolved hydrocarbon delineation;

- Deeper saturated material assessment;
- Groundwater monitoring and
- Measurement of material permeabilities.

A description of each component follows.

3.2.1 Free Product Characterization

The purpose of the first task is to delineate the areal extent of free product at the six sites where it is known to be present. The basis of the program is based upon the results of the remediation completed at the NMG-148C site to the north in the winter of 2003. An area containing free product was excavated to the water table. The bottom of the excavation, where all of the hydrocarbon saturated materials were removed, was an approximate 40 foot by 40 foot rectangle. These results were used as guidance in designing this program.

This program will be conducted at each of the locations with measured free product (MW-8, MW-11, MW-18, MW-23, MW-26 and MW-27). Based upon the data from the NMG-148C excavation, an initial well will be installed at each location at a distance approximate 25 feet down gradient (southeast) at each of the six locations. These wells should be outside the product saturated zone unless more product leaked into the subsurface or enhanced migration is occurring along a preferential pathway.

Additional wells will be also installed at the following locations to provide supplemental information:

- MW-11: in the existing drainage to evaluate the potential for free product migration above MW-11.
- MW-18: northwest of the well to evaluate product migration from source up the groundwater gradient.
- A well will be installed on the southern boundary of the historic pit in the drainage above MW-12 to evaluate that location as a potential source of free product.

Additional wells will also be installed further down gradient at each location where free product is encountered in the initial 25-foot offset well. The distance to the new well will depend upon the thickness of free product present in the 25-foot offset well.

Additional wells may also be installed in other directions away from the source wells. This data would then be used to assess the actual dimension of the area containing free product. These wells will not be necessary if the product saturated materials are limited to an area where removal from a single well would be viable.

All activities will be completed in accordance with the procedures contained in the Project Sampling and Analysis Plan (SAP) that is appended to this document. This plan is introduced and discussed further in Section 5.

All wells that contain free product will be converted to permanent monitoring locations by sealing the annular space to the surface and installing a protective case and a minimum 2-foot by 2-foot concrete pad. DEFS will either abandon the wells that do not have free product or convert them to permanent wells. Wells will be abandoned by pulling the casing and sealing them to the surface with pelletized bentonite or a neat-cement grout.

3.2.2 Dissolved Phase Characterization

The objectives of the dissolved phase characterization program are to: 1) define the extent of hydrocarbon effects regardless of the source; and 2) define and characterize plumes related to potential individual releases. Potential individual release locations include wells that contain free product and wells with measured benzene concentrations above 1 mg/l. Some locations will have to be defined individually. Others will be combined into clusters based upon their proximity to other wells. The proposed characterization plan is based upon the following groupings:

<u>Characterization at Individual Wells (four locations):</u>

- MW-4
- MW-12
- MW-13
- MW-27

<u>Characterization of Clusters (three locations):</u>

- MW-8, MW-10 and MW-11
- MW-18 and MW-19
- MW-23 and MW-26

The individual sites will generally be characterized with a similar strategy. Characterization and the clusters locations will be more location specific.

3.2.2.1 Characterization at Individual Wells

Locations MW-4, MW-12, MW-13 and MW-27 are too distant from other locations to realistically combine them. Wells MW-12, MW-13 and MW-27 will be characterized using a single strategy. Well MW-4 will be assessed in a different fashion because of its differing circumstances.

The plumes at wells MW-12, MW-13 and MW-27 will be delineated using the following procedure:

1. A well will be installed approximately 100 feet southeast of the original well using the procedures contained in the SAP (Appendix 1). This well should lie on or close to the centerline of the plume based upon the groundwater flow direction and assuming uniform subsurface conditions. The well will be developed and sampled for BTEX.

2. If the groundwater from this location exhibits obvious hydrocarbon impacts, an additional well will be installed an additional 100 feet to the southeast (200 feet total). This process will continue on additional 100 foot increments until either: 1) the groundwater sample does not exhibit obvious hydrocarbon impacts; 2) a well exhibits low-permeability behavior during development and sampling that would be indicative of a hydraulic barrier; or 3) the next offset well in the sequence would be installed close to an existing well.

3. Two additional wells will be installed approximately 50 feet northeast and 50 feet southwest of the last well installed under paragraph 1 or 2 above to evaluate the lateral configuration of the plume. Additional offset wells may be installed to complete lateral characterization if field evidence of hydrocarbons in the groundwater is evident.

The area surrounding MW-4 will be characterized in a different fashion because a number of downgradient wells are already present. Characterization at this well will start to the north to evaluate whether its elevated hydrocarbons originate from an unidentified source close to MW-4 or from an identified source at an up gradient location. Three wells will initially be installed approximately 100 feet north, northwest (between MW-4 and MW-6) and northeast of MW-4. Additional wells will be installed in 100 foot increments at locations \elevated hydrocarbon impacts are identified.

3.2.2.2 Dissolved Phase Characterization at Wells MW-8, MW-10 and MW-11

Wells MW-8, MW-10 and MW-11 are considered to be a single location in this plan. Wells MW-8 and MW-11 both contain free product so they both will initially be subjected to the free product characterization activities discussed in Section 3.2 above.

Four wells will be installed at the locations labeled "Proposed Well" on Figure 8 using the procedures described in the attached SAP. The three wells labeled "Product Wells" would be installed during this as part of the free product characterization activities. The proposed well between MW-10 and MW-8 will be used to assess the hydrocarbon relationship between these two wells. The remaining three proposed wells will be installed to characterize the downgradient BTEX distribution. Additional wells will be installed in an iterative fashion downgradient from the proposed wells with evidence of hydrocarbon impacts in the groundwater.

3.2.2.3 Dissolved Phase Characterization at Wells MW-18 and MW-19

Wells MW-18, and MW-19 will also be considered a single location. Well MW-18 contains free product so it will be initially subjected to the free product characterization activities discussed in Section 3.2 above.

Three wells will be installed at the locations labeled "Proposed Well" on Figure 9 using the procedures described in the attached SAP. The two wells labeled "Product Wells" would be installed during this as part of the free product characterization activities. The three proposed wells would be installed to characterize the downgradient BTEX distribution. Additional wells would be installed in an iterative fashion downgradient from the proposed wells where hydrocarbon impacts are present in the groundwater.

3.2.2.4 Dissolved Phase Characterization at Wells MW-23 and MW-26

Wells MW-23 and MW-26 will also be considered a single location. Both wells contain free product so they will be initially subjected to the free product characterization activities discussed in Section 3.2 above.

Well MW-14 had a measured benzene concentration of 0.537 mg/l in June 2003. Remediacon considers it probable that this well will eventually be linked to MW-23 and thus will be included in the characterization effort.

The first two wells will be installed between MW-26 and MW-23 and MW-23 and MW-14. Additional wells will be probably be installed downgradient from MW-14 in a fashion similar to that proposed for the three single wells in Section 3.2.2.1 above.

3.2.3 Vadose Zone Characterization

Vadose zone characterization will be completed at each well advanced in both the free and dissolved phase characterization efforts. Soil measurements will be made using a photoionization detector at each well according to the procedures outlined in the SAP (Appendix 1). The resulting data should prove sufficient to characterize hydrocarbon distributions in the vadose zone. More detailed evaluations will be completed, as necessary, as part of pilot studies that would be included in the design (Stage 2) characterization activities.

3.3 Deeper Saturated Material Assessment

A deep well similar to MW-1d will be installed near to well MW-24 to monitor for dissolved hydrocarbons in the deeper part of the saturated materials. The well (MW-24D) will be installed to tap the interval from 35 to 50 feet. The well will be installed using the procedures contained in the SAP. The well will then be sampled during each monitoring episode.

3.4 Groundwater Monitoring

All wells will be sampled in September 2003 and analyzed for BTEX. The monitoring program will be evaluated and revised as appropriate in the Stage 1 Abatement Plan Report. All wells will also be sampled in December 2003 if the report is not completed and approved by then.

3.5 Additional Permeability Measurements

Additional permeability information will be gathered by completing single well pumping tests while sampling the wells during the initial purging of the new wells and during the quarterly groundwater monitoring program to be completed in September 2003. The depth to water will be measured periodically during the purging of each well. The resulting data can then be evaluated to estimate the hydraulic conductivity at each well.

3.6 Implementation Schedule

The above activities will be completed according to the following schedule:

- The free product characterization activities will be completed within 45 days after receiving permission to proceed from OCD. A report on these activities will be provided to OCD within 30 days after completing the field activities.

- The monitoring wells will be installed, developed and sampled at the same time the free product characterization wells are installed. The data from the sampling will be forwarded to OCD within five business days of receipt and validation. The well will then be added to the quarterly groundwater monitoring program.

- Quarterly groundwater monitoring will be completed in September and December 2003. Permeability testing will be completed in September 2003 for the existing wells and during the initial purging of the new wells.

- A Stage 1 Abatement Plan Report will be prepared within 120 days after receiving permission to proceed. The report will provide updated interpretations of the geologic and hydrogeologic setting and the distribution of free and dissolved phase hydrocarbons.

4 WATER WELL INVENTORY

The Water Administration Technical Engineering Resource System (W.A.T.E.R.S) database that is maintained by the New Mexico Office of the State Engineer will be queried for all water wells inside and within 1 mile of the perimeter of the study area. The resulting list will be attached to the Stage 1 Abatement Plan Report. The data will include:

- The well location;
- The well depth;
- The owner of record and their address (as available);
- The depth to water (if available);
- The formation tapped (if available); and
- Any water sampling information on file as part of the permit.

The potential for impacts on these wells from the releases on the site will be evaluated.

5 QUALITY ASSURANCE PLAN

The Sampling and Analysis Plan included as Appendix 1 is the quality assurance plan requested by OCD and is consistent with the sampling and analytical techniques listed in 20.6.3107.B NMAC for all work to be conducted be prepared and submitted as part of this document..

TABLES

Table 1 – Well Construction Information

Well	Installed By	Date Installed	Total Well Depth	Screen Interval	Sand Interval	Top of Bentonite Pellets
MW-1	AMEC	8/01	28.0	11.8-26.8	9.8-27	7.8
MW-1d	DEFS	1/03	45.0	35-45	33-45	3.0
MW-2	AMEC	8/01	28.0	11.7-26.7	8.7-27	6.7
MW-3	AMEC	8/01	30.0	13.4-28.4	10.4-29	8.4
MW-4	AMEC	8/01	30.0	13.2-28.2	10.2-29	11.2
MW-5	AMEC	8/01	27.0	10.2-25.2	7.2-26	5.2
MW-6	AMEC	8/01	30.0	13.5-28.5	10.5-29.0	8.5
MW-7	AMEC	8/01	35.0	18.6-33.6	15.6-34	13.6
MW-8	AMEC	3/02	30.0	15.0-30.0	12-30	10.0
MW-9	AMEC	3/02	27.0	11.4-26.4	8.4-27	6.4
MW-10	AMEC	3/02	31.0	15.2-30.2	12-31	10.0
MW-11	AMEC	3/02	30.4	15.3-30.3	12-30.4	10.0
MW-12	AMEC	3/02	34.0	18-33	15-34	13.0
MW-13	AMEC	3/02	36.0	18.11-33.11	16-36	14.0
MW-14	AMEC	3/02	32.0	16.11-31.11	14-32	12.0
MW-15	DEFS	9/02	35.5	20-35	18-35.5	3.0
MW-16	DEFS	9/02	25.0	9.5-24.5	9-24.5	3.0
MW-17	DEFS	9/02	25.0	9.5-24.5	9-24.5	3.0
MW-18	DEFS	9/02	32.0	16.5-31.5	15-32	3.0
MW-19	DEFS	9/02	30.0	7-27	6-30	3.0
MW-20	DEFS	9/02	32.0	16.5-31.5	15-32	3.0
MW-21	DEFS	9/02	35.0	19.5-34.5	18-35	3.0
MW-22	DEFS	9/02	36.0	17-32	15-36	2.0
MW-23	DEFS	9/02	30.0	14.5-29.5	11-30	3.0
MW-24	DEFS	1/03	34.0	19-34	17-14	3.0
MW-25	DEFS	2/03	37	17-37	15-37	3-15
MW-26	DEFS	2/03	35	15-35	13-35	3-13
MW-27	DEFS	2/03	37	17-37	15-37	3-15

All units in feet

Table 2 – Summary of Benzene Data for the Eldridge Study Area

Date	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7
8/10/2001	0.943	<.005	<.005	10.0	0.217	0.600	<.005
7/18/2002	0.279	<0.001	0.002	10.4	0.17	0.245	<0.001
2/26/2003	0.018	<0.001	<0.001	5.65	0.018	0.022	0.004
6/5/2003	0.004	0.006	<0.001	3.88	0.019/0.023	0.033	<0.001

	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-14
3/3/2002	NS	<.005	10.6	27.8	9.08	19.8	1.04
7/17/2002	8.60	<0.001	14.0	FPH	6.95	19.8	1.21
10/11/2002	8.37	NS	NS	NS	NS	NS	NS
2/26/2003	9.62	<0.001	12.4	FPH	15.1	23.2	0.895
6/5/2003	FPH	<0.001	9.78	FPH	11.9	26.3	0.537

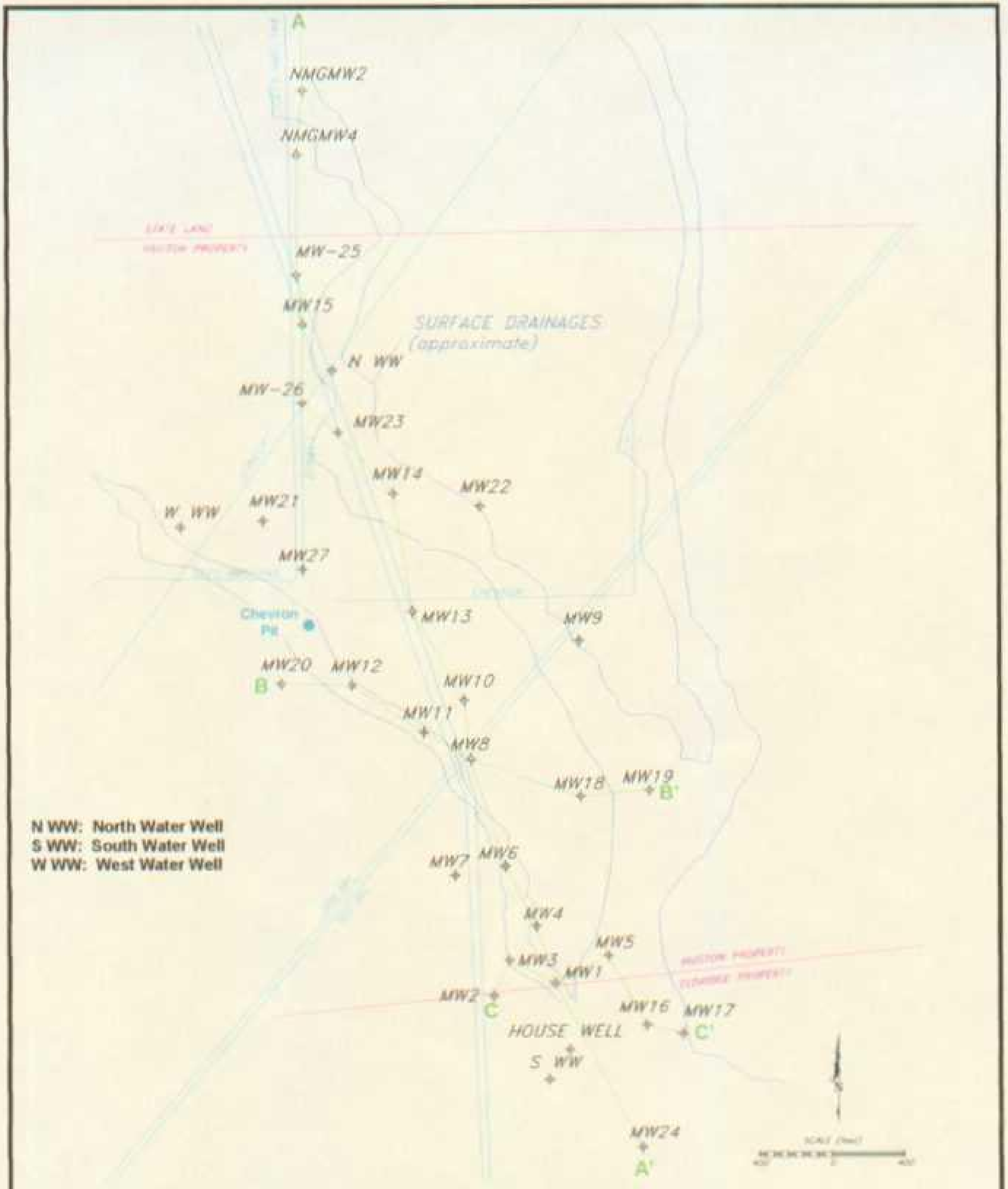
	MW-15	MW-16	MW-17	MW-18	MW-19	MW-20	MW-21
3/3/2002	NS	NS	NS	NS	NS	NS	NS
7/17/2002	NS	NS	NS	NS	NS	NS	NS
10/11/2002	0.002	<0.001	<0.001	0.008	0.003	<0.001	0.011
2/26/2003	0.003	<0.001	<0.001	FPH	0.198	0.001	0.016
6/5/2003	0.001	<0.001	<0.001	FPH	0.092	0.006	0.016/0.017

	MW-22	MW-23	MW-24	N WW	S WW	W WW	MW-1D
3/3/2002	NS	NS	NS	NS	NS	NS	NS
7/17/2002	NS	NS	NS	NS	NS	NS	NS
10/11/2002	<0.001	FPH	<0.001	0.385	<0.001	NS	NS
12/1/2002	NS	NS	<0.001	NS	NS	NS	<0.001
2/26/2003	<0.001	FPH	<0.001	0.383	0.036	<0.001	0.028
6/5/2003	0.002	<0.001	0.004	0.333	<0.001	0.001	<0.001

	House Well	Irrigation Well
3/3/2002	NS	NS
7/17/2002	NS	NS
10/11/2002	0.59	NS
10/23/2002	NS	1.45/1.26
12/1/2002	NS	NS
2/26/2003	0.403	NS
6/5/2003	NS	NS

Notes: 1) All units are mg/l
2) Cells with NS denote no sample collected, cells with FPH denote free product hydrocarbon.
3) N WW: North Water Well, W WW: West Water Well, S WW: South Water Well

FIGURES



Notes
1) Wells NMGMW2 and NMGMW4 are included to show the cross section alignment.
2) Well NMGMW3 is located approximately 769 feet north of NMGMW2.

Figure 1 – Monitor Well and Cross Section Locations
Eldridge Study Area

Duke Energy Field Services

DRAWN BY: MHS
REVISED:
DATE: 7/03

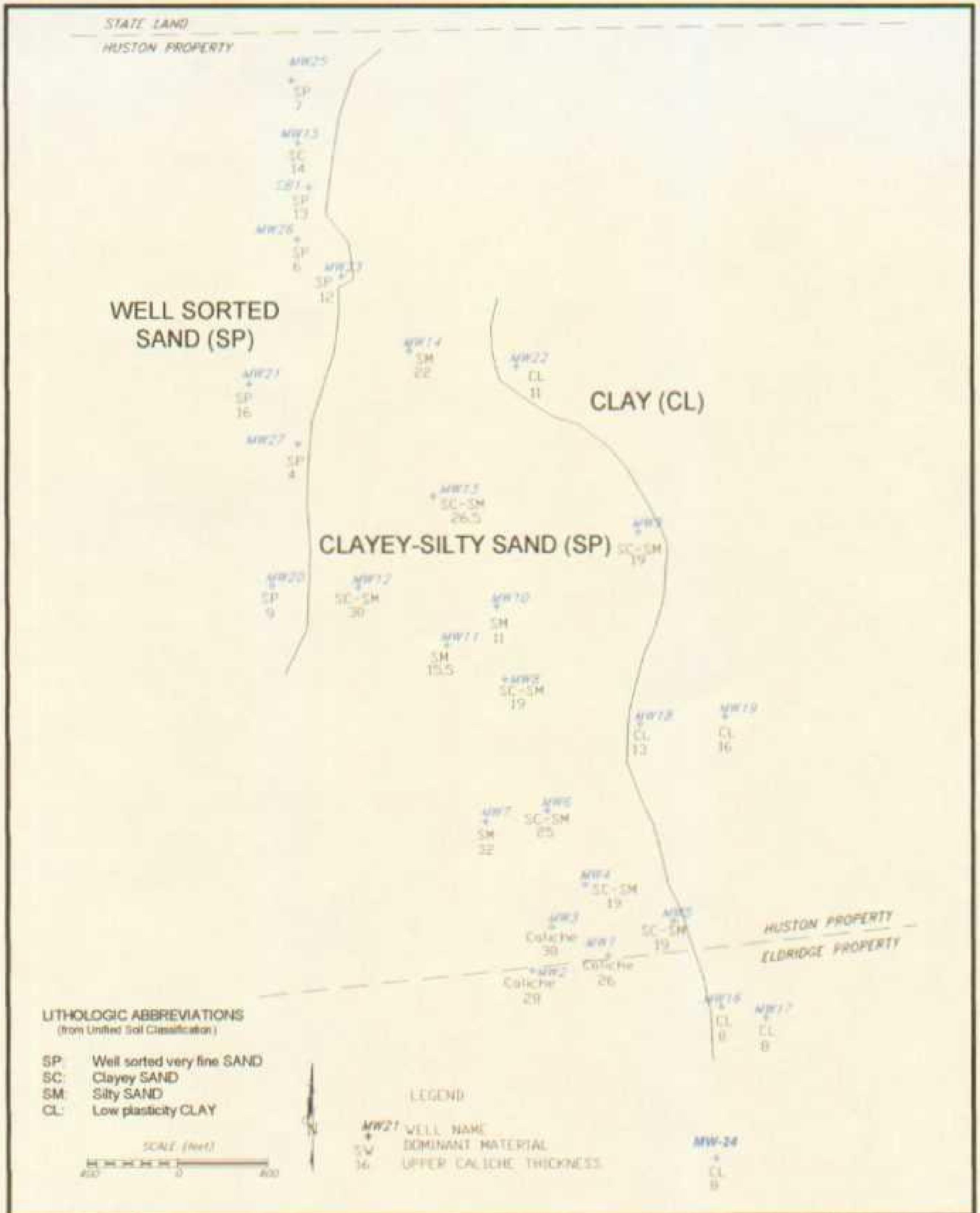
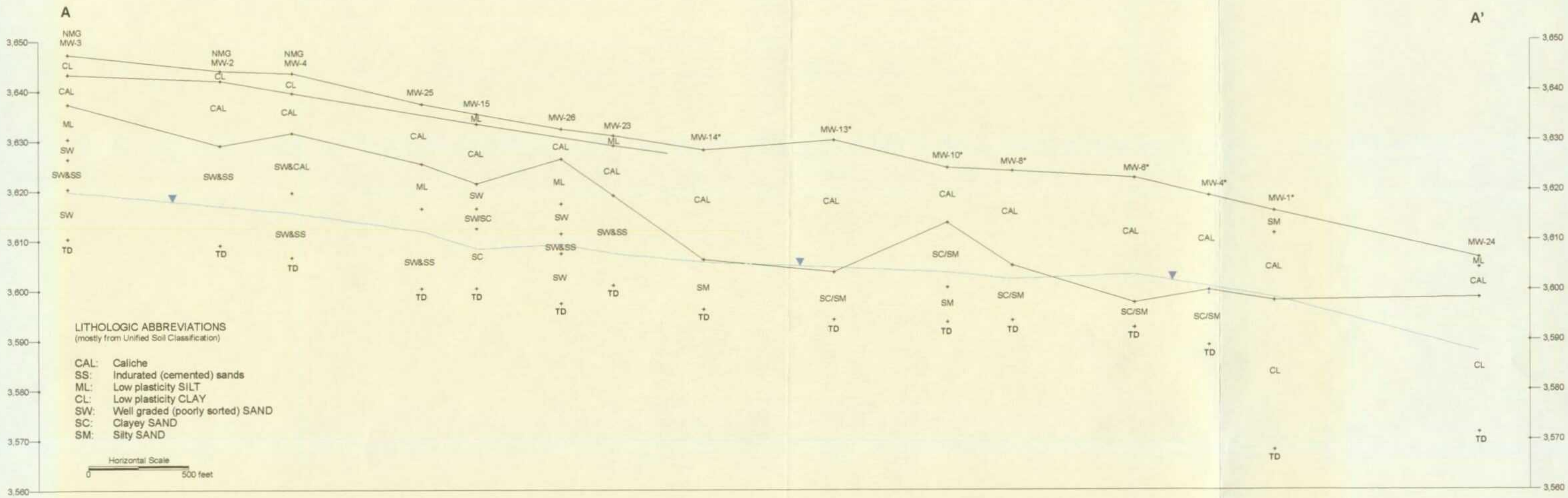


Figure 2 – Subsurface Material Distribution

Eldridge Study Area

Duke Energy Field Services

DRAWN BY: MHS	
REVISED:	
DATE: 7/03	



Notes: 1) Horizontal to vertical exaggeration is 25:1
2) Well names with asterisk (*) have lithology compiled by AMEC, all other wells compiled by Trident.
3) **TD**: Total depth of well

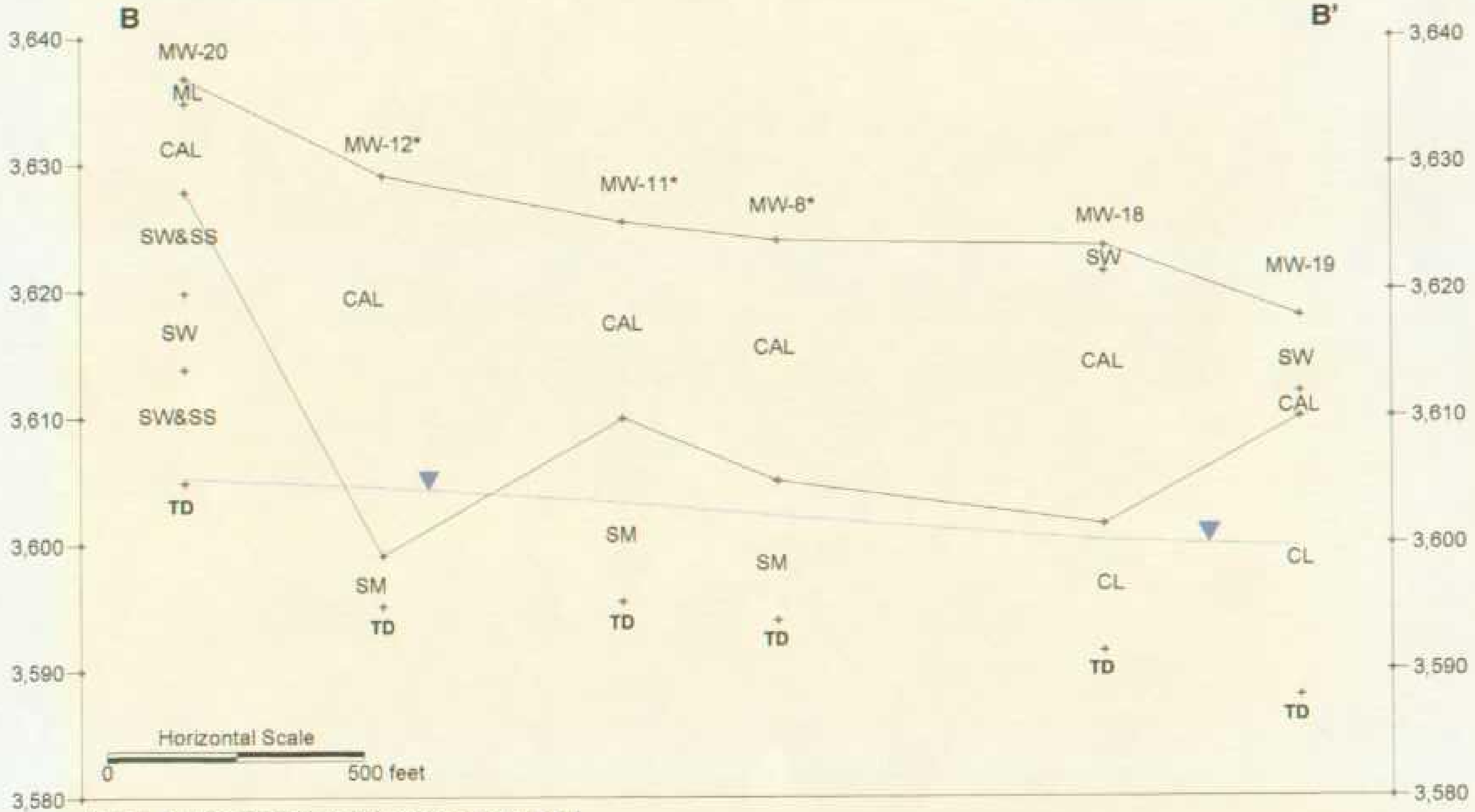
Figure 3 - Cross Section A-A'

Eldridge Ranch Study Area

Duke Energy Field Services

DRAWN BY: MHS

DATE: 7/03



Notes: 1) Horizontal to vertical exaggeration is 25:1
2) Well names with asterisk (*) have lithology compiled by AMEC, all other wells compiled by Trident.
3) **TD**: Total depth of well

LITHOLOGIC ABBREVIATIONS
(mostly from Unified Soil Classification)

CAL: Caliche
SS: Indurated (cemented) sands
ML: Low plasticity SILT
CL: Low plasticity CLAY
SW: Well graded (poorly sorted) SAND
SC: Clayey SAND
SM: Silty SAND

Figure 4 – Cross Section B-B'

Eldridge Study Area

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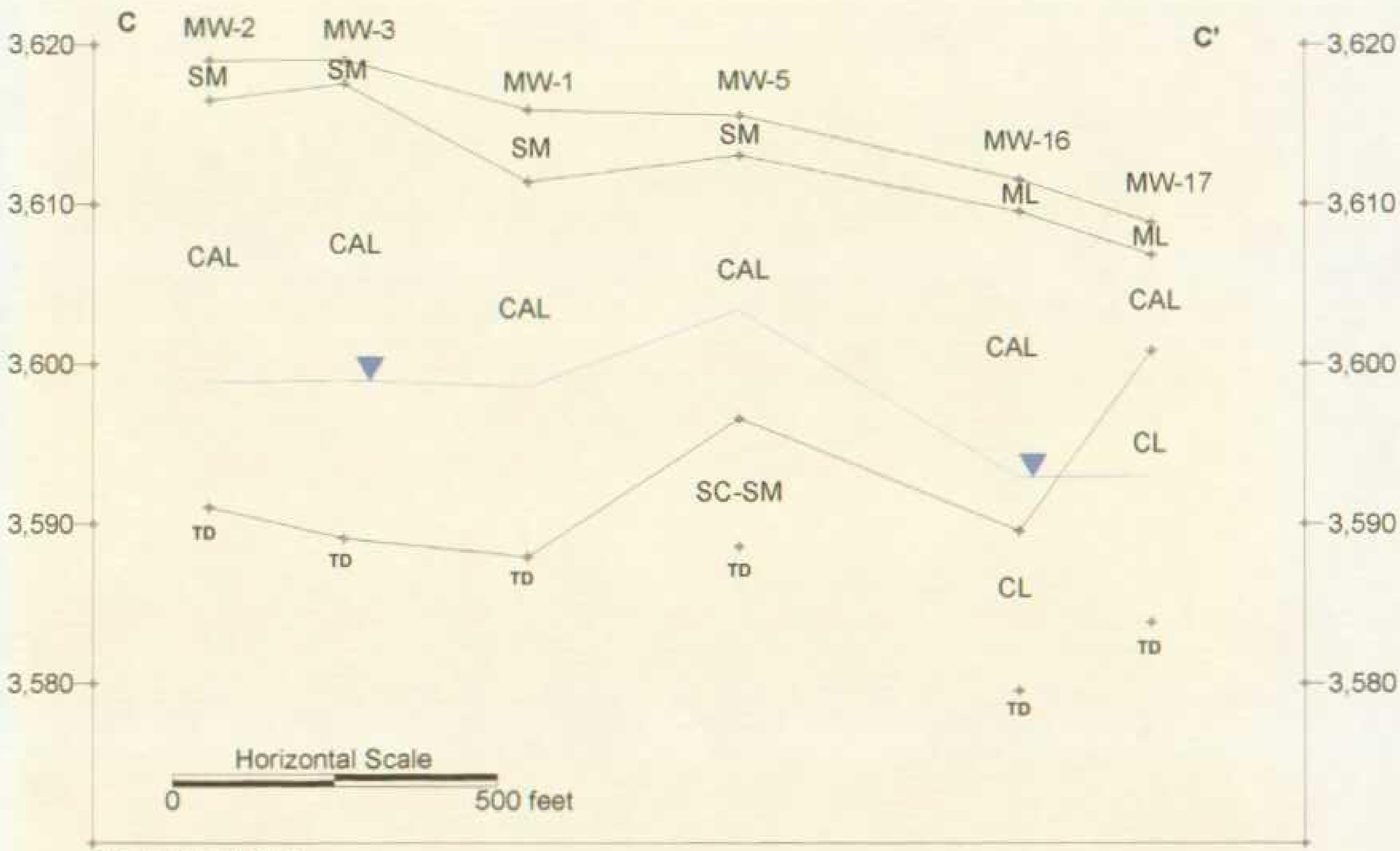

TD: Total depth of well

LITHOLOGIC ABBREVIATIONS
(mostly from Unified Soil Classification)

CAL: Caliche
SS: Indurated (cemented) sands
ML: Low plasticity SILT
CL: Low plasticity CLAY
SW: Well graded (poorly sorted) SAND
SC: Clayey SAND
SM: Silty SAND

Figure 5 – Cross Section C-C'

Eldridge Study Area

Duke Energy Field Services

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DATE: 7/03

Figure 6 – Wells with Free Product and June 2003 Benzene Isopleths
Eldridge Study Area

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REVISED:	
DATE: 7/03	

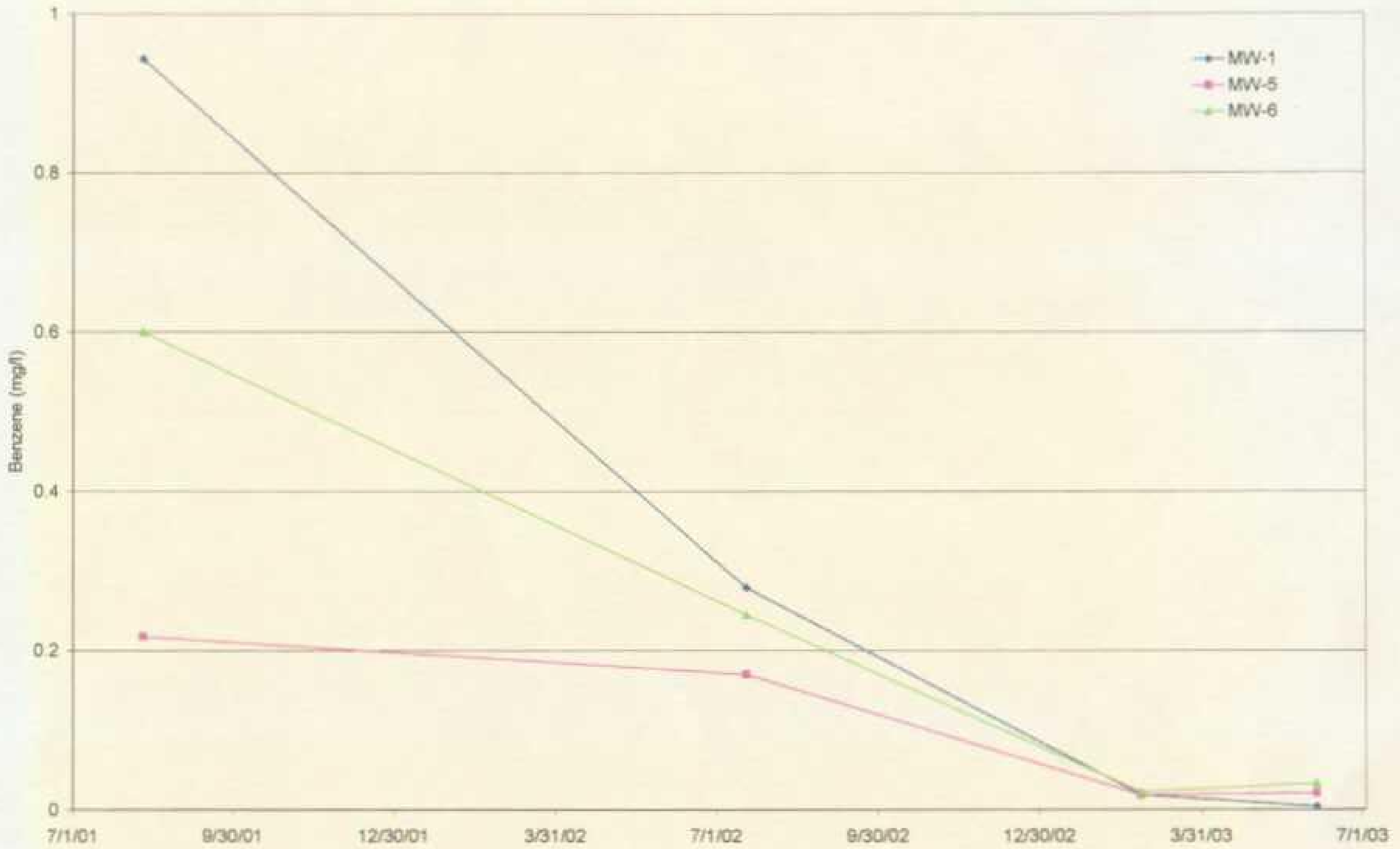

Figure 7 – Benzene Concentrations in Select Wells in the Eldridge Study Area

Eldridge Study Area

Duke Energy Field Services.

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DATE: 7/03

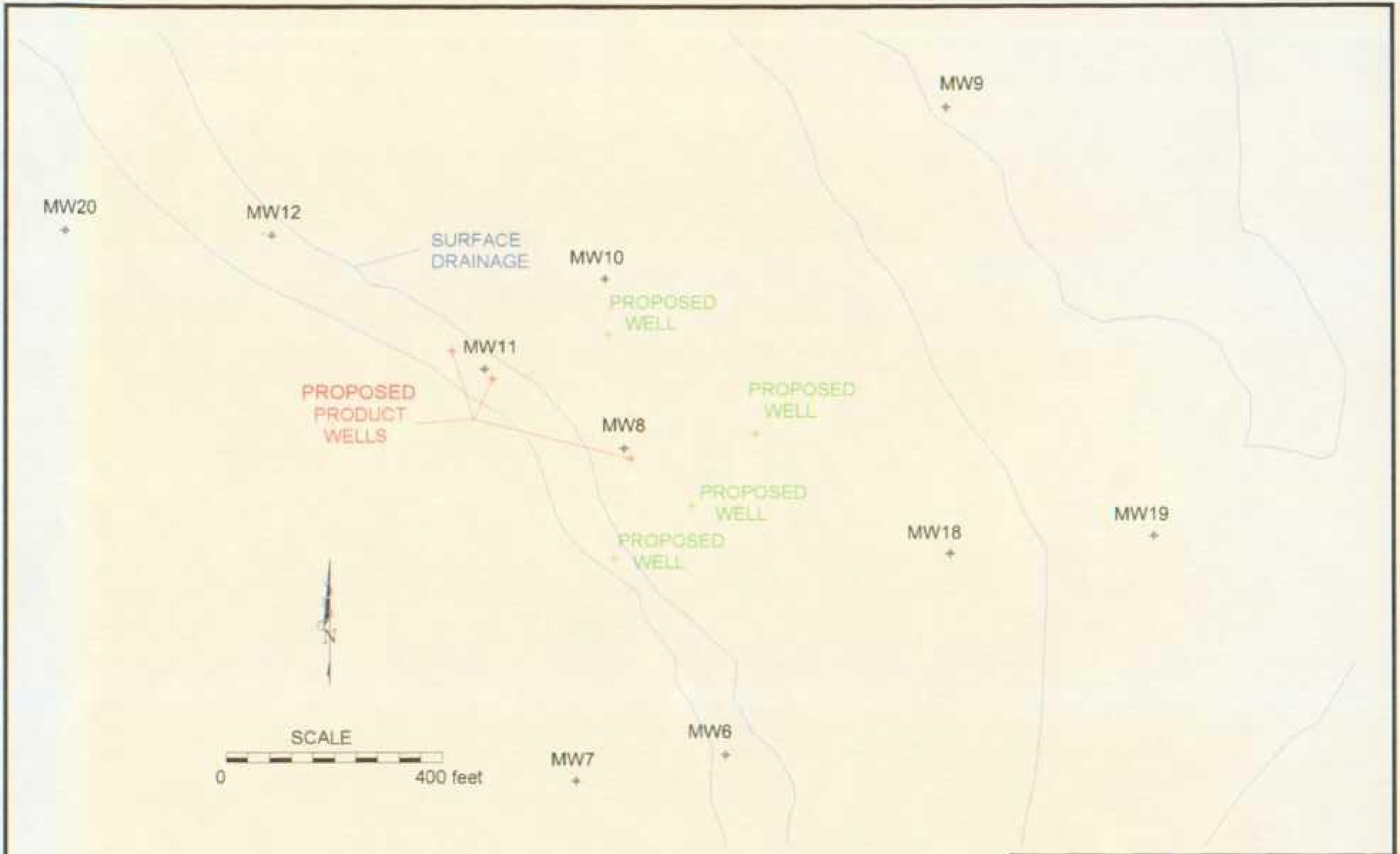

Figure 8 – Proposed Initial Well Locations for the MW-8, MW-10, MW-11 Area

Eldridge Study Area

Duke Energy Field Services

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DATE: 7/03

Figure 9 – Proposed Initial Well Locations for the MW-18, MW-19 Area

Eldridge Study Area

Duke Energy Field Services.

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DATE: 7/03

APPENDIX 1

SAMPLING AND ANALYSIS PLAN FOR THE ELDRIDGE STUDY AREA

SAMPLING AND ANALYSIS PLAN
FOR THE ELDRIDGE RANCH STUDY AREA
LEA COUNTY, NEW MEXICO

(Case #1R334)

Prepared For

Duke Energy Field Services, LP
370 17th Street, Suite 900
Denver, CO 80202

Prepared By

Remediacon Incorporated
PO Box 302
Evergreen, Colorado 80437
(303)674-4370

July 18, 2003

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Table 1 – Well Construction Information, Eldridge Study Area

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Figure 1 – Site Location Map
Figure 2 – Monitoring Well Locations

1 INTRODUCTION

This Sampling and Analysis Plan (SAP) presents the well installation, soil and groundwater sampling procedures and quality assurance protocols that will apply to the Eldridge Study Area in Lea County New Mexico. This plan was prepared to fulfill the requirements for a quality assurance plan listed in 20.6.2.3107.B NMAC as required by the New Mexico Oil Conservation Division (OCD) in their June 19, 2003 letter to Duke Energy Field Services, LP (DEFS).

The purpose of this SAP is to provide adequate background information and protocols to ensure the consistent collection of representative data. The SAP includes specific protocols for several standard field tasks such as well installation, soil boring sampling, depth to water measurements, well purging, sample collection, sample labeling and shipping.

1.1 Background Information

The study is located in Section 21, Township 19 South, Range 37 East approximately 1 mile north of and 0.75 miles east of the town of Monument in Lea County New Mexico (Figure 1). The approximate coordinates are 32 degrees 38.5 minutes north, 103 degrees 15.4 minutes east.

The current monitoring program includes 31 wells. Twenty eight of the wells were installed specifically to characterize the Eldridge Study Area. Three wells, the North Water Well, the South Water Well and the West Water Well, existed before the characterization program. Figure 1 shows their locations within the study area. Construction information for these wells is summarized in Table 1. Anticipated site activities include installation, development and sampling of new monitoring wells, soil sampling during monitoring well installation, and routine groundwater monitoring. Other activities may be conducted that are not included in this SAP. Protocols for those activities will be included in the relevant documents.

The following sections are included in this document:

- Section 2 provides the monitoring well installation protocols;
- Section 3 presents the groundwater monitoring protocols; and
- Section 4 includes all protocols related to quality assurance.

2 MONITORING WELL INSTALLATION PROTOCOLS

This section includes the protocols to install, develop and sample new monitoring wells. The protocols contained in this section were used to install wells MW-15 through MW-27 in the Eldridge study area. The protocols include boring advancement and sampling, monitoring well installation and new monitoring well development and purging.

2.1 Boring Advancement And Sampling

Each new boring will be advanced using either auger or air rotary drilling. Water and drilling additives will not be used without the consent of the field supervisor. Drilling may include either continuous or discrete sampling. The drilling company will provide the equipment necessary to complete the sampling. The drill will be clean prior to entering the site. All equipment will remain on the established roads or DEFS right-of-way whenever possible.

All drilling and installation procedures will be supervised by the field supervisor. The supervisor shall be an experienced geologist or engineer with appropriate experience in supervising well installation and compilation of boring logs.

Unless otherwise specified, each boring will be drilled to a depth approximately 10 feet below the first evidence of saturated materials or to a maximum depth of 35 feet if no saturated materials are encountered. Cuttings will be drummed or placed on plastic pending appropriate analysis. Unaffected cuttings can be thin spread over the drilling area. Affected cuttings should be disposed of based upon the results from the down-hole soil samples. Affected cuttings can be thin spread after receiving approval from the OCD.

Unless otherwise specified, samples will be collected on a regular basis (maximum separation of 5 feet) and screened for the presence of volatiles using a photoionization detector (PID). Samples will be placed in a sealed plastic bag and allow to stabilized for a minimum of 30 minutes prior to measurement. Care should be taken to keep the bags out of direct sunlight or a heat source (such as a car heater) to minimize the generation of water vapor.

The following procedure will be used if soil samples will be collected during the boring advancement.

1. The field supervisor will split each sample into two portions and place them in labeled bags.

2. The first bag will be used for measurement with a PID as described above.

3. The second bag will be placed in an ice-filled cooler for storage until boring advancement is completed.

4. After all of the samples have been measured, the appropriate sample(s) will be placed in a labeled laboratory sample jar. The unused samples can be placed with the rest of the drill cuttings.

Lithologic logs will be compiled for each boring based upon the cuttings and/or samples produced. The logs will include the following information:

- The boring/monitor well descriptor;
- The date the boring was installed;
- The soil sampling intervals;
- The resulting PID measurement;
- The locations of the samples submitted for laboratory analyses;
- The lithologic intervals;
- A description of each lithologic interval that includes:
    - The material type (with a unified soil classification descriptor)
    - The moisture content
    - The relative presence of hyrocarbons
- The depth where saturation was first noted;
- The total depth of the boring;
- A note on the intervals where slotted casing and granular materials were placed; and
- The field supervisor's name

All equipment will be decontaminated between each well using a steam cleaner or a hot power wash. Decontamination will be completed at each drill site following physical removal of as many cuttings as possible.

2.2 Monitoring Well Installation

Unless otherwise specified, 15 feet of 2-inch, threaded, factory-slotted Schedule 40 PVC will be placed in the well (20 feet if no saturated materials are encountered). The annular space will then be backfilled with artificially-graded sand to a minimum depth of 2 feet above the top of the slotted PVC interval. The remaining annular space will then be backfilled with hydrated bentonite.

The surface completion for each well will included an aboveground well protector and a minimum 2 foot by 2 foot concrete pad. Well completion forms will be prepared for each well in included in the report.

2.3 New Monitoring Well Development And Purging

Each new well will be allowed to sit a minimum of 10 hours (overnight) before it is developed and sampled. Each new well will be developed using either a disposable bailer or a submersible pump. Well development will be completed when a minimum of 10 casing volumes of water is removed and the field parameters of temperature, pH and conductivity for the last three casing volumes are stable.

In the event the well cannot be continuously purged, it will be bailed dry a minimum of three times. The well will be allowed to recover a minimum of 75 percent prior to removing the next casing volume. Wells that recover at an extremely slow rate (less than 75 percent recovery in over 3 hours) will be developed on a case-by-case basis at the discretion of the field supervisor with the exact development scheme noted on the boring log.

Each new well will be sampled following development using a disposable bailer. Sampling will be completed (including purging) according to the protocols provided in Section 3 below. Any well that produces measurable free product either after construction or development will not be developed and sampled. Instead, a sample of the product will be collected if sufficient volume is available. The product sample will be submitted to an analytical laboratory for PIANO analysis.

3 GROUNDWATER MONITORING

This section provides the protocols that will be used in the SAP monitoring program. The protocols provided include depth to water measurements, monitor well purging and sampling, and sample labeling and packaging requirements.

Analytical suites will vary based upon specific task requirements. Analytical suites and methods will be provided in each work plan. Analytical methods must conform to the references 20.6.2.3107 B NMAC. Any analytical method that does not conform must be approved by OCD prior to its use.

3.1 Depth to Fluid Measurements

The depth to fluids (water and product if present) will be measured in all monitoring wells prior to beginning the well purging activities. Fluid levels will be obtained using an dual phase interface probe. The probe will be decontaminated between each well using a soap wash followed by a rinse with distilled water.

Water levels will be measured on north edge of the casing stick-up or to the historic measurement point if not on the north side of the casing. The well number and the depth to water and product (if present) will be recorded in a bound field notebook. The data can then be subsequently transferred to individual data sheets as necessary.

3.2 Monitor Well Purging and Sampling

Prior to sampling, monitoring wells will be purged to promote collection of representative groundwater samples. Some wells may produce so little water that bailing them dry is the only way to develop them. Wells with measurable product will not be developed and sampled unless otherwise specified.

The equipment anticipated to be necessary to conduct well stabilization and groundwater sampling activities includes the following:

- A meter capable of measuring temperature, pH and conductivity;
- Instrument manual(s) for each instrument;
- Conductivity and pH standard solutions for instrument calibration;
- Spare batteries, pH probes and other spare parts;
- A separate thermometer for backup and to check temperature probes;
- Disposable plastic cups for sample collection and measurement;
- Containers for purge water;
- Submersible pump for development; and
- Disposable bailers for sampling.

Purging of the monitoring wells will be completed using either a submersible pump or a or disposable bailer. New nylon or polypropylene rope will be used with the bailer for each well. A bailer will be slowly lowered into the water column to avoid agitation of the well water and possible loss of volatile constituents and/or entrainment of sediment.

A minimum of three casing volumes of water will be removed prior to sampling. The casing volume will be calculated by first calculating the height of the water column in the well using the measured depth to water and the total well depth listed in Table 1. The total gallons of water per well casing can then be calculated by multiplying the water column height by, 0.67 for 4-inch wells, and by 0.163 for 2-inch wells.

The field measurement of temperature, pH and conductivity will commence after the removal of a minimum one casing volume. The measurements will be made using a instrument that is calibrated for pH on a daily basis. The field parameters will then be measured after purging the second and third casing volumes and at a minimum interval of ½ casing volume thereafter. Bailing will continue until the field parameters have stabilized in accordance with the following criteria:

- Temperature +/- 10 percent for three successive measurements;
- pH +/- 0.2 standard units for three successive measurements; and
- Conductivity +/- 10 percent for three successive measurements.

Wells that bail down but recover rapidly will be bailed down a minimum of three times and allowed to recover a minimum of 75 percent prior to the removal of the next casing volume. Field parameters will be collected and measured just prior to the completion of bailing.

In the case of very low-yield wells, the well will be purged once to dryness. A sample will be collected after the well recovers (overnight if necessary). The exact sampling protocol should be documented in the field notebook and transferred to the sampling sheets.

Samples will be collected and containerized in the order of volatilization sensitivity (e.g. volatiles, then semivolatiles, then metals then inorganics). Samples will be collected using a disposable bailer.

The following information will be recorded in the field logbooks and/or field for each groundwater sample:

- Well number;
- The time the well was sampled;
- Well sampling equipment used; and
- Total amount of water removed from the well during well sampling activities.

In addition to this general information, the following information will also be recorded for each water sample obtained for field parameter evaluation:

- Time of collection of water samples;
- Volume of water removed prior to the collection of the samples;
- Number of casing volumes removed prior to collection of the samples;
- Description of samples (i.e. turbidity, color, odor, foreign matter, etc.); and
- Field parameter results including temperature, conductivity, and pH.

In addition to the specific well development information, general information including weather conditions, field personnel and other personnel onsite, etc. will also be recorded in the field notebook. A chain-of-custody form will be prepared for all of the samples in accordance with Section 3.3.3 below.

3.3 Sample Labeling and Packaging

This section describes the procedures that will be followed to ensure that the samples are properly labeled, packaged for shipment and transmitted using chain of custody procedures. Each activity is described separately below.

3.3.1 Sample Labeling

A sample label will be affixed to all sample containers sent to the laboratory. This label will be completed with the following information written in indelible ink:

- Project name and location
- Sample location
- Sample identification number
- Date and time of sample collection
- Preservative used
- Sample collector's name and initials
- Filtering (if applicable)
- Type of sample (grab or composite)
- Analysis required

If a sample is split with another party, sample labels with identical information will be attached to each sample container.

3.3.2 Sample Packaging

After labeling, each sample will placed in a cooler containing ice to maintain the sample temperature at 4^{0} C or below. All BTEX samples will be placed in a cooler that contains the trip blank. Packaging materials such as "bubble wrap" will be placed as necessary to minimize the potential for breakage.

Sample coolers will either remain with the field personnel or will be stored in a secure location until they are shipped. The ice in the cooler should be checked on a regular basis to ensure that the samples remain cool.

3.3.3 Chain of Custody Procedures

Sample custody procedures will be used to maintain and document sample integrity during collection, transportation, storage, and analysis. A sample is considered to be in custody if one of the following statements apply:

- It is in a person's physical possession or view; or
- It is in a secure area with restricted access; or
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

Samples and their corresponding documents will be maintained in the custody of authorized personnel from the time they are collected until they are delivered to either the courier for shipping or directly to the analytical laboratory. Field team members will be responsible for proper sample handling and documentation procedures that will allow the possession and handling of individual samples to be traced from the time of their collection to laboratory receipt.

Chain-of-custody record procedures provide an accurate written record that traces the possession of individual samples from the time of their collection in the field to the time of acceptance at the laboratory. The chain-of-custody record will also be used as a record of the samples collected and the analysis requested. Laboratory-specific chain-of-custody records may be used during the site investigation. Information that the field personnel will record on the chain-of-custody record include the:

- Project name and number;
- Sampling location;
- Name and signature of sampler(s);
- Destination of samples (laboratory name);
- Sample identification number;
- Date and time of collection;
- Number and type of containers filled;
- Analysis requested;
- Sample turnaround time;
- Sample matrix;
- Preservatives used;
- Filtering (if applicable);
- Designated MS/MSD samples; and
- Signatures of individuals involved in custody transfer (including date and time of transfer).

Chain-of-custody records initiated in the field will be signed by the field personnel. One chain-of custody record will be completed for each sample shipment. Additional pages may be used when the number of samples collected exceeds the number of lines available on the initial chain-of-custody record.

The completed form will be inserted into a plastic bag and taped to the inside of the cooler used for sample transport if the samples are to be shipped via courier. Signed airbill receipts will serve as evidence of custody transfer between field personnel and the courier and between the courier and the laboratory. Copies of the chain-of-custody record and the airbill will be retained and filed by field personnel prior to shipment.

Custody seals will be used when the coolers are to be shipped by courier to ensure that no tampering occurs. Custody seals will not be necessary if the samples are being transported by the field personnel directly from the location to the analytical laboratory. The seals will be signed and dated prior to placing them on the coolers. The tape will be placed such that the seal must be broken to gain access to the contents of the shipping container.

4 Quality Assurance Procedures

The principal objective of any sampling and analysis program is to obtain accurate and representative environmental samples and to provide valid analytical data. The quality of data will be assessed through the use of Quality Control (QC) sampling performed on a regularly scheduled basis. Laboratory QC samples will also be analyzed, as per analytical method protocols, to evaluate whether laboratory procedures and analysis have been completed properly. For this project, the types of QC samples collected and analyzed are defined and their role in the production of QC data discussed in the following sections.

4.1 Field Quality Control Samples

QC samples are collected in the field and used to evaluate the validity of the field sampling effort. Field QC samples are collected for laboratory analysis to check sampling and analytical precision, accuracy, and representativeness. The following sections discuss the types and purposes of field QC samples that will be collected for this project. Matrix spike (MS) and matrix spike duplicate (MSD) samples are also included in the following discussion because they are collected in the field, even though they are actually laboratory QC samples.

4.1.1 Field Duplicates

Field duplicate samples are two samples collected at the same time and from the same source that are submitted as separate samples to one laboratory for analysis. Field duplicates evaluate the consistency (for precision) of the overall sampling and analytical system.

Field duplicates will be collected at a frequency of one sample per monitoring event. Field duplicates are analyzed for the same parameters as the field samples collected during the event. Field duplicates will be sampled from randomly-selected locations. Field duplicate samples will be collected, numbered, packaged, and sealed in the same manner as other samples; they will be submitted blind to the laboratory.

Field duplicate results are used to evaluate the precision of the analysis by calculating the RPD. Field duplicate limits for precision are arbitrarily set, using best professional judgment, at 25 percent for water matrices.

4.1.2 Split Samples

Split samples are used to evaluate interlaboratory analytical precision and accuracy. Split samples are collected and analyzed like field duplicates, except that they are sent to a laboratory other than the primary laboratory used for field analysis.

Split samples will not be collected for each monitoring episode. They may be selectively collected and analyzed if QC problems are suspected.

4.1.3 Matrix Spike and Matrix Spike Duplicates

The suitability of an analytical method for a particular environmental sample matrix is evaluated by analyzing two identically spiked samples, an MS and an MSD sample. An MS is the analysis of a known concentration of target analytes added to an aliquot of the field sample. To minimize errors, the field samples will not be spiked in the field; instead, the sample will be spiked when it is prepared for analysis at the laboratory. MSs and MSDs measure the efficiency of all of the steps of the analytical method in recovering target analytes from an environmental sample matrix. The percent recoveries will be calculated for each of the spiked analytes and used to evaluate analytical accuracy. The RPD between spiked samples will be calculated to evaluate precision. For inorganic analysis, a matrix duplicate is analyzed in place of a MSD; precision is based on this duplicate and the original analysis.

One MS/MSD sample will be collected for BTEX evaluation per monitoring event. An additional sample BTEX volume will be collected for MS/MSD for water samples.

4.2 Field Blanks

During the collection of field samples, and when the laboratory tests the samples, contamination can be introduced from many external sources. In an attempt to discern these potential sources of contamination, several types of field blanks may be collected and analyzed including source water blanks, trip blanks, and equipment rinsate blanks. The applicability of each of these blanks and their effect on the analytical data are discussed in the following sections.

All blank sample results should remain below the method detection limit for each analyte of interest. If any contaminant (except common laboratory contaminants) is present in any of the blank samples, associated field samples containing the same contaminant must be qualified as not detected if the concentration in the field sample is less than five times the concentration found in the blank. The same criterion of qualification applies to the presence of the following common laboratory contaminants when they are present in the associated field sample at less than 10 times the concentration found in the blank sample: methylene chloride, acetone, 2-butanone, and phthalate esters.

4.2.1 Trip Blanks

The purpose of a trip blank is to demonstrate that contamination is not originating from sample containers and that field samples are not contaminated during transit. A trip blank originates at the laboratory as a 40-milliliter vial (typically used for VOC analysis) that is filled completely with reagent grade (that is, organic-free) water. The trip blanks are then transported to the site with the empty sample containers used for sample collection. The trip blanks are stored at the site until the proposed field samples have been collected. One trip blank will accompany each sample transport container containing field water samples for BTEX analysis back to the laboratory for analysis. The trip blank is not opened until it is returned to the laboratory at the time of analysis. The trip blanks are analyzed only for BTEX because these constituents have the greatest potential for cross-contamination.

4.2.2 Source Water Blanks

Source water blanks consist of the water used in detergent wash and steam cleaning decontamination activities. A domestic water source will be used for decontamination and well construction during this project. This water may be obtained at taps or fire hydrants. Source water blanks will be collected if the quality of the water is suspect or if chemical composition of the water must be assessed.

4.2.3 Equipment Rinsates

The equipment rinsate demonstrates whether the cleaning and decontamination procedure is effective in removing contaminants that may remain after collecting field samples. An equipment rinsate is a sample collected after a sample collection device is subjected to standard decontamination procedures. Contamination in the equipment rinsate indicates that the cleaning procedure is ineffective so cross-contamination can occur.

Equipment rinsates will be collected on an as-needed basis if contamination is suspected. Equipment rinsates will not be collected when dedicated or disposable equipment is used. An equipment rinsate will also not be required for the electric tape used for water level measurements provided that it is cleaned between each measurement and is not used to sound the wells.

Appropriate water for the intended analysis will be poured over or through the sample collection device, collected in a sample container, and sent blind to the laboratory for analysis. For organic parameters, analytically certified, organic-free, high performance liquid chromatography (HPLC)-grade water or equivalent will be used. For inorganic parameters, metal-free (that is, deionized or distilled) water will be used; it will be obtained from the laboratory conducting the analysis.

TABLES

Table 1 – Well Construction Information, Eldridge Study Area

Well	Installed By	Date Installed	Total Well Depth	Screen Interval	Sand Interval	Top of Bentonite Pellets
MW-1	AMEC	8/01	28.0	11.8-26.8	9.8-27	7.8
MW-1d	DEFS	1/03	45.0	35-45	33-45	3.0
MW-2	AMEC	8/01	28.0	11.7-26.7	8.7-27	6.7
MW-3	AMEC	8/01	30.0	13.4-28.4	10.4-29	8.4
MW-4	AMEC	8/01	30.0	13.2-28.2	10.2-29	11.2
MW-5	AMEC	8/01	27.0	10.2-25.2	7.2-26	5.2
MW-6	AMEC	8/01	30.0	13.5-28.5	10.5-29.0	8.5
MW-7	AMEC	8/01	35.0	18.6-33.6	15.6-34	13.6
MW-8	AMEC	3/02	30.0	15.0-30.0	12-30	10.0
MW-9	AMEC	3/02	27.0	11.4-26.4	8.4-27	6.4
MW-10	AMEC	3/02	31.0	15.2-30.2	12-31	10.0
MW-11	AMEC	3/02	30.4	15.3-30.3	12-30.4	10.0
MW-12	AMEC	3/02	34.0	18-33	15-34	13.0
MW-13	AMEC	3/02	36.0	18.11-33.11	16-36	14.0
MW-14	AMEC	3/02	32.0	16.11-31.11	14-32	12.0
MW-15	DEFS	9/02	35.5	20-35	18-35.5	3.0
MW-16	DEFS	9/02	25.0	9.5-24.5	9-24.5	3.0
MW-17	DEFS	9/02	25.0	9.5-24.5	9-24.5	3.0
MW-18	DEFS	9/02	32.0	16.5-31.5	15-32	3.0
MW-19	DEFS	9/02	30.0	7-27	6-30	3.0
MW-20	DEFS	9/02	32.0	16.5-31.5	15-32	3.0
MW-21	DEFS	9/02	35.0	19.5-34.5	18-35	3.0
MW-22	DEFS	9/02	36.0	17-32	15-36	2.0
MW-23	DEFS	9/02	30.0	14.5-29.5	11-30	3.0
MW-24	DEFS	1/03	34.0	19-34	17-14	3.0
MW-25	DEFS	2/03	37	17-37	15-37	3-15
MW-26	DEFS	2/03	35	15-35	13-35	3-13
MW-27	DEFS	2/03	37	17-37	15-37	3-15

All units in feet

FIGURES

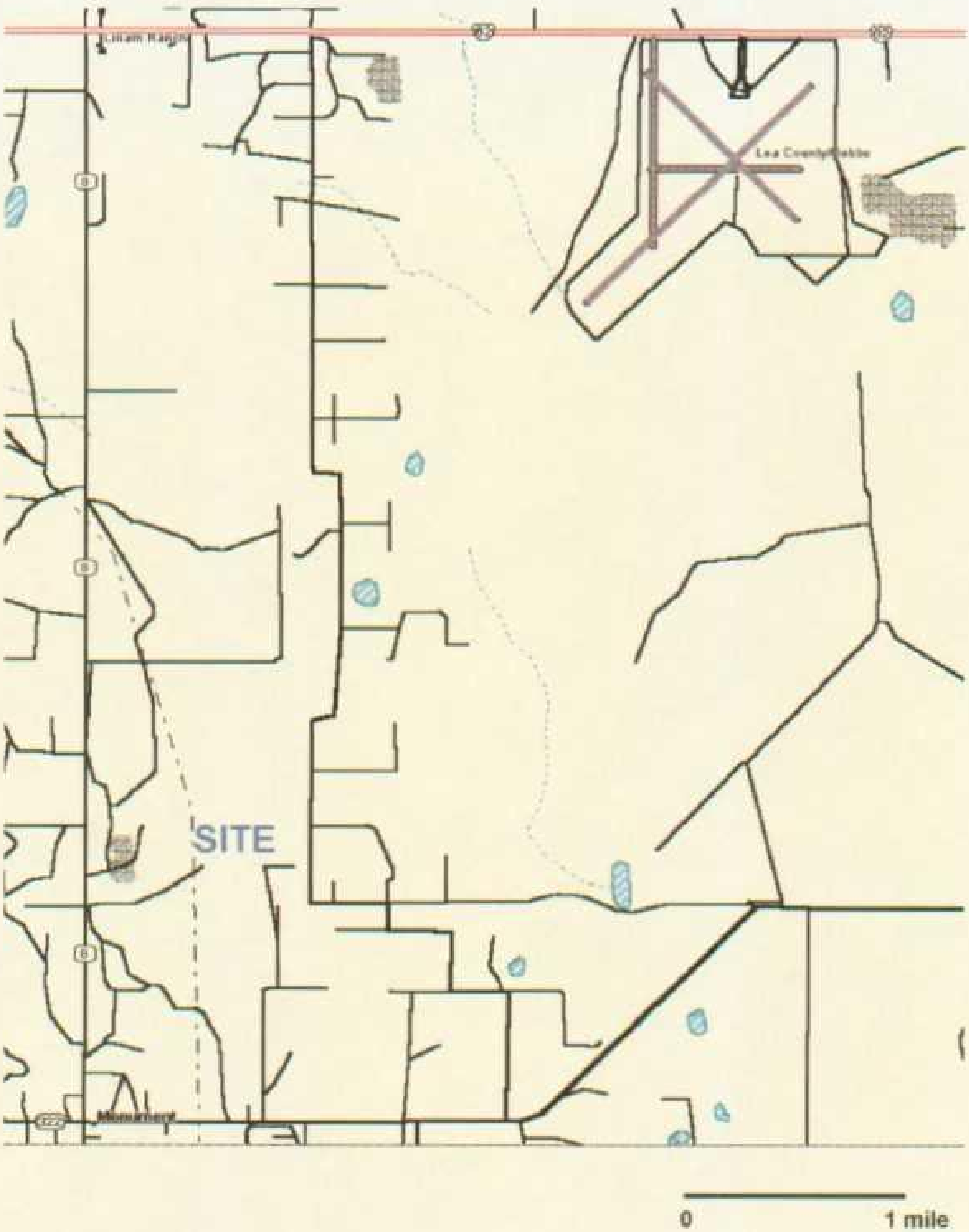

Figure 1 – Site Location Map
Eldridge Study Area

Duke Energy Field Services

DRAWN BY: MHS
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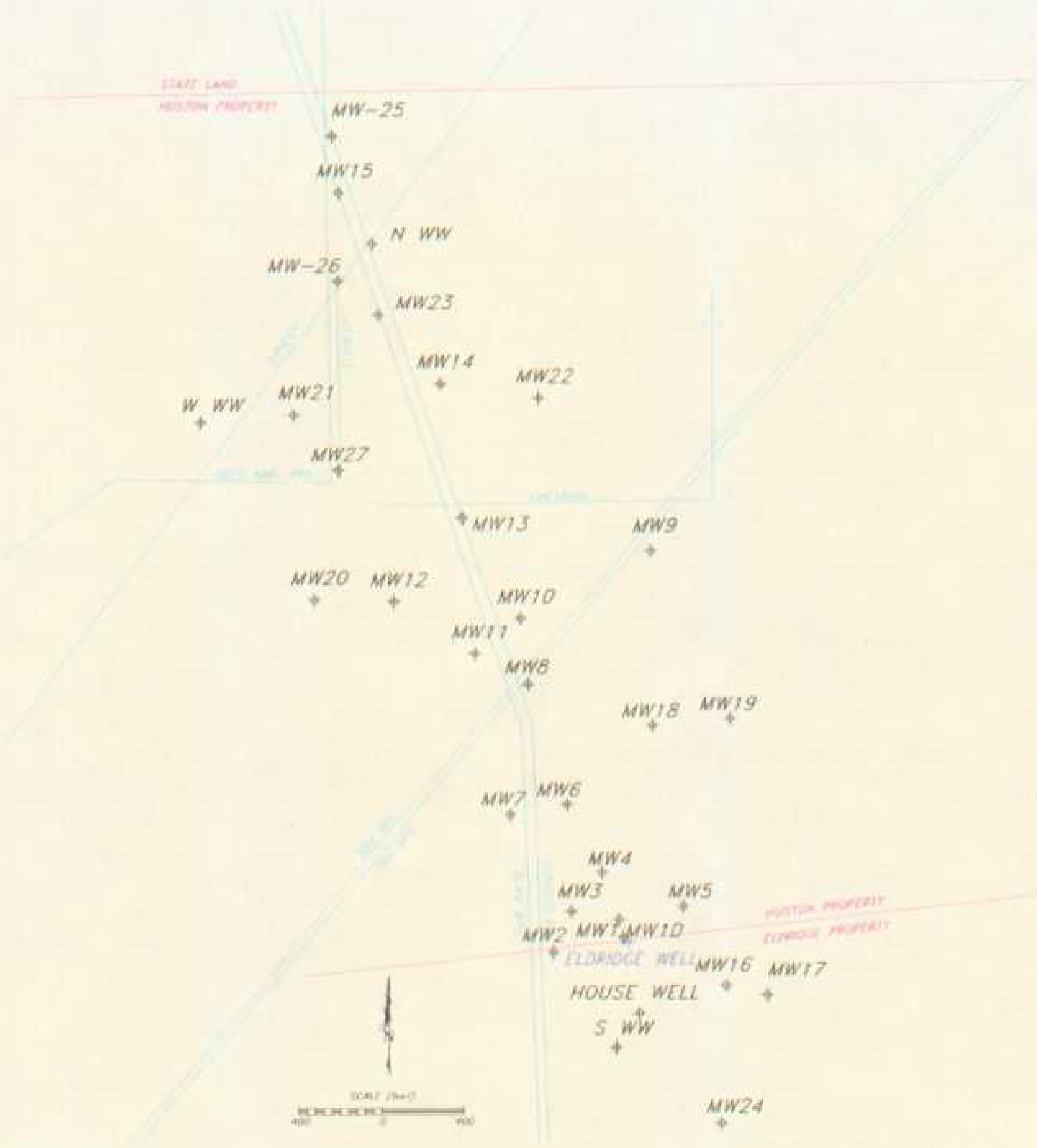
DATE: 5/03



N WW: North Water Well
S WW: South Water Well
W WW: West Water Well

Figure 2 – Monitor Well Locations
Eldridge Study Area

Duke Energy Field Services

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DATE: 5/03