CCR Groundwater Monitoring System Report

Leland Olds Station
Stanton, North Dakota

Basin Electric Power Cooperative

Project number: 60514340

October 17, 2017

Quality information

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Revision History

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List of Acronyms

amsl	above mean sea level
ANOVA	analysis of variance
Basin	Basin Electric Power Cooperative
bgs	below ground surface
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
cm/sec	Centimeters per second
EPA	United States Environmental Protection Agency
FGD	Flue Gas Desulfurization
ft	feet
GWPS	Groundwater Protection Standards
LOS	Leland Olds Station
ml/min	milliliters per minute
MW	megawatt
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act

Monitoring System Certification

Basin Electric Power Cooperative Leland Olds Station CCR Unit: Ash Landfill

AECOM ("Consultant") has been retained by Basin Electric Power Cooperative to prepare the following assessment to determine whether the groundwater monitoring system at the coal combustion residuals ("CCR") landfill at the Leland Olds Station landfill has been designed and constructed to meet the requirements set out in 40 Code of Federal Regulations (CFR) § 257.91.

BACKGROUND

Pursuant to 40 CFR § 257.90(b), owners and operators of new and existing CCR landfills, and new and existing CCR surface impoundments, and all lateral expansions of a CCR unit must install a groundwater monitoring system. 40 CFR § 257.91 requires owners and operators of a CCR unit to install a groundwater monitoring system that, relying on site-specific technical information, consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that accurately represent the quality of background groundwater that has not been affected by leakage from the CCR unit and accurately represent the quality of groundwater passing the waste boundary of the CCR unit.

Pursuant to 40 CFR § 257.91(f), the owner or operator must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of 40 CFR § 257.91, including the performance standards specified in 40 CFR § 257.91(a), based on the site-specific information specified in 40 CFR § 257.91(b). If the groundwater monitoring system includes only the minimum number of downgradient monitoring wells specified in 40 CFR § 257.91(c)(1), (three wells) the certification must document the basis supporting this determination.

In support of Consultant's assessment, Consultant evaluated of the groundwater monitoring system for the above-referenced CCR units to determine that sufficient information is available to make the certification required under 40 CFR § 257.91(f).

LIMITATIONS

The signature of Consultant's authorized representative on this document represents that to the best of Consultant's knowledge, information, and belief in the exercise of its professional judgment, it is Consultant's professional opinion that the aforementioned information is accurate as of the date of such signature. Any opinion or decisions by Consultant are made on the basis of Consultant's experience, qualifications, and professional judgment and are not to be construed as warranties or guaranties. In addition, opinions relating to environmental, geologic, and geotechnical conditions or other estimates are based on available data, and actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

CERTIFICATION

I, Daryl R. Beck, PE, being a Registered Professional Engineer in the State of North Dakota, certify to the best of my knowledge, information, and belief, that the groundwater monitoring system(s) for the CCR unit(s) that is the subject of this certification has been designed and constructed to meet the requirements of 40 CFR § 257.91, and that this certification is true and correct and has been prepared in accordance with generally accepted good engineering practices.

SIGNATURE: ____________________________ DATE: October 17, 2017
Daryl R. Beck, PE-10696
Senior Project Engineer

Statistical Method Certification

Basin Electric Power Cooperative Leland Olds Station CCR Unit: Ash Landfill

AECOM (“Consultant”) has been retained by Basin Electric Power Cooperative to prepare the following assessment of whether the statistical method(s) selected for the evaluation of groundwater monitoring data for the above-referenced coal combustion residuals (“CCR”) surface impoundments and landfill meets the requirements set out in 40 CFR § 257.93(f)(6).

BACKGROUND

Pursuant to 40 Coder of Federal Regulations (CFR) § 257.90(b), owners and operators of new and existing CCR landfills, and new and existing CCR surface impoundments, and all lateral expansions of a CCR unit must install the groundwater monitoring system. 40 CFR § 257.91 requires owners and operators of a CCR unit to install a groundwater monitoring system that, relying on site-specific technical information, consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that accurately represent the quality of background groundwater that has not been affected by leakage from the CCR unit and accurately represent the quality of groundwater passing the waste boundary of the CCR unit.

Pursuant to 40 CFR § 257.93(f), the owner or operator of the CCR unit must select one of the statistical methods specified in paragraphs (f)(1) through (5) of this section to be used in evaluating groundwater monitoring data for each specified constituent. The statistical test chosen shall be conducted separately for each constituent in each monitoring well, and shall comply with the performance standards specified in 40 CFR § 257.93(g). Per 40 CFR § 257.93(f)(6), the owner or operator must obtain a certification from a qualified professional engineer stating that the statistical method for the evaluation of groundwater monitoring data for the groundwater monitoring system meets the requirements of 40 CFR § 257.93(f)(6), including the performance standards specified in 40 CFR § 257.91(a), based on the site-specific information specified in 40 CFR § 257.91(b).

LIMITATIONS

The signature of Consultant’s authorized representative on this document represents that to the best of Consultant’s knowledge, information, and belief in the exercise of its professional judgment, it is Consultant's professional opinion that the aforementioned information is accurate as of the date of such signature. Any opinion or decisions by Consultant are made on the basis of Consultant’s experience, qualifications, and professional judgment and are not to be construed as warranties or guaranties. In addition, opinions relating to environmental, geologic, and geotechnical conditions or other estimates are based on available data, and actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

CERTIFICATION

I, Daryl R. Beck, PE, being a Registered Professional Engineer in the State of North Dakota, certify to the best of my knowledge, information, and belief, that the statistical method selected for the evaluation of groundwater monitoring data for the groundwater monitoring system for the CCR units that are the subject of this certification is appropriate for evaluating the groundwater monitoring data for the CCR management area comply with the performance standards specified in 40 CFR § 257.93(g), and that this certification is true and correct and has been prepared in accordance with generally accepted good engineering practices.

SIGNATURE: ____________________________ DATE: October 17, 2017
Daryl R. Beck, PE-10696
Senior Project Engineer

1. Introduction

On behalf of Basin Electric Power Cooperative, (Basin), AECOM prepared this report documenting the Coal Combustion Residuals (CCR) groundwater monitoring system for the CCR units at Basin's Leland Olds Station (LOS) located in Stanton, North Dakota (see **Figure 1-1**). This report addresses the requirement under Chapter 40 Code of Federal Regulations (CFR) Part 257.105(h) to provide in the Operating Record, as it becomes available, "documentation of the design, installation, development, and decommissioning of any monitoring wells, piezometers and other measurement, sampling, and analytical devices…"

Pursuant to 40 CFR § 257.90(b)(1), by October 17, 2017, an owner and operator of a CCR unit must install a groundwater monitoring system that meets the requirements of 40 CFR § 257.91. The groundwater monitoring system must meet the CCR Rule's performance standard, which requires the system to consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that accurately represent the quality of:

1. Background groundwater that has not been affected by leakage from a CCR unit; and
2. Groundwater passing the waste boundary of the CCR unit—the downgradient monitoring system must be installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer and must monitor all potential contaminant pathways.

This report summarizes the procedures and field activities associated with drilling and installation of monitoring wells that comprise the CCR monitoring network at LOS, as well as the results of groundwater results collected from monitoring of monitoring wells to evaluate the network against the requirements of the Final Rule.

This report is organized as follows:

- Chapter 1 includes a brief introduction to this report;
- Chapter 2 provides a brief background with historical information concerning LOS and associated CCR units;
- Chapter 3 describes the geological and hydrogeological setting of LOS;
- Chapter 4 describes selection and installation of the LOS CCR monitoring well network for all CCR units at LOS, including the drilling and installation of monitoring wells to supplement existing monitoring wells at LOS;
- Chapter 5 presents an evaluation of the LOS CCR monitoring compared to the requirements of the CCR Rule;
- Chapter 6 describes the statistical methodology that will be used to evaluate CCR groundwater monitoring data;
- Chapter 7 describes the professional limitations that apply to this report; and
- Chapter 8 lists the references cited in this report.

Certifications pertaining to the design and construction of the groundwater monitoring system and selection of the statistical method for evaluating data acquired using the groundwater monitoring system, are presented before Chapter 1 in the Monitoring Well Certification Section.

2. Background

LOS is a coal-based generating station located in Mercer County near the city of Stanton, North Dakota. It has a total power output capacity of 669 megawatts (MW) from two coal-based units:

- Unit 1, with a rating of 222 net MW, which began operating in 1966; and
- Unit 2, with a rating of 447 net MW, which began operating in 1975.

CCR from these units is disposed at LOS in the Glenharold Landfill 0143 located approximately 3 miles southwest of the generating units and office complex (**Figure 1-1**). This CCR landfill was permitted and began accepting CCR in 1992. Basin Electric reported that in 2014 the landfill received 201,718 tons of solid waste, including fly ash, flue gas desulfurization (FGD) waste, and a minor contribution of solid debris. The landfill is currently accessed via a haul road running generally northwest to west along the south side of the landfill.

Due to the presence of CCR, the LOS landfill is regulated by the CCR Rule, promulgated by the U.S. Environmental Protection Agency (EPA) under Chapter 40 CFR Part 257, Subtitle D of the Resource Conservation and Recovery Act (RCRA). The CCR Rule establishes requirements for existing CCR landfills and surface impoundments, including groundwater monitoring and corrective action. The groundwater monitoring provisions of the CCR Rule require the installation of a system of monitoring wells, the specification of procedures for sampling these wells, and analysis of the resulting data to detect the presence of hazardous constituents. A corrective action process is required in the event that hazardous constituents are detected above background concentrations at levels exceeding groundwater protection standards (GWPS).

3. Geological and Hydrogeological Setting

The geological and hydrogeological setting is important to understanding the groundwater environment in the vicinity of the LOS. The geology underlying the site includes mine spoils underlain by the Sentinel Butte Formation. This formation is comprised of continental deposits in excess of 1,000 feet of dense clay, weakly cemented sandstone, mudstone and lignite.

Precipitation supplies surface water to perennial and ephemeral streams that flow generally north towards the Missouri River. Groundwater is recharged primarily through infiltration of melt water in the spring. Alluvial drainages bounding the northern (Alderin Creek) convey surface water generally northeast, discharging to the Missouri River (**Figure 1-1**). Some groundwater within these regions will percolate through the mine spoils into the Sentinel Butte formation lignite beds which hold the uppermost aquifer beneath the facility.

The base of the LOS CCR Landfill is underlain by approximately 20 of clay rich mine spoil that overlies the Sentinel Butte Formation. The Sentinel Butte is comprised primarily of dense clay with trace very fine sand and beds of lignite typically ranging from 7- to 10-feet thick at the site. The 2016 AECOM drilling investigation did not penetrate to depths great enough to expose the lower portions of the Sentinel Butte.

Water precipitated in this environment is anticipated to move primarily as surface water runoff with infiltration typically limited to the upper few feet. The uppermost aquifer is found within the 7- to 10-foot thick unmined lignite bed located at depths ranging roughly from 85 to 140 feet below ground surface (ft, bgs). The potentiometric surface of the uppermost groundwater present within the lignite is at a depth of approximately 1847 feet above mean sea level (ft, amsl) in the south portion of the Landfill facility, and slopes generally north falling to approximately 1837 ft, amsl on the northern side of the landfill. The hydraulic gradient for the uppermost aquifer is locally controlled by site-specific composition of the lignite with in hydraulic conductivity typically ranging from 10^{-5} to 10^{-6} centimeters per second (cm/sec).

4. Monitoring Well System Selection and Installation

A monitoring well system has been established at LOS to comply with the requirements of the EPA CCR Rule published in the Federal Register on April 17, 2015.

Monitoring Well Installation in 2016

Eleven monitoring wells were installed at LOS during the summer and fall of 2016 to target the uppermost aquifer in the vicinity of the LOS CCR units. Monitoring wells MW-2016-1 through MW-2016-8 were completed between August 2 and August 19, 2016. After initial testing in September 2016, it was determined that groundwater flow direction beneath the landfill was generally north and that additional monitoring capacity in this area would be required. In response monitoring wells MW-2016-9, MW-2016-10 and MW-2016-11, were installed in November 2016 to supplement the existing downgradient monitoring on the north side of the landfill (**Figure 4-1**). The monitoring well locations were selected to evaluate the direction of groundwater flow in the vicinity of the LOS CCR units, and provide a minimum of three downgradient monitoring wells and one background monitoring well to satisfy the CCR Rule requirements.

Monitoring well installation involved drilling, and soil sampling, well construction, and development, and aquifer testing, as described below.

Drilling and Well Construction

Subsurface utilities in the vicinity of each planned monitoring well installation location were identified by utility representatives following the One-Call of North Dakota notification system. The uppermost 5 feet of each boring was excavated using a hand-auger as an additional precaution against utility strikes.

Monitoring well drilling and construction occurred in two phases between August 2 through August 19, 2016 and November 2 through November 20, 2016. The monitoring wells were installed using sonic drilling methods. Soil cores recovered during drilling operations were photographed and logged by AECOM geologists. Boring logs are included in **Appendix A**. Each boring was drilled approximately 5 feet below the base of the lignite or roughly equivalent to 10 to 15 feet below the elevation at which groundwater was anticipated.

Monitoring wells MW-2016-1 through MW-2016-8 were constructed of 2-inch-diameter, schedule 40 polyvinyl chloride (PVC) riser pipe and slotted screen. The second installation of monitoring wells, including MW-2016-9 through MW-2016-11, were constructed of 4-inch-diameter, schedule 40 PVC riser pipe and slotted screen. The screen interval was constructed using 10 feet of 0.010-inch factory-slotted PVC screen straddling the water table. The annular space within the bore hole around the screen was filled with clean 10/20 silica sand filter pack to a minimum of 2 feet above top of screen. Three to 8 feet of bentonite chips were placed above the filter pack and hydrated with potable water to seal the filter pack from surface influence. The remaining annular space above the bentonite seal was filled with Portland Type I/II grout applied in lifts of approximately 30 feet and allowed to set for a minimum of 24 hours. Above-grade steel protective casings with lockable lids were installed to protect and secure the wellhead. Surface monuments were labeled with the well identification number and set within a 2-foot square concrete pad. Steel bollards were installed around wells located near traffic areas to enhance visibility and protect the wells. All bollards, protective casings and locking lids were painted yellow to help protect against corrosion and improve visibility. The location and elevation of the top of inner casing for each monitoring well was determined by Basin, North Dakota registered land surveyors. Well construction diagrams are included in **Appendix A**, and construction details, including survey information, are summarized in **Table 4-1**.

Well Development

Monitoring wells MW-2016-1 through MW-2016-8 were developed between August 16 and August 24, 2016. Development of the supplementary monitoring wells, MW-2016-9 through MW-2016-11 occurred November 6 through November 22, 2016. Well development activities included measuring the water level and total depth of the well, followed by surging and bailing of the well with a weighted bailer to remove initial influx of sediment into the well, and finally using a submersible pump to purge the well. After well measurements were taken, a surge block was used to surge water into and out of the screened portion of the well for a minimum of 10 to 15 minutes. Bailers were then used to remove water and sediment from the well prior to pumping using a submersible electric pump. A minimum of five well volumes of water were removed from each monitoring well during well development. Field parameters (pH, temperature, specific conductance and turbidity) were measured and recorded at regular intervals during development. Purge water generated during well development was spread on the adjacent ground surface. The submersible pump was decontaminated between uses with a phosphate-free detergent water solution followed by a distilled water rinse.

Aquifer Testing

Pump tests were performed between August 19, 2017 and August 23, 2017 at monitoring wells MW-2016-4, MW-2016-8 and MW-2016-10 to assess the hydraulic characteristics of the uppermost aquifer. The tests at MW-2016-4, MW-2016-8 and MW-2016-10 were allowed to proceed for approximately 4 hours, 3 hours and 2.5 hours, respectively. The duration of theses test was sufficient to provide a reasonable estimate of the hydraulic conductivity for each of the wells. Manual measurements were recorded on field aquifer testing forms and electronic data was removed from the transducer and used for data evaluation.

Monitoring well MW-2016-8 is located at a background (upgradient) position southeast of the landfill while MW-2016-10 is at a downgradient location north of the landfill, and MW-2016-4 is at a background (cross-gradient) location relative to the landfill (**Figure 4-1**). Prior to starting each aquifer test, water level and total well depth measurements were taken. A pressure transducer was attached to the pump tubing approximately 1 foot above the top of the well's dedicated pump. Groundwater sampling was performed at each well, during the initial portion of the pumping test with flow rates ranging from 40 to 100 milliliters per minute (ml/min). After sampling was completed, the pumping rates were increased to rates ranging from 150 to 200 ml/min. The pumping rate was held constant during the second portion of the test and drawdown in the well was recorded using periodic manual measurements using an electronic water level meter. The pump remained on until drawdown neared the elevation of the transducer, or the water level in the well stabilized. Prior to shutting off the pump and post water level stabilization, the transducer was turned on to record water level data. The pump was then shut off and recovery of the water level was measured until 95 percent of the pre-pumping static water level was reached, at which time the test was stopped and equipment removed from the well. Manual measurements were recorded on field aquifer testing forms (**Appendix B**) and electronic data was removed from the transducer and used for data evaluation.

Pumping Test Analysis Process

Data from the pumping tests performed at the Site were processed and analyzed using the AQTESOLV software package (Duffield, 2007), which provides type curve solutions corresponding to various conceptual models, each with their own hydrologic assumptions. Type curve solutions for pumping tests available in AQTESOLV typically require observation well data. In cases where observations from only the pumping well are available, aquifer storage calculations are not usable; however, hydraulic conductivity calculations are still valid. Data were analyzed as single well recovery tests using the recovery solution for a pumping test in a non-leaky confined aquifer (Theis, 1935). The Analysis involves matching a straight line to residual drawdown data collected after the termination of a pumping test. The solution assumes a line source for the pumped well and therefore neglects wellbore storage. An option in AQTESOLV also allows for variable flow rates during the pumping period. The Theis solution utilizes the following assumptions:

- Aquifer has infinite areal extent;
- Aquifer is homogeneous, isotropic and of uniform thickness;
- Control well is fully penetrating;
- Flow to control well is horizontal;
- Aquifer is non-leaky confined;

- Flow is unsteady;
- Water is released instantaneously from storage with decline of hydraulic head;
- Diameter of pumping well is very small so that storage in the well can be neglected;
- Values of u' are small (i.e., r is small and t' is large)

Reports from the AQTESOLV pumping test analyses are presented in **Appendix B**. The estimated hydraulic conductivity for MW-2016-04 was 2.22E-5 cm/sec. The estimated hydraulic conductivity for MW-2016-08 was 2.05E-6 cm/sec. The estimated hydraulic conductivity for MW-2016-10 was 2.13E-5 cm/sec. During the pumping test for MW-2016-08, the water level dropped below the top of the well screen, which is reflected in the residual drawdown plot. The straight-line fit was performed to match the portion of data corresponding to late time, after the water level had risen above the top of the well screen.

5. System Evaluation

The Final CCR Rule establishes the following general performance standard for CCR groundwater monitoring systems:

- All groundwater monitoring systems must consist of a sufficient number of appropriately located wells (at least one background and three downgradient wells) in order to yield groundwater samples from the uppermost aquifer that represent the quality of background groundwater and the quality of groundwater passing the CCR waste boundary.
- The objective of a groundwater monitoring system is to intercept groundwater to determine whether the groundwater has been contaminated by the CCR disposal unit. The number, spacing, and depths of the monitoring wells must be determined based on a thorough characterization of the site, including a number of specifically identified factors relating to the hydrogeology of the site.

The “uppermost aquifer” and “aquifer” are defined in the Final CCR Rule in § 257.53, as follows:

“Uppermost aquifer” means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility’s property boundary. Upper limit is measured at a point nearest to the natural ground surface to which the aquifer rises during the wet season.

“Aquifer” means a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs.

As described in the drilling and well construction discussion in **Chapter 4**, drilling equipment and procedures were employed to identify the uppermost aquifer and ensure each new monitoring well was installed with appropriate total depth and placement of the well screen to: (1) facilitate collection of representative samples of the uppermost aquifer, and (2) accurately measure water table elevations to support evaluation of groundwater gradient and flow direction.

Also as described in **Chapter 4**, selection and construction of the CCR monitoring system for LOS evolved and was adapted based on the results obtained from baseline groundwater monitoring in 2016 and 2017. The final monitoring system consists of nine monitoring wells that were sampled and will be included as part of the detection monitoring program going forward. The list of wells selected for sampling background and downgradient groundwater quality for each CCR unit is summarized below:

CCR unit/multi-unit	Background wells	Downgradient wells
Landfill	MW-2016-3, MW-2016-4, MW-2016-5, MW-2016-6, MW-2016-8	MW-2016-2, MW-2016-9, MW-2016-10, MW-2016-11

Monitoring well MW-2016-7 is not included in the groundwater monitoring network due to placement of the screen interval across a perched lignite bed that is not hydraulically connected to the uppermost aquifer. Additionally, MW-2016-1 is excluded from the groundwater monitoring network due to insufficient water production to allow collection of a representative groundwater sample. Both monitoring wells remain in place for groundwater level measurement as appropriate.

Potentiometric surface maps have been constructed using the depth-to-groundwater measurements obtained during baseline groundwater monitoring and subsequent monitoring groundwater monitoring events. Maps of the potentiometric surface for the eight baseline events are presented as **Figures 5-1** through **Figure 5-8** respectively. The associated depth-to-groundwater measurements and calculated groundwater elevations are presented in **Table 5-1**. Groundwater elevations were calculated at each well by subtracting the measured depth-to-groundwater from the surveyed top of casing elevation. Groundwater elevations for each monitoring well are posted on the figures, with inferred elevation contours of the groundwater potentiometric surface. The direction of groundwater flow is generally to the north-northeast, perpendicular to the potentiometric contour lines. **Figures 5-1** though **Figure 5-8** illustrate the relatively consistent pattern of groundwater flow beneath between events with flow from south-southeast to north-

northwest with a moderate gradient groundwater flow beneath the LOS CCR unit. The data evaluated for this report support the selection of the wells listed above to represent background groundwater quality and the quality of groundwater downgradient of the CCR units.

6. Statistical Methodology

Regulatory Guidance

Regulatory guidance provided in 40 CFR §257.90 specifies that a CCR groundwater monitoring program include selection of the statistical procedures to be used for evaluating groundwater quality data as required by 40 CFR §257.93. Groundwater quality monitoring data will be collected under the detection monitoring program outlined in this plan and will include collection and analysis of a minimum of eight independent groundwater samples from each background and downgradient compliance well, for each CCR unit or multi-unit, as required by 40 CFR §257.94(b). The groundwater samples will be analyzed for the constituents listed in 40 CFR §257 Appendices III and IV.

After the eight sets of groundwater samples are collected and analyzed, these data must be statistically evaluated to determine if there are any statistically significant increases over background concentrations for the Appendix III and IV constituents. In determining whether a statistically significant increase has occurred, the constituent concentrations at the downgradient wells and the background wells for each unit/multi-unit will be compared using one or more of the statistical methods discussed below.

40 CFR §257.93(f) outlines the statistical methods available to evaluate groundwater monitoring data. The statistical test(s) chosen will be conducted separately for each constituent in each monitoring well and will be appropriate for the constituent data and their distribution. The available statistical methods include the following:

- A parametric analysis of variance (ANOVA) followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well’s mean and the background mean levels for each constituent;
- An ANOVA based on ranks followed by multiple comparison procedures to identify statistically significant evidence of impacts. The method must include estimation and testing of the contrasts between each compliance well’s median and the background median levels for each constituent;
- A tolerance or prediction interval procedure, in which an interval for each constituent is established from the distribution of the background data and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit;
- A control chart approach that gives control limits for each constituent; or
- Another statistical test method that meets the performance standards of 40 CFR 257.94(g) outlined in the paragraph below.

The chosen statistical method will comply with the following performance standards, as appropriate, based on the statistical test method used. The performance standards include the following:

- The statistical method used to evaluate groundwater monitoring data will be appropriate for the constituent distribution (i.e., parametric or nonparametric).
- If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a groundwater protection standard, the test shall be done at a Type I error level no less than 0.01 or 0.05, depending on the method chosen. This performance standard does not apply to tolerance intervals, prediction intervals, or control charts.
- If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be such that this approach is at least as effective as any of the other statistical analysis approaches specified above.
- If a tolerance interval or a prediction interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be such that this approach is at least as effective as any of the other statistical analysis approaches specified above.

- The statistical method must account for data below the limit of detection with one or more statistical procedures that shall be at least as effective as any of the other statistical analysis approaches specified above.
- If necessary, the statistical method must include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

Per 40 CFR §257.93(h)(2), statistical analysis of the first eight rounds of data must be completed within 90 days after completing the detection groundwater sampling and analysis to determine whether there has been a statistically significant increase over background for any constituent. The first eight rounds of groundwater sampling and analysis must be completed no later than October 17, 2017. In accordance with 40 CFR §257, LOS must obtain a certification from a qualified professional engineer stating that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area. The certification must include a narrative description of the statistical method selected to evaluate the groundwater monitoring data.

Assessment monitoring is required per 40 CFR §257.95 whenever a statistically significant increase over background levels has been detected for one or more of the indicator parameters listed in 40 CFR §257 Appendix III. An assessment monitoring program also includes annual groundwater sampling and analysis for the constituents listed in 40 CFR §257 Appendix IV. The purpose of assessment monitoring is to determine if releases of CCR constituents have occurred.

The facility can return to detection monitoring once assessment monitoring results are at or below background values for two consecutive assessment monitoring events. If the assessment monitoring demonstrates an exceedance of a GWPS for any of the CCR constituents specified in 40 CFR 257 Appendices III and IV, groundwater corrective action must be initiated.

Statistical Analysis Approach

There is no single method of statistical analysis that is appropriate for each groundwater constituent dataset. It is most prudent to use a suite of statistical methods that are dependent on the data and their distributions. The statistical analyses will be based on an interwell and/or an intrawell approach for the purpose of determining if an LOS CCR unit has impacted groundwater quality. The statistical algorithms used for the interwell and intrawell approaches will be chosen based on the groundwater constituent data and their distributions as well as consideration of natural seasonally- or spatially-varying groundwater constituent concentrations.

Eight rounds of baseline groundwater monitoring data were collected and analyzed for the 40 CFR 257 Appendices III and IV constituents. These data will be used to represent background groundwater quality for the LOS CCR unit. The detection monitoring data collected at the downgradient wells will be used to determine if the CCR unit has impacted groundwater quality. The initial eight rounds of detection monitoring sampling and analysis were completed by the October 17, 2017 deadline established in the CCR Rule (40 CFR §257.94).

A preliminary, exploratory statistical analysis was conducted after the eight rounds of baseline data were obtained to initially assess the constituent data and determine the most appropriate statistical approach(es) for the data. The data were examined for outliers and the percentage of non-detect values to verify that the data collected are suitable for statistical analysis. The data were also examined using goodness-of-fit tests to determine the most appropriate statistical distribution and time series plots and areal maps were used to determine if seasonal or spatial variations in constituent concentrations were present. Based on this preliminary evaluation of the data, an interwell statistical approach was selected as appropriate for evaluating groundwater at LOS, as described below.

Per 40 CFR 257.93(h)(2), statistical analysis of all eight rounds of data must be completed within 90 days after completing groundwater sampling and analysis to determine whether there has been a statistically significant increase over background for any Appendix III constituent.

Interwell Statistical Approach

Interwell tests compare the statistical differences between background and downgradient compliance wells. An interwell statistical approach will be used during detection monitoring for the following reasons:

- Sufficient data are available in the background well to ensure adequate degrees of statistical power to detect real exceedances above background levels, and also reasonable control over the site-wide false positive rate so that spurious exceedances have little chance of being identified.
- Although there is evident spatial variation among most, if not all, of the Appendix III constituents, it is unclear to what extent the similarly evident variation among the downgradient wells is due strictly to natural differences in groundwater quality and/or other factors unrelated to management of the CCR ash. Because of this uncertainty, an interwell comparison strategy appears to be initially more appropriate for LOS.

As a caveat to this approach, for constituents that occur naturally and vary substantially in concentration across LOS due to natural hydrogeologic or geochemical factors — thus, exhibiting significant spatial variability — an interwell testing scheme will not always be helpful. Using an interwell approach, constituent concentrations greater than background might be attributed to anthropogenic contamination, when the differences are actually natural and due to locally varying distributions of groundwater constituents. In such cases, an intrawell approach may be warranted.

Furthermore, there is no requirement either in RCRA or the CCR Rule to use exactly the same statistical method or approach for every constituent. Depending on characteristics of LOS and data that are collected, a mix of interwell and intrawell tests may be warranted. At this site, the initial statistical screening suggests that interwell comparisons are most appropriate despite evident spatial variability. However, that conclusion could change as additional data are collected during future detection monitoring. If new information indicates that constituent concentrations remain relatively stable and that the existing spatial variation is unrelated to the CCR units, a modification of the statistical approach to intrawell testing may be recommended for one or more constituents.

Under an interwell statistical approach in detection monitoring, the actual statistical method(s) chosen will be determined based on the constituent data distribution (as outlined below), which in turn is influenced both by the percentage and pattern of non-detect measurements as well as the temporal stability of the concentration levels.

When (1) the percentage of non-detects is low to moderate (i.e., less than 50-60 percent), (2) the background data can be normalized (perhaps via a standard transformation), and (3) the results are stationary (i.e., stable over time), the following statistical methods are highly recommended by EPA (2009):

- Interwell control charts with retesting; or
- Parametric interwell prediction limit methods with retesting.

When the background data cannot be normalized (perhaps due to a large percentage of non-detects), but the data are stationary (i.e., stable over time), the following statistical method is recommended by EPA (2009):

- Non-parametric interwell prediction limits with retesting.

Note that the specific retesting method in each of these options will be chosen to account for the size of the well network, the amount of background data available, the number of constituents being monitored, the site-specific mix of intrawell and interwell tests, and the impact of these factors on the statistical power and accuracy of the test. At this site, the background wells relative to the number of downgradient wells to be tested on a semi-annual basis will enable use of a 1-of-2 retesting plan. This necessitates collection of a single independent resample at any location in which the initial routine measurement exceeds its respective statistical limit. A confirmed statistical exceedance will not be recorded unless both the initial measurement and resample value both exceed the statistical limit.

If the background data are non-stationary and thus exhibit a clear trend, it will suggest that factors unrelated to the CCR unit are impacting background groundwater quality. Three general scenarios will be considered:

- Older background data may no longer be representative of current site conditions and may need to be excluded from statistical calculations. In this case, the interwell statistical limits will be updated to include only the most representative background data.
- The compliance wells will be examined to see if similar trends are occurring downgradient. If so, a common trend component will be estimated across the site and removed from every well. The residual data will then be used to construct revised statistical limits and tested as described above.

- If the trend in background wells is not reflected in downgradient wells, further investigation may be needed to determine if the background data still serve as a reasonable background with which to compare downgradient compliance measurements. If not, the statistical approach will be modified to an appropriate intrawell strategy.

Because of the decision matrix needed to establish the correct statistical approach, the background data for each constituent will be periodically screened prior to construction of new or revised statistical limits. This screening will examine the proportion and pattern of outliers and potential data anomalies (perhaps due to laboratory or field sampling factors), the presence or absence of statistically significant trends over time, the presence or absence of statistically significant outliers, and the identification of an appropriate statistical distribution. In particular, any confirmed background outliers will be excluded from statistical calculations, so as not to unduly bias the statistical limits.

Proposed Statistical Methods for Appendix III Analytes

Table 6-1 provides a summary of the proposed statistical method by well for Appendix III analytes. The table is based on a preliminary screening of the background well data collected to date. The proposed statistical method may be modified when all of the background data has been statistically evaluated for the annual report to be submitted in January 2018.

7. Limitations

The signature of AECOM’s (Consultant’s) authorized representative on this document represents that, to the best of Consultant’s knowledge, information, and belief in the exercise of its professional judgment, it is Consultant's professional opinion that the aforementioned information is accurate as of the date of such signature. Any opinion or decisions by Consultant are made on the basis of Consultant’s experience, qualifications, and professional judgment and are not to be construed as warranties or guaranties. In addition, opinions relating to environmental, geologic, and geotechnical conditions or other estimates are based on available data, and actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

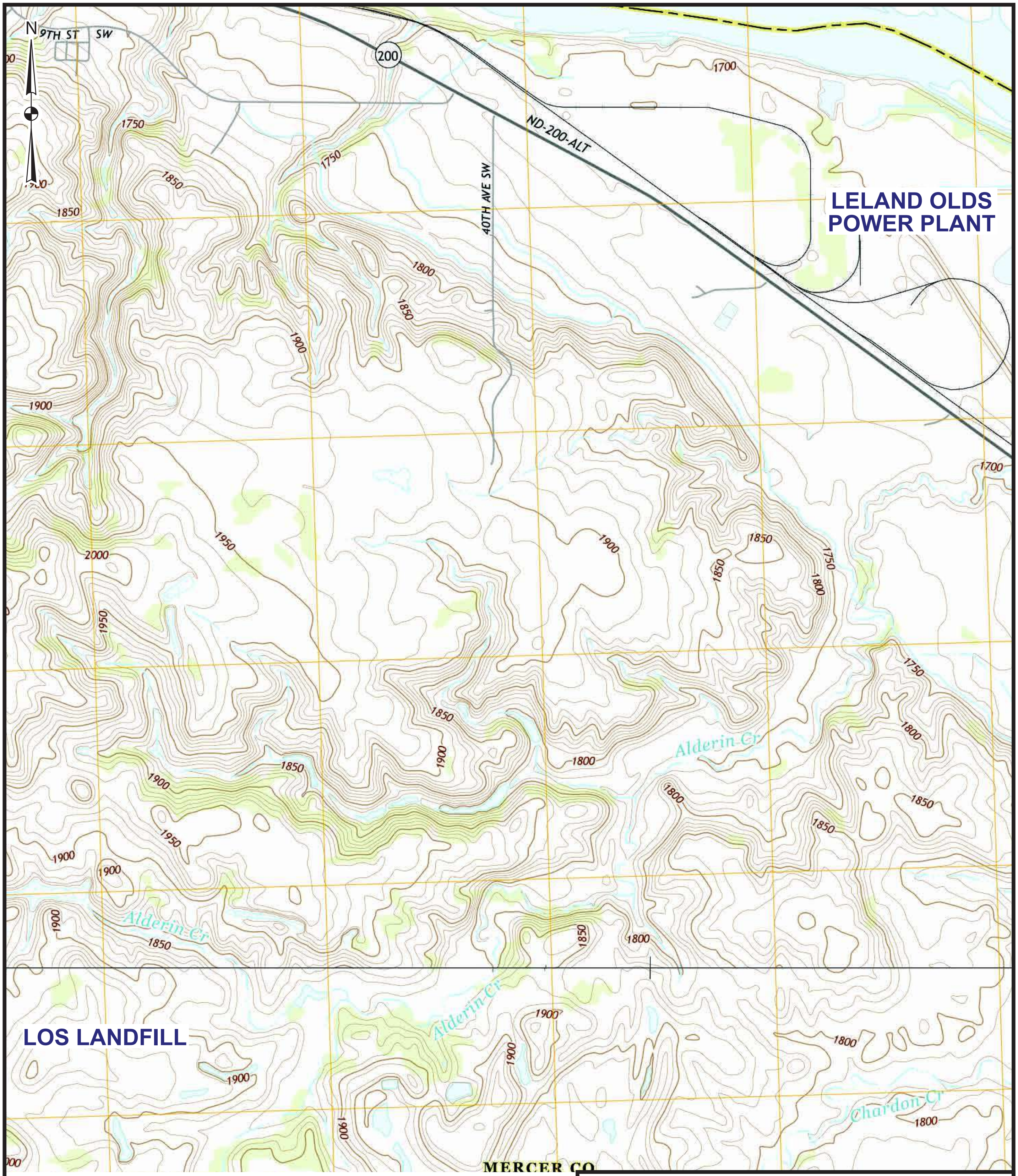
8. References

Duffield, G. M. 2007. AQTESOLV Version 4.50, s.l.: HydroSOLVE, Inc.

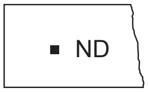
Theis C. 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground-water storage, 16, pp. 519-524.

U.S. Environmental Protection Agency. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities. Unified Guidance. EPA 530-R-09-007. March. 884 pp.

Figures



BASE MAP SOURCE: USGS 7½ minute topographic quadrangle maps: Hannover NE, North Dakota 2014; Stanton SE, North Dakota 2014.



Quadrangle Location

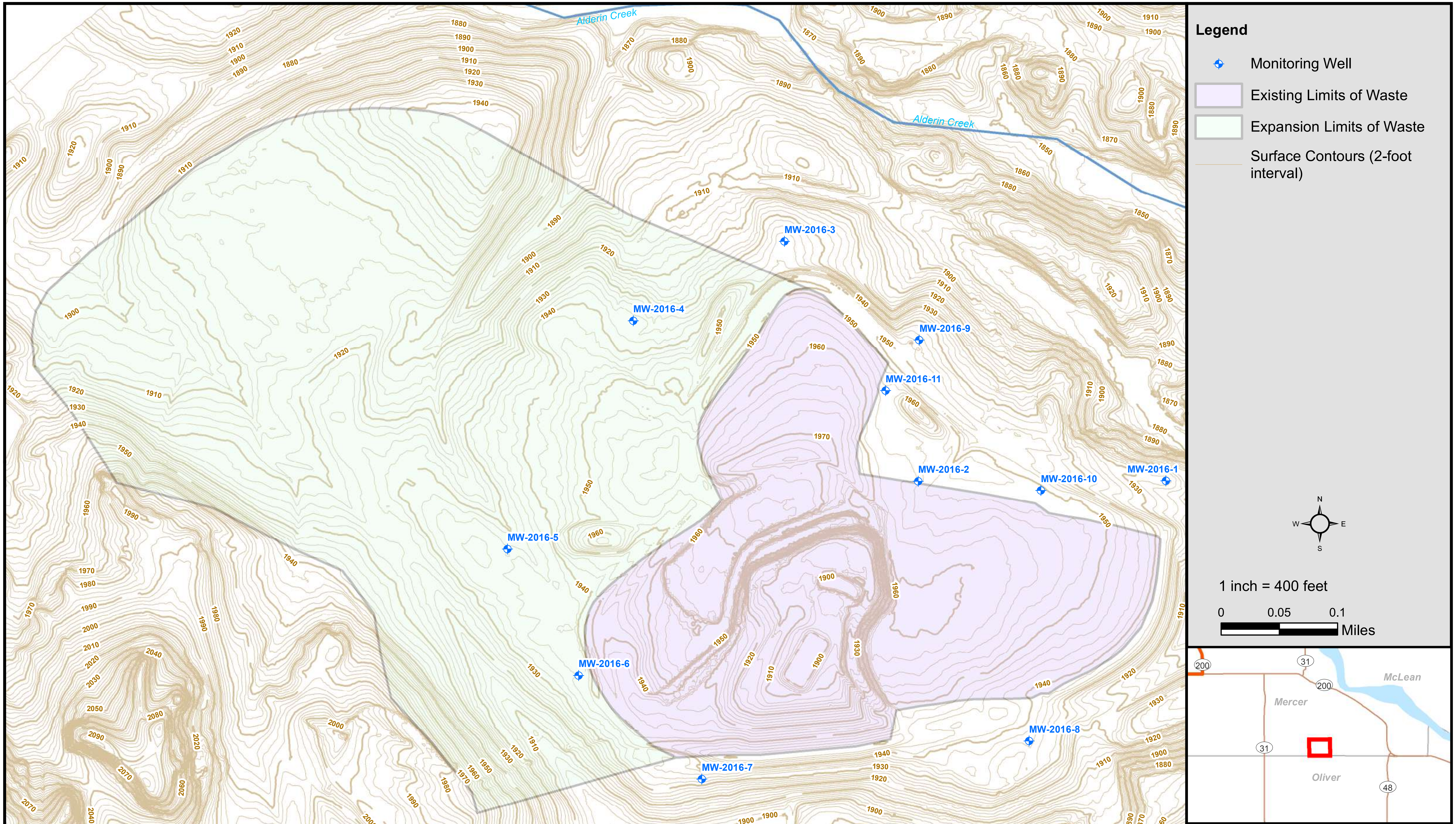
BASIN ELECTRIC POWER COOPERATIVE

FIGURE 1-1
SITE VICINITY MAP
LOS LANDFILL

JOB NO. 60514340

AECOM

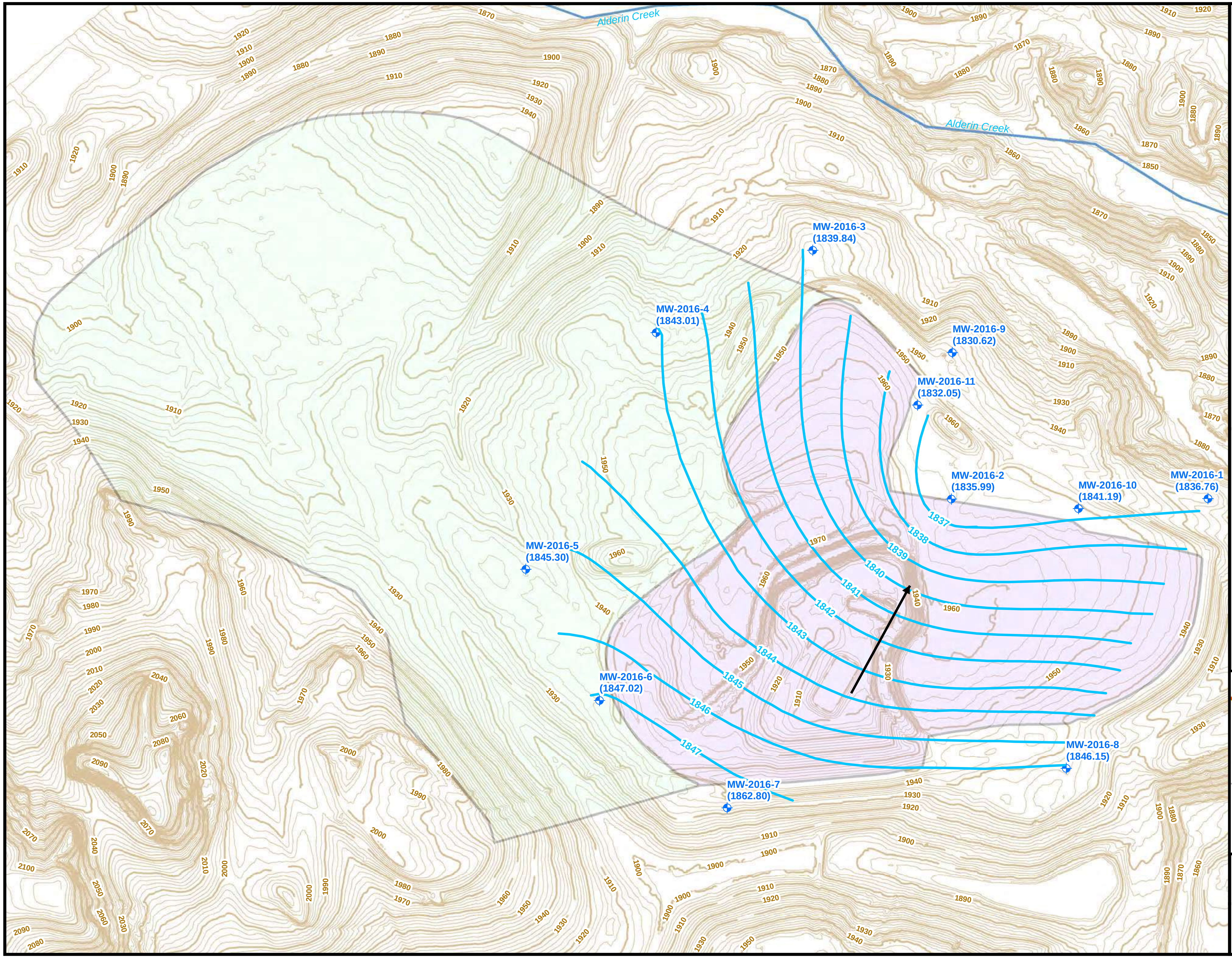
J:\Project\B\Basin Electric Coop\60514340 LOS Landfill CCR Well\Data-Tech\TI



BASIN ELECTRIC POWER COOPERATIVE
FIGURE 4-1
MONITORING WELL
LOCATION MAP
LOS LANDFILL

JOB NO. 60514340

AECOM

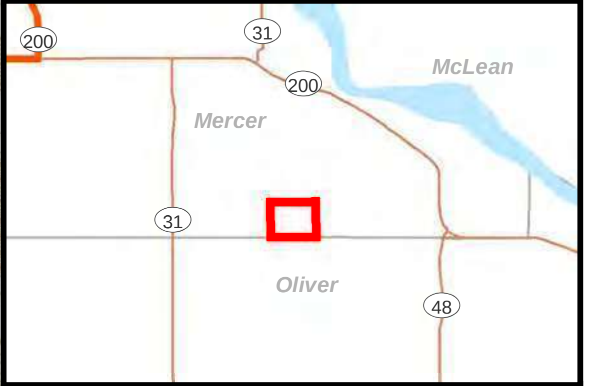


Legend

- ━ Piezometric Surface Contour (1-foot interval) September 27, 2016 (3rd quarter)
- → Groundwater Flow Direction
- ⊕ Monitoring Well
- 🟪 Existing Limits of Waste
- 🟩 Expansion Limits of Waste
- ━ Surface Contours (2-foot interval)

NOTE: Groundwater elevations were obtained on September 27, 2016.

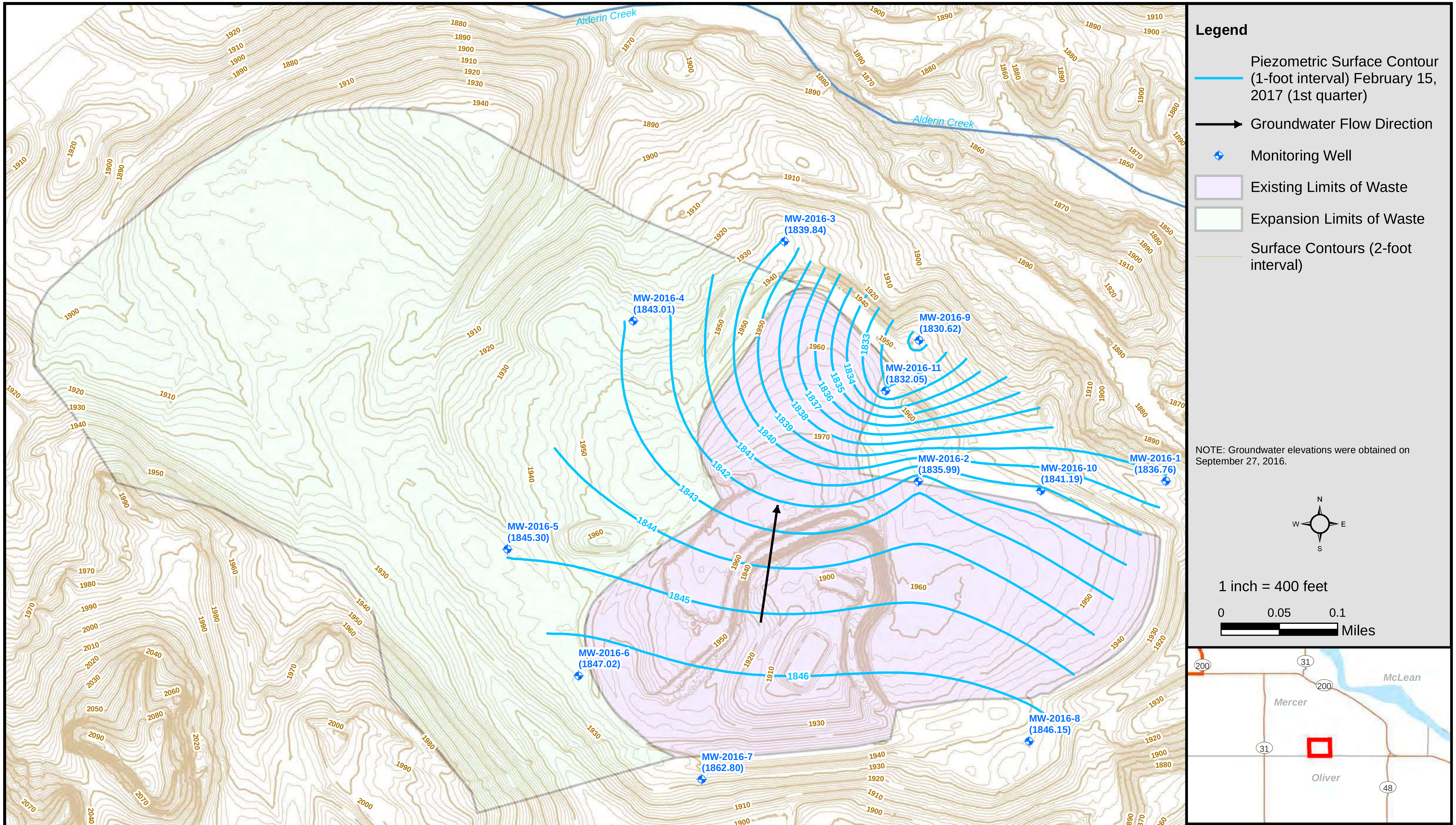
1 inch = 400 feet



BASIN ELECTRIC POWER COOPERATIVE
FIGURE 5-1
PIEZOMETRIC SURFACE MAP
SEPTEMBER 2016
LOS LANDFILL

JOB NO. 60514340

AECOM



Legend

	Piezometric Surface Contour (1-foot interval) February 15, 2017 (1st quarter)
→	Groundwater Flow Direction
⊕	Monitoring Well
🟪	Existing Limits of Waste
🟩	Expansion Limits of Waste
	Surface Contours (2-foot interval)

NOTE: Groundwater elevations were obtained on September 27, 2016.

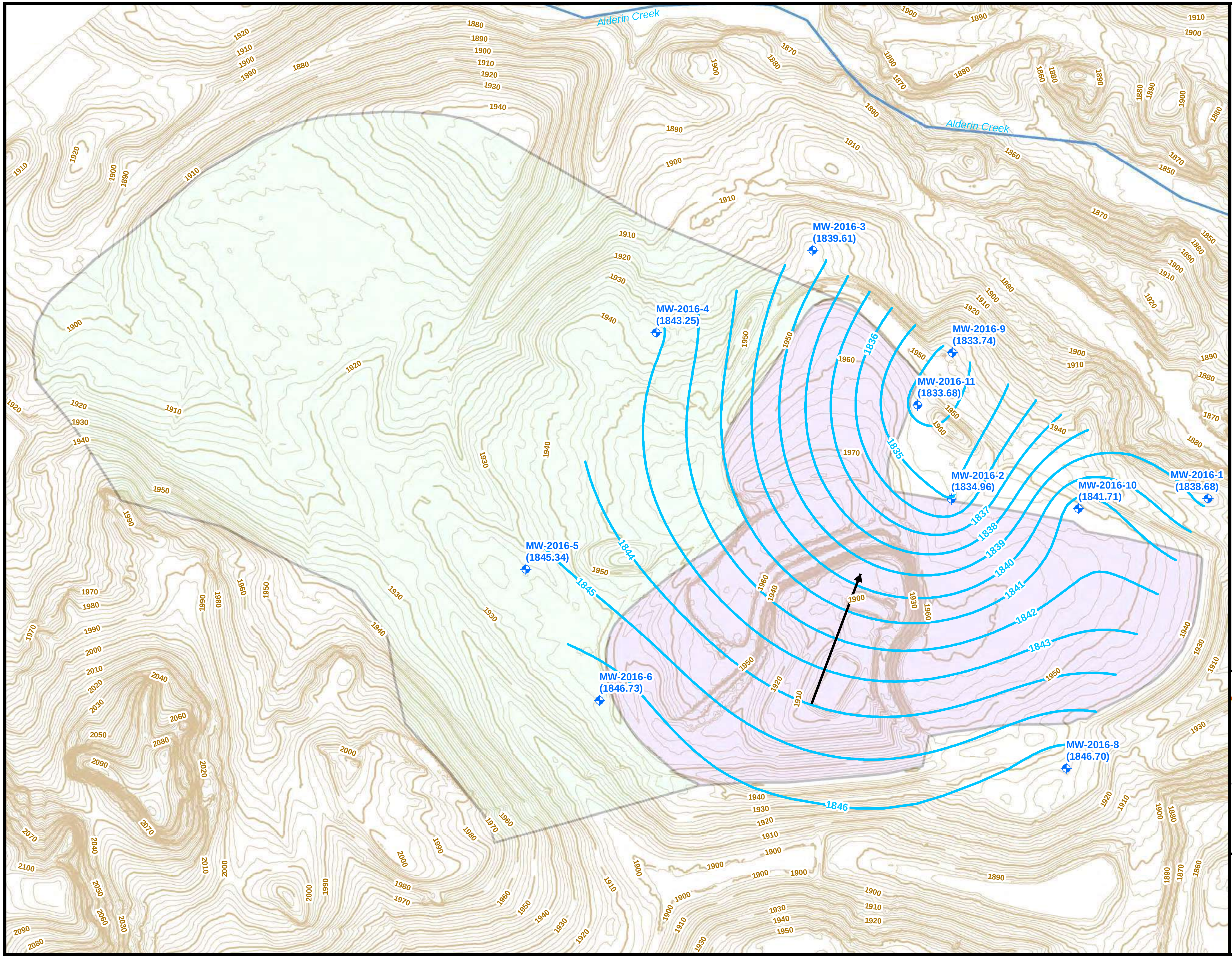
1 inch = 400 feet

0 0.05 0.1 Miles

BASIN ELECTRIC POWER COOPERATIVE
FIGURE 5-2
PIEZOMETRIC SURFACE MAP
FEBRUARY 2017
LOS LANDFILL

JOB NO. 60514340

AECOM



Legend

—	Piezometric Surface Contour (1-foot interval) March 15, 2017 (1st quarter)
→	Groundwater Flow Direction
⊕	Monitoring Wells
🟪	Existing Limits of Waste
🟩	Expansion Limits of Waste
—	Surface Contours (2-foot interval)

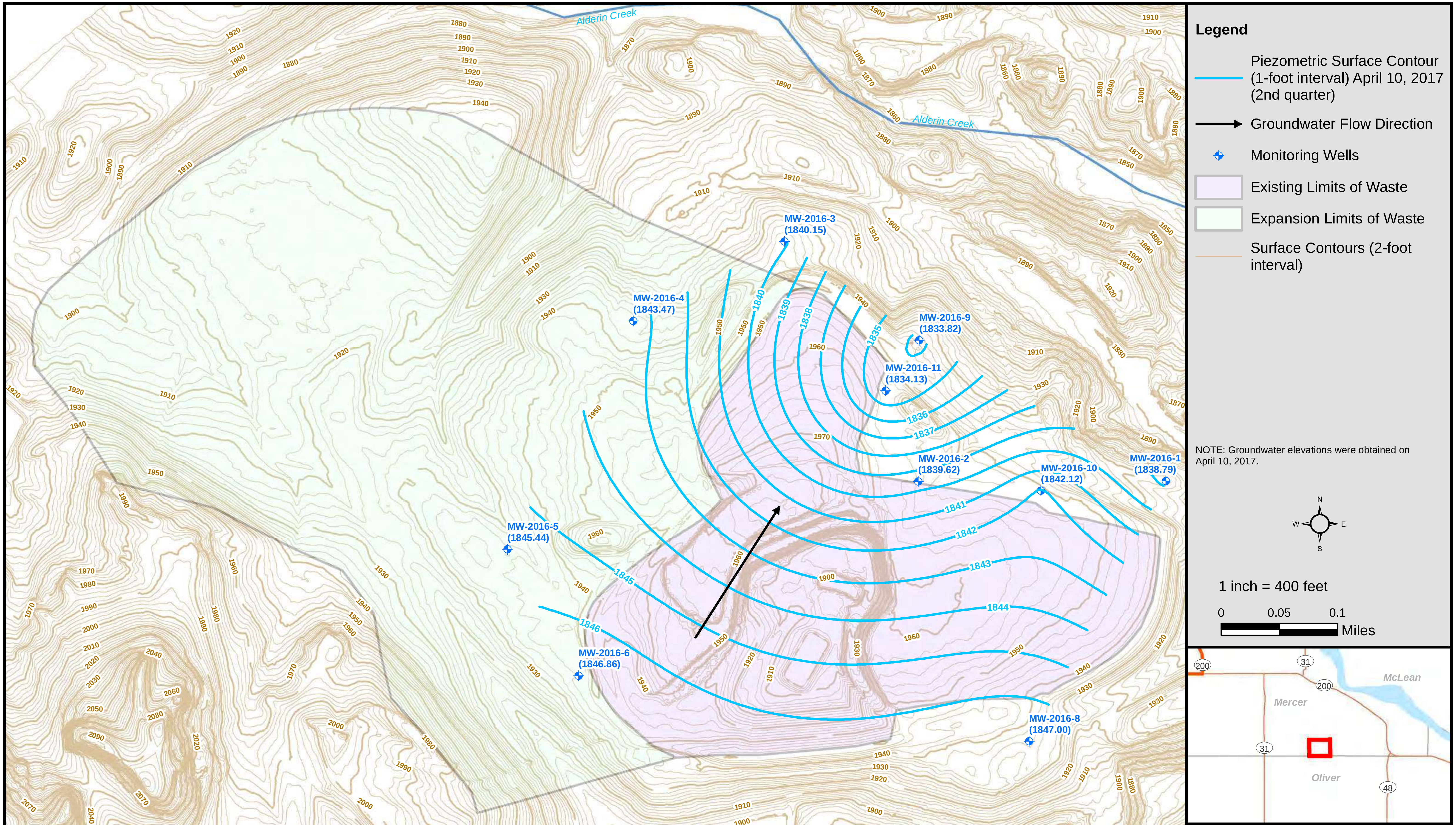
NOTE: Groundwater elevations were obtained on March 15, 2017.

1 inch = 400 feet

BASIN ELECTRIC POWER COOPERATIVE
FIGURE 5-3
PIEZOMETRIC SURFACE MAP
MARCH 2017
LOS LANDFILL

JOB NO. 60514340

AECOM



Legend

Piezometric Surface Contour (1-foot interval) April 10, 2017 (2nd quarter)

Groundwater Flow Direction

Monitoring Wells

Existing Limits of Waste

Expansion Limits of Waste

Surface Contours (2-foot interval)

NOTE: Groundwater elevations were obtained on April 10, 2017.

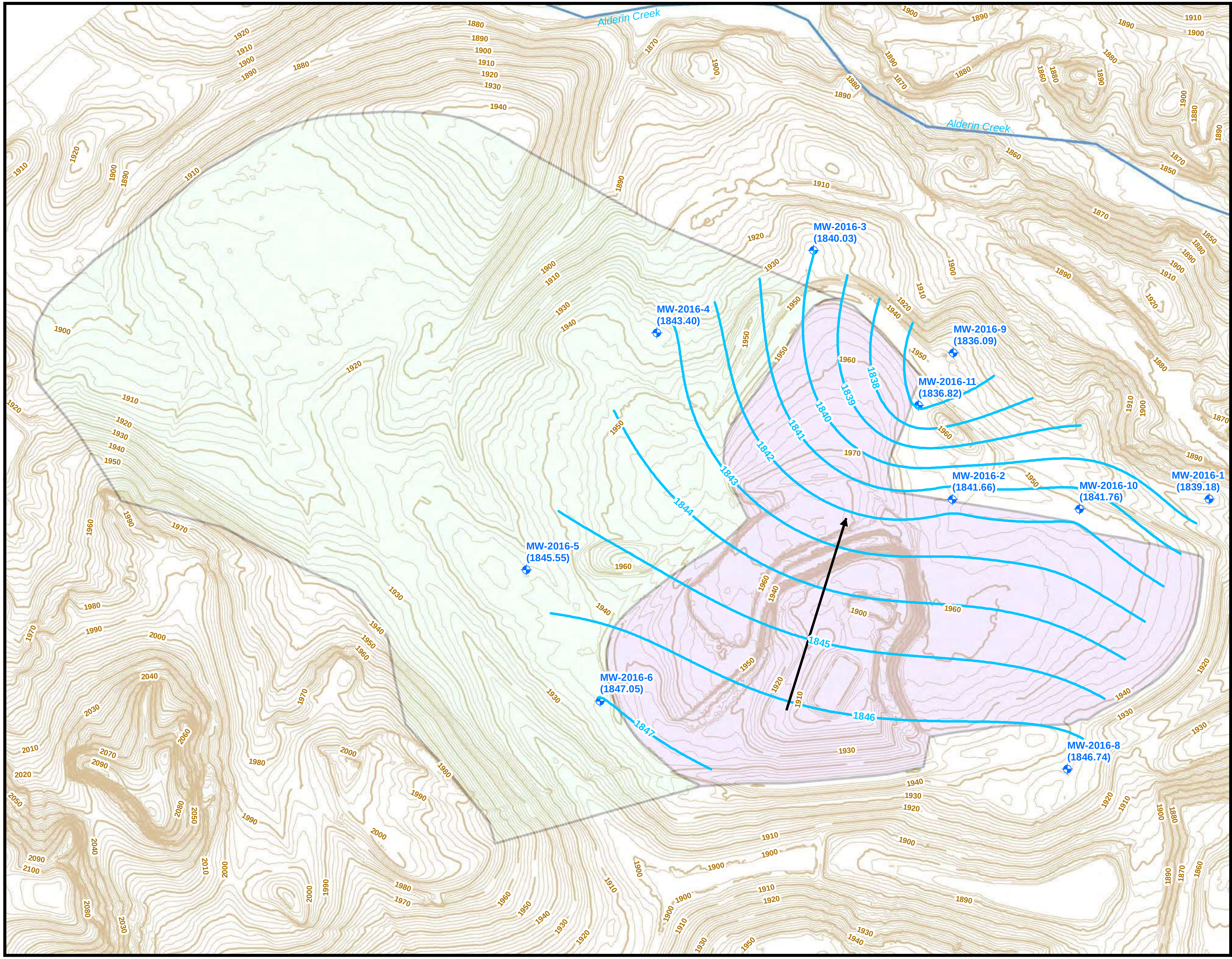
1 inch = 400 feet

0 0.05 0.1 Miles

BASIN ELECTRIC POWER COOPERATIVE
FIGURE 5-4
PIEZOMETRIC SURFACE MAP
APRIL 2017
LOS LANDFILL

JOB NO. 60514340

AECOM



Legend

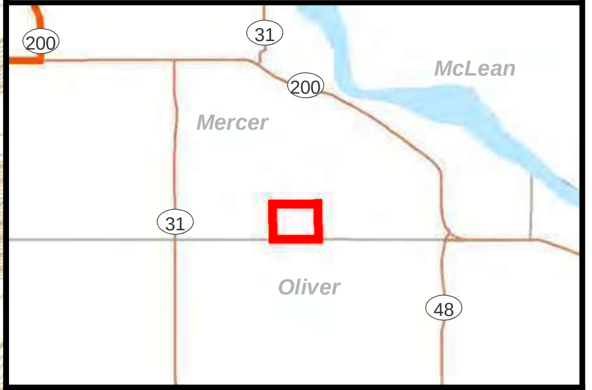
- Piezometric Surface Contour (1-foot interval) May 17, 2017 (2nd quarter)
- → Groundwater Flow Direction
- ⊕ Monitoring Wells
- 🟪 Existing Limits of Waste
- 🟩 Expansion Limits of Waste
- Surface Contours (2-foot interval)

NOTE: Groundwater elevations were obtained on May 17, 2017.

N
W E
S

1 inch = 400 feet

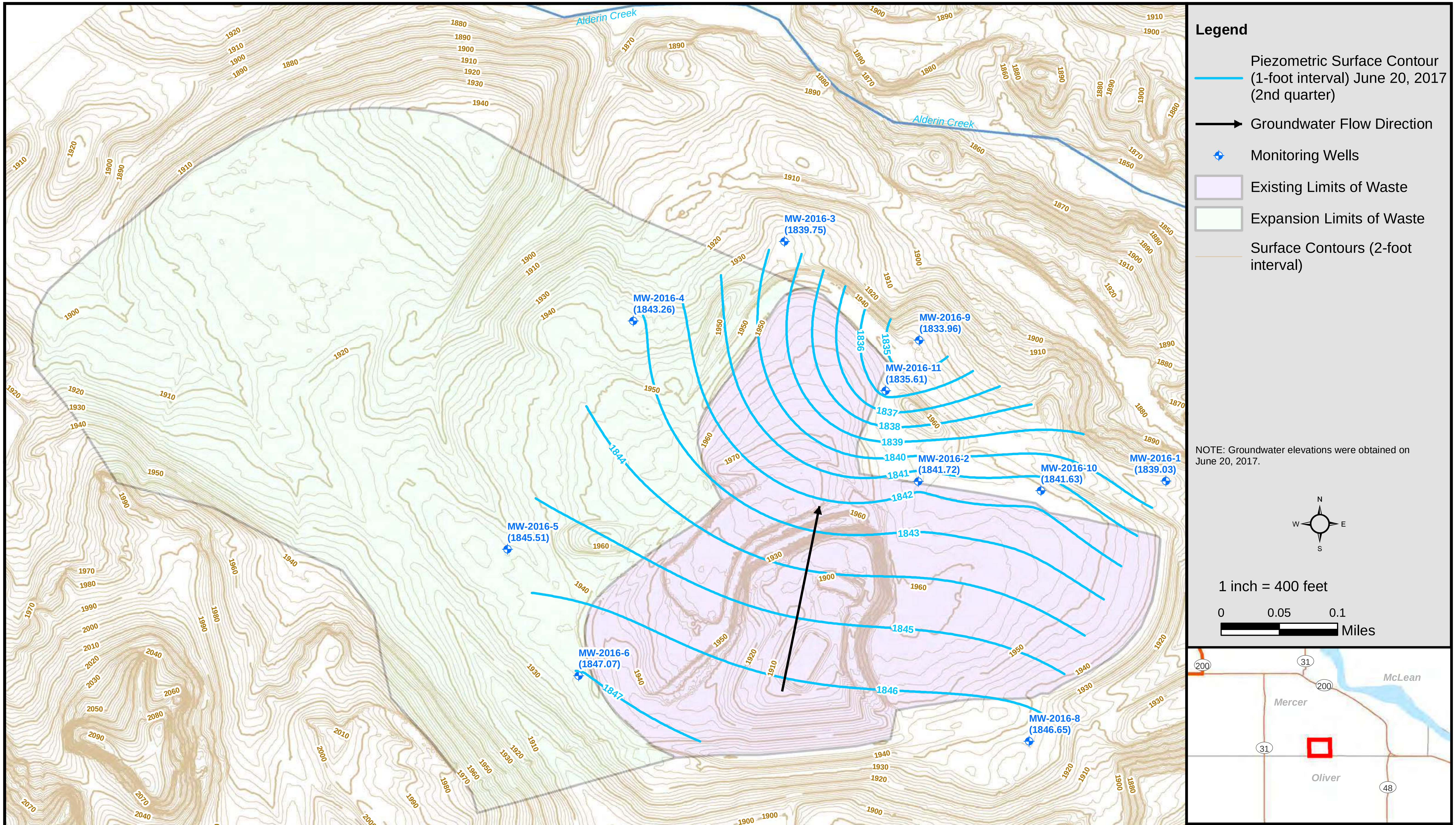
0 0.05 0.1 Miles



BASIN ELECTRIC POWER COOPERATIVE
FIGURE 5-5
PIEZOMETRIC SURFACE MAP
MAY 2017
LOS LANDFILL

JOB NO. 60514340

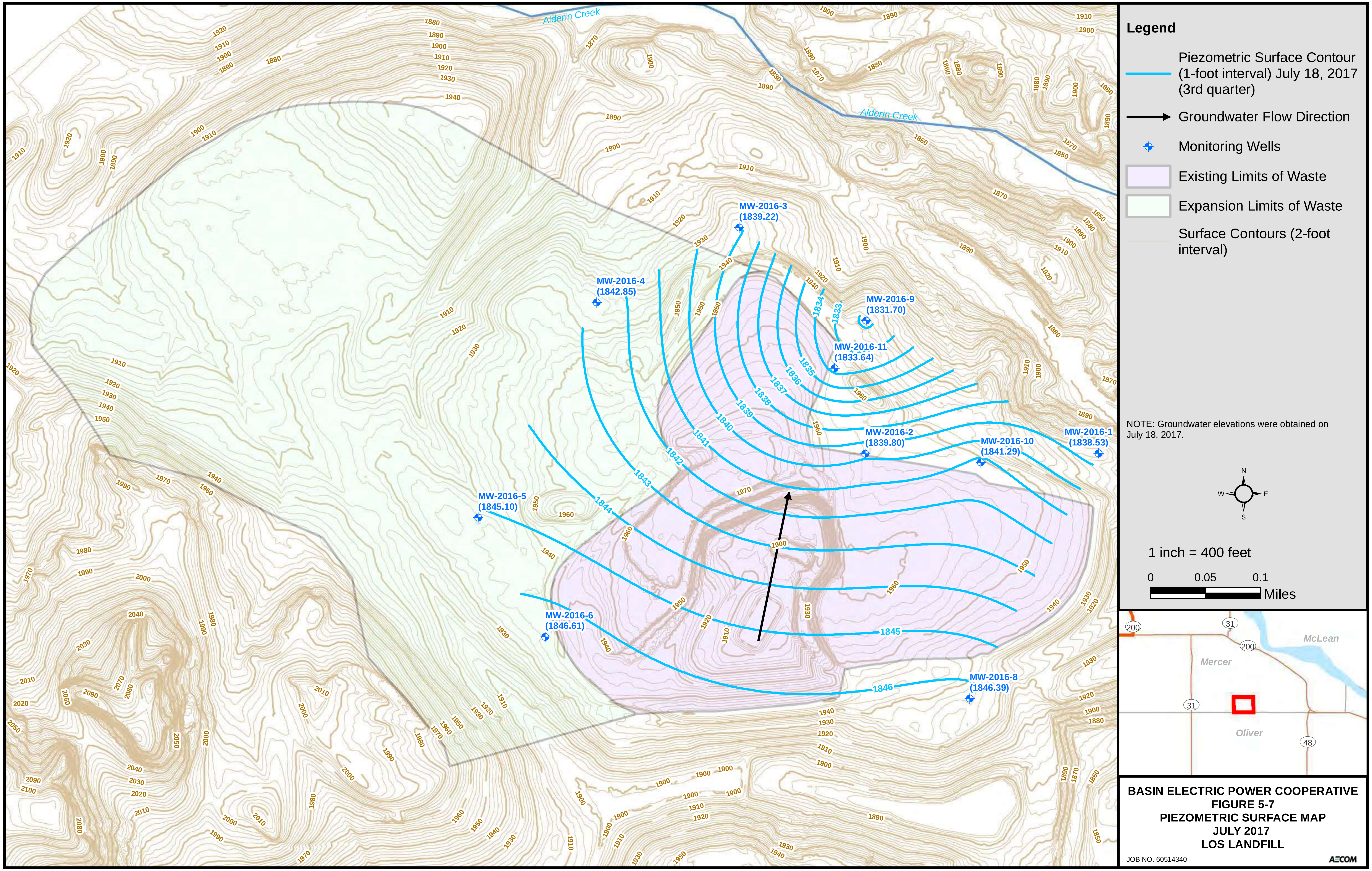
AECOM



BASIN ELECTRIC POWER COOPERATIVE
FIGURE 5-6
PIEZOMETRIC SURFACE MAP
JUNE 2017
LOS LANDFILL

JOB NO. 60514340

AECOM

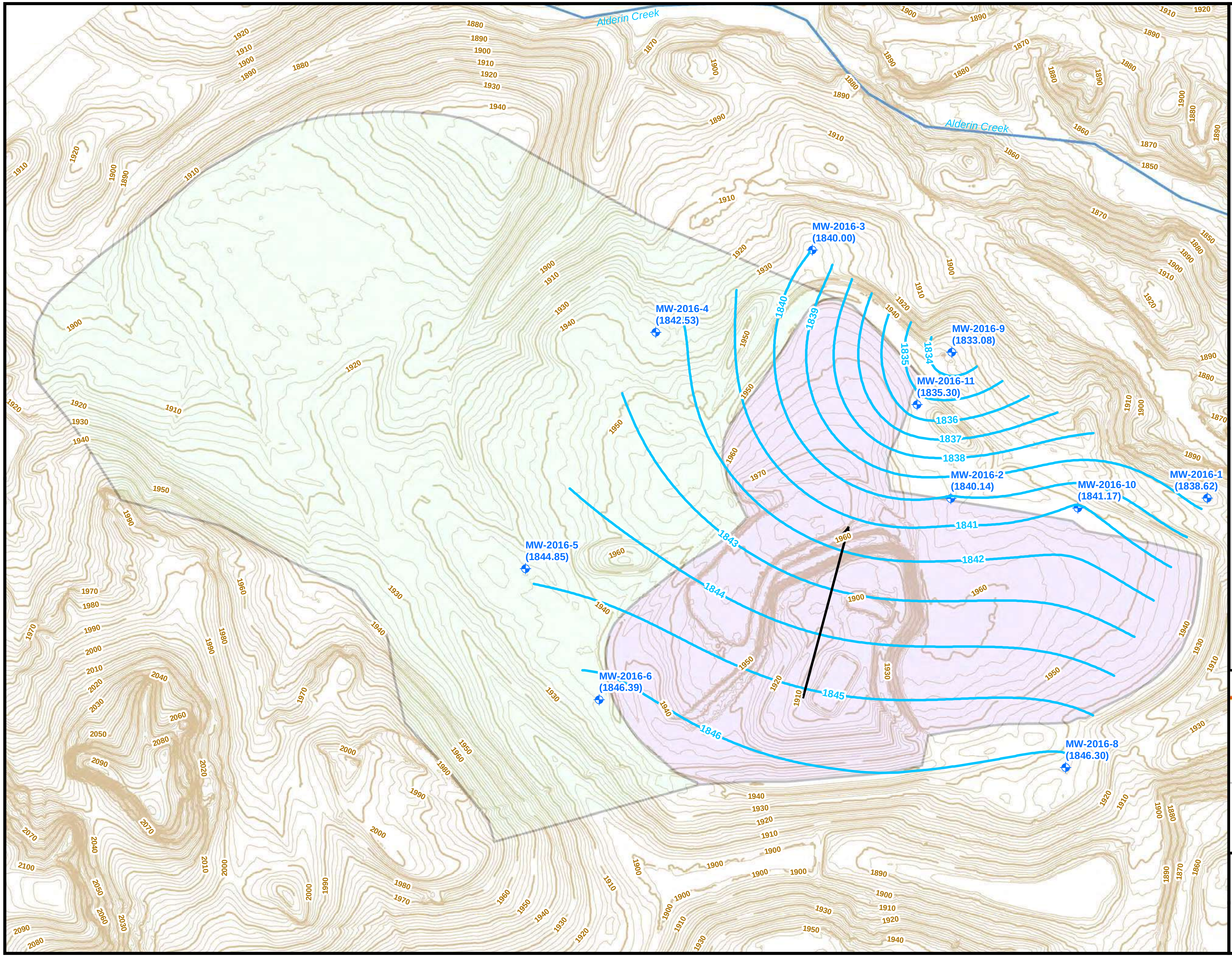


NOTE: Groundwater elevations were obtained on July 18, 2017.

BASIN ELECTRIC POWER COOPERATIVE
FIGURE 5-7
PIEZOMETRIC SURFACE MAP
JULY 2017
LOS LANDFILL

JOB NO. 60514340

AECOM



Legend

Piezometric Surface Contour (1-foot interval) August 21, 2017 (3rd quarter)

Groundwater Flow Direction

Monitoring Wells

Existing Limits of Waste

Expansion Limits of Waste

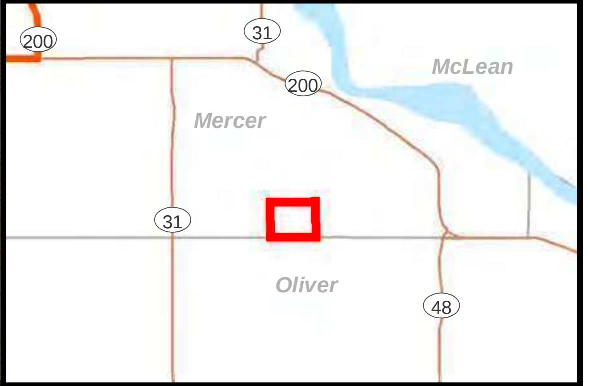
Surface Contours (2-foot interval)

NOTE: Groundwater elevations were obtained on August 21, 2017.

N
W E
S

1 inch = 400 feet

0 0.05 0.1 Miles



BASIN ELECTRIC POWER COOPERATIVE
FIGURE 5-8
PIEZOMETRIC SURFACE MAP
AUGUST 2017
LOS LANDFILL

JOB NO. 60514340

AECOM

Tables

TABLE 4-1

CCR GROUNDWATER MONITORING SYSTEM

BASIN ELECTRIC - LELAND OLDS STATION
CCR LANDFILL
MERCER COUNTY, NORTH DAKOTA

Well No.	Site Position	Location*		Reference Elevation**		Casing Length	Size / Type	Sand Pack Interval (feet below GS)		Screened Interval (Elevation, feet, NAVD)			Bottom of Boring
Well ID		**Northing**	**Easting**	**TOIC (feet, NAVD)**	**GS (feet, NAVD)**	**(feet, TOIC)**	**(ID / Material)**	Top	Bottom	Top	Pump Intake	Bottom	**(feet, GS)**
MW-2016-1	Down-gradient	577563.4	1786605.09	1931.725	1929.19	98.93	2 inch / PVC	83	97	1843.19	1835.33	1833.19	100
MW-2016-2	Down-gradient	577560.64	1785497.98	1957.977	1955.597	138.79	2 inch / PVC	124	137	1829.60	1821.68	1819.60	140
MW-2016-3	Cross-Gradient	578652.16	1784880.82	1939.881	1937.265	128.72	2 inch / PVC	113	127	1821.27	1812.38	1811.27	134
MW-2016-4	Cross-Gradient	578282.62	1784229.27	1939.973	1937.488	129.93	2 inch / PVC	114	128	1820.49	1811.97	1810.49	136
MW-2016-5	Up-gradient	577257.45	1783618.06	1937.538	1935.148	120.11	2 inch / PVC	105	119	1827.15	1819.04	1817.15	123
MW-2016-6	Down-gradient	576684.53	1783949.78	1939.312	1936.861	116.15	2 inch / PVC	100	114	1833.86	1824.31	1823.86	114
MW-2016-7	Not Applicable	576226.36	1785071.11	1936.114	1933.75	77.70	2 inch / PVC	61	76	1868.75	1860.91	1858.75	82
MW-2016-8	Up-gradient	576383.7	1785994.31	1939.361	1936.932	108.67	2 inch / PVC	93	107	1840.93	1832.36	1830.93	107
MW-2016-9	Down-gradient	578206.83	1785499.348	1947.392	1945.505	132.55	4 inch / PVC	115	133	1825.51	1816.39	1815.51	135
MW-2016-10	Down-gradient	577524.2	1786051.255	1953.315	1951.612	133.70	4 inch / PVC	117	133	1829.61	1821.32	1819.61	145
MW-2016-11	Down-gradient	577977.52	1785347.299	1956.727	1954.851	142.20	4 inch / PVC	124	145	1824.85	1815.73	1814.85	162

Reference elevation of monitoring wells surveyed by Basin Electric State Registered Land Surveyors
Horizontal Datum* - NAD 83 (1983), Vertical Datum** - NAVD 88 GPS
NAVD = North American Vertical Datum of 1988 (NAVD 88)
PVC = Polyvinyl chloride
ID = Internal Diameter
TOIC = Top of internal casing
GS = Ground Surface
Not Applicable = Well deemed to not be screened in uppermost aquifer.

TABLE 5-1

MONITORING WELL GROUNDWATER ELEVATIONS - SEPTEMBER 2016 THROUGH AUGUST 2017

BASIN ELECTRIC
LELAND OLDS STATION - MERCER COUNTY, NORTH DAKOTA

LANDFILL

Well ID		Reference Elevation Top of Casing* (feet, NAVD 88)	September 28, 2016		January 25, 2017		February 14, 2017		March 16, 2017		April 10, 2017		May 17, 2017		June 20, 2017		July 18, 2017		July 18, 2017	
			DTW (feet)	Groundwater Elevation (ft, NAVD 88)	DTW (feet)	Groundwater Elevation (ft, NAVD 88)	DTW (feet)	Groundwater Elevation (ft, NAVD 88)	DTW (feet)	Groundwater Elevation (ft, NAVD 88)	DTW (feet)	Groundwater Elevation (ft, NAVD 88)	DTW (feet)	Groundwater Elevation (ft, NAVD 88)	DTW (feet)	Groundwater Elevation (ft, NAVD 88)	DTW (feet)	Groundwater Elevation (ft, NAVD 88)	DTW (feet)	Groundwater Elevation (ft, NAVD 88)
MW-2016-1	D	1931.73	94.97	1836.76	NM	NM	92.59	1839.14	93.04	1838.69	92.94	1838.79	92.55	1839.18	92.70	1839.03	93.20	1838.53	93.20	1838.53
MW-2016-2	D	1957.98	121.99	1835.99	NM	NM	115.22	1842.76	123.02	1834.96	118.36	1839.62	116.32	1841.66	116.26	1841.72	118.18	1839.80	118.18	1839.80
MW-2016-3	C	1939.88	100.04	1839.84	NM	NM	99.92	1839.96	100.27	1839.61	99.73	1840.15	99.85	1840.03	100.13	1839.75	100.66	1839.22	100.66	1839.22
MW-2016-4	C	1939.97	96.96	1843.01	NM	NM	97.05	1842.92	96.72	1843.25	96.50	1843.47	96.57	1843.40	96.71	1843.26	97.12	1842.85	97.12	1842.85
MW-2016-5	U	1937.54	92.24	1845.30	NM	NM	92.65	1844.89	92.20	1845.34	92.10	1845.44	91.99	1845.55	92.03	1845.51	92.44	1845.10	92.44	1845.10
MW-2016-6	D	1939.31	92.29	1847.02	NM	NM	92.69	1846.62	92.58	1846.73	92.45	1846.86	92.26	1847.05	92.24	1847.07	92.70	1846.61	92.70	1846.61
MW-2016-7	NA	1936.11	73.31	1862.80	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW-2016-8	U	1939.36	93.21	1846.15	NM	NM	92.77	1846.59	92.66	1846.70	92.36	1847.00	92.62	1846.74	92.71	1846.65	92.97	1846.39	92.97	1846.39
MW-2016-9	D	1947.39	NM	NM	109.22	1838.17	116.77	1830.62	113.65	1833.74	113.57	1833.82	111.30	1836.09	113.43	1833.96	115.69	1831.70	115.69	1831.70
MW-2016-10	D	1953.32	NM	NM	112.10	1841.22	112.12	1841.20	111.60	1841.72	111.2	1842.12	111.56	1841.76	111.69	1841.63	112.03	1841.29	112.03	1841.29
MW-2016-11	D	1956.73	NM	NM	117.26	1839.47	124.68	1832.05	123.05	1833.68	122.6	1834.13	119.91	1836.82	121.12	1835.61	123.09	1833.64	123.09	1833.64

(Horizontal Datum* - NAD 83 (1983), Vertical Datum** - NAVD 88 GPS)
NAVD = North American Vertical Datum of 1988 (NAVD 88)
TOIC = Top of internal casing
U = Upgradient / Background
D = Downgradient
C = Crossgradient
NM = Not Measured (Well did not exist or no longer sampled)
DTW = Depth To Water
GW = Groundwater

TABLE 6-1

PROPOSED STATISTICAL METHODS FOR APPENDIX III CONSTITUENTS IN BACKGROUND WELLS

BASIN ELECTRIC – LELAND OLDS SYSTEM
CCR LANDFILL
MERCER COUNTY, NORTH DAKOTA

CCR Unit	Background Wells	Statistical Method	Constituent(s)
LOS Landfill	MW-2016-3, MW-2016-4, MW-2016-5, MW-2016-6, MW-2016-8	Parametric Prediction Interval	Boron, pH
LOS Landfill	MW-2016-3, MW-2016-4, MW-2016-5, MW-2016-6, MW-2016-8	Nonparametric Prediction Interval	Calcium, Chloride, Fluoride, Sulfate, TDS

Appendix A

Boring Logs and Well Construction Diagrams

AECOM

WELL NUMBER MW-2016-1

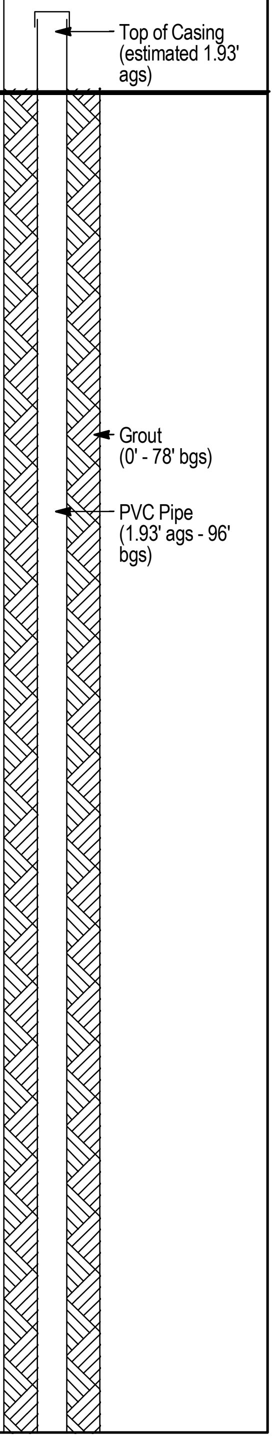
PAGE 1 OF 3

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND
DATE STARTED 8/7/2016 **COMPLETED** 8/7/2016
GROUND ELEVATION 1929.2 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Rotary Sonic
AT TIME OF DRILLING ---
LOGGED BY Ryan Klute **CHECKED BY** A. Lanning
AT END OF DRILLING ---
COORDINATES 577563.4 N 1786605.09 E
▽ **AFTER DRILLING** 67.87 ft / Elev 1861.33 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SONIC	100		CL	▨	CLAY, reworked material; light brown
5	SONIC	100			▨	
10	SONIC	100			▨	
15					▨	
16.0				CL	▨	CLAY, trace gravel, reworked material; brown to light brown (1913.2)
20.0	SONIC	100		CL	▨	CLAY, very sticky, trace gravel, reworked material; brown to light brown (1909.2)
25					▨	
30					▨	
35.0						(1894.2)

Casing Top Elev: 1.93 (ft)
Casing Type: 2" PVC Pipe

WELL DIAGRAM



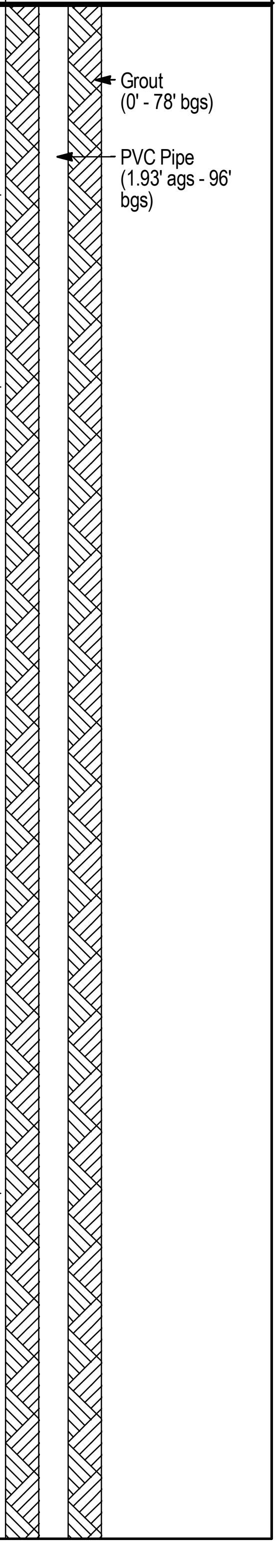
(Continued Next Page)

AECOM

WELL NUMBER MW-2016-1

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
35	SONIC	100		CL	▨	CLAY, sticky, reworked material; brown	
40.0				CL	▨	SILTY CLAY, reworked material; light brown	1889.2
45.0	SONIC	100		CL	▨	SANDY CLAY, very hard, crumbly; red	1884.2
50	SONIC	100			▨		
55	SONIC	100			▨		
65					▨		
66.0				CL	▨	CLAY, very hard, native material; gray ▼	1863.2
70	SONIC	100			▨		
75.0							1854.2



(Continued Next Page)

WELL NUMBER MW-2016-1

CLIENT Basin Electric

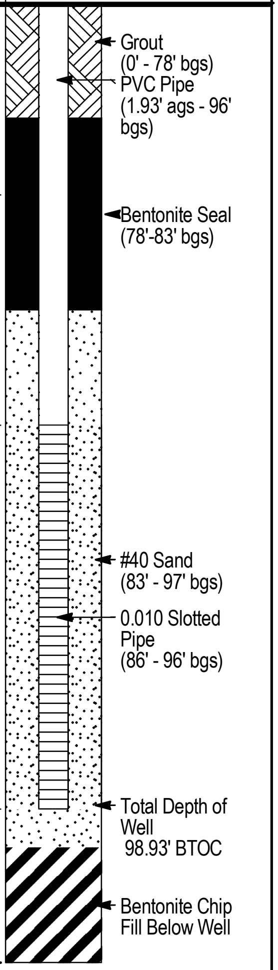
PROJECT NAME Lelands Olds Landfill

PROJECT NUMBER 60514340

PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		
75				CL	▨	CLAY, hard, native material; gray	80.0	1849.2
80	SONIC	100		CL	▨	CLAY, hard; gray	86.0	1843.2
85	SONIC	100		COAL	■	LIGNITE, dry, crumbly; brown to black	96.0	1833.2
95	SONIC	100		CL	▨	CLAY, hard; gray	100.0	1829.2

WELL DIAGRAM



Bottom of borehole at 100.0 feet.

AECOM

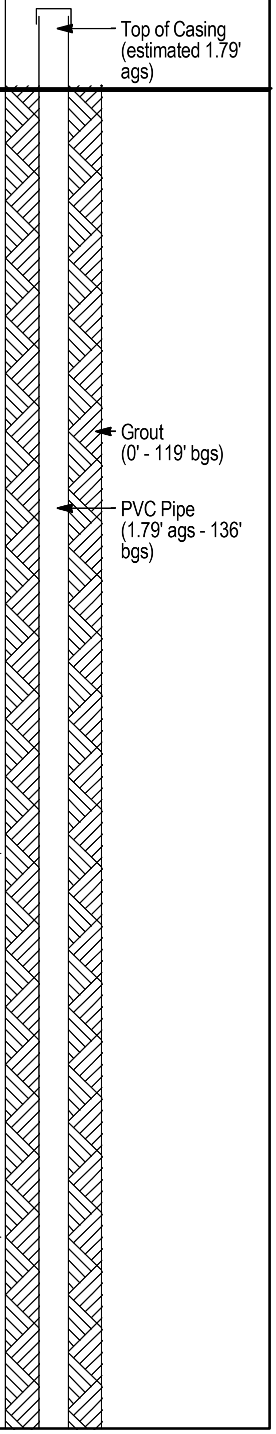
WELL NUMBER MW-2016-2

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND
DATE STARTED 8/6/2016 **COMPLETED** 8/6/2016
GROUND ELEVATION 1954.7 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Rotary Sonic
AT TIME OF DRILLING ---
LOGGED BY Ryan Klute **CHECKED BY** A. Lanning
AT END OF DRILLING ---
COORDINATES 577560.64 N 1785497.98 E
▽ **AFTER DRILLING** 107.05 ft / Elev 1847.65 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						CLAY, very sticky, reworked material; brown
	SONIC	100				
5						
10	SONIC	100		CL		
15						
20	SONIC	100				20.0 1934.7 CLAY, trace silt, reworked material; brown to light brown
25				CL		
30	SONIC	100				30.0 1924.7 SILTY CLAY, reworked material; gray
				CL		
35						

Casing Top Elev: 1.79 (ft)
Casing Type: 2" PVC Pipe

WELL DIAGRAM



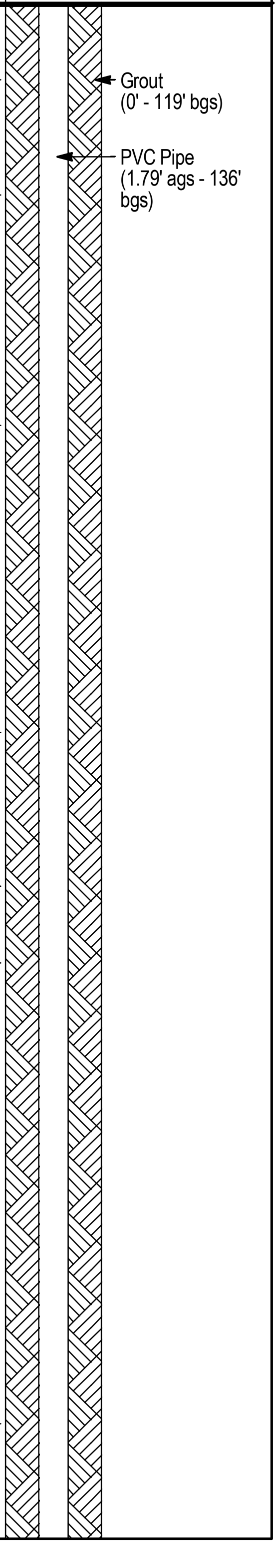
(Continued Next Page)

WELL NUMBER MW-2016-2

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENETROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				CL	▨	SILTY CLAY, reworked material; gray
37.0						1917.7
				CL	▨	CLAY, sticky, reworked; brown
40	SONIC	100				
40.0						1914.7
				CL	▨	S.A.A., brown to light brown
45						
46.0						1908.7
				CL	▨	SILTY CLAY, reworked material; light brown to gray
50	SONIC	100				
54.0						1900.7
				CL	▨	SILTY CLAY, reworked material; gray
55						
58.0						1896.7
				CL	▨	CLAY, reworked material; brown to gray
60	SONIC	100				
60.0						1894.7
				ML	▥	CLAYEY SILT, crumbly, reworked material; gray
65						
70	SONIC	100				
72.0						1882.7
				CL	▨	CLAY, very sticky, reworked material; brown
75						

WELL DIAGRAM



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CLIENT Basin Electric

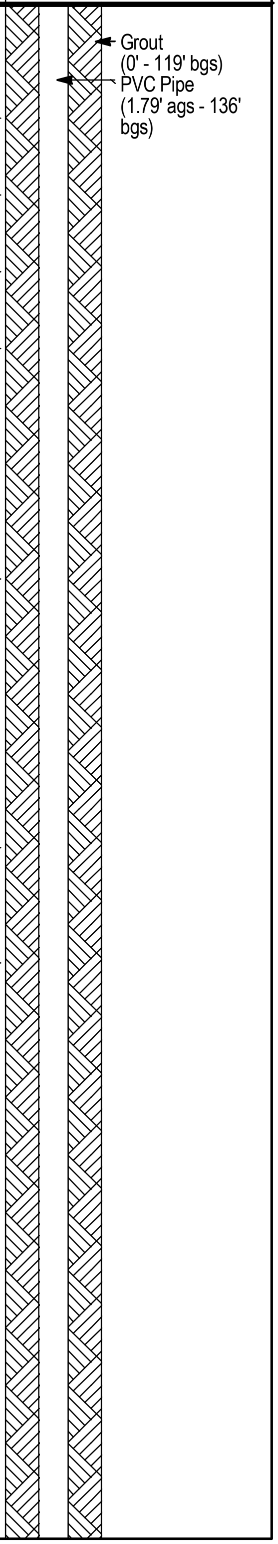
PROJECT NAME Lelands Olds Landfill

PROJECT NUMBER 60514340

PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
75				CL		CLAY, very sticky, reworked material; brown
						78.0 1876.7
				CL		CLAY, reworked material; gray
80	SONIC	100				80.0 1874.7
				CL		CLAY, stiff, reworked material; gray
						82.0 1872.7
				COAL		LIGNITE; brown
						84.0 1870.7
85				CL		CLAY, reworked material; gray with orange clay fragments
90	SONIC	100				90.0 1864.7
				CL		CLAY, with lignite fragments, reworked material; brown to light brown
95						
						97.0 1857.7
				CL		CLAY, hard, trace silt, native material; gray Slow drilling
100	SONIC	100				100.0 1854.7
				CL		CLAY, very hard; gray
105						
	SONIC	100				▼
110						
115	SONIC	100				

WELL DIAGRAM



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AECOM

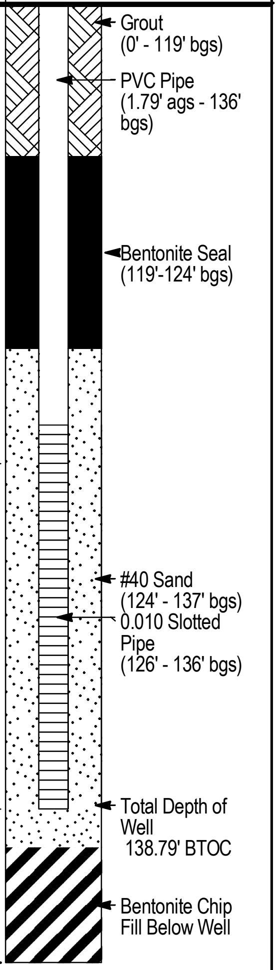
WELL NUMBER MW-2016-2

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
115						CLAY, very hard; gray	
120	SONIC	100		CL	▨		
125							
127.0						LIGNITE, dry, crumbly; brown to black	1827.7
130	SONIC	100		COAL	■		
135							
136.0						CLAY, very hard; gray	1818.7
	SONIC	100		CL	▨		
140.0							1814.7

Bottom of borehole at 140.0 feet.

WELL DIAGRAM



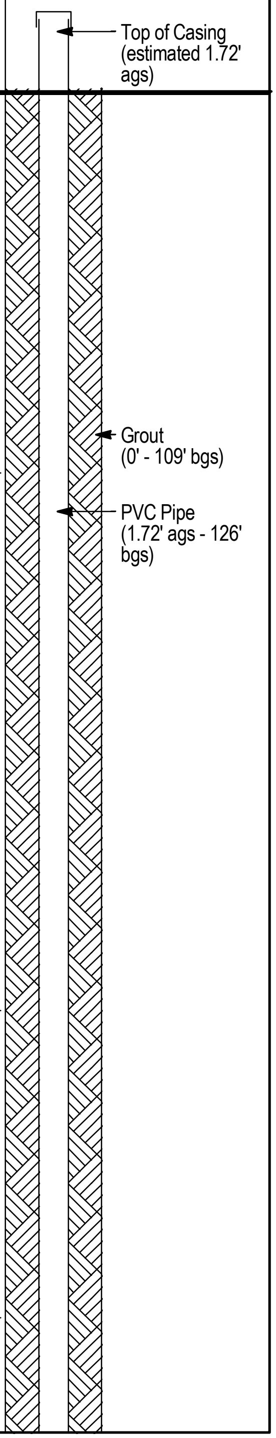
WELL NUMBER MW-2016-3

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND
DATE STARTED 8/5/2016
COMPLETED 8/5/2016
GROUND ELEVATION 1937.1 ft
HAMMER TYPE Not Applicable
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Rotary Sonic
AT TIME OF DRILLING ---
LOGGED BY Ryan Klute
CHECKED BY A. Lanning
AT END OF DRILLING ---
COORDINATES 578652.16 N 1784880.82 E
▽ **AFTER DRILLING** 93.14 ft / Elev 1843.96 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SONIC	100		CL	▨	CLAY, with fragments of lignite, reworked material; brown to light brown
5	SONIC	100			▨	
10				CL	▨	10.0 CLAY, trace silt, reworked material; brown 1927.1
15	SONIC	100			▨	
20					▨	
24.0				CL	▨	SILTY CLAY, reworked material; gray 1913.1
25	SONIC	100			▨	
30					▨	
32.0				CL	▨	CLAY, trace gravel, very sticky, reworked material; brown 1905.1
35					▨	

Casing Top Elev: 1.72 (ft)
Casing Type: 2" PVC Pipe

WELL DIAGRAM



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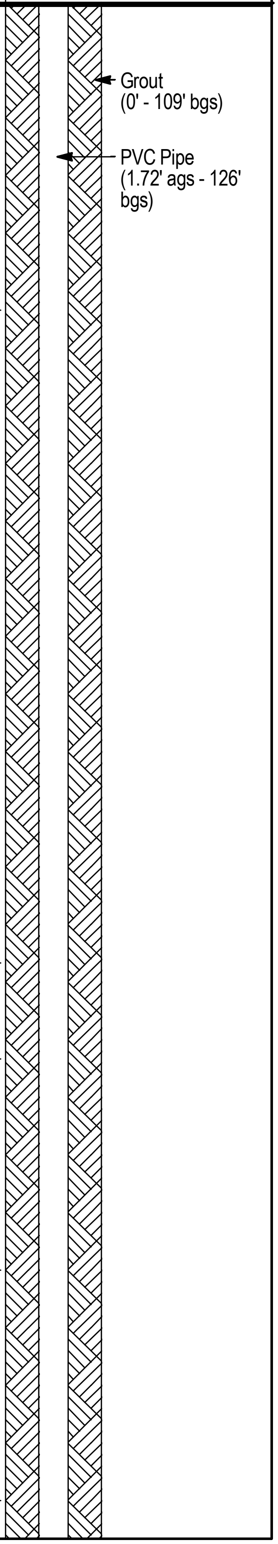
WELL NUMBER MW-2016-3

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				CL	▨	CLAY, trace gravel, very sticky, reworked material; brown
40	SONIC	100				
				CL	▨	43.0 — 1894.1 CLAY, with gray silt, reworked material; dark brown
45						
50	SONIC	100				
55						
60	SONIC	100		CL	▨	60.0 — 1877.1 CLAY, very sticky, reworked material; dark brown
				CL	▨	62.5 — 1874.6 SILTY CLAY, hard, reworked material; gray
65						
				CL	▨	68.0 — 1869.1 CLAY, reworked material; brown to orange
70	SONIC	100				
				CL	▨	74.0 — 1863.1 CLAY, sticky, reworked material; brown
75						

WELL DIAGRAM



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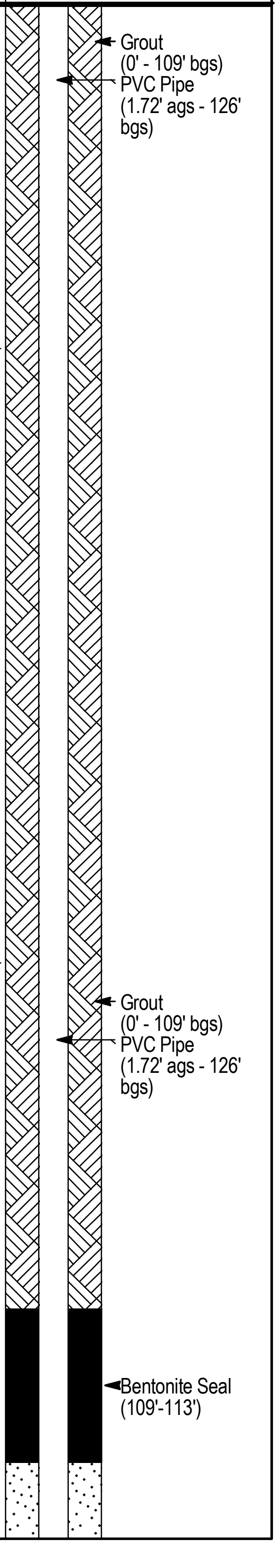
CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENETROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
75						CLAY, sticky, reworked material; brown
80	SONIC	100		CL		
84.0						CLAY, trace silt, very hard, native soil; gray Very hard drilling (84.0 – 1853.1)
85	SONIC	100				
90	SONIC	100		CL		▽
95	SONIC	100				
100						CLAY, very hard; gray Very hard drilling (100.0 – 1837.1)
100	SONIC	100				
105	SONIC	100		CL		
108	SONIC	100				
113						
115						115.0 – 1822.1

WELL DIAGRAM



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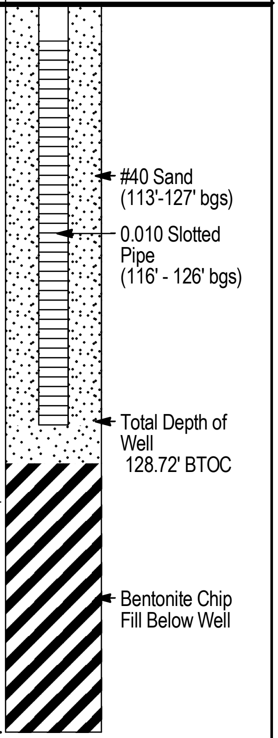
AECOM

WELL NUMBER MW-2016-3

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENETROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
115	SONIC	100		COAL		LIGNITE, dry, very crumbly; brown	
120	SONIC	100					
128.0						1809.1	
				CL		CLAY, very hard; gray	
130	SONIC	100					
134.0						1803.1	

Bottom of borehole at 134.0 feet.



AECOM

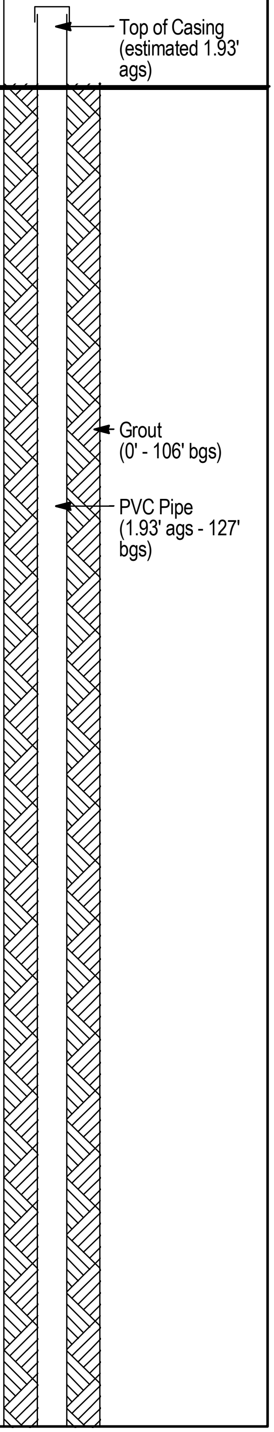
WELL NUMBER MW-2016-4

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND
DATE STARTED 8/2/2016
COMPLETED 8/4/2016
GROUND ELEVATION 1937.1 ft
HAMMER TYPE Not Applicable
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Rotary Sonic
AT TIME OF DRILLING ---
LOGGED BY Ryan Klute
CHECKED BY A. Lanning
AT END OF DRILLING ---
COORDINATES 578282.62 N 1784229.27 E
▽ **AFTER DRILLING** 75.41 ft / Elev 1861.69 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0							
0.5				OL		ORGANIC SILT, top soil; black	1936.6
	SONIC	100		CL		CLAY, reworked material; red to brown	
5							
5.5						CLAYEY SILT, reworked material; light brown to gray	1931.6
10	SONIC	100		ML			
15							
16.0						CLAY, sticky, reworked material; brown to light brown	1921.1
20	SONIC	100					
25				CL			
30	SONIC	100					
31.0						SILTY CLAY, reworked material; light brown Lenses of sticky brown clay	1906.1
35				CL			

Casing Top Elev: 1.93 (ft)
Casing Type: 2" PVC Pipe

WELL DIAGRAM



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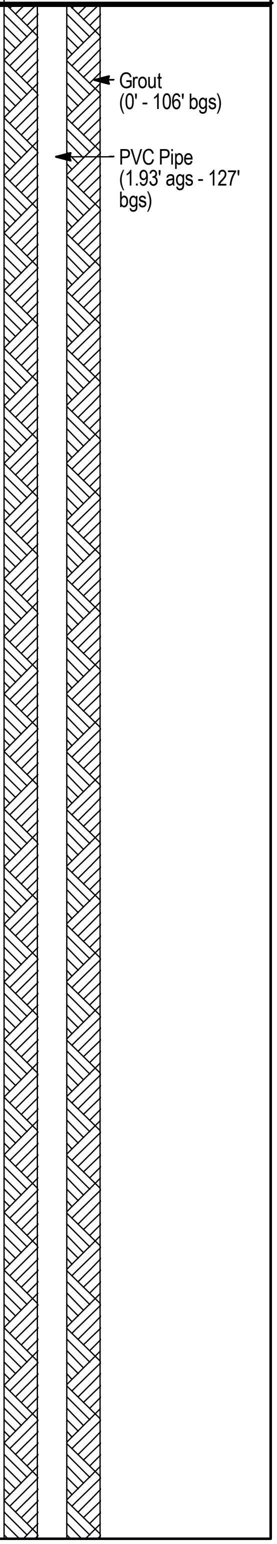
CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				CL	▨	SILTY CLAY, reworked material; light brown Lenses of sticky brown clay
38.0						1899.1
40	SONIC	100		ML	▥	CLAYEY SILT, crumbly, reworked material; gray
45.0						1892.1
45				CL	▨	CLAY, trace silt, reworked material; light brown to gray
50	SONIC	100				
51.0						1886.1
55				ML	▥	CLAYEY SILT, reworked material; gray
60	SONIC	100				
64.0						1873.1
65				CL	▨	CLAY, sticky, reworked material; moist, brown to light brown
70	SONIC	100				
73.0						1864.1
				COAL	■	LIGNITE, crumbly; brown to black
73.5						1863.6
75				CL	▨	CLAY, sticky, reworked material; brown to gray

WELL DIAGRAM



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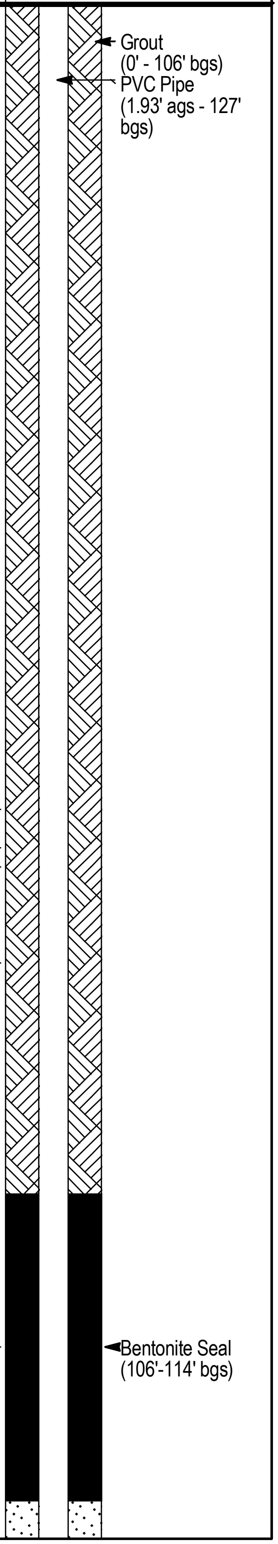
WELL NUMBER MW-2016-4

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENETROMETER, TSF	U.S.C.S.	MATERIAL DESCRIPTION	
75				CL	▽ CLAY, sticky, reworked material; brown to gray	
80	SONIC	100				
85						
90	SONIC	100				
95						
96.0				CL	CLAY, very hard, native material; gray	1841.1
97.0	SONIC	100		COAL	LIGNITE, very hard; brown	1840.1
97.5				CL	CLAY, very hard; gray	1839.6
100.0				CL	CLAY, very hard, trace silt; gray	1837.1
	SONIC	100				
105						
	SONIC	100				
110.0				CL	SILTY CLAY, with small lignite horizons; gray	1827.1
	SONIC	100				
115						

WELL DIAGRAM



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AECOM

WELL NUMBER MW-2016-4

CLIENT Basin Electric

PROJECT NAME Lelands Olds Landfill

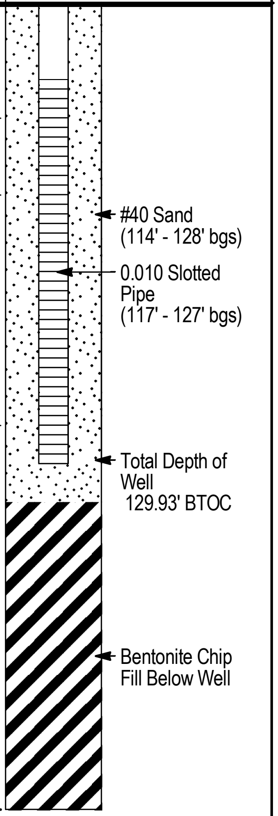
PROJECT NUMBER 60514340

PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENETROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
115	SONIC	100		CL	▨	SILTY CLAY, with small lignite horizons; gray	
118.0				COAL	■	LIGNITE; brown	1819.1
120.0				COAL	■	LIGNITE, dry, crumbly; brown to black	1817.1
125	SONIC	100					
126.0				CL	▨	CLAY, very hard; gray	1811.1
130	SONIC	100					
136.0							1801.1

Bottom of borehole at 136.0 feet.

WELL DIAGRAM



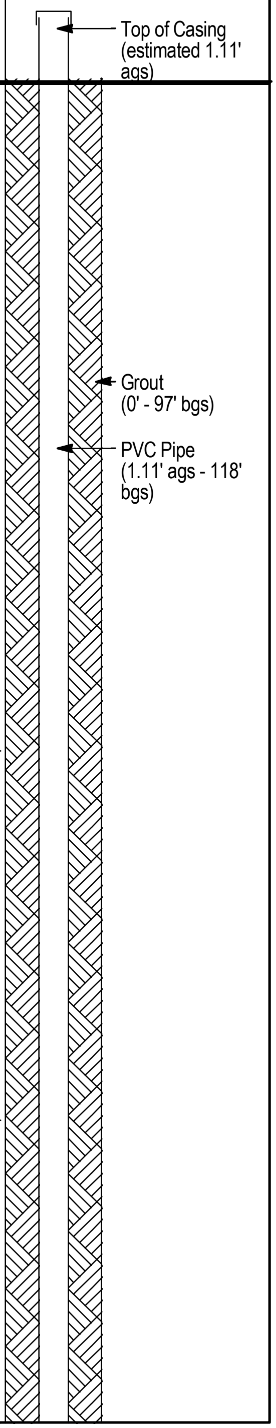
WELL NUMBER MW-2016-5

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND
DATE STARTED 8/10/2016 **COMPLETED** 8/10/2016
GROUND ELEVATION 1935.2 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Rotary Sonic
AT TIME OF DRILLING ---
LOGGED BY Ryan Klute **CHECKED BY** A. Lanning
AT END OF DRILLING ---
COORDINATES 577257.45 N 1783618.06 E
▽ **AFTER DRILLING** 49.81 ft / Elev 1885.39 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0	SONIC	100		CL	▨	CLAY, reworked material; brown	
5	SONIC	100					
15	SONIC	100					
20.0				CL	▨	CLAY, with lignite fragments, reworked material; brown	1915.2
31.0				CL	▨	SANDY CLAY, reworked material; light brown	1904.2
35							
40.0							1895.2

Casing Top Elev: 1.11 (ft)
Casing Type: 2" PVC Pipe

WELL DIAGRAM



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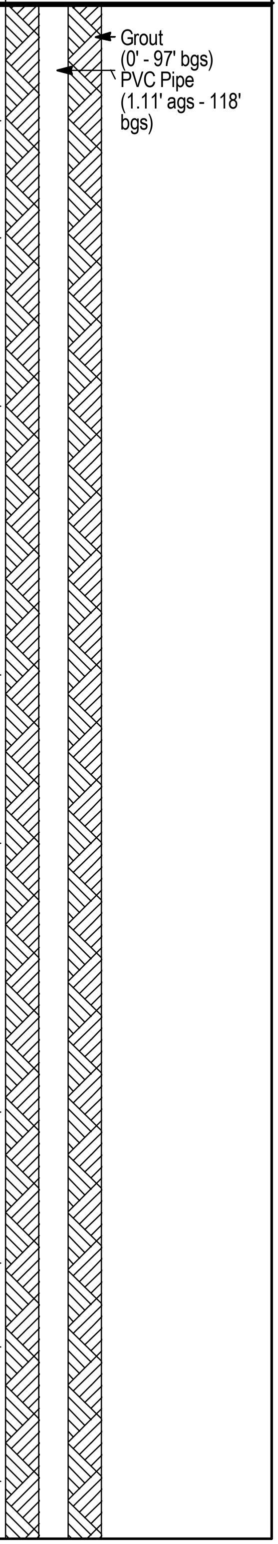
AECOM

WELL NUMBER MW-2016-5

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
40	SONIC	100		CL	▨	CLAY, reworked material; brown
43.5				CL	▨	1891.7 SANDY CLAY, reworked material; gray
45					▨	
47.0				CL	▨	1888.2 CLAY, sticky, reworked material; brown
50	SONIC	100			▨	▽
52.0				CL	▨	1883.2 SANDY CLAY, reworked material; brown with orange clay horizons
55					▨	
60	SONIC	100			▨	
60.0				CL	▨	1875.2 SANDY CLAY, trace gravel, reworked material; gray
65					▨	
65.0				CL	▨	1870.2 SANDY CLAY, trace gravel, crumbly, reworked material; light brown
70	SONIC	100			▨	
73.0				CL	▨	1862.2 CLAY, with lignite fragments, very hard; gray
75					▨	
77.5				CL	▨	1857.7 CLAY, sticky, trace gravel and lignite fragments, reworked materials; brown
80	SONIC	100			▨	
80.0				CL	▨	1855.2 CLAY, with lignite fragments, reworked materials; brown to light brown
84.0				CL	▨	1851.2 CLAY, with lignite, reworked horizons; brown with orange clay horizons
85					▨	

WELL DIAGRAM



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AECOM

WELL NUMBER MW-2016-5

CLIENT Basin Electric

PROJECT NAME Lelands Olds Landfill

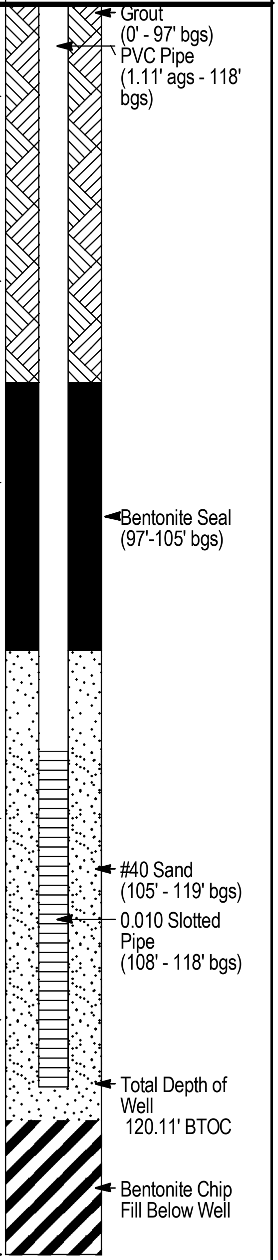
PROJECT NUMBER 60514340

PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION	
	SONIC	100		CL		88.5	CLAY, with lignite, reworked horizons; brown with orange clay horizons	1846.7
90				CL		94.0	SANDY CLAY, very hard, crumbly, reworked material; light brown	1841.2
95	SONIC	100		CL		100.0	CLAY, trace silt, very hard, native material; gray Very hard drilling	1835.2
100 105	SONIC	100		CL		110.0	CLAY, trace silt, very hard; gray Very hard drilling	1825.2
110 115	SONIC	100		COAL		116.0	LIGNITE, dry, crumbly; brown	1819.2
120	SONIC	100		CL		123.0	CLAY, hard; gray	1812.2

Bottom of borehole at 123.0 feet.

WELL DIAGRAM



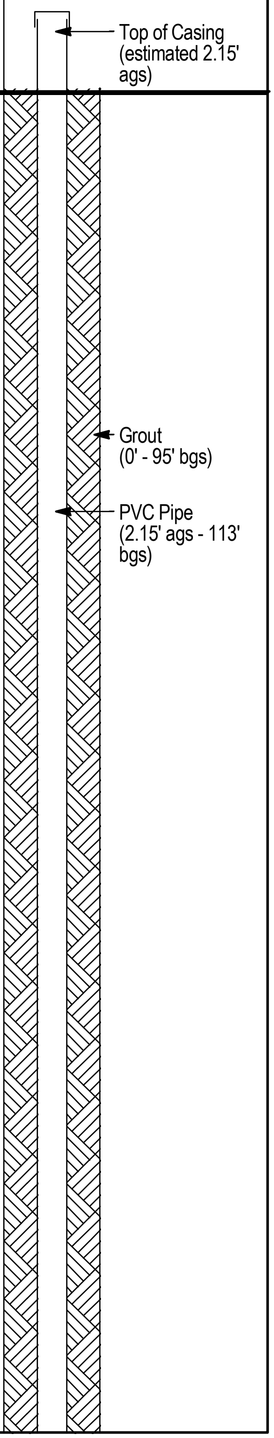
WELL NUMBER MW-2016-6

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND
DATE STARTED 8/9/2016 **COMPLETED** 8/9/2016
GROUND ELEVATION 1936.3 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Rotary Sonic
AT TIME OF DRILLING ---
LOGGED BY Ryan Klute **CHECKED BY** A. Lanning
AT END OF DRILLING ---
COORDINATES 576684.53 N 1783949.78 E
▽ **AFTER DRILLING** 41.47 ft / Elev 1894.83 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0	SONIC	100		CL		CLAY, reworked material; brown to light brown	
5	SONIC	100					
11.0				CL		CLAY, sticky, reworked material; brown	1925.3
15	SONIC	100					
31.0				CL		SANDY CLAY, reworked material; gray	1905.3
35.0							1901.3

Casing Top Elev: 2.15 (ft)
Casing Type: 2" PVC Pipe

WELL DIAGRAM



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AECOM

WELL NUMBER MW-2016-6

CLIENT Basin Electric

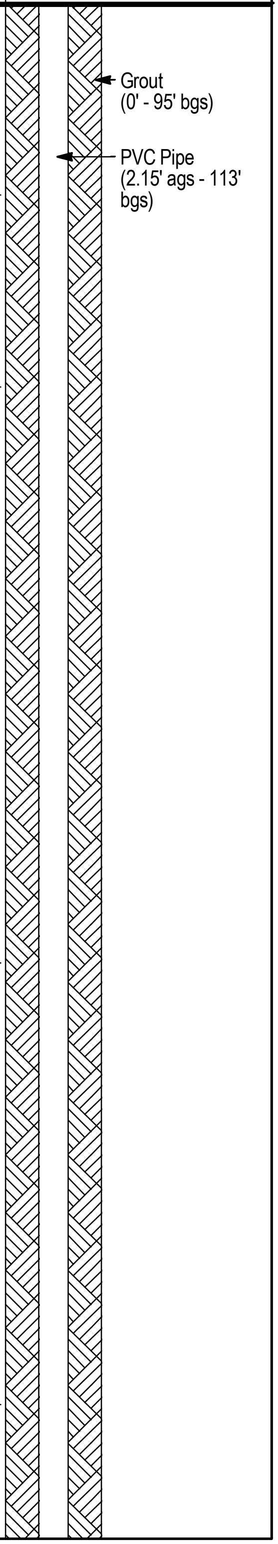
PROJECT NUMBER 60514340

PROJECT NAME Lelands Olds Landfill

PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
35	SONIC	100		CL	▨	CLAY, reworked material; light brown	
40.0				CL	▨	SILTY CLAY, stiff, reworked material; gray ▽	1896.3
45.0	SONIC	100		CL	▨	SANDY CLAY, very soft, reworked material; gray with brown clay lenses	1891.3
55	SONIC	100			▨		
60.0				CL	▨	SANDY CLAY, reworked material; gray with brown clay lenses	1876.3
71.5				CL	▨	SANDY CLAY, with lignite fragments, reworked material; gray	1864.8
75							

WELL DIAGRAM



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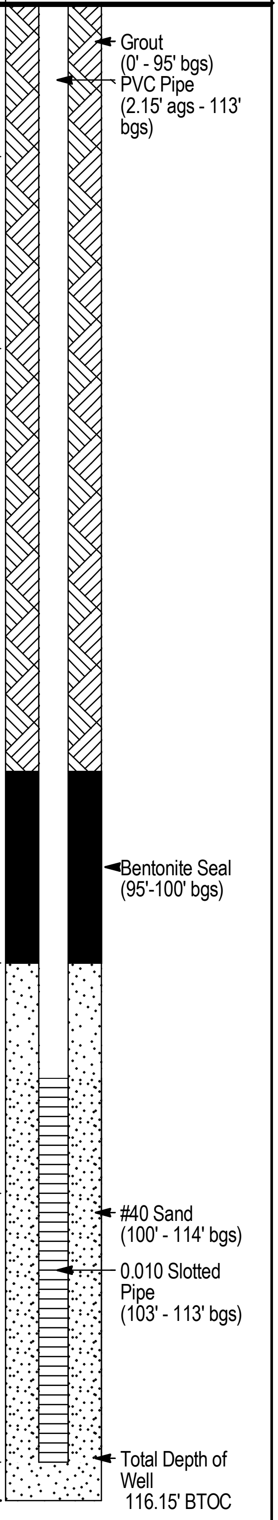
WELL NUMBER MW-2016-6

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
75	SONIC	100		CL	▨	SANDY CLAY, with lignite fragments, reworked material; gray	
						79.0	1857.3
80				CL	▨	CLAY, with lignite fragments, reworked material; brown	
						84.0	1852.3
85	SONIC	100		CL	▨	CLAY, very hard, native material; gray	
90	SONIC	100			▨		
95	SONIC	100			▨		
						100.0	1836.3
100	SONIC	100		CL	▨	CLAY, very hard, native material; gray Very hard drilling	
						106.0	1830.3
105	SONIC	100		COAL	■	LIGNITE, crumbly; brown	
110	SONIC	100			■		
						113.0	1823.3
				CL	▨	CLAY, very hard; gray	
						114.0	1822.3

Bottom of borehole at 114.0 feet.

WELL DIAGRAM



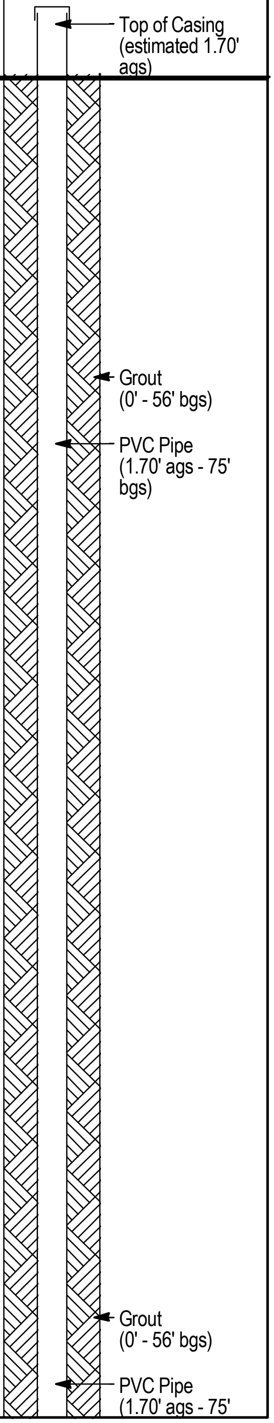
WELL NUMBER MW-2016-7

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND
DATE STARTED 8/8/2016 **COMPLETED** 8/8/2016
GROUND ELEVATION 1926.6 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Rotary Sonic
AT TIME OF DRILLING ---
LOGGED BY Ryan Klute **CHECKED BY** A. Lanning
AT END OF DRILLING ---
COORDINATES 576226.36 N 1785071.11 E
AFTER DRILLING 72.93 ft / Elev 1853.67 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SONIC	100		CL		CLAY, sticky, reworked material; brown to light brown
5	SONIC	100				
9.5				CL		SILTY CLAY, reworked material; gray (1917.1)
15	SONIC	100				
19.0				CL		CLAY, reworked material; brown to light brown (1907.6)
30.0				CL		SILTY CLAY, reworked material; gray (1896.6)
35						
36.0				CL		CLAY, sticky; brown (1890.6)
40.0						(1886.6)

Casing Top Elev: 1.7 (ft)
Casing Type: 2" PVC Pipe

WELL DIAGRAM



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AECOM

WELL NUMBER MW-2016-7

CLIENT Basin Electric

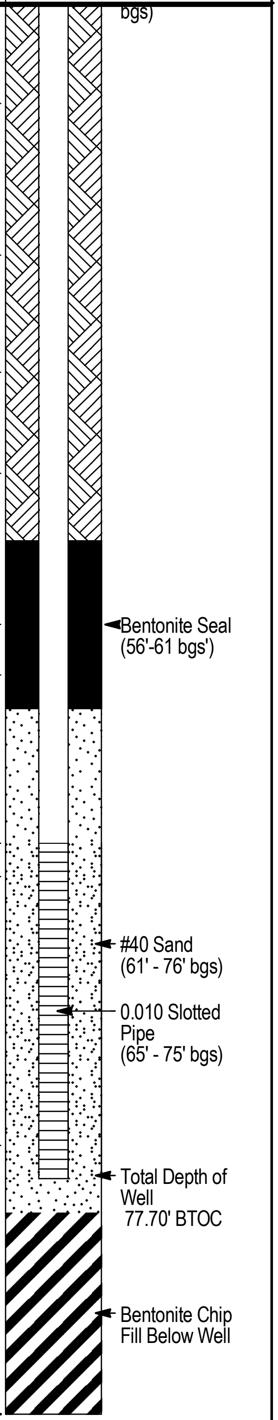
PROJECT NAME Lelands Olds Landfill

PROJECT NUMBER 60514340

PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		
40	SONIC	100		CL		CLAY, sticky, reworked material; brown	43.0	1883.6
45				ML		CLAYEY SILT, hard, reworked material; gray	47.5	1879.1
50	SONIC	100		CL		CLAY, sticky, reworked material; brown	51.0	1875.6
				CL		CLAY, with lignite and gravel fragments, reworked material; brown	54.0	1872.6
55				CL		SILTY CLAY, reworked material; gray	58.5	1868.1
60	SONIC	100		CL		CLAY, sticky, reworked material; brown	60.0	1866.6
				CL		CLAY, sticky, reworked material; brown to orange	65.0	1861.6
65				CL		CLAY, hard, native material; gray	66.0	1860.6
70	SONIC	100		COAL		LIGNITE, powdery; black to brown ∇	74.0	1852.6
75 80	SONIC	100		CL		CLAY, very hard; gray	82.0	1844.6

WELL DIAGRAM



Bottom of borehole at 82.0 feet.

AECOM

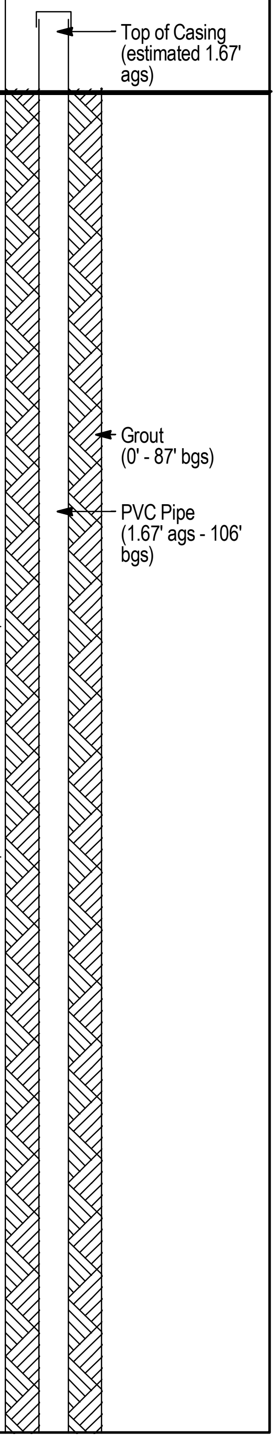
WELL NUMBER MW-2016-8

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND
DATE STARTED 8/8/2016 **COMPLETED** 8/9/2016
GROUND ELEVATION 1936.9 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Rotary Sonic
AT TIME OF DRILLING ---
LOGGED BY Ryan Klute **CHECKED BY** A. Lanning
AT END OF DRILLING ---
COORDINATES 576383.7 N 1785994.31 E
▽ **AFTER DRILLING** 57.93 ft / Elev 1878.97 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENETROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0	SONIC	100		CL	▨	CLAY, reworked material; brown	
5	SONIC	100			▨		
14.0				CL	▨	SANDY CLAY, reworked material; light brown	1922.9
15	SONIC	100			▨		
20.0				CL	▨	CLAY, reworked material; brown with light brown sandy clay horizons	1916.9
35							

Casing Top Elev: 1.67 (ft)
Casing Type: 2" PVC Pipe

WELL DIAGRAM



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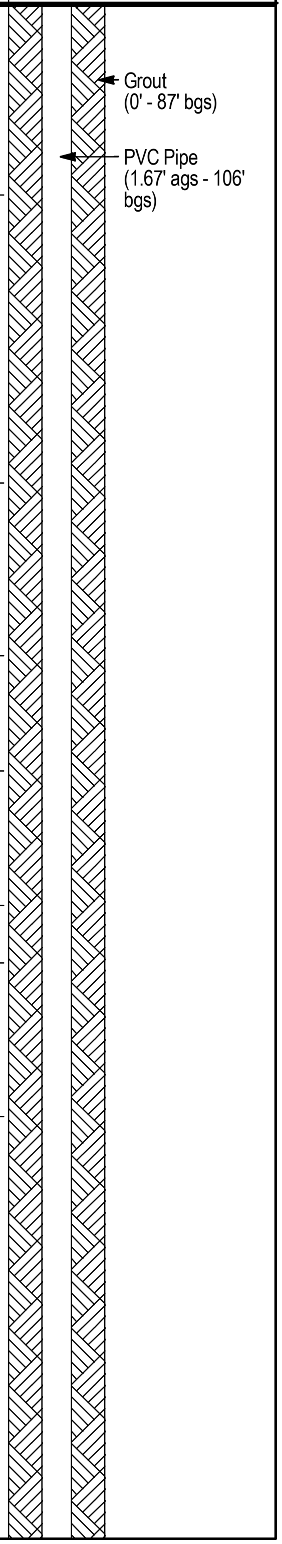
WELL NUMBER MW-2016-8

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35				CL	▨	CLAY, reworked material; brown with light brown sandy clay horizons
40	SONIC	100		CL	▨	40.0 1896.9 CLAY, with sandy clay, reworked material; brown with gray clay horizons
45						
				CL	▨	47.5 1889.4 CLAY, reworked material; brown
50	SONIC	100				
				CL	▨	52.0 1884.9 CLAY, with lignite, reworked material; brown
55				CL	▨	55.0 1881.9 SANDY CLAY, reworked material; brown
				CL	▨	▼ 58.5 1878.4 CLAY, with lignite fragments, sticky, reworked material; brown
60	SONIC	100		CL	▨	60.0 1876.9 CLAY, sticky, reworked material; brown
				SANDSTONE	░	64.0 1872.9 SANDSTONE, poorly cemented, very crumbly; red to orange
65						
70	SONIC	100				
75						

WELL DIAGRAM



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WELL NUMBER MW-2016-8

CLIENT Basin Electric

PROJECT NAME Lelands Olds Landfill

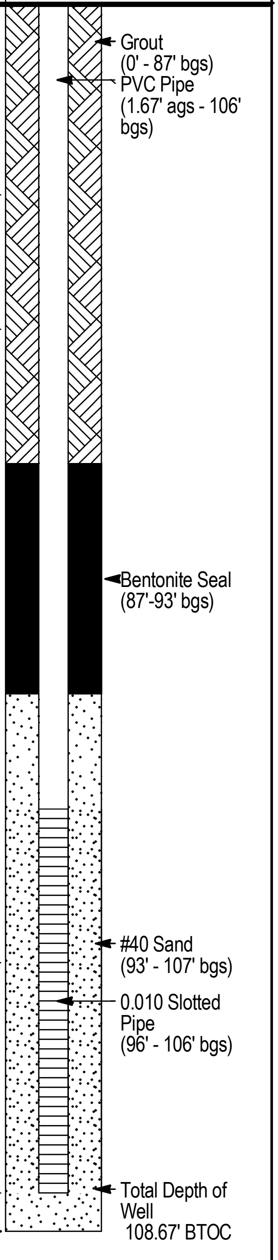
PROJECT NUMBER 60514340

PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		
75	SONIC	100		SANDSTONE		SANDSTONE, poorly cemented, very crumbly; red to orange	80.0	1856.9
80				CL		CLAY, very hard; light brown	83.5	1853.4
85	SONIC	100		CL		CLAY, very hard, native material; gray		
95	SONIC	100					100.0	1836.9
100				COAL		LIGNITE, crumbly; brown to black		
102	SONIC	100					106.0	1830.9
106				CL		CLAY, hard; gray	107.0	1829.9

Bottom of borehole at 107.0 feet.

WELL DIAGRAM



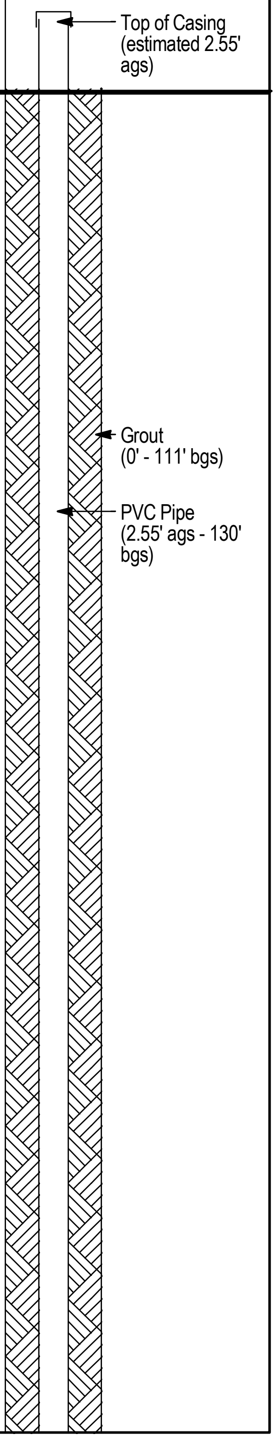
WELL NUMBER MW-2016-9

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND
DATE STARTED 11/2/2016 **COMPLETED** 11/3/2016
GROUND ELEVATION 1945.505 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Rotary Sonic
AT TIME OF DRILLING ---
LOGGED BY Ryan Klute **CHECKED BY** A. Lanning
AT END OF DRILLING ---
COORDINATES 578206.826 N 1785499.348 E
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						FILL - CLAY, reworked; brown
5	SONIC	100				
10						
15	SONIC	100				
				CL		
20						
25						
30	SONIC	100				
35						

Casing Top Elev: 2.55 (ft)
Casing Type: 4" PVC Pipe

WELL DIAGRAM



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AECOM

WELL NUMBER MW-2016-9

CLIENT Basin Electric

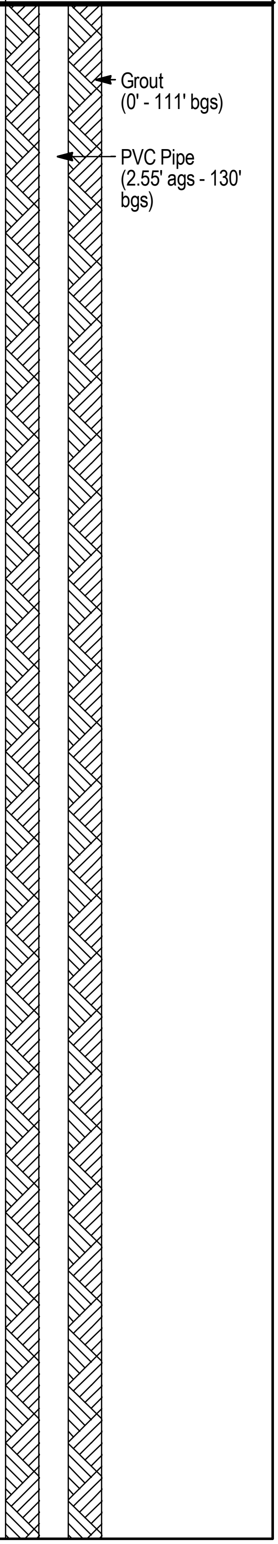
PROJECT NAME Lelands Olds Landfill

PROJECT NUMBER 60514340

PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENETROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
35						FILL - CLAY, reworked; brown
40						
45						
50	SONIC	100				
55				CL		
60						
65	SONIC	100				
70						
75						

WELL DIAGRAM



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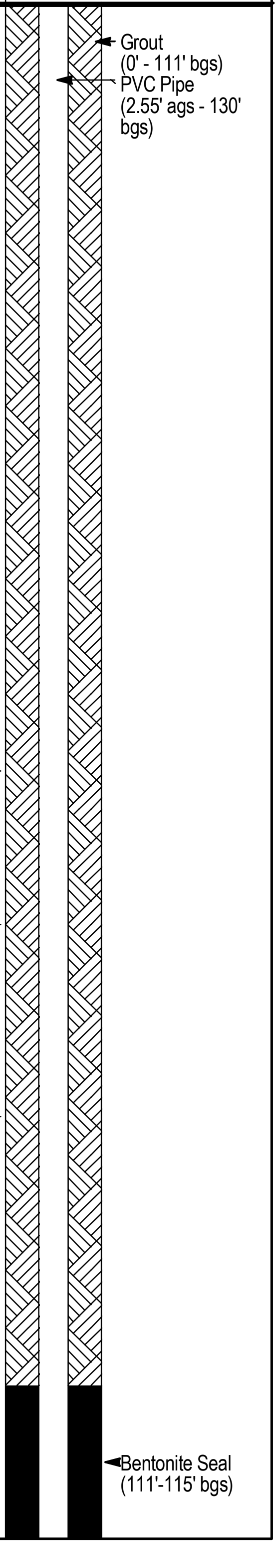
WELL NUMBER MW-2016-9

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	MATERIAL DESCRIPTION	
75	SONIC	100			FILL - CLAY, reworked; brown	
80						
85	SONIC	100		CL		
90						
95	SONIC	100			95.0	1850.5
				CL	CLAY, native material, very hard; gray	
					99.0	1846.5
100				COAL	LIGNITE, clay; gray	
					104.0	1841.5
105	SONIC	100			CLAY, very hard; moist; gray	
110				CL		
115						

WELL DIAGRAM



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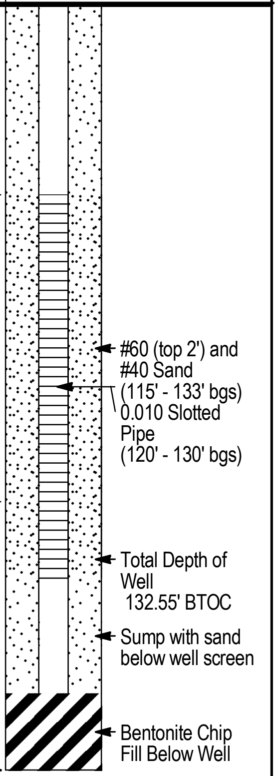
WELL NUMBER MW-2016-9

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	MATERIAL DESCRIPTION		
115	SONIC	100		CL	CLAY, very hard; moist; gray	120.0	1825.5
120	SONIC SONIC SONIC	100 100 100		COAL	LIGNITE; brown and black	128.0	1817.5
130	SONIC	100		CL	CLAY, very hard; gray	135.0	1810.5
135							

Bottom of borehole at 135.0 feet.

WELL DIAGRAM



AECOM

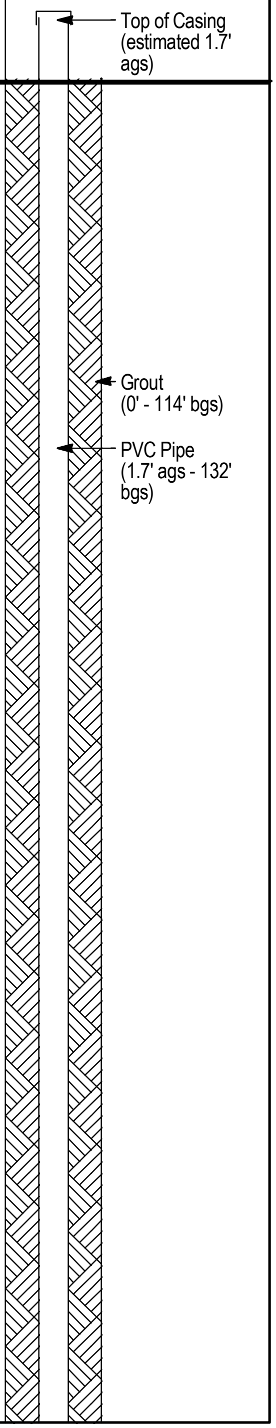
WELL NUMBER MW-2016-10

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND
DATE STARTED 11/4/2016 **COMPLETED** 11/5/2016
GROUND ELEVATION 1951.612 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Rotary Sonic
AT TIME OF DRILLING ---
LOGGED BY Ryan Klute **CHECKED BY** A. Lanning
AT END OF DRILLING ---
COORDINATES 577524.198 N 1786051.255 E
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					▨	FILL - CLAY, reworked; brown
5	SONIC	100			▨	
10					▨	
15	SONIC	100			▨	
20				CL	▨	
25	SONIC	100			▨	
30					▨	
35	SONIC	100			▨	
40					▨	

Casing Top Elev: 1.7 (ft)
Casing Type: 4" PVC Pipe

WELL DIAGRAM



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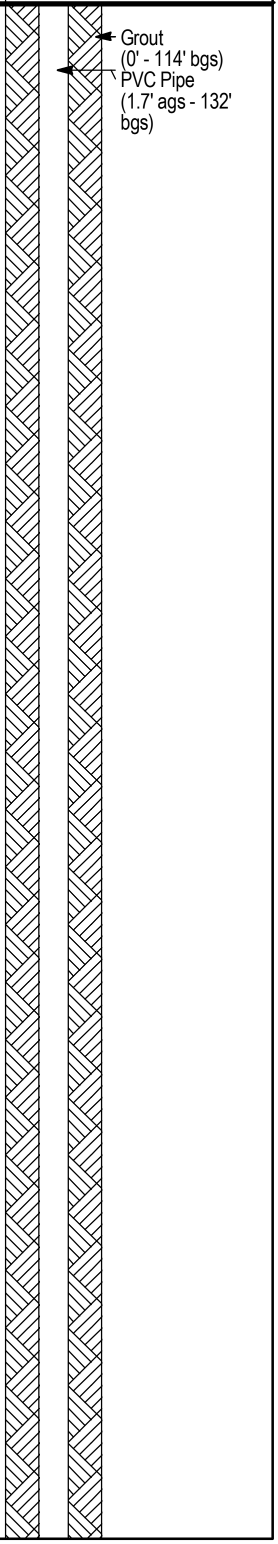
CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
40					▨		
45	SONIC	100			▨		
50					▨		
55	SONIC	100			▨		
60					▨		
65	SONIC	100		CL	▨		
70					▨		
75	SONIC	100			▨		
80					▨		
85	SONIC	100			▨		



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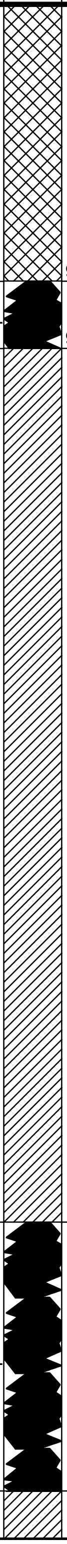
CLIENT Basin Electric

PROJECT NUMBER 60514340

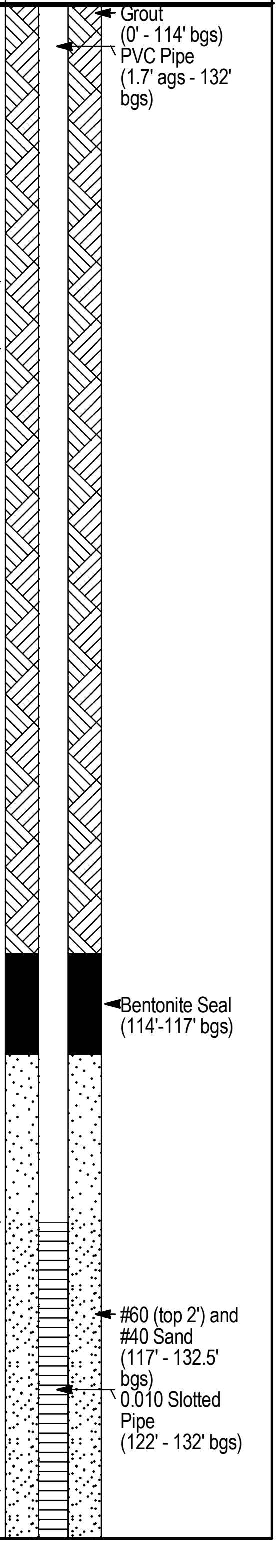
PROJECT NAME Lelands Olds Landfill

PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
90				CL		
94.0						1857.6
95	SONIC	100		COAL		LIGNITE; black and brown
96.0						1855.6
						CLAY, very hard; gray
100						
105	SONIC	100				
110				CL		
115	SONIC	100				
120						
122.0						1829.6
						LIGNITE; brown
125	SONIC	100		COAL		
130.0						1821.6
130				CL		CLAY, very hard; gray



WELL DIAGRAM



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AECOM

WELL NUMBER MW-2016-10

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENETROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		
135 140	SONIC	100		CL	▨	CLAY, very hard; gray LIGNITE (<1")	140.0	1811.6
	SONIC	100		SANDSTONE	░	SANDSTONE, uncolsidated; gray and light brown	142.0	1809.6
145				LIMESTONE	▦	LIMESTONE	145.0	1806.6

Bottom of borehole at 145.0 feet.

WELL DIAGRAM

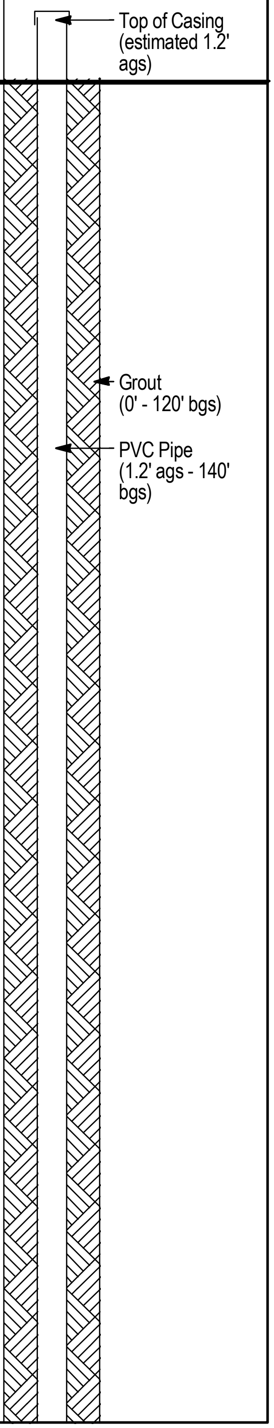
WELL NUMBER MW-2016-11

CLIENT Basin Electric
PROJECT NAME Lelands Olds Landfill
PROJECT NUMBER 60514340
PROJECT LOCATION Stanton, ND
DATE STARTED 11/18/2016 **COMPLETED** 11/20/2016
GROUND ELEVATION 1954.851 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling
GROUND WATER LEVELS:
DRILLING METHOD Rotary Sonic
AT TIME OF DRILLING ---
LOGGED BY Ryan Klute **CHECKED BY** A. Lanning
AT END OF DRILLING ---
COORDINATES 577977.515 N 1785347.299 E
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENETROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					▨	FILL - CLAY, reworked; brown
5	SONIC	100			▨	
10					▨	
15	SONIC	100			▨	
20				CL	▨	
25	SONIC	100			▨	
30					▨	
35	SONIC	100			▨	
40					▨	

Casing Top Elev: 1.2 (ft)
Casing Type: 4" PVC Pipe

WELL DIAGRAM



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CLIENT Basin Electric

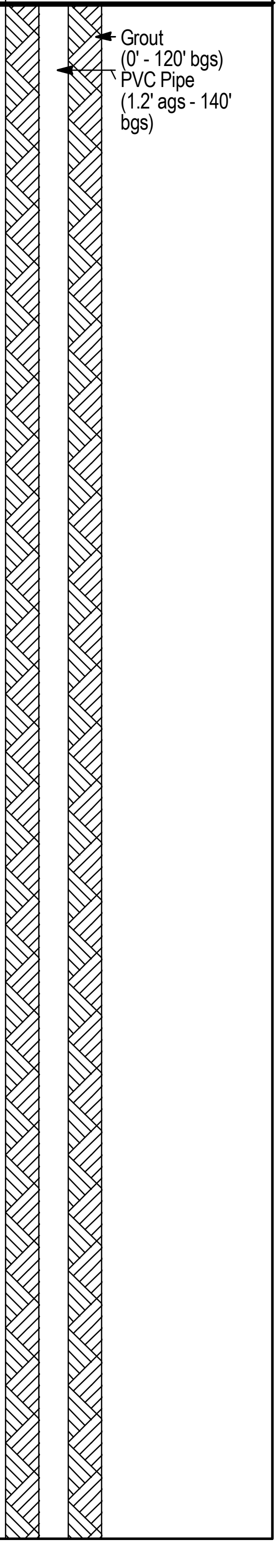
PROJECT NAME Lelands Olds Landfill

PROJECT NUMBER 60514340

PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
40					▨	FILL - CLAY, reworked; brown
45	SONIC	100				
50						
55	SONIC	100				
60						
65	SONIC	100		CL		
70						
75	SONIC	100				
80						FILL - CLAY, reworked; brown trace lignite fragments
85	SONIC	100				

WELL DIAGRAM



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WELL NUMBER MW-2016-11

CLIENT Basin Electric

PROJECT NAME Lelands Olds Landfill

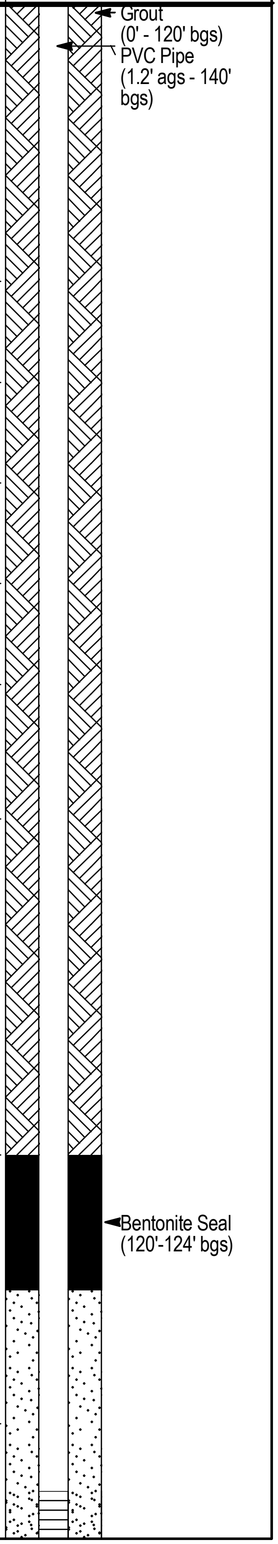
PROJECT NUMBER 60514340

PROJECT LOCATION Stanton, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENETROMETER, TSF
90 - 100	SONIC	100	
100 - 110	SONIC	100	
110 - 120	SONIC	100	
120 - 125	SONIC	100	
125 -	SONIC	100	

DEPTH (ft)	U.S.C.S.	MATERIAL DESCRIPTION	ELEVATION
	CL	FILL - CLAY, reworked; brown trace lignite fragments	
94.0	SANDSTONE	SANDSTONE/CHERT, unconsolidated, reworked material; orange	1860.9
97.0	CL	FILL - CLAY, reworked; brown and orange	1857.9
100.0	CL	FILL - CLAY, reworked, minor lignite fragments; brown and orange	1854.9
103.0	CL	FILL - CLAY, reworked material; orange	1851.9
106.0	CL	CLAY/SILT, very hard; gray	1848.9
110.0	CL	LIGNITE (<1") CLAY, crumbly, native material; gray	1844.9
120.0	CL	CLAY, very hard; gray	1834.9
128.0	COAL	LIGNITE, minor moisture present in fractures; brown and black	1826.9

WELL DIAGRAM



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WELL NUMBER MW-2016-11

CLIENT Basin Electric

PROJECT NAME Lelands Olds Landfill

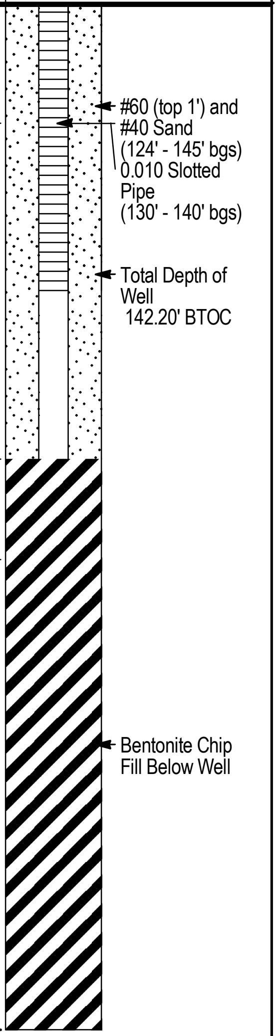
PROJECT NUMBER 60514340

PROJECT LOCATION Stanton, ND

DEPTH (ft)	U.S.C.S.	MATERIAL DESCRIPTION	
to 135.0	COAL	LIGNITE, minor moisture present in fractures; brown and black	1819.9
135.0 – 145.0	CL	CLAY, very hard; gray	1809.9
145.0 – 148.0	LIMESTONE	LIMESTONE/SANDSTONE, unconsolidated; yellow	1806.9
148.0 – 162.0	CL	CLAY, very hard; gray	1792.9

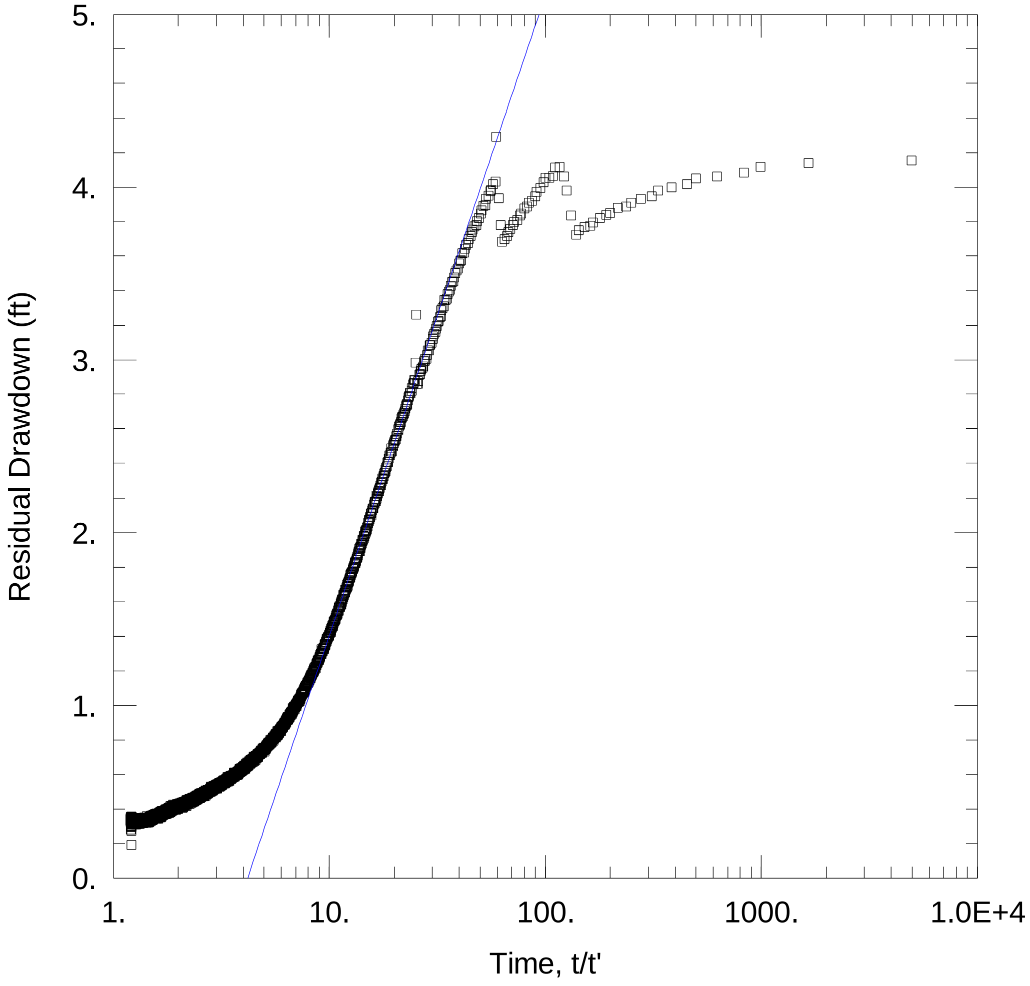
SAMPLE TYPE NUMBER	% RECOVERY
SONIC	100
SONIC	100
SONIC	100
SONIC	100
SONIC	100

Bottom of borehole at 162.0 feet.



Appendix B

Aquifer Test Procedures, Data and Analysis



WELL TEST ANALYSIS

Data Set: C:\...\Basin Electric MW-2016-4.aqt
Date: 09/28/17 Time: 15:35:07

PROJECT INFORMATION

Company: AECOM
Client: Basin Electric
Project: 60514340
Location: Lelands Olds Landfill
Test Well: MW-2016-4
Test Date: 8/23/2016

AQUIFER DATA

Saturated Thickness: 8. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

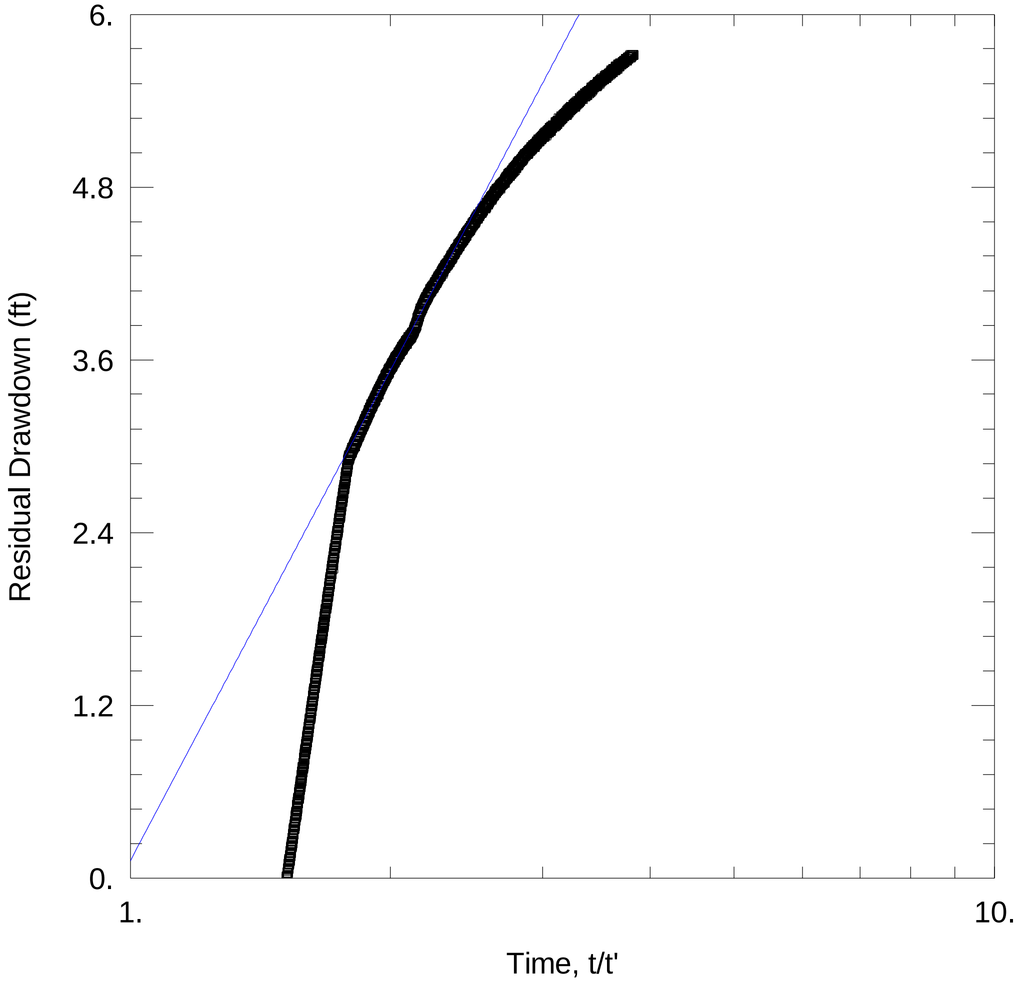
Well Name	X (ft)	Y (ft)
MW-2016-4	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ MW-2016-4	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)
K = 2.22E-5 cm/sec S/S' = 4.194



WELL TEST ANALYSIS

Data Set: C:\...\Basin Electric MW-2016-8.aqt
Date: 09/28/17 Time: 15:41:56

PROJECT INFORMATION

Company: AECOM
Client: Basin Electric
Project: 60514340
Location: Lelands Olds Landfill
Test Well: MW-2016-8
Test Date: 8/22/2016

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

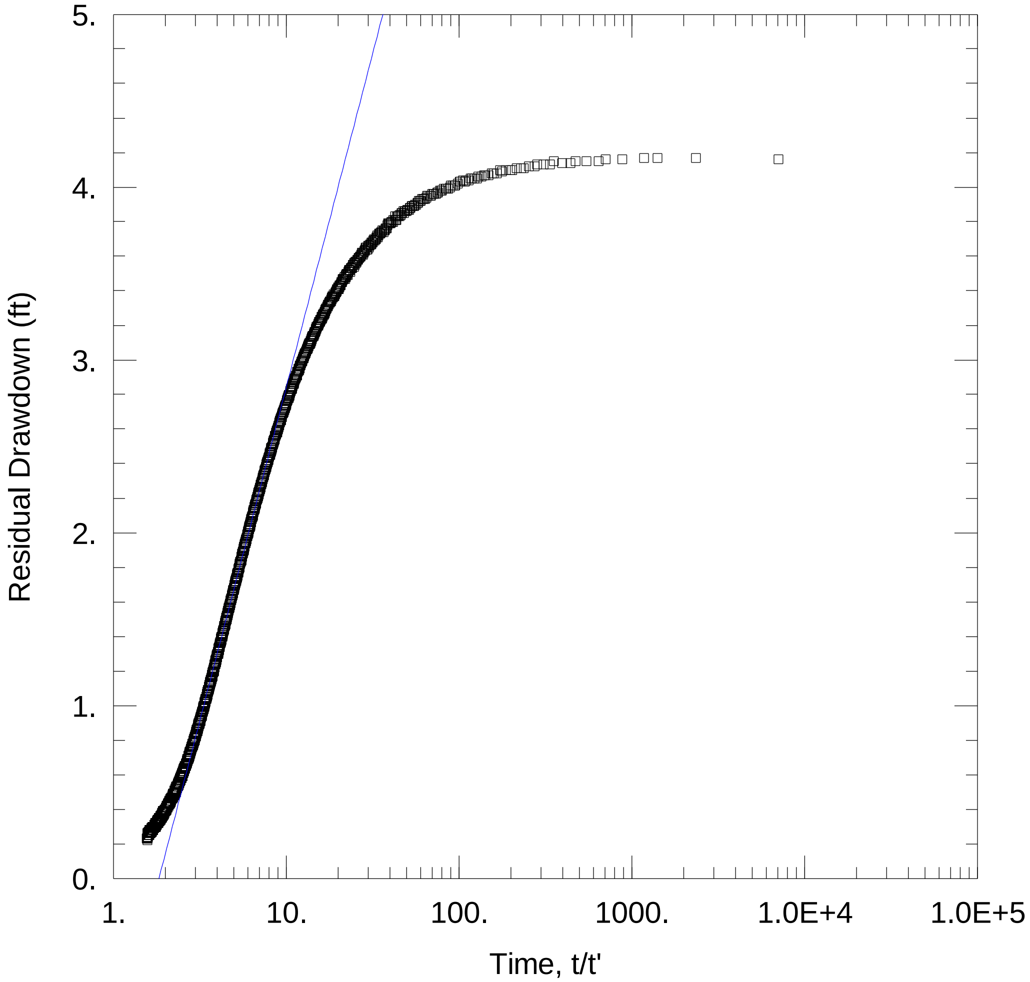
Well Name	X (ft)	Y (ft)
MW-2016-8	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ MW-2016-8	0	0

SOLUTION

Aquifer Model: Confined
Solution Method: Theis (Recovery)
K = 7.26E-6 cm/sec
S/S' = 0.9763



WELL TEST ANALYSIS

Data Set: C:\...\Basin Electric MW-2016-10.aqt
Date: 09/28/17 Time: 15:46:02

PROJECT INFORMATION

Company: AECOM
Client: Basin Electric
Project: 60514340
Location: Lelands Olds Landfill
Test Well: MW-2016-10
Test Date: 8/22/2016

AQUIFER DATA

Saturated Thickness: 8. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW-2016-10	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ MW-2016-10	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

K = 2.13E-5 cm/sec S/S' = 1.842

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Bismarck, ND 58503
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