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SUPPLEMENTAL DATA COLLECTION PROGRAM TRIP REPORT

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1.0 INTRODUCTION

As part of its efforts to reclaim the Split Rock Site in Jeffrey City, Wyoming, Western Nuclear, Inc. (WNI) submitted to the Nuclear Regulatory Commission (NRC) a comprehensive site characterization and a proposed site closure plan for addressing groundwater compliance and license termination (SMI, 1999). As a result of NRC's review of this submittal, NRC developed a request for additional information (RAI; NRC, 2001). WNI responded to most of the RAI questions in its submittals dated November 13, 2001 and January 14, 2002. Further conversations with NRC staff in a meeting on October 3, 2001 and in subsequent phone calls identified a need for additional data collection to resolve remaining questions regarding site-derived constituents in groundwater. Based on these conversations and NRC technical staff input, WNI developed and performed a supplemental data collection program (SDCP). This document summarizes the activities performed as part of the SDCP and presents the resulting data in support of the response to the NRC RAI.

2.0 SITE INVESTIGATION

2.1 Introduction

The SCDP Shepherd Miller (SM) recently performed included boring core logging, aquifer material sampling, well installation, and groundwater sampling. The field investigation was conducted from January 7 through January 18, 2002 and focused on the Red Mule (RM) and Claytor Ranch (CL) areas to more accurately characterize the hydrology and geochemistry of these locations (Figure 2-1). Specifically, SM acquired groundwater samples and aquifer material for geochemical testing and analysis and installed additional groundwater monitoring wells between the Red Mule area and the site. This work was performed pursuant to the SDCP work scope for the Split Rock Site (SM, 2001a) and associated Health and Safety Plan (Attachment A).

In addition, WNI personnel conducted further groundwater sampling of both existing and newly installed wells during February and April 2002. This sampling was designed to:

- Aid in characterizing the geochemistry in the Red Mule area
- Aid in further characterizing the potential movement of contaminants from the Southwest Valley in relation to the Red Mule area
- Aid in further characterizing the potential movement of contaminants from the Southwest Valley in relation to the truck shop area

The following sections address the specific components of the field investigation, including drilling and sampling of borings and the installation and completion of monitoring wells. Discussion of the geochemical sampling and analysis of boring materials and groundwater is presented in Section 3.

2.2 Boring Drilling and Monitoring Well Installation

Five borings and four monitoring wells were installed between January 7 and January 18, 2002 to facilitate the site supplemental geochemical characterization. The intended boring and well locations, the specific depths targeted, and specific objectives for the boring and wells are presented in the work scope. The actual locations of the final borings and monitoring wells are shown on Figure 2-1. The coordinates and elevations of the monitoring wells, determined by survey following completion of the monitoring wells, are presented in Table 2-1.

Boring and monitoring well drilling, monitoring well construction, and well development were performed in accordance with the following standard operating procedures (SOP) specified in Appendix A of the Site Closure Plan (SMI, 1999):

- Borehole logging procedures - SOP No. 9, "Visual Description and Classification of Subsurface Samples Obtained During Drilling"
- Decontamination procedures - SOP No. 15, "Decontamination"
- Boring abandonment procedures - SOP No. 16, "Abandonment of Wells, Piezometers, and Exploratory Borings"

Specific deviations from the methods specified in the SOPs are described under the applicable subsection of this report.

2.2.1 Well Permitting

Wells were permitted as required under "Regulations and Instructions, State Engineer's Office, State of Wyoming, Part II, Groundwater" (State of Wyoming, 1974). All permits are within Water Division No. 1, District 10, in the Fremont County U.W. District. Permits were recorded on December 18, 2001. A summary of the pertinent details of the well permitting is presented in Table 2-2.

2.2.2 Drilling and Construction Methods

Drilling of both the borings and monitoring wells was performed according to SOP No. 21, "Dual Rotary Casing Advance Drilling and Sampling" by Ruen Drilling, Inc. of Clark Fork, Idaho. Air rotary drilling was performed using a Formost Barber DR12 drilling rig. Sampling during drilling was performed according to SOP No. 13, "Sampling of Cuttings and Sampling and Field Analysis of Groundwater During Drilling." The air-rotary method was employed as a tool for continuous discrete sampling of subsurface cuttings and groundwater and for installing wells. The method allowed for the collection of cuttings and groundwater samples from known depths while isolating penetrated units during drilling and minimizing the potential for sample contamination and cross-contamination between units. As a result, a detailed vertical geochemical profile of the formation waters was constructed. Groundwater and aquifer material samples were collected during drilling at each boring and monitoring well except at SWAB-39. SWAB-39 was installed adjacent to SWEB-15 where soil and water samples were collected. Groundwater samples were analyzed in the field for electrical conductance, pH and temperature. Aquifer material was screened for gamma radiation as described in Section 2.2.5.1 of this report.

Monitoring wells were constructed according to the methods specified in SOP No. 8 "Monitor Well and Piezometer Installation and Development." Well completion diagrams that include documentation of the materials used, and dimensions of the well screen, well casing, sand pack, seals, etc., are provided in Attachment B. Table 2-3 presents monitoring well completion details of wells installed during this field effort.

Monitoring wells were constructed in temporary steel casing advanced during the air rotary drilling. The steel casing was removed incrementally as the monitoring wells were constructed. The steel casing was cut above the ground surface with a torch as required throughout monitor well construction. If a cut was required during installation of the filter pack, a temporary casing seal constructed from a steel plug and hydrated bentonite was installed prior to cutting to prevent steel slag from entering the filter pack interval. After cutting, the seal was removed and well completion activities were resumed.

If boreholes were drilled deeper than the planned completion interval, chip bentonite was installed in the bottom of the borehole to provide the proper depth of the base of the filter pack. Bentonite chip was also installed to isolate steel casing slag if an initial steel cut was required prior to well installation.

USF Johnson manufactured all of the PVC casings and screens. Two-inch nominal diameter flush-threaded Schedule 40 PVC blank well-casing, machine slotted well screen, and threaded end caps were installed in SWAB-39 and SWAB-40. Four-inch nominal diameter flush-threaded Schedule 40 PVC blank well casing, machine slotted well screen, and threaded end caps were installed in SWEB-15 and SWEB-16. The screen slot size for all the well screens was 0.020 inch. All well screen and blank casing were kept in the manufacturer's plastic protective wrapping and stored off the ground until the time of use. Clean gloves were used when handling the screen and casing. The lengths of the blank casing, screen, and bottom caps were measured to the nearest 0.1-foot before installation. Centralizers were attached to the top and bottom of screen intervals to ensure proper filterpack installation.

Oglebay Norton Sand Company's 10-20 silica sand was installed through the temporary steel casing as filter pack by gravity placement into the annular space between the PVC casing and the boring to above the top of the screen. The temporary steel casing were removed incrementally as the filter pack was installed. A weighted tape was used to measure filter pack depths and determine filter pack volumes. Sand pack depths and volumes were monitored to ensure that any bridging would be detected.

A bentonite seal of Cetco Volclay Pure Gold 3/8-inch Bentonite tablets was installed on top of the filter pack. From the top of the bentonite pellet seal to ground surface 3/8-inch Wyoming Bentonite chips were installed. The depth intervals of both the pellet bentonite and the chip bentonite seal for each monitoring well are provided in Table 2-3. Bentonite pellets and chips were gravity placed by pouring from the surface. The temporary steel casing was removed incrementally as the bentonite was installed. Bentonite depths were verified using a weighted tape. Bentonite depths and volumes above the filter pack were monitored to ensure that any bridging would be detected.

Protective steel casings with lockable caps were installed above ground surface after completing each monitoring well. The protective casing consists of eight-inch nominal diameter steel casing for SWEB-15 and SWEB-16 and six-inch nominal diameter steel casing for SWAB-39 and SWAB-40. The casing is secured into the bentonite well seal below grade. The annular space between the well casing and the protective casing above grade was filled with chip bentonite.

2.2.3 Monitoring Well Development Methods

Development of the monitoring wells was performed according to SOP No. 8 "Monitor Well and Piezometer Installation and Development." The entire length of each well screen was surged with a bailer starting at the top of the screen and working toward the bottom. After surging, any accumulated sediment at the bottom of the screen was removed using a bailer. The monitoring wells were surged and bailed until sediment production had stabilized or ceased. An electric submersible pump was installed in monitoring wells after bailing. The monitoring wells were surged again by alternately turning the pump on to lower the water level and then off to allow partial or full recovery of the water level. After surging, the well was pumped until the turbidity stabilized. A summary of pertinent well development data is provided in Table 2-4. Table 2-5 presents static water level data measured after development.

2.2.4 Boring and Monitoring Well Characteristics and Specifications

Individual monitoring well characteristics and specifications are presented in this section in chronological order of installation. In addition, any deviations from the SOPs are noted. Table 2-3 summarizes as-built data for the installed monitoring wells. Attachment B presents boring logs and monitoring well completion diagrams. Figure 2-1 shows the boring/well locations as proposed in the work plan, and the actual locations of the completed monitoring wells and borings.

2.2.4.1 Monitoring Well SWEB-15

Monitoring well SWEB-15 was drilled at Location No. 1 (Figure 2-1) on January 8, 2002 to a depth of 117 feet below ground surface (bgs). The boring log for SWEB-15 is included in Attachment B. Following installation, SWEB-15 was developed by bailing/surging with a bailer

followed by surging/purging with a RediFlo2 pump. A total of 445 gallons was purged during development. Static water level measured in SWEB-15 on March 6, 2002 was 29.56 feet below the top of PVC casing, or 6270.82 feet above mean sea level (amsl).

Monitoring well SWEB-15 was completed within the Upper Split Rock Unit (USR). Bentonite chip was placed in the bottom of the borehole to a depth of 99 feet bgs. After sitting overnight, a static water level of 27.5 feet bgs was measured inside the steel casing set to approximately 98 feet bgs. The filter pack interval for monitoring well SWEB-15 was 76.3 to 99 feet bgs. During installation of the bentointe seal bentonite pellets bridged in the steel casing after approximately 2.3 feet of pellets (to 74.3 bgs) were installed. The bridged bentonite could not be removed from the steel casing. All steel casing was then removed and the borehole walls were allowed to collapse to 38 feet bgs. Chip bentonite was then installed from 38 feet to ground surface. From the top of the bentonite pellets at 74.3bgs to 38 feet bgs, the existing formation collapsed and bentonite was not installed. The well construction log for SWEB-15 is presented in Attachment B.

2.2.4.3 Monitoring Well SWEB-16

Monitoring well SWEB-16 was drilled at Location No. 2 (Figure 2-1), approximately 25 feet northwest of SWAB-31 on January 9 and 10, 2002 to a depth of 118 feet bgs. The boring log for SWEB-16 is included in Attachment B. Following completion, SWEB-16 was developed by bailing/surging with a bailer followed by surging/purging with a RediFlo2 pump. A total of 400 gallons was purged during development. Static water level measured in SWEB-16 on March 6, 2002 was 30.92 feet below the top of PVC casing, or 6272.46 feet amsl.

Monitoring well SWEB-16 was completed within the USR unit. Bentonite chip was placed in the bottom of the borehole to a depth of 100.3 feet bgs. The filter pack interval for monitoring well SWEB-16 was 76.7 to 100.3 feet bgs. From 76.7 to 74.7 feet bgs bentonite pellets were installed. Heaving sands prevented bentonite placement from 74.7 to 67 feet bgs and the formation was allowed to collapse against the PVC casing. Chip bentonite was installed from 67 to 21 feet bgs. Removal of the steel casing allowed the formation to collapse against the PVC

casing from 21 to 14 feet bgs. Chip bentonite was then installed from 14 feet bgs to ground surface. The well construction log for SWEB-16 is presented in Attachment B.

2.2.4.2 Monitoring Well SWAB-39

Monitoring well SWAB-39 was drilled at Location No. 1 (Figure 2-1), approximately 25 feet southeast of SWEB-15 on January 11 and 12, 2002 to a depth of 44.1 feet bgs. No logging or sampling occurred at SWAB-39 because the samples and log obtained at SWEB-15 provided sufficient geochemical and hydrogeological characterization of the immediate area. Following completion, SWAB-39 was developed by bailing/surging with a bailer followed by surging/purging with a RediFlo2 pump. A total of 250 gallons was purged during development. Static water level measured in SWAB-39 on March 6, 2002 was 28.6 feet below the top of PVC casing, or 6271.29 feet amsl.

Monitoring well SWAB-39 was completed within the USR unit. The filter pack interval for monitoring well SWAB-39 was 29.5 to 44.1 feet bgs. The well construction log for SWAB-39 is presented in Attachment B.

2.2.4.4 Monitoring Well SWAB-40

Monitoring well SWAB-40 was drilled at Location No. 6 (Figure 2-1) on January 12, 2002 to a depth of 48.45 feet bgs. The boring log for SWAB-40 is included in Attachment B. Following completion, during the attempt to develop the well sand was encountered at 7 feet bgs. Although installation of SWAB-40 was completed without adverse incidences, a breach apparently developed in the well screen and or well casing allowing filter pack and/or aquifer material into the well. Monitoring well SWAB-40 was completed within the USR unit. A static water level of 31.4 feet bgs was measured (after 15 minutes of recovery) inside steel casing set at 36 feet. The filter pack interval for monitoring well SWAB-40 was 31.9 to 45 feet bgs. The well construction log for SWAB-40 is presented in Attachment B.

2.2.4.5 Boring SMI BH01

Boring SMI BH01 was drilled at Location No. 4 (Figure 2-1) on January 13, 2002 to a depth of 95 feet bgs. The boring log for SMI BH01 is included in Attachment B. SMI BH01 was plugged with solid bentonite chips throughout the entire depth of the borehole as per SOP No. 16.

2.2.4.6 Boring SMI BH02

Boring SMI BH02 was drilled at location No. 5 (Figure 2-1) on January 13-14, 2002 to a depth of 115 feet bgs. The boring log for SMI BH02 is included in Attachment B. During drilling, an overnight static water level of 20.85 feet bgs was measured inside steel casing set at 76 feet bgs. SMI BH02 was plugged with solid bentonite chips throughout the entire depth of the borehole as per SOP No. 16.

2.2.4.7 Boring SMI BH03

Boring SMI BH03 was drilled on January 15-16, 2002 to a depth of 115 feet bgs at a contingency location not specified in the SDCP for the Split Rock Site (SM, 2001a). SMI BH03 is located approximately 800 feet southwest of the SMI BH04 (Figure 2-1). The boring log for SMI BH03 is included in Attachment B. During drilling, an overnight static water level of 7.9 feet bgs was measured inside steel casing set at 36 feet bgs. SMI BH03 was plugged with solid bentonite chips throughout the entire depth of the borehole as per SOP No. 16.

2.2.4.8 Boring SMI BH04

Boring SMI BH04 was drilled at location No. 3 (Figure 2-1) on January 16, 2002 to a depth of 115 feet bgs. The boring log for SMI BH04 is included in Attachment B. During drilling, an overnight static water level of 31.3 feet bgs was measured inside steel casing set at 115 feet bgs. SMI BH04 was plugged with solid bentonite chips throughout the entire depth of the borehole as per SOP No. 16.

2.2.4.9 Boring SMI BH05

Boring SMI BH05 was drilled at location No. 7 (Figure 2-1) on January 17, 2002 to a depth of 115 feet bgs. The boring log for SMI BH05 is included in Attachment B. SMI BH05 was plugged with solid bentonite chips throughout the entire depth of the borehole as per SOP No. 16.

2.2.5 Groundwater and Aquifer Material Sampling

The primary objective for groundwater and aquifer material sampling and analyses at the Split Rock site was to characterize the horizontal and vertical distribution of constituents in groundwater at and near the area of study and to establish if naturally occurring materials may be responsible for observed elevated uranium groundwater concentrations.

2.2.5.1 Gamma Screening of Aquifer Material

Screening level gamma monitoring was performed on all aquifer solid material as it was collected from drilling to identify any regions within the aquifer that may contain relatively high radionuclide contents. Results of the gamma monitoring are present in Section 3.3.1 (see Table 2-6). Gamma monitoring was performed using a Ludlum Model 2350-1 data logger paired with a Ludlum Model 44-10 gamma scintillator. The 44-10 contains a 2-inch diameter, 2-inch long sodium iodide crystal. Performance and local ambient gamma level checks were conducted at the beginning of each working day, and at least once more before the end of that working day. Local ambient gamma level checks were also performed whenever work was moved to a new location. Operational performance checks of the monitoring device consisted of centering the base of the detector over a lantern mantle containing Th-232. Local ambient gamma level checks were performed with the base of the detector exposed to air at tabletop level. Whether performing checks or screening material, the detector maintained contact with source for at least one minute before readings were taken. The average of ten readings was recorded.

After collecting drill cuttings in a 5-gallon plastic bucket, any standing water was decanted and stored in temporary 1-gallon plastic containers. The surface of the solid material in the bucket was leveled, and a plastic household trash bag was placed on the material. The base of the gamma detector was then centered on the surface of the solid material and reading taken.

2.2.5.2 Groundwater and Aquifer Material Sampling During Drilling

Sampling of groundwater and aquifer material during drilling was performed according to SOP No. 13, "Sampling of Cuttings and Sampling and Field Analysis of Groundwater During Drilling." Groundwater and aquifer material samples were obtained from all of the newly installed wells and borings except at SWAB-39. Cuttings and/or slurry of cuttings and groundwater were collected in 5-gallon plastic buckets from the discharge stream during air rotary drilling every 5 feet. Groundwater samples were obtained when there was sufficient groundwater to clear the borehole of cuttings. When there was insufficient water during drilling to clear the borehole of cuttings and collect groundwater samples, the borehole was allowed to recover 10 to 30 minutes and then airlifted in an attempt to collect water samples. Some intervals were wet, but due to locally higher clay content in the aquifer materials, only thick slurry was recovered and groundwater samples could not be collected. Groundwater collected during drilling was analyzed for field indicator parameters (pH, conductivity, and temperature). Samples were drawn from specific buckets for laboratory analyses (as described below), and remaining groundwater and aquifer material from each sampling point was sealed in its collection bucket and archived at the Split Rock site.

A subsample of groundwater and aquifer material for laboratory analysis and testing was drawn from the buckets on alternating 5 foot intervals. Additional groundwater samples and aquifer material for laboratory analyses and testing were collected where the gamma screening of aquifer material identified high gamma levels relative to background.

Groundwater collected for laboratory analysis was placed into 2 liter, 1 liter, and 125 ml plastic bottles and prepared for analyses of a wide suite of constituents (major constituents, metals, indicators, and radionuclides, see Table 2-7). Selected groundwater samples were also placed in 40-ml amber glass bottles and analyzed for Dissolved Organic Carbon. Groundwater samples were sent to Energy Laboratories, Inc (ELI) in Casper, Wyoming for analysis. Results of geochemical analyses of groundwater are presented in Section 3.2.2.2.

Samples of aquifer material were split, archived for potential batch leach testing and sent to ELI for analysis of radionuclides. Aquifer material was placed in 250-ml glass jars. A small split of

the aquifer material subsample was collected from SMI Borings 2, 3, and 4 and sealed in 125-ml glass jars. This material was archived at the Split Rock Site for potential mineralogical analysis. Results of geochemical analyses of aquifer material are presented in Section 3.3.2.2.

2.2.5.3 Groundwater Sampling of Newly Installed and Existing Wells

Groundwater samples from newly installed wells and from selected existing wells were collected by WNI personnel between February 4 and April 15, 2002. Samples were sent to ELI for analysis. Groundwater was collected according to SOP No. 1, "Groundwater and surface water sampling and field analysis." Well sample locations are shown on Figure 2-1. The results of geochemical analyses of groundwater from wells are presented in Section 3.2.2.2.

2.2.5.4 Field QC Samples

Field duplicate groundwater samples for quality control (QC) were obtained from three locations during drilling and from two locations during supplemental well sampling. Analytic results and relative percent difference (RPD) between primary and field QC duplicate groundwater samples are presented in Section 3.2.2.1. Duplicate samples of aquifer material were not collected during drilling, however duplicates from archived material from four locations were analyzed for uranium post-drilling. Analytic results and RPD between aquifer material samples is presented in Section 3.3.2.1

Three equipment rinsate blanks were collected, one during drilling, two during sampling of existing wells. The results of the analyses of rinsate blanks are presented in Section 3.2.2.2.

2.2.5.5 Groundwater Level Measurements

Static groundwater level measurements were performed in all newly installed wells and selected existing wells listed in Table 2-8. Groundwater level measurements were performed in accordance with SOP No. 2. The results of the water level measurements are presented in Table 2-8. A site-wide piezometric surface map is presented in Figure 2-2. Due to sparse current water level data east and south of the Red Mule area, the piezometric surface map included data both from 2002 measurements, supplemented with data from selected 1996-1997 measurements.

A comparison of 1996-1997 data to 2002 data revealed an approximate water level increase of about 0.33 feet in wells south and east of the site (Table 2-9). Using this average increase, water levels from 1996-1997 data was extrapolated (Table 2-10) to 2002 levels to aid in constructing the piezometric surface map (Figure 2-2).

The regional and local groundwater flow in 2002 is essentially the same as it was in 1996-1997 (SMI, 1999). Primary direction of regional groundwater flow is east and northeast along the direction of the Sweetwater River. At the Split Rock site, groundwater flows from areas high in elevation surrounding the Main Tailing Impoundment, down the Northwest and Southwest Valleys, where it merges with regional flow. Groundwater flows northeast through Jeffrey City until it reaches a zone of very low gradient, nearly stagnant groundwater southwest of the mouth of the Southwest Valley. From the north end of Jeffery City to SWAB-21 (3,600 horizontal feet), groundwater elevation drops less than 5 feet. Groundwater flow near the Red Mule area is generally northeast.

2.3 Summary of Field Investigation Activities

During the 2002 field investigation, SM acquired groundwater samples and aquifer material for geochemical testing and analysis and installed additional groundwater monitoring wells between the Red Mule area and the site. Geochemical testing of groundwater and aquifer material has aided in defining the extent of impact from site-derived constituents, results of the geochemical study are described in Section 3.

Geologic characterization of the Red Mule area westward to the location of SWAB-40 (Figure 2-1) revealed the presence of a clay-rich zone within the USR unit (see SMI 1999 for description of USR), a zone not seen during previous investigations of the site and apparently unique to the local area. In general, the stratigraphy of the Red Mule area consists of unconsolidated eolian and/or fluvial deposits to about 15 feet below the surface, underlain by fine-grained sandstones of the USR. The clay rich-zone, consisting of about 25-40 percent clay, was found in the USR at SWAB-39, SWEB-15, SWEB-16, SMI BH02, SMI BH03, SMI BH04, and SMI BH05. This zone ranges from about 5 feet thick near SWEB-16 to about 15 feet thick under the Red Mule subdivision, and is characterized as wet, sticky clay with very low groundwater yield. Typically,

little to no groundwater was found in the sandstone above the clay-rich zone, during drilling, while high groundwater yield was noted from below the clay-rich zone.

Geochemical analysis of aquifer material (see Section 3.2.2.2) revealed relatively high concentrations of uranium, radium-226, and thorium-230 in the unconsolidated sediments as compared to the underlying USR. Uranium mineralization is prevalent in the mountains south of the Red Mule area, and elevated uranium, radium and thorium concentrations in the Red Mule area are consistent with both eolian and fluvial deposition of naturally occurring minerals from a source area to the south. In samples taken throughout the Red Mule area, uranium activity was near equal the combined activity of radium-226 and thorium-230, suggesting the activity of the parent radionuclide (uranium) is in near secular equilibrium with the daughter products (radium-226 and thorium-230). This suggests that the depositional environment in the Red Mule area represent a naturally occurring uranium-bearing system that has been relatively undisturbed throughout much of the late Pleistocene.

3.0 GEOCHEMICAL ANALYSIS AND TESTING

3.1 Introduction

This section presents data regarding the chemical composition of groundwater and aquifer material at the Split Rock site and surrounding areas that was obtained during the 2002 Supplemental Data Collection Program. Field screening data of groundwater quality, gamma count screening of aquifer material, aquifer material and groundwater sample analyses results from the 2002 program and supplemental sampling at select monitoring wells are summarized in this section. Background concentrations for potential site-derived constituents have been calculated (SM, 2001b), and are presented here (Table 3-1) for comparison with data from the 2002 program. Also summarized are analytical procedures used, and a summary of quality control review of laboratory and field results.

3.2 Groundwater Sample Analysis

3.2.1 Field Screening Data

Samples obtained during drilling were analyzed in the field for pH, electrical conductivity, and temperature. Results of field screening data are given in Table 3-2. Temperature values are not presented. Field conditions in Wyoming in February made accurate groundwater temperature measurement problematic and unreliable.

3.2.2 Laboratory Analysis

3.2.2.1 Analytical Procedures and Reporting Limits

Groundwater samples were obtained during drilling and also during the supplemental sampling program of select wells in and near the site. Analyses for inorganic constituents and radionuclides were performed by Energy Laboratory, Inc. (ELI) of Casper, Wyoming, in accordance with EPA-approved methods. Groundwater samples collected during drilling from various depths and analyzed for a number inorganic constituents, including major ions (Ca, Mg, Na, K, SO_4, Cl, NH_4, NO_2+NO_3, P) indicator parameters (TDS, and alkalinity), trace metals (Al, As, Ba, Fe, Mn, Mo), and radionuclides including Ra-226, and Th-230, and $Uranium_{(nat)}$. Total

organic carbon was analyzed for in all groundwater samples collected during drilling except for those collected at SMI BH01. Groundwater samples collected from newly installed and selected existing monitoring wells were analyzed for Be, Cd, Ca, Cr, Pb, Mg, Mn, Na, K, Se, SO_4, Cl, NH_4, NO_2+NO_3, TDS, carbonate, bicarbonate, total organic carbon, Ra-226, Ra-228, and $Uranium_{(nat)}$. Analysis methods and reporting limits for the various analytes is presented in Table 2-7.

3.2.2.2 Data Quality Control Evaluation Summary

Laboratory analytical results for groundwater samples collected by SM were subjected to QC review. Analytical QC summary reports from ELI are presented in Attachment C. The QC review included checking for analysis of samples within holding times, by requested methods, and using requested detection limits. Results of laboratory and field QA/QC samples were checked for potential blank contamination, for recovery of analytes from laboratory control and matrix spike samples, and for precision of laboratory and field duplicate analyses.

Accuracy and precision of laboratory analyses were acceptable, based on recoveries of analytes from spiked samples and comparison of duplicate analyses. The QC criteria for acceptance of data are summarized in Table 3-3. The terms and procedures that will be used to measure data quality for this project are defined and discussed below:

- Relative Percent Difference (RPD) is used to evaluate the precision of duplicate sample results and is calculated as follows:

$$\text{RPD} = \frac{|\text{1st sample result - 2nd sample result}|}{(\text{1st sample result} + \text{2nd sample result})/2} \times 100$$

- Comparing the sample result with the true or accepted result for the measured parameter assesses accuracy. For laboratory analyses, accuracy will be assessed by percent recovery of known amounts of analytes contained in standards or reference samples or spiked into splits of samples. Percent recovery (%R) is calculated as follows for standard or reference samples:

$$\%R = \frac{\text{sample result}}{\text{certified value}} \times 100$$

- To calculate the percent recovery of an analyte from a spike sample, the following formula was used:

$$\%R = \frac{(\text{spiked sample result - sample result})}{\text{spike added}} \times 100$$

Based on the QC review, laboratory data for groundwater samples collected by SM appear to be of good quality and suitable for their intended use. All samples were analyzed within the allotted holding time, and were analyzed using appropriate methods and detection limits. No percent recovery limit was exceeded nor was any RDP limit exceeded in any laboratory duplicate.

Field duplicate samples of groundwater were collected during drilling at three locations and from three locations during well sampling. Field duplicate samples of aquifer material were not collected during drilling, however duplicate archived material from four locations were analyzed for uranium after drilling. The RPD between the results of the analyses of field duplicate samples collected in the field is presented in Table 3-4. The RPD criteria was exceeded only in one set of sample/duplicate samples for phosphorus between SMIBH02-GW-01-105-020114 (<0.1 mg/L) and SMIBH02-GW-02-105-020114 (1.23 mg/L). Because the duplicate value is higher by nearly an order of magnitude over any other phosphorus value recorded during this investigation, it is probable that this sample was contaminated, most likely from accidental contamination with the preservative with H_3PO_4.

Four equipment rinsate blanks were collected, one during drilling, three during sampling of existing wells. All analyte concentrations from the rinsate blanks were below detection limits, except for calcium in the two field blanks collected during well sampling (Table 3-4).

3.2.2.3 Analytical Results

Analytical results for groundwater obtained during drilling is presented in Table 3-5. Analytical results for groundwater samples obtained during the subsequent well sampling are presented in

Table 3-6. This section summarizes the concentrations and distributions of the various constituents in the groundwater. Except for uranium, most of the samples analyzed were below either background values (SM, 2001b) or analytical detection limits for any given constituent. Most instances where metals or nitrogen concentration are above detection limits or background occur in wells in the known groundwater plume near the evaporation ponds (i.e. SWAB-2, SWAB-4, SWAB-5, and SWEB-13.

3.2.2.3.1 Inorganic Constituents

Analytical results of groundwater for inorganic constituents are presented in Tables 3-5 and 3-6. This section summarizes the concentrations and distributions of the various constituents in the groundwater.

Aluminum

Aluminum concentration is below the analytical detection limit at all locations except at SMI BH02 at 65 feet bgs (0.324 mg/L).

Arsenic

Arsenic exceeds the revised background concentration of 0.011 mg/L in three groundwater samples, SWAB-36, SWAB-3, and SWAB-24 (0.0279, 0.0233, and 0.0136 mg/L, respectively). Arsenic is below background in all other samples analyzed in 2002.

Nitrate + Nitrite as N

Nitrate + Nitrite as N exceeds the background concentration of 2.24 mg/L in eleven groundwater samples. Highest values are found in SWAB-2, SWAB-1, SWAB-4, and SWAB-5 (113, 84.5, 40.2, 14.9 mg/L, respectively), which are known to represent site-derived groundwater. No other samples exceed the MCL of 10 mg/L. Nitrate + Nitrite as N exceeds background at four Red Mule locations, RM-1, Veach-2, KK-1, and Johnson (3.95, 3.65, 3.16, and 2.87, respectively). These values likely reflect locally slightly elevated nitrate values due effects from residential septic systems and leach fields. Wells between the site and Red Mule (i.e SWAB-29, SWEB-16, SWEB-15, SWAB-39) are below background for nitrate.

Total Dissolved Solids

Total dissolved solids (TDS) exceed the background concentration of 659 mg/L at only three locations, SWAB-4, SWAB-3, and SWAB-5 (1,330, 864, and 679 mg/L, respectively). SWAB-3, SWAB-4 and SWAB-5 are known to represent site-derived groundwater.

Manganese

Manganese exceeds the background concentration of 0.53 mg/L at two locations, SWAB-2 and SWAB-5 (6.45 and 0.831 mg/L, respectively), which are known to represent site-derived groundwater.

Sulfate

Sulfate exceeds the background concentration of 98 mg/L at eight locations. Sulfate concentrations at SWAB-2, SWAB-1, SWAB-4, SWAB-3, SWAB-5, and SWEB-10 are 1320, 773, 521, 339, 224, and 129 mg/L, respectively. These locations are known to represent site-derived groundwater. SWAB-33 (117 mg/L) is located northeast of the Red Mule area. Figure 3-1 displays maximum sulfate concentrations at individual locations or well pairs.

3.2.2.3.2 Radionuclides

Radium-226

Radium-226 exceeds the analytical detection limit of 0.2 pCi/L in only ten samples, and only exceeds 0.5 pCi/L in two samples, SWAB-2 and SWAB-4 (3.6 and 2.8 pCi/L, respectively). These locations are known to represent site-derived groundwater.

Radium-228

Radium-228 exceeds the analytical detection limit of 1 pCi/L in six samples, and exceeds 2.2 pCi/L in only two samples, SWAB-2 and SWAB-4 (6 and 4 pCi/L, respectively). These locations are known to represent site-derived groundwater.

Thorium-230

Thorium-230 does not exceed the background activity of 0.5 pCi/L in any sample.

Uranium

Uranium exceeds the background concentration of 0.088 mg/L at twenty-one locations. Highest uranium concentrations occur southwest of the evaporation ponds in SWAB-2, SWAB-1, and SWAB-4 (1.39, 1.24, and 1.14 mg/L, respectively), locations known to represent site-derived groundwater. Uranium concentrations do not exceed 0.5 mg/L at any other location. Figure 3-2 shows the maximum concentration of uranium at a given location or well pair. Figure 3-2 show that uranium is greater than background values in wells southwest of the evaporation ponds, extending eastward to SWAB-15. Uranium also exceeds background concentrations at nine locations in the Red Mule area. Figures 3-3 through 3-10 shows the uranium in the aqueous phase with depth at each boring location.

3.2.2.3.3 Total Organic Carbon

Total organic carbon (TOC) ranges from 11.6 mg/L to less than 0.5 mg/L. Highest values are found at SWEB-16, SWEB-15, and SWAB-40 (11.5964, 9.3614, and 9.1608 mg/L, respectively).

3.3 Aquifer Material Analysis

3.3.1 Field Gamma Screening Data

Aquifer material samples obtained during drilling were measured in the field for gamma radiation. Results of the gamma screening are presented in Table 2-6. Figures 3-3 through 3-10 shows the gamma counts with depth at each boring location. In general, gamma counts were less than 2 μR/hr greater than local ambient gamma in most samples. Determination of local ambient of gamma radiation is described in Section 2.2.5.1. Exceptions to this generally occurred in near-surface samples, where gamma counts tended to be higher. Significantly higher readings occur at shallow depths from SMI BH02, SMI BH04, SMI BH05, SWEB-15, and SWEB-16. Higher gamma readings were recorded both in the shallow and mid-level depth at SMI BH03. Gamma counts were within 2 μR/hr of local ambient in all samples at SWAB-40 and SMI BH01. It should be noted that the higher gamma counts from field screening were typically from samples many feet below the surface and represent the gamma signature of undisturbed and naturally occurring materials.

3.3.2 Laboratory Analysis

3.3.2.1 Bulk Chemical Analyses Procedures and Reporting Limits

Selected aquifer material samples obtained during drilling were analyzed for uranium, Ra-226, and Th-230. Analytical methods and reporting limits for the various analytes is presented in Table 3-7. Background concentrations for aquifer solids constituents Ra-228, Th-230, and Uranium are 0.494 pCi/g, .618 pCi/g, and 0.865 mg/kg, respectively (SMI, 1999, Table 6).

Duplicate samples of aquifer material were not collected during drilling, however duplicates from archived material from four locations were analyzed for uranium post-drilling. The RPD between the results of the analyses of duplicate samples collected in the field is presented in Table 3-8. RPD is within acceptable limits for all duplicate samples.

3.3.2.2 Results

Analytical results for aquifer material obtained during drilling is presented in Table 3-9. Figures 3-3 through 3-10 show the distribution of various radionuclides with depth at each boring location. Distribution is displayed as activity. Uranium activity was calculated as

$$1 \text{ mg/kg U} = 0.692 \text{ pCi/g}$$

This section summarizes the concentrations and distributions of the various constituents in the aquifer material.

3.3.2.2.1 Radiun-226

Radium-226 activity in aquifer materials is typically low except in a few, shallow samples. Of 93 samples analyzed, only 21 displayed Ra-226 activity greater than the background concentration of 0.494 pCi/g, and of those only five samples were greater than 1 pCi/g. Highest Ra-226 occurred at 10 and 15 bgs at SMI BH02 (2.3 and 2.6 pCi/g, respectively), at 5 feet bgs at SMI BH04 (1.1 pCi/g), at 25 feet bgs at SWEB-15 (2.0 pCi/g), and at 5 feet bgs at SWEB-16 (1.1 pCi/g).

3.3.2.2.2 Thorium-230

The variability of Thorium-230 activity with depth maintained a close correlation with Ra-226 activity variability with depth. Th-230 exceed the background concentration of 0.618 pCi/g in only seven samples, and of those only two samples were greater than 1.1 pCi/g. Highest Th-230 occurred at 10 and 15 feet bgs at SMI BH02 (2.2 and 2.6 pCi/g, respectively). Th-230 was slightly above background (between 0.618 and 1.1 pCi/g) in near surface samples from SMI BH03, SMI BH04, and SWEB-15 (Figures 3-5, 3-6 and 3-9). Typically, where the samples, which have elevated Th-230, have elevated Ra-226 values. Because there is no mechanism for site-derived radium or thorium to reach these materials, these concentrations are interpreted to be naturally occurring.

3.3.2.2.3 Uranium

Uranium concentration in aquifer material exceeds the background concentration of 0.865 mg/kg in fifty-one samples. Of these, however, only 6 samples exceeded 2 mg/kg, at SMI BH02 at 10 and 15 feet bgs (4.98 and 6.98 mg/kg, respectively), at SMI BH03 at 10 feet bgs (2.46 mg/kg), and at SWEB-15 at 20, 25, and 30 feet bgs (3.93, 3.58, and 2.26 mg/kg). Uranium activity variability with depth maintained a reasonably close correlation with both Ra-226 and Th-230 activity variability with depth. These data indicate that there are naturally occurring concentrations of uranium, radium and thorium in the shallow soils of the Red Mule area that are not related to site activities.

3.4 Summary of Geochemical Analysis and Testing

Geochemical analysis of groundwater and aquifer solid material during this field investigation revealed relatively low concentrations of all constituents between SWAB-7/SWEB-12 and SWAB-31/SWEB-16, a distance of nearly one mile. Also, except for uranium, and solid phase radium and thorium, all constituents displayed relatively low concentrations in the wells and borings of the Red Mule area. Therefore, there is no evidence to suggest that elevated uranium in the Red Mule area is site-derived. Furthermore, the evidence suggest that naturally occurring radionuclides in the Red Mule area are near secular equilibrium, indicating a natural, local source for uranium in the groundwater at Red Mule.

4.0 REFERENCES

Shepherd Miller (SM, 2001a). "Supplemental Data Collection Program for the Split Rock Site." Consultant's Work Scope. November.

Shepherd Miller (SM, 2001b). "WNI Response to NRC Request of 9/6/01 for Additional Information on Site Closure Plan for the Split Rock, Wyoming Site." November.

Shepherd Miller, Inc. (SMI), 1999. "Site Closure Plan." Consultant's Report. October 29.

State of Wyoming, 1974 "Regulations and Instructions, State Engineer's Office, State of Wyoming, Part II, Groundwater."

TABLES

Table 2-1 Supplemental Monitoring Well and Boring Survey Information

Monitoring Well/Boring I.D.	Northing[1]	Easting[1]	Top of PVC Elevation[2]	Stickup (ft)[3] (PVC height above ground surface)	Ground Surface Elevation[4]	Water Level Measuring Point Elevation[5]
SWAB-39	1225.46	14661.99	6301.74	1.8	6299.94	6301.74
SWAB-40	1526.39	12992.63	6309.83	2.0	6307.83	6309.83
SWEB-15	1251.20	14662.06	6302.74	2.21	6300.53	6302.74
SWEB-16	1329.51	13840.21	6305.80	2.26	6303.54	6305.80
SMI BH01	5310.39	14422.27	NA	NA	6304.92	NA
SMI BH02	2438.25	17784.35	NA	NA	6285.31	NA
SMI BH03	362.50	15152.61	NA	NA	6295.90	NA
SMI BH04	1039.04	15423.46	NA	NA	6297.80	NA
SMI BH05	1973.10	17186.97	NA	NA	6290.09	NA

1 Site coordinates of rim of PVC well casing.
2 Surveyed top of PVC well casing, feet above mean sea level.
3 Stickup measured during well construction.
4 Ground surface elevation (feet above mean sea level) calculated using surveyed top of PVC well casing and stickup measured during completion.
5 Elevation (feet above mean sea level) of water level measuring point top of PVC well casing.

Table 2-2 Summary of Well Permit Details

Well	Permit No. U.W.	Book No.	Page No.
SWEB-15	141368	1049	94
SWEB-16	141369	1049	95
SWAB-39	141370	1049	96
SWAB-40	141371	1049	97

Table 2-3 Supplemental Monitoring Well Completion Information

Monitor Well	Total Depth of Boring	Open Borehole	Top of Lower Bentonite Seal	Total Depth of Well	Bottom of Screen	Top of Screen	Bottom of Filter Pack	Top of Filter Pack	Top of Bentonite Pellets	PVC Stickup	Protective Casing Stickup	Nominal Borehole Diameter	PVC Diameter
	Elevation[1] (Depth)[2]	Elevation[1] (Depth[2)]	Elevation[1] (Depth)[2]	Elevation[1] (Depth)[2]	Elevation[1] (Depth)[2]	Elevation[1] (Depth)[2]	Elevation[1] (Depth)[2]	Elevation[1] (Depth)[2]	Elevation[1] (Depth)[2]	Elevation[1] (Height)[3]	Elevation[1] (Height)[3]	Inches	Inches
SWAB-39	6255.84 (44.1)	6255.84 (44.1)	NA	6256.42 (43.52)	6256.74 (43.2)	6266.74 (33.2)	6255.84 (44.1)	6270.44 (29.5)	6274.64 (25.3)	6301.74 (1.8)	6302.14 (2.2)	7.25	2
SWAB-40	6259.38 (48.45)	6259.38 (48.45)	6262.83 (45.0)	6262.53 (45.3)	6262.83 (45.0)	6272.83 (35.0)	6262.83 (45.0)	6275.93 (31.9)	6278.13 (29.7)	6309.83 (2.0)	6310.53 (2.7)	7.25	2
SWEB-15	6183.53 (117)	6185.13 (115.4)	6201.53 (99.0)	6200.94 (99.59)	6201.24 (99.29)	6221.24 (79.29)	6201.53 (99.0)	6224.23 (76.3)	6226.23 (74.3)	6302.74 (2.21)	6303.13 (2.6)	9.25	4
SWEB-16	6185.54 (118)	6190.14 (113.4)	6203.24 (100.3)	6203.79 (99.75)	6204.09 (99.45)	6224.14 (79.4)	6203.24 (100.3)	6226.84 (76.7)	6228.84 (74.7)	6305.80 (2.26)	6306.04 (2.5)	9.25	4

1 Feet Above Mean Sea Level
2 Feet Below Ground Surface
3 Above Ground Surface

Table 2-4 Supplemental Monitoring Well Development Data

Monitoring Well	Approximate Saturated Borehole Volume (gallons)	Total Water Volume Removed (gallons)	Final Filed Parameter Values (at end of development)		
			pH (s.u.)	Conductivity (mS/cm)	Temperature (C)
SWAB-39	46	250	7.16	0.409	11.8
SWAB-40[1]	NA	NA	NA	NA	NA
SWEB-15	225	445	7.48	0.374	10.3
SWEB-16	225	400	7.05	0.393	10.3

1 Well casing breached, full of sand, no development performed

Table 2-5 Supplemental Monitoring Well Static Water Level Data

Well	Elevation Top of PVC (feet above mean sea level)	Depth to Static Water Level (feet below ground surface)	Elevation Static Water Level (feet above mean sea level)	Measurement Date
SWAB-39	6301.74	28.6	6271.29	3/6/2002
SWAB-40[1]	6309.83	NA	NA	3/6/2002
SWEB-15	6302.74	29.56	6270.82	3/6/2002
SWEB-16	6305.80	30.92	6272.46	3/6/2002

1 Well casing breached, full of sand no water level measured

Table 2-6 Field Gamma Screening Data of Aquifer Material (Page 1 of 2)

Location	Depth, ft	Gamma counts μR/hr
SMI BH01	0	11.6
	5	13.6
	10	13.5
	15	14.4
	20	13.5
	25	14.3
	30	14
	35	14
	40	13.9
	45	13.4
	50	14.1
	55	14.5
	60	13.2
	65	13.5
	70	13.7
	75	12.9
	80	13.4
	85	13.6
	90	13.7
	95	13.4
SMI BH02	0	11.86
	5	14.8
	10	17.2
	15	17.4
	20	13.5
	25	12.5
	30	13.7
	35	12.8
	40	12.7
	45	12.3
	50	12.5
	55	13
	60	13.2
	65	12.7
	70	12.5
	75	12.4
	80	13.3
	85	13
	90	13.3
	95	13.2
	100	12.8
	105	12.4
	110	12.4
	115	13

Location	Depth, ft	Gamma counts μR/hr
SMI BH03	0	11.78
	5	13.4
	10	15.9
	15	15.5
	20	13.5
	25	13.1
	30	12.3
	35	12.9
	40	15.1
	45	14.7
	50	15
	55	15
	60	14.1
	65	13.6
	70	14.4
	75	14.3
	80	13.9
	85	14.4
	90	13.1
	95	12.7
	100	13.3
	105	12.8
	110	13.1
	115	13.5
SMI BH04	0	11.45
	5	14.4
	10	12.6
	15	12.4
	20	12.6
	25	12.2
	30	11.6
	35	11.8
	40	11.3
	45	11.9
	50	11.8
	55	11.8
	60	12.3
	65	11.9
	70	11.4
	75	11.3
	80	11.7
	85	11.3
	90	11.3
	95	11.5

Note: 0 ft depth = local ambient gamma at each location

Table 2-6 Field Gamma Screening Data of Aquifer Material (Page 2 of 2)

Location	Depth, ft	Gamma counts μR/hr
SMI BH04	100	11.5
	105	11.6
	110	11.4
	115	11.8
SMI BH05	0	12.2
	5	15.2
	10	15.3
	15	14.8
	20	15.2
	25	14.6
	30	14.7
	35	13.9
	40	14.6
	45	13.9
	50	13.9
	55	13.2
	60	13.6
	65	13.5
	70	12.4
	75	13.3
	80	13.6
	85	13.2
	90	13.6
	95	13.2
	100	13.8
	105	13.5
	110	13.9
	115	12.3
SWAB-40	0	10.4
	5	12.3
	10	12.4
	15	12.7
	20	12.6
	25	12.8
	30	12.3
	35	12.5
	40	12.2
	45	12.4
SWEB-15	0	11.51
	5	14.3
	10	14.5
	15	13.8
	20	14
	25	14

Location	Depth, ft	Gamma counts μR/hr
SWEB-15	30	13.2
	35	12.8
	40	12.5
	45	12.8
	50	12.5
	55	11.7
	60	11.8
	65	11.5
	70	11.1
	75	11.5
	80	11.8
	85	11.8
	90	12.4
	95	12
	100	12.2
	105	12.5
	110	12.4
	115	12.2
	118	11.8
SWEB-16	0	11.2
	5	14.5
	10	14.1
	15	14.2
	20	12.8
	25	13.3
	30	12.3
	35	12.7
	40	11
	45	10.8
	50	11.7
	55	11.8
	60	11.5
	65	11.5
	70	11.5
	75	11.7
	80	12.2
	85	12.5
	90	12.2
	95	11.9
	100	11.8
	105	12.8
	110	11.4
	115	11.5
	118	11.4

Note: 0 ft depth = local ambient gamma at each location

Table 2-7 Analytes, Reporting Limits, and Analytical Methods for Groundwater Samples

Analyte	Method	Reporting Limits	Units
Alkalinity, Total as CaCO3	A2320 B	1	mg/L
Ammonia as N	A4500-NH3 G	0.05	mg/L
Nitrate+Nitrite as N	E353.2	0.1	mg/L
Organic Carbon, Total	A5310 C	0.5	mg/L
Solids, Total Dissolved Calculated	A1030 E	-250	mg/L
Solids, Total Dissolved TDS @ 180	A2540 C	10	mg/L
A/C Balance (± 5)	A1030 E	-250	%
Aluminum	E200.8	0.1	mg/L
Anions	A1030 E	-250	meq/L
Arsenic	E200.8	0.001	mg/L
Barium	E200.8	0.1	mg/L
Beryllium	E200.8	0.004	mg/L
Bicarbonate as HCO3	A2320 B	1	mg/L
Cadmium	E200.8	0.001	mg/L
Calcium	E200.7	1	mg/L
Carbonate as CO3	A2320 B	1	mg/L
Cations	A1030 E	-250	meq/L
Chloride	E200.7	1	mg/L
Chromium	E200.8	0.005	mg/L
Hydroxide as OH	A2320 B	1	
Iron	E200.7	0.03	mg/L
Lead	E200.8	0.005	mg/L
Magnesium	E200.7	1	mg/L
Manganese	E200.8	0.01	mg/L
Molybdenum	E200.8	0.1	mg/L
Nickel	E200.8	0.05	mg/L
pH	A2320 B	0	s.u.
Phosphorus	E200.7	0.1	mg/L
Potassium	E200.7	1	mg/L
Radium 226	E903.0	0.2	pCi/L
Radium 228	E904.0	1	pCi/L
Selenium	E200.8	0.005	mg/L
Sodium	E200.7	1	mg/L
Sulfate	E200.7	1	mg/L
TDS Balance	A1030 E	-250	dec. %
Thorium 230	E907.0	0.2	pCi/L
Uranium	E200.8	0.0003	mg/L

Table 2-8 Groundwater Levels 2002 (Page 1 of 3)

Location	Easting	Northing	Ground Elevation[1]	Casing Top Elevation[1]	Groundwater Depth[2]	Groundwater Elevation[1]
NWEB-1	7551.591	9707.277	6295.2	6297.04	15.22	6281.82
NWEB-2	7906.119	9895.177	6295.5	6297.43	13.59	6283.84
NWEB-3	7199.817	9519.817	6296.2	6298.11	17.04	6281.07
P-1	10297	8185	6375.6	6375.6	64.01	6311.59
SAB-1	-2259.14	-8962.5	6369.3	6371.85	17.65	6354.2
SAB-2	-384.086	-2955.53	6342.8	6345.72	42.79	6302.93
SAB-3	7899.273	-2512.11	6334	6336.03	44.04	6291.99
SAB-4	2127.2	-6091.3	6359.7	6361.38	57.47	6303.91
SAB-5	6112.067	-7183.2	6347	6349.26	53.81	6295.45
SAB-7	3757.544	-9359.4	6364.1	6366.59	11.06	6355.53
SAB-8	-5618.96	1710.672	6367.5	6370.38	65.09	6305.29
SEB-1	7912.516	-2490.59	6334.2	6336.56	44.56	6292
SWAB-1	7401.5	2654.5	6320	6321.31	26.96	6294.35
SWAB-10	7556.836	1493.015	6316.1	6317.79	24.56	6293.23
SWAB-11	6249.014	2875.987	6313	6314.76	19.08	6295.68
SWAB-12	3809.473	3909.622	6309.7	6311.61	15.03	6296.58
SWAB-13	8015.824	3680.016	6326.6	6327.58	32.48	6295.1
SWAB-14	2945.734	3580.138	6309.4	6310.95	13.88	6297.07
SWAB-15	9074.378	1413.004	6304.5	6306.23	15.63	6290.6
SWAB-16	10580.84	2719.848	6347.1	6348.8	61.35	6287.45
SWAB-17	8206.33	2370.382	6324	6325.44	32.69	6292.75
SWAB-18	7537.909	3756.37	6312.7	6314.51	18.65	6295.86
SWAB-19	6432.493	4468.838	6312.4	6314.07	17.52	6296.55
SWAB-2	6684.8	3582.8	6317.4	6319.06	23.08	6295.98
SWAB-20	5221.385	4755.532	6316.3	6317.94	21.29	6296.65
SWAB-21	3045.316	5730.582	6304.2	6306.05	10.93	6295.12
SWAB-22	3865.468	8681.551	6305.9	6307.64	19.88	6287.76
SWAB-23	1683.961	7630.48	6316.3	6317.92	25.93	6291.99
SWAB-24	1624.511	5669.573	6308.1	6309.64	10.22	6299.42
SWAB-25	2308.561	4906.15	6305.7	6307.67	11.59	6296.08
SWAB-26	350.6	5571.7	6317.8	6319.46	22.91	6296.55
SWAB-27	195.9	3740.1	6313.9	6315.72	16.82	6298.9
SWAB-28	11009.9	1281.8	6310	6312.06	27.56	6284.5
SWAB-29	11999.3	1730.3	6293.4	6295.03	13.22	6281.81
SWAB-3	5743.8	4291	6312.6	6314.65	18.37	6291.03
SWAB-30	4591.905	3679.661	6314.118	6315.495	19.14	6296.355
SWAB-31	13847.02	1306.919	6302.3	6304.44	29.86	6274.58
SWAB-32	13783.04	-64.251	6303.7	6305.31	28.78	6276.53
SWAB-33	17782.78	2417.2	6285.4	6287.92	22.05	6265.87
SWAB-34	15564.22	2943.62	6291.5	6293.94	24.53	6269.41
SWAB-35	3930.41	4845.79	6308.37	6310.81	14.88	6295.93
SWAB-36	2381.47	4130.7	6307.56	6309.16	12.60	6296.56
SWAB-39	14661.82	1225.46	6299.89	6301.74	28.6	6273.14

1 Feet above mean sea level
2 Feet below ground surface

Table 2-8 Groundwater Levels 2002 (Page 2 of 3)

Location	Easting	Northing	Ground Elevation[1]	Casing Top Elevation[1]	Groundwater Depth[2]	Groundwater Elevation[1]
SWAB-4	4674.3	6651.4	6305.5	6307.23	13.89	6293.34
SWAB-5	5079.4	5762.4	6310.2	6311.43	16.18	6295.25
SWAB-6	4911.4	2208.2	6314.4	6316.24	19.93	6296.31
SWAB-7	9963.6	2100.8	6303.4	6305.03	15.93	6289.1
SWAB-8	5872	3706	6323.4	6325.3	29.15	6296.15
SWAB-9	5429	2966	6302.2	6304	7.84	6296.16
SWEB-1	7517.511	5462.824	6325.5	6327.61	32.08	6295.53
SWEB-10	5102.1	5783.5	6311.9	6314.14	18.88	6295.26
SWEB-11	5660.4	4422.2	6304.7	6307.31	10.67	6296.64
SWEB-12	9952.2	2078.1	6302.9	6305.22	16.21	6289.01
SWEB-13	4598.663	3705.72	6314.4	6316.89	20.24	6296.65
SWEB-14	11974.4	1743.5	6294.4	6297.16	14.63	6282.53
SWEB-15	14662.06	1251.2	6300.38	6302.74	29.56	6273.18
SWEB-16	13840.21	1329.51	6303.38	6305.8	30.92	6274.88
SWEB-2	7690	5185	6331.7	6333.5	32.45	6301.05
SWEB-3	7118.77	5939.4	6313.5	6316.09	18.12	6297.97
SWEB-4	8229	4762.4	6311.2	6312.74	14.04	6298.7
SWEB-5	5965.5	5564.9	6320.2	6322.04	25.56	6296.48
SWEB-6	6706.2	3611.3	6317.7	6320.49	36.87	6283.62
SWEB-7	4600.371	8046.159	6295.3	6297.62	10.17	6287.45
SWEB-8	7417.342	2676.008	6319.3	6320.95	26.63	6294.32
SWEB-9	8167.5	2389.8	6322.2	6324.12	31.47	6292.65
WELL-1	7333.59	5670.92	6324.3	6326.52	26	6300.52
WELL-28	7303.57	5430.86	6318.1	6320.31	23.01	6297.3
WELL-3	5645.93	5395.47	6317.6	6319.72	24.57	6295.15
WELL-30	7876.04	9250.19	6303.3	6305.62	21.27	6284.35
WELL-31	7249.68	9849.79	6294.5	6297.02	16.44	6280.58
WELL-4E	8061.6	9040.17	6306.2	6308.2	22.46	6285.74
WELL-4R	8138.07	8936.82	6307.1	6309.32	21.8	6287.52
WELL-5	7498.16	9973.15	6294.2	6296.02	16.01	6280.01
WELL-7	9366.41	9107.84	6342.3	6343.12	43.16	6299.96
WN-15	8330.94	2411.67	6336.6	6338.62	46.13	6292.49
WN-16	2984.2	5736.1	6303.7	6307.19	11.91	6295.28
WN-17	6501.87	10130.41	6283.4	6285.92	7.28	6278.64
WN-18	7266.1	10809.79	6280.2	6282.2	5.86	6276.34
WN-19	11101.56	12821.93	6271.7	6273.9	6.83	6267.07
WN-21	6369.832	4393.738	6313.8	6316.49	19.74	6296.75
WN-23	8580.35	11429.93	6277.4	6280.5	6.98	6273.52
WN-24	5111.32	4724.93	6317.4	6319	24.13	6294.87
WN-25	7473.96	3718.31	6311.6	6313.62	18.1	6295.52
WN-26	10900.11	11542.14	6311.4	6313.3	37.03	6276.27
WN-32A	7481	5554.1	6326.9	6330.18	30.96	6299.22
WN-32B	7494	5533.8	6326.2	6328.5	30.69	6297.81

1 Feet above mean sea level
2 Feet below ground surface

Table 2-8 Groundwater Levels 2002 (Page 3 of 3)

Location	Easting	Northing	Ground Elevation[1]	Casing Top Elevation[1]	Groundwater Depth[2]	Groundwater Elevation[1]
WN-32C	7509.5	5510.8	6325.6	6328.64	31.57	6297.07
WN-33B	10304.65	7575.19	6391.9	6400.29	84.92	6315.37
WN-33C	10354.23	7576.07	6391.6	6399.57	83.83	6315.74
WN-33D	10404.29	7576.14	6391.4	6399.32	54.02	6345.3
WN-34	9500.365	8500.552	6352.7	6354.3	49.51	6304.79
WN-35A	8167.395	9022.649	6304.8	6307.49	21.52	6285.97
WN-35B	8162.836	9045.874	6304.3	6305.82	17.55	6288.27
WN-36A	7486.248	9863.386	6295.2	6297.68	16.33	6281.35
WN-36B	7460.2	9853	6294.9	6297.44	16.31	6281.13
WN-36C	7440	9845.4	6294.6	6297.14	16.04	6281.1
WN-37E	8835.313	6206.788	6353.5	6356.78	54.36	6302.42
WN-38A	13044.64	13344.7	6269.4	6271.71	6.14	6265.57
WN-38B	13051.33	13319.69	6269.7	6271.95	6.7	6265.25
WN-38C	13057.81	13295.27	6270	6271.94	7.4	6264.54
WN-39A	8906.1	11679.24	6276.1	6278.11	4.71	6273.4
WN-39B	8901.14	11654.25	6276.2	6278.59	5.03	6273.56
WN-39C	8893.65	11629.1	6276.7	6277.66	4.2	6273.46
WN-40A	8972.7	12667.8	6276.8	6279.23	4.37	6274.86
WN-40B	8975.5	12693.8	6276.9	6278.85	7.77	6271.08
WN-40C	8978.3	12719.9	6276.8	6278.94	8.09	6270.85
WN-41A	10004.5	12736.6	6273.7	6276.58	3.28	6273.3
WN-41B	9991.1	12761.2	6273.8	6276.36	4.62	6271.74
WN-41C	9979.9	12782.9	6274.4	6277.37	7.16	6270.21
WN-42A	7838.7	11160.7	6281	6283.37	6.52	6276.85
WN-42B	7832.7	11187.2	6280.5	6283.24	6.34	6276.9
WN-42C	7826.9	11210.7	6280.1	6282.59	5.98	6276.61
WN-43A	4739.6	11491	6285.3	6287.86	6.89	6280.97
WN-43B	4732.1	11516.4	6285.1	6287.49	6.66	6280.83
WN-43C	4724.5	11540.7	6285.2	6288	7.15	6280.85
WN-A	7752.76	4904.75	6316.55	6317.1	19.34	6297.76
WN-B	7376.92	5448.88	6321.4	6321.4	22.2	6299.2
WN-C	6962.14	5903.8	6316.16	6316.8	18.45	6298.35

1 Feet above mean sea level
2 Feet below ground surface

Table 2-9 Comparison of Water Level Data between 1997 and 2002 (Page 1 of 2)

Location	1997 Water Level (ft)	2002 Water Level (ft)	Difference in Water Level (ft)
SAB-1	18.17	17.65	-0.52
SAB-2	42.68	42.79	0.11
SAB-3	44.52	44.04	-0.48
SAB-4	59.35	57.47	-1.88
SAB-5	53.59	53.81	0.22
SAB-7	13.72	11.06	-2.66
SAB-8	64.9	65.09	0.19
SEB-1	44.37	44.56	0.19
SWAB-1	26.2	26.96	0.76
SWAB-10	24.1	24.56	0.46
SWAB-11	18.33	19.08	0.75
SWAB-12	14.28	15.03	0.75
SWAB-13	31.51	32.48	0.97
SWAB-14	13.19	13.88	0.69
SWAB-15	16.4	15.63	-0.77
SWAB-16	60.78	61.35	0.57
SWAB-17	32.05	32.69	0.64
SWAB-18	17.6	18.65	1.05
SWAB-19	16.36	17.52	1.16
SWAB-2	22.08	23.08	1
SWAB-20	20.93	21.29	0.36
SWAB-21	10.09	10.93	0.84
SWAB-22	17.95	19.88	1.93
SWAB-23	24.62	25.93	1.31
SWAB-25	10.72	11.59	0.87
SWAB-26	22.13	22.91	0.78
SWAB-27	16.27	16.82	0.55
SWAB-28	27.14	27.56	0.42
SWAB-29	12.76	13.22	0.46
SWAB-30	18.48	19.14	0.66
SWAB-31	29.52	29.86	0.34
SWAB-32	28.58	28.78	0.2
SWAB-33	22.12	22.05	-0.07
SWAB-34	24.17	24.53	0.36
SWAB-35	14.05	14.88	0.83
SWAB-4	12.6	13.89	1.29
SWAB-5	14.97	16.18	1.21
SWAB-6	19.3	19.93	0.63
SWAB-7	15.38	15.93	0.55
SWAB-8	28.33	29.15	0.82
SWAB-9	7.1	7.84	0.74
SWEB-1	27.93	32.08	4.15
SWEB-10	17.71	18.88	1.17

Table 2-9 Comparison of Water Level Data between 1997 and 2002 (Page 2 of 2)

Location	1997 Water Level (ft)	2002 Water Level (ft)	Difference in Water Level (ft)
SWEB-11	9.71	10.67	0.96
SWEB-12	15.6	16.21	0.61
SWEB-13	19.63	20.24	0.61
SWEB-14	14.68	14.63	-0.05
SWEB-2	33.81	32.45	-1.36
SWEB-3	15.96	18.12	2.16
SWEB-4	11.93	14.04	2.11
SWEB-5	24.29	25.56	1.27
SWEB-7	7.99	10.17	2.18
SWEB-8	25.8	26.63	0.83
SWEB-9	30.76	31.47	0.71
WN-15	45.5	46.13	0.63
WN-16	11.25	11.91	0.66
WN-25	17.11	18.1	0.99
WN-26	34.98	37.03	2.05
Average Water Level Difference			**0.339**

Table 2-10 Extrapolation of Select Water Level Data to 2002 Levels

Location	Measurement Date	Water level, Elevation (ft)	2002 Extrapolated Value[1]
Anderson-1	6/18/97	6286.13	6286.5
Claytor-1	6/18/97	6287.002	6287.3
Claytor-2	6/18/97	6273.81	6274.1
Cox-1	6/18/97	6265.98	6266.3
Durben-1	11/25/96	6275.254	6275.6
Fox-1	11/25/96	6264.26	6264.6
Green-Mtn-S	6/18/97	6295.49	6295.8
Jamerman-1	3/29/97	6283.999	6284.3
Johnson	3/30/97	6273.452	6273.8
Crandell-1	6/18/97	6255.65	6256.0
KK-1	10/2/96	6268.92	6269.3
RM-1	9/30/96	6271.77	6272.1
School-16	6/18/97	6248.79	6249.1
Swick	8/14/96	6301.48	6301.8
SWAB-37	7/10/98	6254.79	6255.1
SWAB-38	7/10/98	6244.32	6244.7

1 0.339 ft added to water level recorded on measurement date

Table 3-1 Revised Background Upper Prediction Limits for Split Rock Formation Groundwater[1] (Page 1 of 2)

Analyte	Distribution	Records	Percent Non-Detect	UPL Type	UPL k=1	% Conf.	Resamples	UPL k=5	% Conf.	Resamples	UPL k=10	% Conf.	Resamples
Ag (mg/L)	0	101	100	0	-	-	-	-	-	-	-	-	-
Al (mg/L)	0	101	100	0	-	-	-	-	-	-	-	-	-
Alkalinity (mg/L)	0	101	51.5	2	226	99	0	226	95	0	226	91	1
As (mg/L)	0	101	57.4	2	0.011	99	0	0.011	95	0	0.011	91	1
B (mg/L)	0	101	65.3	2	0.14	99	0	0.14	95	0	0.14	91	1
Ba (mg/L)	0	101	85.1	2	0.14	99	0	0.14	95	0	0.14	91	1
Be (mg/L)	0	101	100	0	-	-	-	-	-	-	-	-	-
Ca (mg/L)	4	101	21.8	2	141	99	0	141	95	0	141	91	1
Cd (mg/L)	0	101	98	2	0.01	99	0	0.01	95	0	0.01	91	1
Cl (mg/L)	4	101	19.8	2	177	99	0	177	95	0	177	91	1
Co (mg/L)	0	101	100	0	-	-	-	-	-	-	-	-	-
Conductivity	4	101	12.9	2	1118	99	0	1118	95	0	1118	91	1
Cr (mg/L)	0	29	100	0	-	-	-	-	-	-	-	-	-
Cu (mg/L)	0	29	100	0	-	-	-	-	-	-	-	-	-
F (mg/L)	0	29	93.1	2	0.21	97	0	0.21	85	1	0.21	74	1
Fe (mg/L)	0	29	100	0	-	97	0	-	85	1	-	74	1
Hg (mg/L)	0	29	100	0	-	97	0	-	85	1	-	74	1
K (mg/L)	4	29	0	2	7.51	97	0	7.51	85	1	7.51	74	1
Mg (mg/L)	4	29	0	2	19.1	97	0	19.1	85	1	19.1	74	1
Mn (mg/L)	2	29	48.3	0	-	-	-	-	-	-	-	-	
Mo (mg/L)	0	29	100	0	-	97	0	-	85	1	-	74	1
Na (mg/L)	4	29	0	2	52.1	97	0	52.1	85	1	52.1	74	1
NH4-N (mg/L)	0	29	89.7	2	0.12	97	0	0.12	85	1	0.12	74	1
NO2+NO3-as-N (mg/L)	2	29	34.5	0	-	-	-	-	-	-	-	-	-
NO2-as-N (mg/L)	0	29	100	0	-	-	0	-	-	-	-	-	-
NO3-as-N (mg/L)	0	29	100	0	-	-	0	-	-	-	-	-	-
P (mg/L)	0	29	82.8	2	0.1	97	0	0.1	85	1	0.1	74	1
Pb (mg/L)	0	29	100	0	-	-	0	-	-	-	-	-	-
Pb-210 (pCi/L)	0	29	100	0	-	-	0	-	-	-	-	-	-
pH (field) s.u.	2	29	6.9	0	-	-	-	-	-	-	-	-	-

Table 3-1 Revised Background Upper Prediction Limits for Split Rock Formation Groundwater[1] (Page 2 of 2)

Analyte	Distribution	Records	Percent Non-Detect	UPL Type	UPL k=1	% Conf.	Resamples	UPL k=5	% Conf.	Resamples	UPL k=10	% Conf.	Resamples
Po-210 (pCi/L)	0	29	100	0	-	-	-	-	-	-	-	-	-
Ra Combined (pCi/L)	0	29	100	0	-	-	-	-	-	-	-	-	-
Ra-226 (pCi/L)	0	29	100	0	-	-	-	-	-	-	-	-	-
Ra-228 (pCi/L)	0	29	100	0	-	-	-	-	-	-	-	-	-
Sb (mg/L)	0	29	100	0	-	-	-	-	-	-	-	-	-
Se (mg/L)	0	29	72.4	2	0.004	97	0	0.004	85	1	0.004	74	1
Silica (mg/L)	4	29	0	2	49.8	97	0	49.8	85	1	49.8	74	1
Sulfate (mg/L)	4	29	0	2	98	97	0	98	85	1	98	74	1
Sr (mg/L)	2	29	10.3	0	-	-	-	-	-	-	-	-	-
TDS (mg/L)	4	29	0	2	659	97	0	659	85	1	659	74	1
Th230 (pCi/L)	0	29	96.6	2	0.5	97	0	0.5	85	1	0.5	74	1
Tl (mg/L)	0	29	100	0	-	-	-	-	-	-	-	-	-
U (mg/L)	3	29	0	4	0.088	95	0	0.151	95	0	0.186	95	0
V (mg/L)	0	29	96.6	2	0.1	97	0	0.1	85	1	0.1	74	1
Zn (mg/L)	0	29	96.6	2	0.03	97	0	0.03	85	1	0.03	74	1

1 This table is a copy of a table included in the January 2002 WNI response to NRC RAI submittal, and does not include new data.

- designates that all samples were below the detection limit and therefore no upper prediction limit was calculated for this submittal. For a more complete discussion of background for all elements refer to SMI 1999 Table F-5-4.

Distribution Codes

0 = data distributed not tested
1 = normal distribution
2 = not normal
3 = log normal distribution
4 = data neither normal or log normal

Upper Prediction Limit (UPL) Codes

0 = no UPL calculated
1 = Poisson UPL
2 = nonparametric UPL
3 = normal UPL
4 – log normal UPL expressed as antilog values

Table 3-2 Field Screening Data of Groundwater of Samples Obtained During Drilling

Location	Depth, ft	pH	Conductivity, ms/cm
SMI BH01	60	8.26	212
	65	7.73	295
	70	6.73	200
	75	7.78	163
	80	8.23	167
	85	8.24	174
	90	8.26	178
	95	8.09	178
SMI BH02	40	8.69	442
	60	8.14	396
	65	7.91	392
	70	7.87	387
	75	7.95	373
	80	7.67	403
	85	7.98	380
	90	7.86	390
	95	7.76	396
	100	8	384
	105	8.13	418
	110	8.14	402
	115	7.96	392
SMI BH03	35	6.27	390
	55	7.85	374
	65	7.9	369
	70	7.94	412
	75	8.11	346
	80	7.88	359
	85	7.96	356
	90	7.82	347
	95	7.95	355
	105	7.9	412
	110	7.99	397
	115	8.2	368
SMI BH04	40	7.87	388
	65	8.08	405
	70	7.87	301
	75	8.02	374
	80	8.19	376
	85	7.76	361

Location	Depth, ft	pH	Conductivity, ms/cm
SMI BH04 Cont	90	7.98	360
	95	7.94	375
	100	7.93	368
	105	8	358
	110	8.27	225
	115	8.16	368
SMI BH05	60	7.93	422
	75	7.48	404
	85	7.52	397
	90	7.82	433
	95	6.49	361
	100	7.44	370
	105	7.63	416
	110	7.76	366
	115	7.96	369
SWAB-40	40	7.96	378
	45	6.89	377
SWEB-15	40	7.44	435
	75	7.44	349
	80	7.93	346
	90	7.84	208
	95	7.95	366
	100	8	372
	105	7.8	383
	110	7.8	383
	115	7.84	377
	118	7.84	374
SWEB-16	40	8.05	331
	65	7.47	342
	70	7.81	350
	80	7.34	273
	90	7.78	380
	95	7.78	342
	100	7.73	385
	105	7.41	386
	110	7.72	388
	115	8	385
	118	8.14	398

Table 3-3 Summary of Quality Control Requirements for Water Analyses

Analyte or Group	Method[a]	Spike Recovery (field or laboratory)	Duplicate RPD[b] (field or laboratory)	Holding Time/Preservative[c]
Ca, Mg, P, Na, Fe, K, Cl, SO4	ICP	80-120% Recovery	Lab: 20% RPD; Field: 50% RPD	6 mos./HNO_3 to pH<2 (Hg 28 days)
Al, As, Ba, Mn, Mo	ICP	70-130% Recovery	Lab: 20% RPD; Field: 50% RPD	6 mos./HNO_3 to pH<2 (Hg 28 days)
Uranium, total	ICP, ICP-MS	75-125% Recovery[d]	Lab: 20% RPD; Field: 50% RPD	6 mos./HNO_3 to pH<2
Ra-226, Ra-228	EPA 903.0	70-130% Recovery[d]	Lab: 30% RPD; Field: 50% RPD	6 mos./HNO_3 to pH<2
Th-230	alpha spectroscopy	70-130% Recovery[d]	Lab: 30% RPD; Field: 50% RPD	6 mos./HNO_3 to pH<2
NH_3, NO_3+NO_3	wet chemistry	80-120% Recovery	Lab: 20% RPD; Field: 50% RPD	28 days/H_2SO_4 to pH<2
pH	EPA 150.1	N/A[e]	N/A	field, ASAP in lab/none
TDS	EPA160.1, 120.1	90-110% Recovery	Lab: 10% RPD; Field: 50% RPD	TDS 7 days, Cond. 28 days/none
Alkalinity	EPA 310.1	N/A[e]	Lab: 20% RPD; Field: 50% RPD	14 days/none
Total organic carbon	EPA 415.2	85-115% Recovery	Lab: 10% RPD; Field: 50% RPD	28 days/H_3PO_4 to pH<2

Notes: a See Table 2-7 for specific methods.
b RPD = relative percent difference.
c All samples should be maintained at 4 ± 2°C.
d Laboratory control limits for these analyses will be used.
e N/A = not applicable.

Table 3-4 Relative Percent Difference of Field Groundwater Duplicate Samples, Field Blank Analyses Results (Page 1 of 4)

Location	Sample Date	CaCO3	Ammonia as N	Nitrate+Nitrite as N	TOC	TDS, Calc.	TDS @ 180	A/C Balance (± 5)	Al
GROUNDWATER									
SMIBH02-GW-01-105-020114	1/14/02	159	0.05	0.97	2.33	240.82	330.00	1.70	0.10
SMIBH02-GW-02-105-020114	1/14/02	156	0.05	0.95	2.55	243.16	279.00	1.48	0.10
RPD		**1.90**	**0.00**	**2.08**	**8.86**	**0.97**	**16.75**	**13.84**	**0.00**
SMIBH05-GW-01-105-020117	1/17/02	142	0.05	0.95	0.50		248.00		0.10
SMIBH05-GW-02-105-020117	1/17/02	144	0.05	0.91	0.50		249.00		0.10
RPD		**1.40**	**0.00**	**4.30**	**0.00**		**0.40**		**0.00**
SWEB16-GW-01-040-020110	1/10/02	103	0.05	1.66	8.74		224.00		0.10
SWEB16-GW-02-040-020110	1/10/02	104	0.08	1.67	9.05		208.00		0.10
RPD		**0.97**	**46.15**	**0.60**	**3.49**		**7.41**		**0.00**
SWEB-16	3/6/02		0.05	0.90					
SWEB-16S	3/6/02		0.05	0.88					
RPD			**0.00**	**2.25**					
SWAB-15(2)	4/15/02			1.01		380.00			
SWAB-15S(2)	4/15/02			1.06		403.00			
RPD				**0.59**		**11.62**			
COX-1	2/12/02		0.05	1.24					
COX 1-S	2/12/02		0.05	1.24					
RPD			0.00	0.00					
FIELD BLANK									
SWEB16-GW-03-020110	1/10/02								<0.1
Field Blank	3/6/02		<0.05	<0.1					
Field Blank	2/12/02		<0.05	<0.1					
Field Blank	3/6/02								

Table 3-4 Relative Percent Difference of Field Groundwater Duplicate Samples, Field Blank Analyses Results (Page 2 of 4)

Location	Sample Date	Anions	As	Ba	Be	Bicarbonate	Cd	Ca	Carbonate as CO3	Cations
GROUNDWATER										
SMIBH02-GW-01-105-020114	1/14/02	4.34	0.01	0.10				48.00		4.49
SMIBH02-GW-02-105-020114	1/14/02	4.37	0.00	0.10				48.20		4.50
RPD		**0.69**	**4.00**	**0.00**				**0.42**		**0.22**
SMIBH05-GW-01-105-020117	1/17/02		0.00	0.10				45.30		
SMIBH05-GW-02-105-020117	1/17/02		0.00	0.10				45.40		
RPD			**0.00**	**0.00**				**0.22**		
SWEB16-GW-01-040-020110	1/10/02		0.00	0.10				37.70		
SWEB16-GW-02-040-020110	1/10/02		0.00	0.10				37.60		
RPD			**0.00**	**0.00**				**0.27**		
SWEB-16	3/6/02					178.00		52.80	1.00	
SWEB-16S	3/6/02					178.00		54.20	1.00	
RPD						**0.00**		**2.62**	**0.00**	
SWAB-15(2)	4/15/02				0.00		0.00			
SWAB-15S(2)	4/15/02				0.00		0.00			
RPD					**0.00**		**0.00**			
Cox-1	2/12/02				160.00		35.08	1.00		6.60
Cox 1-S	2/12/02				162.00		35.80	1.00		6.60
RPD					**1.24**		**2.03**	**0.00**		**0.00**
FIELD BLANK										
SWEB16-GW-03-020110	1/10/02		<0.001	<0.1				<1		
Field Blank	3/6/02							2.40		
Field Blank	2/12/02							2.40		
Field Blank	3/6/02							<1		

Table 3-4 Relative Percent Difference of Field Groundwater Duplicate Samples, Field Blank Analyses Results (Page 3 of 4)

Location	Sample Date	Cl	Cr	Pb	Fe	Mg	Mn	Mo	Ni	P
GROUNDWATER										
SMIBH02-GW-01-105-020114	1/14/02	8.17			0.03	8.91	0.03	0.10		0.10
SMIBH02-GW-02-105-020114	1/14/02	9.55			0.03	8.96	0.03	0.10		1.23
RPD		**15.58**			**0.00**	**0.56**	**1.37**	**0.00**		**169.92**
SMIBH05-GW-01-105-020117	1/17/02	6.74			0.03	7.97	0.01	0.10		0.10
SMIBH05-GW-02-105-020117	1/17/02	9.00			0.03	7.95	0.01	0.10		0.10
RPD		**28.72**			**0.00**	**0.25**	**0.00**	**0.00**		**0.00**
SWEB16-GW-01-040-020110	1/10/02	12.70			0.03	5.08	0.07	0.10		0.15
SWEB16-GW-02-040-020110	1/10/02	12.50			0.03	5.07	0.07	0.10		0.16
RPD		**1.59**			**0.00**	**0.20**	**0.45**	**0.00**		**3.82**
SWEB-16	3/6/02	6.40				6.60	0.01			
SWEB-16S	3/6/02	7.10				6.70	0.01			
RPD		**10.37**				**1.50**	**0.00**			
SWAB-15(2)	4/15/02	22.60	0.01	0.01					0.05	
SWAB-15S(2)	4/15/02	21.00	0.01	0.01					0.05	
RPD		**8.29**	**0.00**	**0.00**					**0.00**	
Cox-1	2/12/02				5.70	0.01				4.70
Cox 1-S	2/12/02				5.70	0.01				4.70
RPD					**0.00**	**0.00**				**0.00**
FIELD BLANK										
SWEB16-GW-03-020110	1/10/02	<1			<0.03	<1	<0.01	<0.1		<0.1
Field Blank	3/6/02							<0.1		
Field Blank	2/12/02							<0.1		
Field Blank	3/6/02	<1				<1				

Table 3-4 Relative Percent Difference of Field Groundwater Duplicate Samples, Field Blank Analyses Results (Page 4 of 4)

Location	Sample Date	K	Ra-226	Ra-228	Se	Na	SO4	TDS Balance	Th-230	U_{nat}
GROUNDWATER										
SMIBH02-GW-01-105-020114	1/14/02	4.48	0.20			28.30	41.50	1.36	0.20	0.083
SMIBH02-GW-02-105-020114	1/14/02	4.44	0.20			28.30	44.20	1.14	0.20	0.080
RPD		**0.90**	**0.00**			**0.00**	**6.30**	**17.60**	**0.00**	**3.574**
SMIBH05-GW-01-105-020117	1/17/02	4.60	0.20			20.60	33.70		0.20	0.025
SMIBH05-GW-02-105-020117	1/17/02	4.59	0.20			20.60	33.90		0.20	0.025
RPD		**0.22**	**0.00**			**0.00**	**0.59**		**0.00**	**0.806**
SWEB16-GW-01-040-020110	1/10/02	1.71	0.20			19.60	36.80		0.20	0.013
SWEB16-GW-02-040-020110	1/10/02	1.70	0.20			19.50	36.00		0.20	0.014
RPD		**0.59**	**0.00**			**0.51**	**2.20**		**0.00**	**4.380**
SWEB-16	3/6/02	3.50	0.20	1.00		23.80	44.50		0.20	0.035
SWEB-16S	3/6/02	3.60	0.20	1.00		24.40	44.00		0.20	0.036
RPD		**2.82**	**0.00**	**0.00**		**2.49**	**1.13**		**0.00**	**1.695**
SWAB-15(2)	4/15/02				0.01		64.50			0.087
SWAB-15S(2)	4/15/02				0.01		67.90			0.086
RPD					**0.00**		**8.45**			**0.006**
Cox-1	2/12/02	0.20			30.30	32.10			0.03	0.031
Cox 1-S	2/12/02	0.20			30.00	32.10			0.03	0.032
RPD		**0.00**			**1.00**	**0.00**			**4.74**	**4.739**
FIELD BLANK										
SWEB16-GW-03-020110	1/10/02	<1	<0.2			<1	<1		<0.2	<0.0003
Field Blank	3/6/02		<0.2			<1				<0.0003
Field Blank	2/12/02		<0.2							<0.0003
Field Blank	3/6/02	<1				<1				

Table 3-5 Analytical Results of Groundwater, Samples from Drilling, 2002 (Page 1 of 6)

Location	Sample depth, ft.	Date Sampled	Alkalinity as CaCO3 (mg/L)	Ammonia as N (mg/L)	Nitrate+Nitrite as N (mg/L)	TOC (mg/L)	TDS, Calculated (mg/L)	TDS @ 180 (mg/L)	A/C Balance (± 5) %	Al (mg/L)	Anions (meq/L)
SMI BH01	55	1/13/02	87	<0.05	1.8		117.18	284	-1.47	<0.1	2.17
	65	1/13/02	82	<0.05	1.66		109.90	192	-1.05	<0.1	2.03
	75	1/13/02	71	<0.05	1.21		87.53	191	0.01	<0.1	1.62
	85	1/13/02	72	<0.05	1.06		93.57	168	0.81	<0.1	1.71
	95	1/13/02	75	<0.05	1.15		96.56	150	0.38	<0.1	1.78
SMI BH02	36	1/13/02	164	<0.05	0.96	3.45	255.97	303	0.54	<0.1	4.59
	56	1/13/02	156	<0.05	1.16	3.17	227.97	378	0.51	<0.1	4.15
	65	1/13/02	154	<0.05	1.1	1.24	227.53	273	1.31	0.3	4.12
	75	1/13/02	158	<0.05	1.12	0.76	232.20	273	-0.36	<0.1	4.27
	85	1/14/02	147	<0.05	1.14	1.13	218.62	253	1.24	<0.1	3.96
	95	1/14/02	156	<0.05	1.07	1.47	231.52	283	2.64	<0.1	4.14
	105	1/14/02	159	<0.05	0.97	2.33	240.82	330	1.70	<0.1	4.34
	115	1/14/02	152	<0.05	1.08	1.36	223.90	279	1.42	<0.1	4.04
	105	1/14/02	156	<0.05	0.95	2.55	243.16	279	1.48	<0.1	4.37
SMI BH03	36	1/15/02	130	0.17	1.48	3.24	234.44	265	0.01	<0.1	4.14
	55	1/16/02	140			2.91		273			
	75	1/16/02	130	<0.05	1.63	1.68	207.18	226	-0.51	<0.1	3.72
	85	1/16/02	139	<0.05	1.45	0.94	208.23	225	0.38	<0.1	3.77
	95	1/16/02	140	<0.05	1.55	0.80	210.80	261	0.22	<0.1	3.83
	105	1/16/02	147	<0.05	0.99	0.71	224.79	268	1.11	<0.1	4.07
	115	1/16/02	149	0.16	0.59	0.50	216.74	248	0.50	<0.1	3.96
SMI BH04	55	1/16/02	162	<0.05	1.26	2.43		299		<0.1	
	65	1/16/02	158	<0.05	1.34	1.14		241		<0.1	
	75	1/16/02	152	<0.05	1.29	0.54		245		<0.1	
	85	1/16/02	147	<0.05	1.2	0.58		249		<0.1	
	95	1/16/02	148	<0.05	1.05	0.56		241		<0.1	
	105	1/16/02	149	<0.05	0.9	0.52		251		<0.1	
	115	1/16/02	152	<0.05	0.59	<.5		261		<0.1	

Table 3-5 Analytical Results of Groundwater, Samples from Drilling, 2002 (Page 2 of 6)

Location	Sample depth, ft.	Date Sampled	Alkalinity as CaCO3 (mg/L)	Ammonia as N (mg/L)	Nitrate+Nitrite as N (mg/L)	TOC (mg/L)	TDS, Calculated (mg/L)	TDS @ 180 (mg/L)	A/C Balance (± 5) %	Al (mg/L)	Anions (meq/L)
SMI BH05	55	1/17/02	160			3.92		272		<0.1	
	75	1/17/02	154	<0.05	1.14	2.97		217		<0.1	
	85	1/17/02	150	<0.05	1.06	0.95		255		<0.1	
	95	1/17/02	148	<0.05	1.09	0.67		273		<0.1	
	105	1/17/02	142	<0.05	0.95	<.5		248		<0.1	
	115	1/17/02	147	<0.05	0.94	0.74		246		<0.1	
	105	1/17/02	144	<0.05	0.91	<.5		249		<0.1	
SWAB40	36	1/12/02	134	0.08	1.03	9.16	206.27	239	0.20	<0.1	3.74
	45	1/12/02	142	<0.05	0.69	1.80	217.77	240	2.21	<0.1	3.88
SWEB15	80	1/8/02	137	0.07	0.55	9.36		270		<0.1	
	95	1/8/02	146	0.08	0.49	2.92		244		<0.1	
	105	1/8/02	149	<0.05	0.44	2.12		238		<0.1	
	115	1/8/02	152	<0.05	0.44	0.83		239		<0.1	
SWEB16	40	1/10/02	103	<0.05	1.66	8.74		224		<0.1	
	60	1/10/02	132	0.06	1.66	7.76		222		<0.1	
	80	1/10/02	137	0.11	1.78	11.60		289		<0.1	
	90	1/10/02	143	0.1	0.89	3.85		233		<0.1	
	100	1/10/02	144	<0.05	1.28	1.90		237		<0.1	
	110	1/10/02	154	<0.05	1.08	1.14		241		<0.1	
	118	1/10/02	151	<0.05	0.94	1.00		262		<0.1	
	40	1/10/02	104	0.08	1.67	9.05		208		<0.1	
	55	1/10/02								<0.1	

Table 3-5 Analytical Results of Groundwater, Samples from Drilling, 2002 (Page 3 of 6)

Location	Sample depth, ft.	Date Sampled	As mg/L	Ba mg/L	Ca mg/L	Cations meq/L	Cl mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	P mg/L
SMI BH01	55	1/13/02	0.001	<0.1	26.7	2.10	4.80	<0.03	3.4	0.01	<0.1	<0.1
	65	1/13/02	0.002	<0.1	25.4	1.99	4.56	<0.03	3.3	0.01	<0.1	<0.1
	75	1/13/02	0.003	<0.1	21.1	1.62	<1	<0.03	2.8	<0.01	<0.1	<0.1
	85	1/13/02	<0.001	<0.1	23.7	1.74	<1	<0.03	2.9	<0.01	<0.1	<0.1
	95	1/13/02	0.002	<0.1	24.9	1.79	<1	<0.03	3.1	<0.01	<0.1	<0.1
SMI BH02	36	1/13/02	0.001	<0.1	43.7	4.64	6.80	<0.03	8.3	0.04	<0.1	<0.1
	56	1/13/02	0.001	<0.1	46.6	4.19	4.24	<0.03	8.5	0.04	<0.1	<0.1
	65	1/13/02	0.002	<0.1	46.9	4.23	4.99	<0.03	8.5	0.03	<0.1	<0.1
	75	1/13/02	0.004	<0.1	47.9	4.24	8.61	<0.03	8.9	0.03	<0.1	<0.1
	85	1/14/02	<0.001	<0.1	45.1	4.06	5.34	<0.03	8.9	0.04	<0.1	<0.1
	95	1/14/02	0.003	<0.1	46.4	4.37	4.64	<0.03	8.7	0.03	<0.1	<0.1
	105	1/14/02	0.005	<0.1	48.0	4.49	8.17	<0.03	8.9	0.03	<0.1	<0.1
	115	1/14/02	0.004	<0.1	48.3	4.16	5.58	0.08	7.3	<0.01	<0.1	<0.1
	105	1/14/02	0.005	<0.1	48.2	4.50	9.55	<0.03	9.0	0.03	<0.1	1.2
SMI BH03	36	1/15/02	<0.001	<0.1	38.6		19.90	<0.03	4.6	0.04	<0.1	<0.1
	55	1/16/02										
	75	1/16/02	0.001	<0.1	36.5		10.80	<0.03	5.3	0.04	<0.1	<0.1
	85	1/16/02	0.001	<0.1	40.9		8.90	<0.03	6.4	0.01	<0.1	<0.1
	95	1/16/02	0.003	<0.1	43.8		9.70	<0.03	7.2	0.01	<0.1	<0.1
	105	1/16/02	0.002	<0.1	50.2		9.90	<0.03	7.7	<0.01	<0.1	<0.1
	115	1/16/02	0.004	<0.1	49.7		7.66	<0.03	6.7	<0.01	<0.1	<0.1
SMI BH04	55	1/16/02	0.001	<0.1	50.1		12.00	<0.03	8.7	0.03	<0.1	<0.1
	65	1/16/02	0.002	<0.1	45.6		12.40	<0.03	8.1	0.04	<0.1	<0.1
	75	1/16/02	0.003	<0.1	47.2		9.92	<0.03	7.9	0.03	<0.1	<0.1
	85	1/16/02	0.004	<0.1	47.9		8.71	<0.03	6.9	<0.01	<0.1	<0.1
	95	1/16/02	0.004	<0.1	48.1		9.72	<0.03	7.0	<0.01	<0.1	<0.1
	105	1/16/02	0.003	<0.1	48.1		10.30	<0.03	7.0	0.01	<0.1	<0.1
	115	1/16/02	0.001	<0.1	50.7		7.87	<0.03	6.9	<0.01	<0.1	<0.1

Table 3-5 Analytical Results of Groundwater, Samples from Drilling, 2002 (Page 4 of 6)

Location	Sample depth, ft.	Date Sampled	As mg/L	Ba mg/L	Ca mg/L	Cations meq/L	Cl mg/L	Fe mg/L	Mg mg/L	Mn mg/L	Mo mg/L	P mg/L
SMI BH05	55	1/17/02	<0.001	<0.1	49.4		10.60	<0.03	8.8	0.05	<0.1	<0.1
	75	1/17/02	<0.001	<0.1	48.0		9.63	<0.03	8.5	0.04	<0.1	0.1
	85	1/17/02	0.001	<0.1	49.0		11.00	<0.03	8.5	0.04	<0.1	<0.1
	95	1/17/02	0.002	<0.1	47.2		8.25	<0.03	8.3	0.05	<0.1	0.1
	105	1/17/02	0.003	<0.1	45.3		6.74	<0.03	8.0	<0.01	<0.1	<0.1
	115	1/17/02	0.001	<0.1	47.8		9.13	<0.03	8.0	<0.01	<0.1	<0.1
	105	1/17/02	0.003	<0.1	45.4		9.00	<0.03	8.0	<0.01	<0.1	<0.1
SWAB40	36	1/12/02	<0.001	<0.1	42.4	3.76	9.00	<0.03	6.3	0.06	<0.1	<0.1
	45	1/12/02	0.003	<0.1	47.8	4.06	4.48	<0.03	6.7	0.02	<0.1	<0.1
SWEB15	80	1/8/02	<0.001	<0.1	46.8		6.77	<0.03	6.8	0.07	<0.1	<0.1
	95	1/8/02	0.001	<0.1						<0.01	<0.1	
	105	1/8/02	0.003	<0.1	46.4		7.46	<0.03	6.6	<0.01	<0.1	0.1
	115	1/8/02	0.004	<0.1	48.3		5.66	<0.03	6.9	<0.01	<0.1	<0.1
SWEB16	40	1/10/02	<0.001	<0.1	37.7		12.70	<0.03	5.1	0.07	<0.1	0.2
	60	1/10/02	<0.001	<0.1	42.2		9.13	<0.03	5.5	0.06	<0.1	<0.1
	80	1/10/02	<0.001	<0.1	45.8		9.25	<0.03	6.7	0.10	<0.1	<0.1
	90	1/10/02	0.003	<0.1	46.9		7.94	<0.03	6.1	0.01	<0.1	0.2
	100	1/10/02	<0.001	<0.1	47.2		9.93	<0.03	6.4	0.11	<0.1	0.1
	110	1/10/02	0.003	<0.1	47.4		7.62	<0.03	6.1	0.01	<0.1	<0.1
	118	1/10/02	0.004	<0.1	49.7		5.98	<0.03	6.3	<0.01	<0.1	0.2
	40	1/10/02	<0.001	<0.1	37.6		12.50	<0.03	5.1	0.07	<0.1	0.2
	55	1/10/02	<0.001	<0.1	<1		<1	<0.03	<1	<0.01	<0.1	<0.1

Table 3-5 Analytical Results of Groundwater, Samples from Drilling, 2002 (Page 5 of 6)

Location	Sample depth, ft.	Date Sampled	K mg/L	Ra-226 pCi/g	Na mg/L	SO4 mg/L	TDS Balance dec. %	Th-230 pCi/g	U_{nat} mg/L
SMI BH01	55	1/13/02	4.69	<0.2	8.32	8.09	2.42	<0.2	0.008
	65	1/13/02	4.87	<0.2	7.38	7.02	1.74	<0.2	0.005
	75	1/13/02	3.86	<0.2	5.44	5.13	2.18	<0.2	0.003
	85	1/13/02	4.33	<0.2	4.58	8.40	1.79	<0.2	0.002
	95	1/13/02	3.68	<0.2	4.44	9.45	1.55	<0.2	0.003
SMI BH02	36	1/13/02	4.25	<0.2	38.00	50.50	1.18	<0.2	0.090
	56	1/13/02	4.98	<0.2	23.40	39.80	1.65	<0.2	0.049
	65	1/13/02	5.15	<0.2	23.10	39.60	1.20	<0.2	0.054
	75	1/13/02	4.78	<0.2	22.50	38.00	1.17	<0.2	0.065
	85	1/14/02	4.23	<0.2	22.10	38.20	1.15	<0.2	0.036
	95	1/14/02	4.54	<0.2	27.70	39.50	1.22	<0.2	0.067
	105	1/14/02	4.48	<0.2	28.30	41.50	1.36	<0.2	0.083
	115	1/14/02	4.52	<0.2	23.40	37.10	1.24	<0.2	0.058
	105	1/14/02	4.44	<0.2	28.30	44.20	1.14	<0.2	0.080
SMI BH03	36	1/15/02	2.78	<0.2	40.10	42.20	1.13	<0.2	0.056
	55	1/16/02							
	75	1/16/02	3.50	<0.2	30.50	33.90	1.09	<0.2	0.062
	85	1/16/02	4.16	<0.2	25.70	30.90	1.07	<0.2	0.023
	95	1/16/02	4.71	<0.2	21.70	31.40	1.23	<0.2	0.044
	105	1/16/02	4.26	<0.2	20.80	37.80	1.19	<0.2	0.022
	115	1/16/02	4.59	<0.2	19.60	34.80	1.14	<0.2	0.024
SMI BH04	55	1/16/02	4.24	0.3	35.40	53.90		<0.2	0.150
	65	1/16/02	4.35	<0.2	31.00	41.20		<0.2	0.109
	75	1/16/02	4.48	<0.2	22.80	34.50		<0.2	0.051
	85	1/16/02	4.66	<0.2	20.30	33.40		<0.2	0.023
	95	1/16/02	4.70	<0.2	20.00	34.00		<0.2	0.024
	105	1/16/02	4.73	<0.2	20.30	36.00		<0.2	0.022
	115	1/16/02	4.80	0.3	20.10	36.00		<0.2	0.013

Table 3-5 Analytical Results of Groundwater, Samples from Drilling, 2002 (Page 6 of 6)

Location	Sample depth, ft.	Date Sampled	K mg/L	Ra-226 pCi/g	Na mg/L	SO4 mg/L	TDS Balance dec. %	Th-230 pCi/g	U_{nat} mg/L
SMI BH05	55	1/17/02	4.47	<0.2	30.50	51.30		<0.2	0.049
	75	1/17/02	4.45	<0.2	25.10	43.60		<0.2	0.030
	85	1/17/02	4.79	<0.2	24.50	45.50		<0.2	0.033
	95	1/17/02	4.72	<0.2	22.50	36.20		<0.2	0.038
	105	1/17/02	4.60	<0.2	20.60	33.70		<0.2	0.025
	115	1/17/02	4.54	<0.2	21.00	38.00		<0.2	0.018
	105	1/17/02	4.59	<0.2	20.60	33.90		<0.2	0.025
SWAB40	36	1/12/02	3.07	<0.2	23.40	35.40	1.15	<0.2	0.033
	45	1/12/02	3.64	<0.2	23.30	41.90	1.10	<0.2	0.043
SWEB15	80	1/8/02	3.45	<0.2	24.40	49.60		<0.2	0.014
	95	1/8/02		<0.2				<0.2	0.011
	105	1/8/02	3.19	<0.2	22.00	39.60		<0.2	0.015
	115	1/8/02	3.30	<0.2	22.10	42.20		<0.2	0.018
SWEB16	40	1/10/02	1.71	<0.2	19.60	36.80		<0.2	0.013
	60	1/10/02	2.61	<0.2	19.30	33.60		<0.2	0.015
	80	1/10/02	3.19	<0.2	21.60	50.60		<0.2	0.013
	90	1/10/02	2.96	<0.2	21.40	42.90		<0.2	0.032
	100	1/10/02	3.11	<0.2	21.90	39.80		<0.2	0.029
	110	1/10/02	2.88	<0.2	21.00	44.00		<0.2	0.031
	118	1/10/02	2.98	<0.2	21.20	45.50		<0.2	0.033
	40	1/10/02	1.70	<0.2	19.50	36.00		<0.2	0.014
	55	1/10/02	<1	<0.2	<1	<1		<0.2	<0.0003

Table 3-6 Analytical Results from Groundwater, Samples from Wells (Page 1 of 4)

Location	Date Sampled	Depth, ft	Easting	Northing	Ammonia as N mg/L	Nitrate+Nitrite as N Mg/L	TOC mg/L	TDS mg/L	HCO3 mg/L	Ca mg/L
Cline	06-Feb-02		19056.27	972.59	<0.5	1.50	0.529	234	165	50.7
Cox-1	12-Feb-02	89.8	17990.6	2012.1	<0.5	1.24			160	35.08
Cox-2	12-Feb-02		18223.6	1273.8	<0.5	1.12		252	190	36.5
Fox-1	06-Feb-02	40	19377.36	959.19	<0.5	0.88	<0.5	226	170	47.5
Johnson	12-Feb-02	65	15351.59	-21.893	<0.5	2.87		208	151	31.9
KK-1	06-Feb-02	57	17048.46	955.22	<0.5	3.16	1.145	293	185	59.5
RM-1	06-Feb-02	60	15808.7	1179.6	<0.5	3.95	2.046	396	257	81.0
Stoilkov Home	06-Feb-02		16184.67	-283.28	<0.5	1.30	0.541	243	173	51.7
SWAB-1	07-Feb-02	28	7401.5	2654.5	<0.5	84.50			289	337
SWAB-10	04-Feb-02	29.9	7556.836	1493.015	<0.5	1.69			200	
SWAB-14	04-Feb-02	18.1	2945.734	3580.138	<0.5	0.23	0.678	356	178	74.9
SWAB-15	05-Feb-02	22.5	9074.378	1413.004	<0.5	0.72			309	
SWAB-17	07-Feb-02	38.5	8206.33	2370.382	<0.5	4.93			172	82
SWAB-2	05-Feb-02	28.3	6684.8	3582.8	96.7	113.00			332	
SWAB-26	04-Feb-02	25	350.6	5571.7	<0.5	1.70	1.145	260	160	46.7
SWAB-28	07-Feb-02	33.5	11009.9	1281.8	<0.5	1.26			200	53.1
SWAB-29	07-Feb-02	18.5	11999.3	1730.3	<0.5	<0.1			221	61.6
SWAB-30	05-Feb-02	23.5	4591.905	3679.661	<0.5	0.77	1.017	287	181	61.2
SWAB-31	06-Feb-02	40	13847.02	1306.919	<0.5	1.13	0.693	234	190	56.2
SWAB-32	06-Feb-02	34	13783.04	-64.251	<0.5	1.15	1.722	324	213	66.0
SWAB-33	06-Feb-02	29	17782.78	2417.2	<0.5	0.36	5.354	501	281	72.4
SWAB-34	06-Feb-02	33	15564.22	2943.62	<0.5	0.85	1.158	255	192	58.8
SWAB-35	04-Feb-02	20	3930.41	4845.79	<0.5	0.58	0.514	302	184	66.5
SWAB-39	06-Mar-02	44.1	14661.99	1225.46	<0.5	1.48			197	55.2
SWAB-4	04-Feb-02	18.8	4674.3	6651.4	10.0	40.20	3.789	1330	258	241.0
SWAB-5	04-Feb-02	20.4	5079.4	5762.4	5.2	14.90	1.652	679	201	113.0
SWAB-6	04-Feb-02	22.92	4911.4	2208.2	<0.5	1.12			193	

Table 3-6 Analytical Results from Groundwater, Samples from Wells (Page 2 of 4)

Location	Date Sampled	Depth, ft	Easting	Northing	Ammonia as N mg/L	Nitrate+Nitrite as N Mg/L	TOC mg/L	TDS mg/L	HCO3 mg/L	Ca mg/L
SWAB-7	07-Feb-02	20.3	9963.6	2100.8	<0.5	4.88			197	71.7
SWEB-10	04-Feb-02	231	5102.1	5783.5	<0.5	1.45	<0.5	435	177	92.4
SWEB-12	07-Feb-02	494	9952.2	2078.1	<0.5	0.43			182	51.9
SWEB-13	05-Feb-02	555	4598.663	3705.72	<0.5	<0.1	<0.5	272	39.7	22.7
SWEB-14	11-Feb-02	109.5	11974.4	1743.5	<0.5	<0.1			201	54.4
SWEB-15	06-Mar-02	99.59	14662.06	1251.2	<0.5	0.52			188	52.4
SWEB-16	06-Mar-02	99.75	13840.21	1329.51	<0.5	0.90			178	52.8
SWEB-6	05-Feb-02	396	6706.2	3611.3	0.8	<0.1			100	
SWEB-8	11-Feb-02	195	7417.342	2676.008	<0.5	0.38			178	66.6
SWEB-9	11-Feb-02	416	8167.5	2389.8	<0.5	<0.1			60.2	3.2
Veach-2	06-Feb-02	75	15750	1600	<0.5	3.65	1.381	312	218	63.8
WM-1	06-Feb-02	65	16081	1980.83	<0.5	1.91	1.124	289	215	64.7
WM-2	06-Feb-02	65	16099	1687	<0.5	2.09	0.956	302	217	62.4
SWAB-15 (2)	15-Apr-02	27.5	9074.37	1413.004		1.01		380		
SWAB-37	15-Apr-02		21897.83	4857.53		0.4		249		
SWAB-38	15-Apr-02		27439.16	9957.64		0.39		271		
SWAB-3	24-Apr-02		5743.8	4291	0.1	9.79	2.0662	864		136

Table 3-6 Analytical Results from Groundwater, Samples from Wells (Page 3 of 4)

Location	Date Sampled	Depth, ft	CO3 mg/L	Cl Mg/L	Mg mg/L	Mn mg/L	K Mg/L	Ra-226 PCi/L	Ra-228 pCi/L	Na mg/L	SO4 mg/L	U_{nat} mg/L
Cline	06-Feb-02		<1	2.63	6.50	<0.01	4.04	<0.2	<1	21.7	38.8	0.040
Cox-1	12-Feb-02	89.8	<1	6.6	5.7	<0.01	4.7	<0.2		30.3	32.1	0.031
Cox-2	12-Feb-02		<1	2.45	5.94	<0.01	4.04	<0.2		18.0	39.0	0.053
Fox-1	06-Feb-02	40	<1	4.66	7.05	<0.01	5.10	0.5		20.7	33.0	0.027
Johnson	12-Feb-02	65	<1	6.48	4.62	<0.01	3.23	<0.2		15.3	24.8	<0.0003
KK-1	06-Feb-02	57	<1	10.70	9.07	<0.01	5.16	<0.2		28.6	49.1	0.073
RM-1	06-Feb-02	60	<1	17.20	12.40	<0.01	5.21	<0.2		39.0	62.2	0.314
Stoilkov Home	06-Feb-02		<1	5.85	7.21	<0.01	4.50	<0.2	<1	21.8	37.8	0.027
SWAB-1	07-Feb-02	28	<1	35.3	85.6	<0.01	8.4	<0.2		92.2	773.0	1.240
SWAB-10	04-Feb-02	29.9	<1	10.4		<0.01		<0.2	2		41.5	0.056
SWAB-14	04-Feb-02	18.1	<1	29.60	9.57	<0.01	5.73	<0.2	<1	29.9	83.6	0.045
SWAB-15	05-Feb-02	22.5	<1	26.7		<0.01		<0.2	<1		70.5	0.106
SWAB-17	07-Feb-02	38.5	<1	11.9	13.1	0.0139	6	0.3		37.7	43.4	0.104
SWAB-2	05-Feb-02	28.3	<1	47.2		6.45		3.6	6		1320.0	1.390
SWAB-26	04-Feb-02	25	<1	19.40	5.67	<0.01	6.51	<0.2	<1	27.7	28.2	0.016
SWAB-28	07-Feb-02	33.5	<1	7.6	7.4	<0.01	4.2	0.5		22.5	27.1	0.049
SWAB-29	07-Feb-02	18.5	<1	5.7	12	<0.01	3.5	<0.2		6.4	112.0	0.018
SWAB-30	05-Feb-02	23.5	<1	8.65	8.02	0.0212	5.61	<0.2	<1	24.1	55.4	0.032
SWAB-31	06-Feb-02	40	<1	10.10	6.45	<0.01	3.19	<0.2	<1	23.6	29.5	0.033
SWAB-32	06-Feb-02	34	<1	13.50	8.86	<0.01	5.32	<0.2	<1	34.1	56.9	0.163
SWAB-33	06-Feb-02	29	<1	29.70	12.80	<0.01	6.46	<0.2	<1	81.4	117.0	0.337
SWAB-34	06-Feb-02	33	<1	7.89	8.03	<0.01	3.60	<0.2	<1	24.6	39.7	0.054
SWAB-35	04-Feb-02	20	<1	10.60	8.15	<0.01	6.32	<0.2	<1	21.9	60.5	0.032
SWAB-39	06-Mar-02	44.1	<1	11	9.7	0.0134	3.3	<0.2	<1	24.4	35.4	0.105
SWAB-4	04-Feb-02	18.8	<1	36.30	55.30	<0.01	19.60	2.8	4	58.5	521.0	1.140
SWAB-5	04-Feb-02	20.4	<1	31.50	30.40	0.831	12.80	0.5	1.5	42.5	224.0	0.434
SWAB-6	04-Feb-02	22.92	<1	18		<0.01			<1		66.3	0.045
SWAB-7	07-Feb-02	20.3	<1	4	6.6	<0.01	4.1	0.3		12.3	34.6	0.082

Table 3-6 Analytical Results from Groundwater, Samples from Wells (Page 4 of 4)

Location	Date Sampled	Depth, ft	CO3 mg/L	Cl Mg/L	Mg mg/L	Mn mg/L	K mg/L	Ra-226 pCi/L	Ra-228 pCi/L	Na mg/L	SO4 mg/L	U_{nat} mg/L
SWEB-10	04-Feb-02	231	<1	25.60	13.50	0.143	7.58	<0.2	2.1	25.2	129.0	0.042
SWEB-12	07-Feb-02	494	<1	18.60	8.00	<0.01	7.10	<0.2		32.5	55.2	0.025
SWEB-13	05-Feb-02	555	<1	96.00	5.80	0.0296	7.73	<0.2	<1	64.2	47.2	<0.0003
SWEB-14	11-Feb-02	109.5	<1	6.50	8.20	0.207	5.90	<0.2		24.5	45.7	0.017
SWEB-15	06-Mar-02	99.59	<1	4.80	7.20	<0.01	3.70	<0.2	<1	23.6	42.0	0.022
SWEB-16	06-Mar-02	99.75	<1	6.40	6.60	<0.01	3.50	<0.2	<1	23.8	44.5	0.035
SWEB-6	05-Feb-02	396	1.7	16.20		0.0733		<0.2	<1		<1	0.001
SWEB-8	11-Feb-02	195	<1	34.20	9.70	<0.01	6.70	<0.2		27.0	61.4	0.018
SWEB-9	11-Feb-02	416	4.1	10.50	6.10	<0.01	6.40	0.4		20.7	16.0	<0.0003
Veach-2	06-Feb-02	75	<1	11.60	9.59	<0.01	4.26	<0.2	<1	34.1	43.8	0.170
WM-1	06-Feb-02	65	<1	9.54	9.18	<0.01	4.71	<0.2	<1	28.8	44.2	0.165
WM-2	06-Feb-02	65	<1	9.58	9.01	<0.01	4.62	<0.2		30.7	44.0	0.155
SWAB-15	15-Apr-02			22.6							64.5	.0868
SWAB-37	15-Apr-02			7.29							47.5	0.103
SWAB-38	15-Apr-02			7.39							55.7	0.0415
SWAB-3	24-Apr-02		229	16.4	33.6	0.01	13.5			65.9	339	0.492

Additional Constituents Tested

Location	Date Sampled	Al (mg/L)	As (mg/L)	Ba (mg/L)	Fe (mg/L)	P (mg/L)
SWAB-3	24-Apr-02	<0.1	0.0233	<0.1	0.03	<0.1

Table 3-7 Analytes, Reporting Limits, and Analytical Methods for Sediment Samples

Analyte	Method	Reporting Limits	Units
Radium 226	E903.0	0.1	pCi/g
Thorium 230	E907.0	0.1	pCi/g
Uranium	SW6020	0.02	mg/kg

Table 3-8 Relative Percent Difference of Aquifer Material Samples

Location	Sample Date	Uranium
SMIBH02-SO-01-010-020113	13-Jan-02	4.98
SMI-BH02-SO-01-010-031202	12-Mar-02	4.94
RPD		**0.81**
SMIBH02-SO-01-015-020113	13-Jan-02	6.98
SMI-BH02-SO-01-015-031202	12-Mar-02	8.44
RPD		**18.94**
SMIBH04-SO-01-05-020116	16-Jan-02	1.45
SMI-BH04-SO-01-05-031202	12-Mar-02	1.46
RPD		**0.69**
SMIBH04-SO-01-065-020116	16-Jan-02	1.93
SMI-BH04-SO-01-065-031202	12-Mar-02	1.43
RPD		**29.76**

Table 3-9 Analytical Results, Aquifer Material Obtained During Drilling in 2002 (Page 1 of 3)

	Depth	Ra-226 pCi/g	Th-230 pCi/g	Uranium mg/kg
SMI BH01	15	0.4	0.32	0.631
SMI BH01	25	0.6	0.46	0.894
SMI BH01	30	0.5	0.3	0.941
SMI BH01	50	0.4	0.25	0.82
SMI BH01	55	0.4	0.22	0.772
SMI BH02	10	2.3	2.2	4.98
SMI BH02	15	2.6	2.6	6.98
SMI BH02	20	0.4	0.28	1.01
SMI BH02	30	0.2	0.12	0.506
SMI BH02	40	0.4	0.26	0.912
SMI BH02	50	0.5	0.3	0.894
SMI BH02	60	0.4	0.33	0.868
SMI BH02	70	0.3	0.21	0.704
SMI BH02	80	0.4	0.32	0.728
SMI BH02	85	0.38	0.27	0.714
SMI BH02	90	0.2	0.25	0.847
SMI BH02	95	0.2	0.13	0.361
SMI BH02	105	0.2	<0.1	0.434
SMI BH02	115	<0.1	<0.1	0.293
SMI BH03	5	0.92	0.67	1.18
SMI BH03	10	-	-	2.46
SMI BH03	15	0.89	0.84	1.54
SMI BH03	20	-	-	1.28
SMI BH03	25	0.47	0.25	1.02
SMI BH03	35	0.45	0.24	1.1
SMI BH03	40	0.47	0.26	1.17
SMI BH03	50	0.52	0.35	1.36
SMI BH03	55	0.55	0.36	1.42
SMI BH03	65	0.45	0.42	1.64
SMI BH03	75	0.53	0.32	1.49
SMI BH03	85	0.31	0.21	0.524
SMI BH03	95	0.16	0.11	0.327
SMI BH03	105	0.13	<0.1	0.326
SMI BH03	115	0.17	<0.1	0.293
SMI BH04	5	1.1	1.1	1.45
SMI BH04	10	-	-	0.78
SMI BH04	15	0.5	0.42	1.8
SMI BH04	25	0.6	0.43	1.93
SMI BH04	35	0.4	0.19	1.34
SMI BH04	45	0.4	0.37	1.39
SMI BH04	55	0.6	0.22	1.31
SMI BH04	60	-	-	1.93

Table 3-9 Analytical Results, Aquifer Material Obtained During Drilling in 2002 (Page 2 of 3)

	Depth	Ra-226 pCi/g	Th-230 pCi/g	Uranium mg/kg
SMI BH04	65	0.6	0.47	1.93
SMI BH04	70	-	-	0.92
SMI BH04	75	0.3	0.27	0.932
SMI BH04	85	0.3	0.35	0.73
SMI BH04	95	0.4	0.34	1.23
SMI BH04	105	0.2	0.12	0.306
SMI BH04	115	<0.1	0.16	0.363
SMI BH05	5	0.6	0.48	0.612
SMI BH05	10	0.6	0.48	0.67
SMI BH05	15	0.6	0.47	0.836
SMI BH05	20	0.4	0.36	1.67
SMI BH05	25	0.3	0.2	1.09
SMI BH05	35	0.3	0.43	1.13
SMI BH05	45	0.5	0.33	1.25
SMI BH05	55	0.4	0.34	1.05
SMI BH05	60	0.5	0.3	0.933
SMI BH05	65	0.4	0.27	0.919
SMI BH05	75	0.5	0.31	0.94
SMI BH05	85	0.3	0.31	0.972
SMI BH05	95	0.2	0.17	0.693
SMI BH05	105	0.2	0.16	0.602
SMI BH05	115	0.2	0.11	0.288
SWAB-40	5	0.4	0.26	0.463
SWAB-40	15	0.5	0.32	0.55
SWAB-40	25	0.5	0.42	1.59
SWAB-40	35	0.4	0.24	1.08
SWAB-40	45	0.3	0.16	0.658
SWEB-15	5	0.8	0.57	0.914
SWEB-15	15	0.7	0.46	1.42
SWEB-15	20	-	-	3.93
SWEB-15	25	2	0.74	3.58
SWEB-15	30	-	-	2.26
SWEB-15	35	0.7	<0.1	1.36
SWEB-15	45	0.46	0.33	1.1
SWEB-15	55	0.3	0.22	0.683
SWEB-15	65	0.2	0.12	0.447
SWEB-15	75	0.3	<0.1	0.349
SWEB-15	85	0.4	0.18	0.592
SWEB-15	90	0.5	0.33	0.81
SWEB-15	95	0.3	0.21	0.339
SWEB-15	105	0.2	0.13	0.32
SWEB-16	5	1.1	0.71	1.22

Table 3-9 Analytical Results, Aquifer Material Obtained During Drilling in 2002 (Page 3 of 3)

	Depth	Ra-226 pCi/g	Th-230 pCi/g	Uranium mg/kg
SWEB-16	15	0.5	0.28	0.66
SWEB-16	25	0.7	0.41	1.21
SWEB-16	35	0.6	0.44	1.1
SWEB-16	40	0.5	0.27	0.87
SWEB-16	45	0.4	0.25	0.64
SWEB-16	55	0.4	0.18	0.48
SWEB-16	60	0.4	0.18	0.56
SWEB-16	75	0.2	<0.1	0.54
SWEB-16	80	0.4	0.34	0.93
SWEB-16	85	0.3	0.27	0.85
SWEB-16	100	0.3	0.11	0.4
SWEB-16	110	<0.1	<0.1	0.3
SWEB-16	118	0.2	0.13	0.36

FIGURES

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

FIGURE 2-1
SITE INVESTIGATION LOCATIONS
2002
SPLIT ROCK SITE
JEFFREY CITY, WYOMING

WITHIN THIS PACKAGE

NOTE: Because of these page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

FIGURE 2-2
SITE-WIDE PIEZOMETRIC SURFACE
2002 - SPLIT ROCK SITE
JEFFREY CITY, WYOMING

WITHIN THIS PACKAGE

NOTE: Because of these page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.

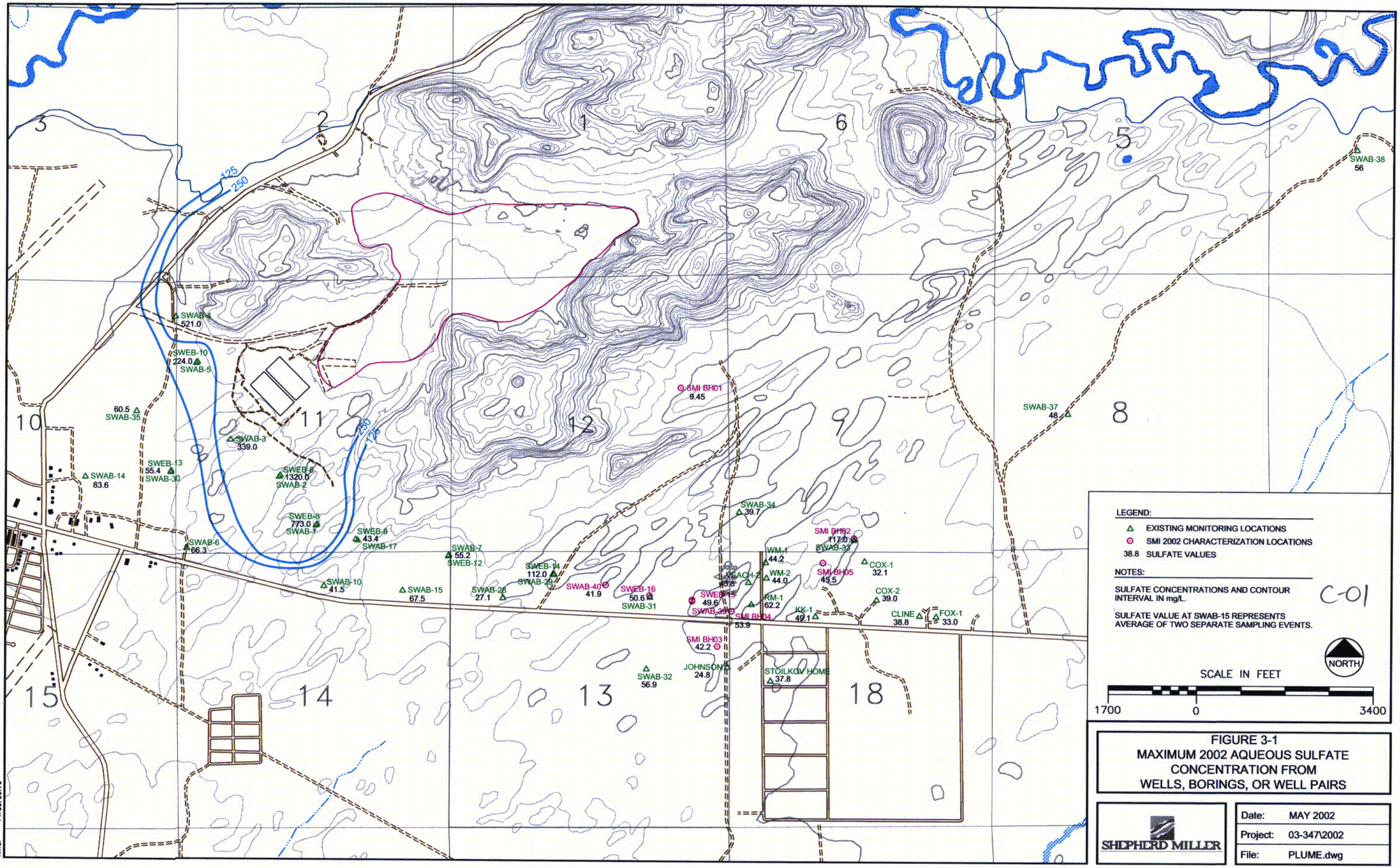

FIGURE 3-1
MAXIMUM 2002 AQUEOUS SULFATE CONCENTRATION FROM WELLS, BORINGS, OR WELL PAIRS

SHEPHERD MILLER

Date:	MAY 2002
Project:	03-347\2002
File:	PLUME.dwg

Filename: E:\03-347\2002\PLUME.dwg
Date: 05/09/2002
Time: 14:39:06.76

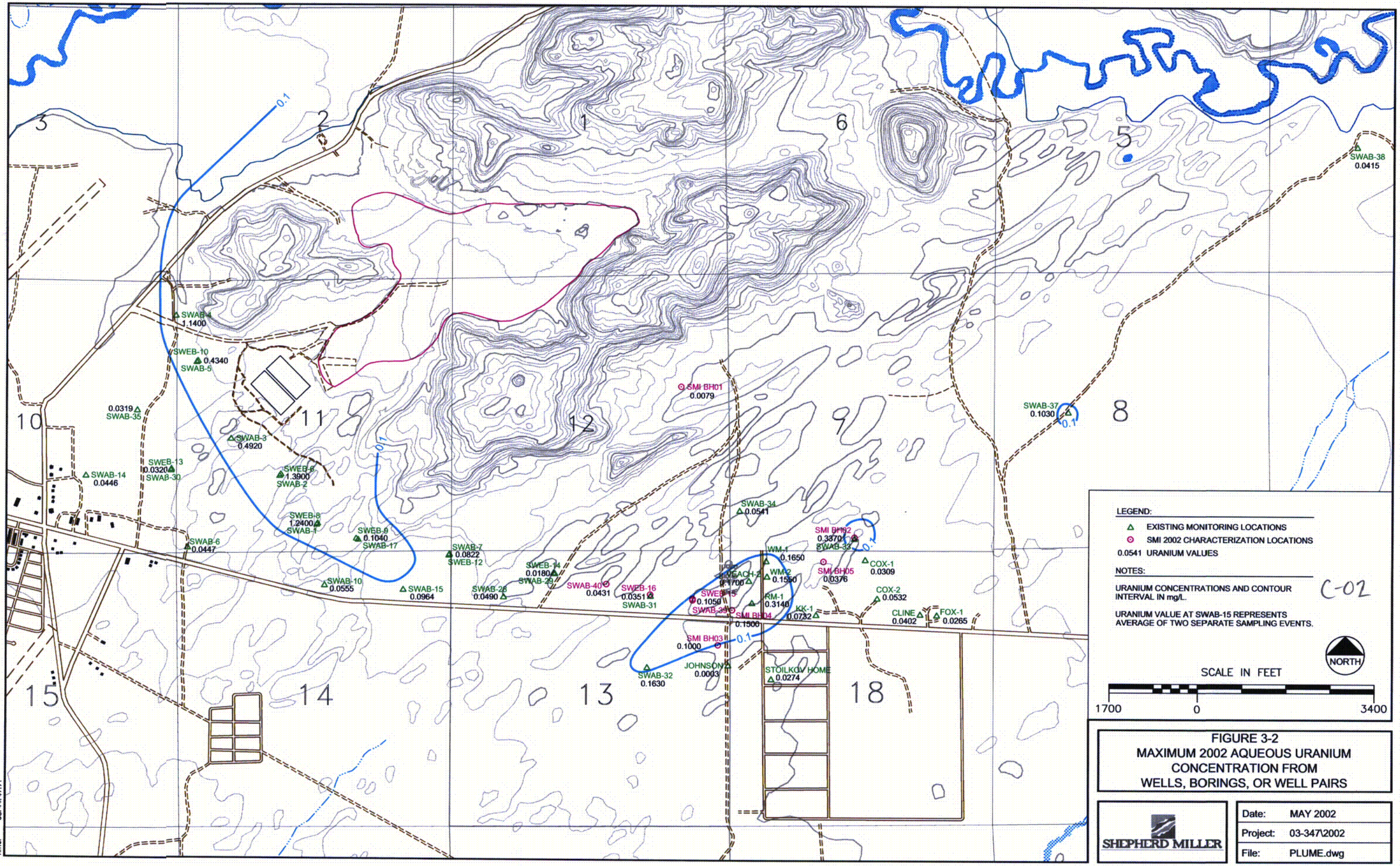

FIGURE 3-2
MAXIMUM 2002 AQUEOUS URANIUM CONCENTRATION FROM WELLS, BORINGS, OR WELL PAIRS

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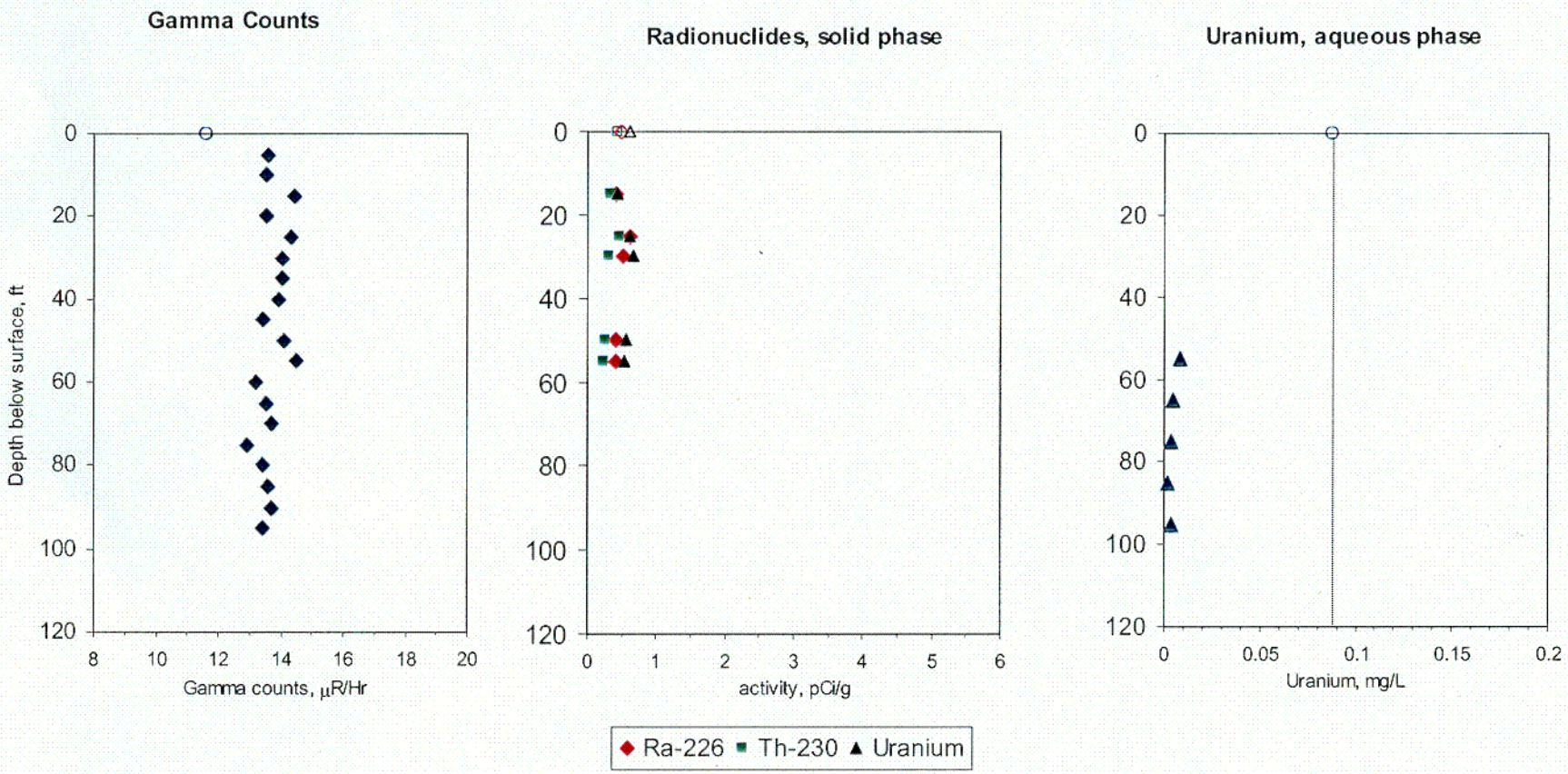
Project:	03-347\2002
File:	PLUME.dwg



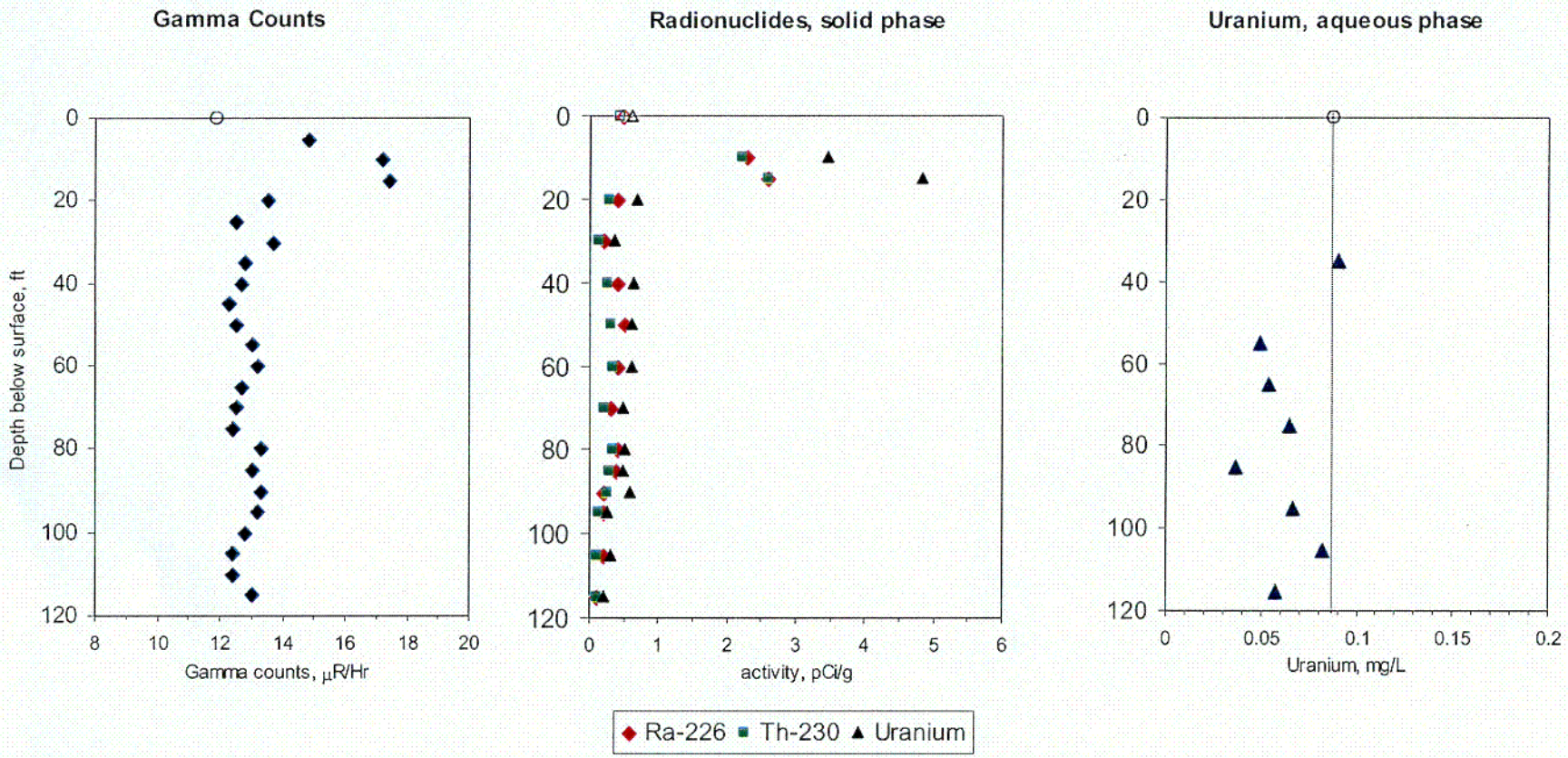
Note: open symbols represent background values

C-03

SHEPHERD MILLER
INCORPORATED

FIGURE 3-3
RADIONUCLIDES AND GAMMA COUNT WITH DEPTH, SMI BH01

Date:	MAY 2002
Project:	P:\03-347\SCR2002
File:	RAD PLOTS.ppt



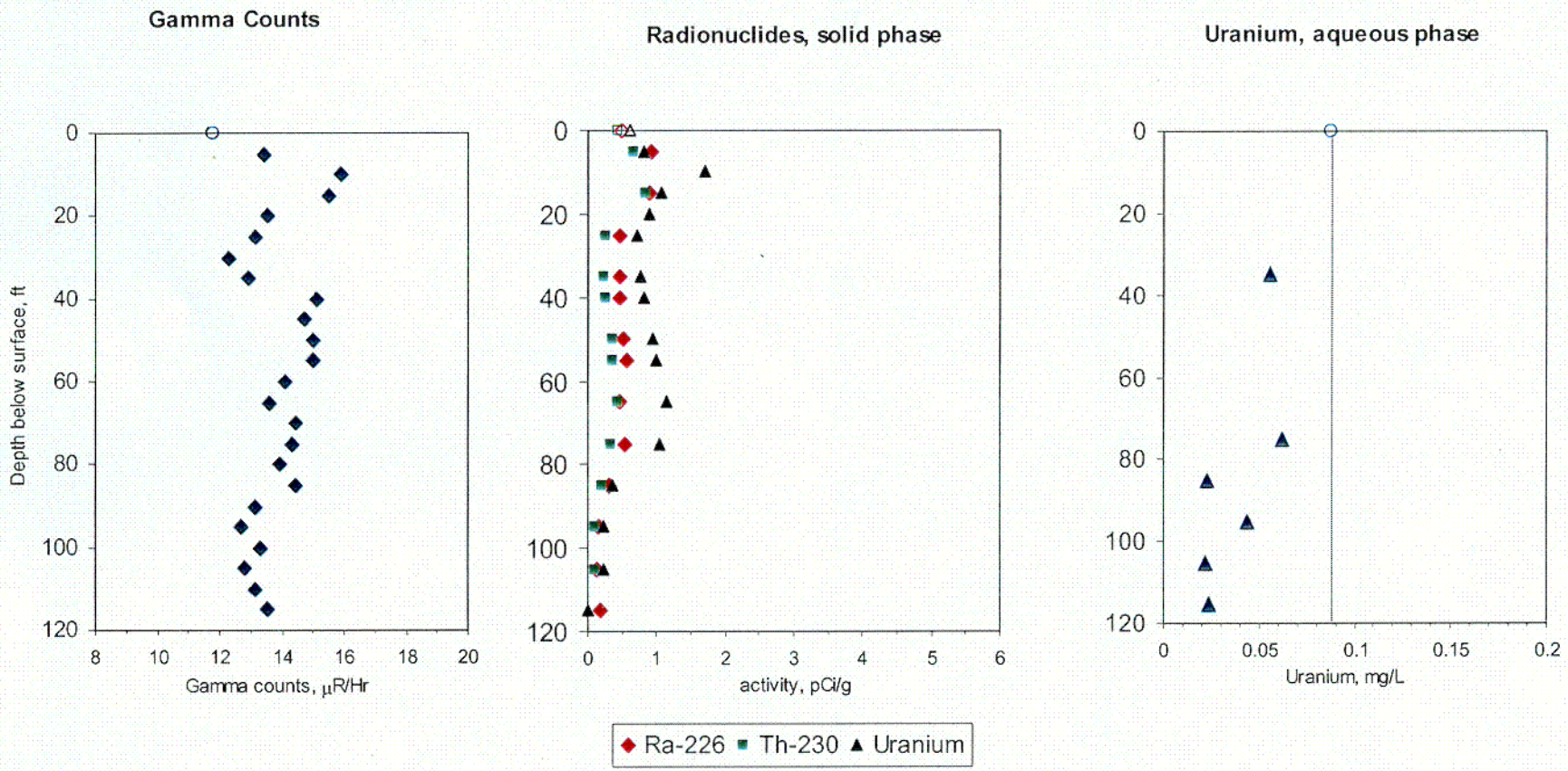
Note: open symbols represent background values

C-04

SHEPHERD MILLER
INCORPORATED

FIGURE 3-4
RADIONUCLIDES AND GAMMA COUNT WITH DEPTH, SMI BH02

Date:	MAY 2002
Project:	P:\03-347\SCR2002
File:	RAD PLOTS.ppt



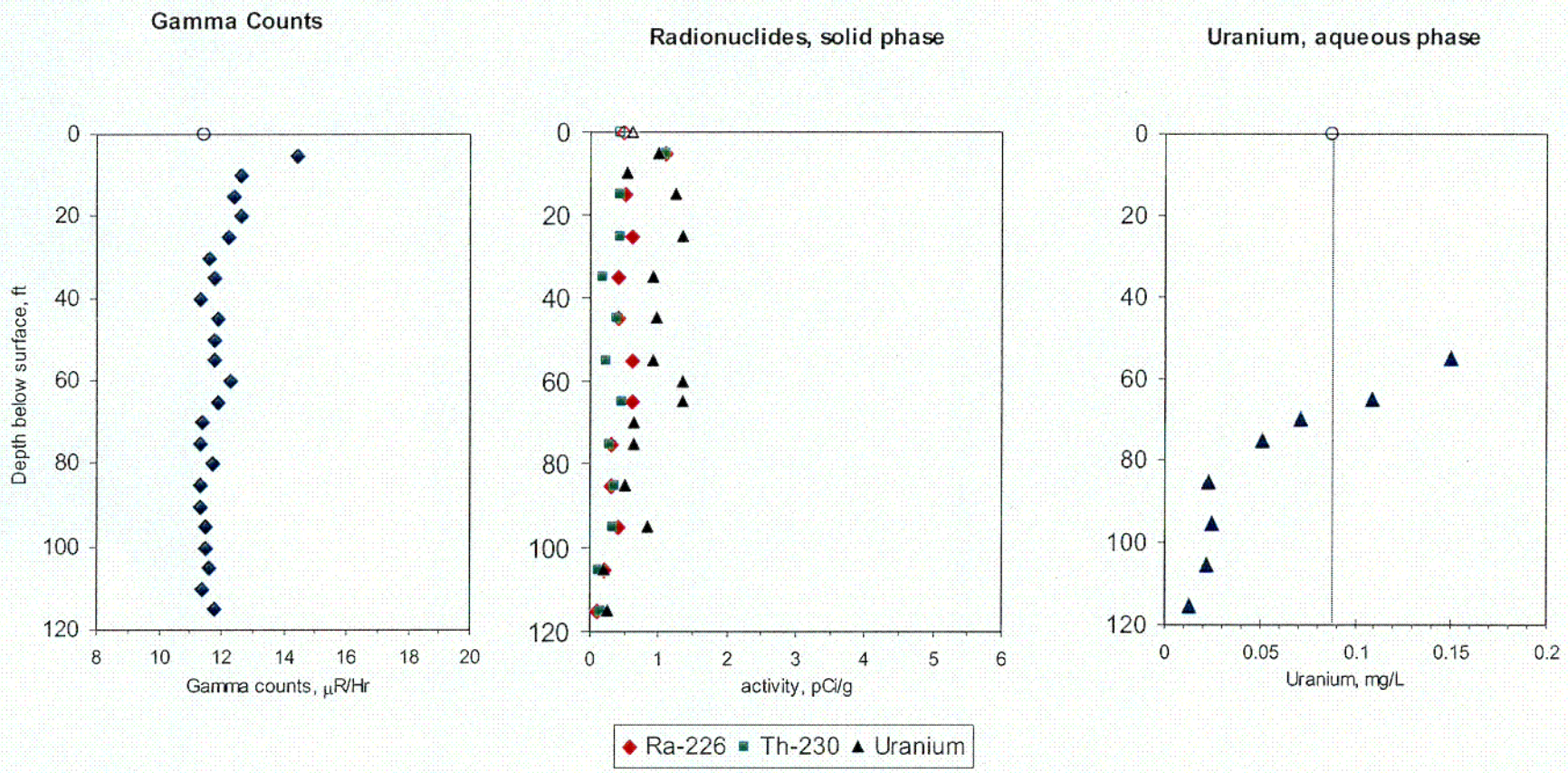
Note: open symbols represent background values

C-05

SHEPHERD MILLER
INCORPORATED

FIGURE 3-5
RADIONUCLIDES AND GAMMA COUNT WITH DEPTH, SMI BH03

Date:	MAY 2002
Project:	P:\03-347\SCR2002
File:	RAD PLOTS.ppt



Note: open symbols represent background values

C-016

SHEPHERD MILLER INCORPORATED

FIGURE 3-6
RADIONUCLIDES AND GAMMA COUNT WITH DEPTH, SMI BH04

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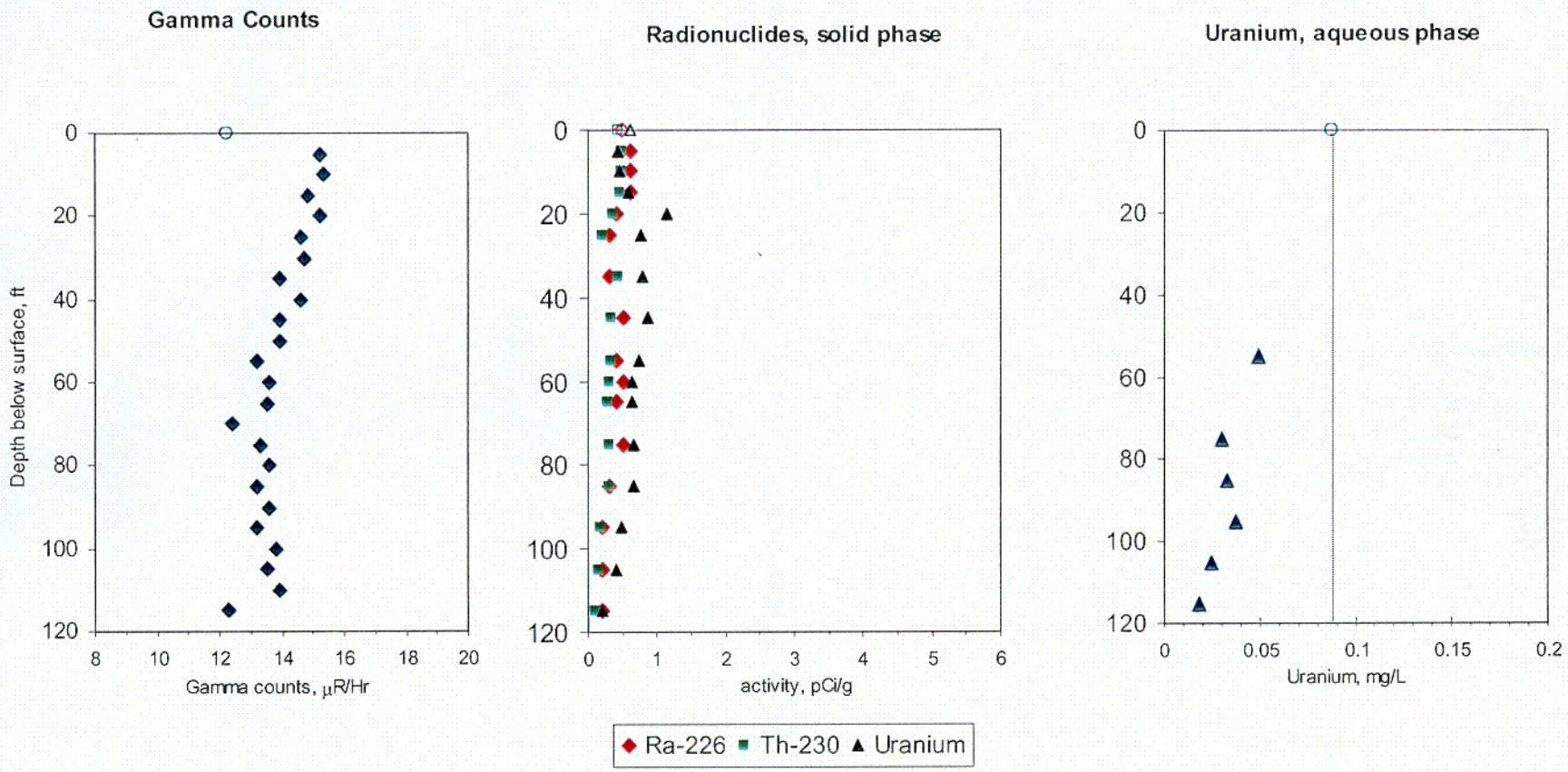
Project:	P:\03-347\SCR2002
File:	RAD PLOTS.ppt



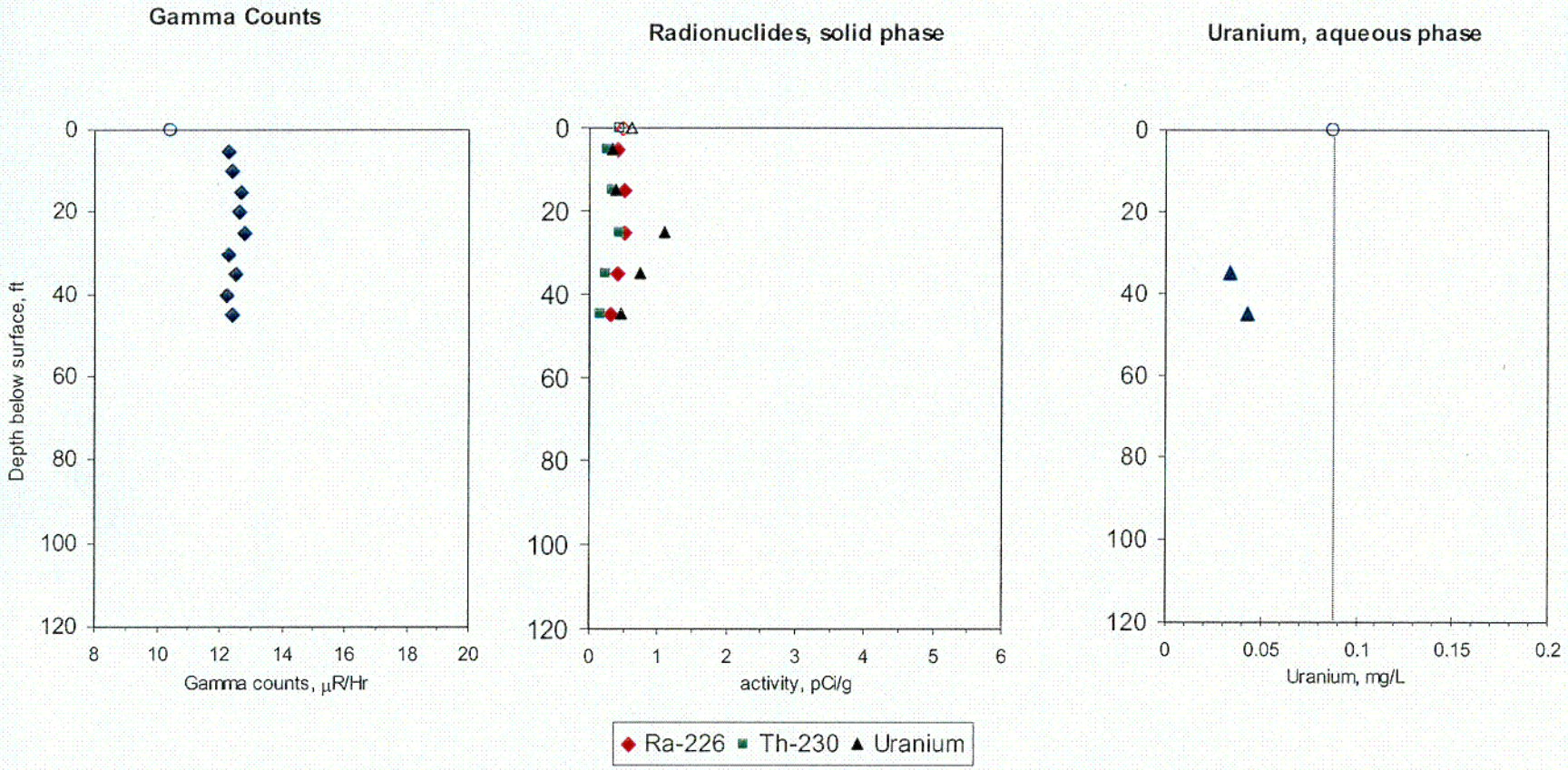
Note: open symbols represent background values

C-07

SHEPHERD MILLER
INCORPORATED

FIGURE 3-7
RADIONUCLIDES AND GAMMA COUNT WITH DEPTH, SMI BH05

Date:	MAY 2002
Project:	P:\03-347\SCR2002
File:	RAD PLOTS.ppt



Note: open symbols represent background values

C-08

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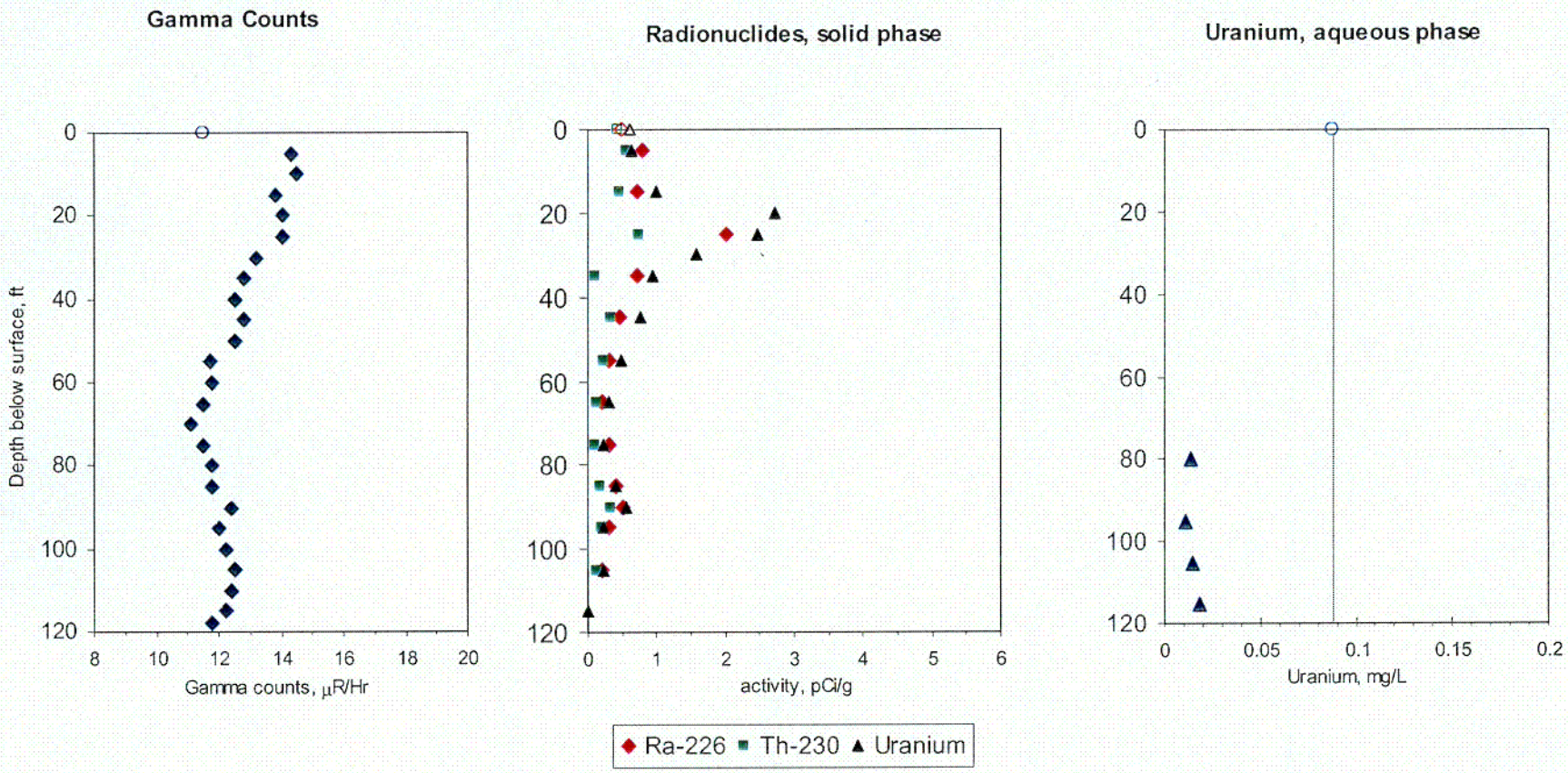
INCORPORATED

FIGURE 3-8
RADIONUCLIDES AND GAMMA COUNT WITH DEPTH, SWAB-40

Date:	MAY 2002
Project:	P:\03-347\SCR2002
File:	RAD PLOTS.ppt



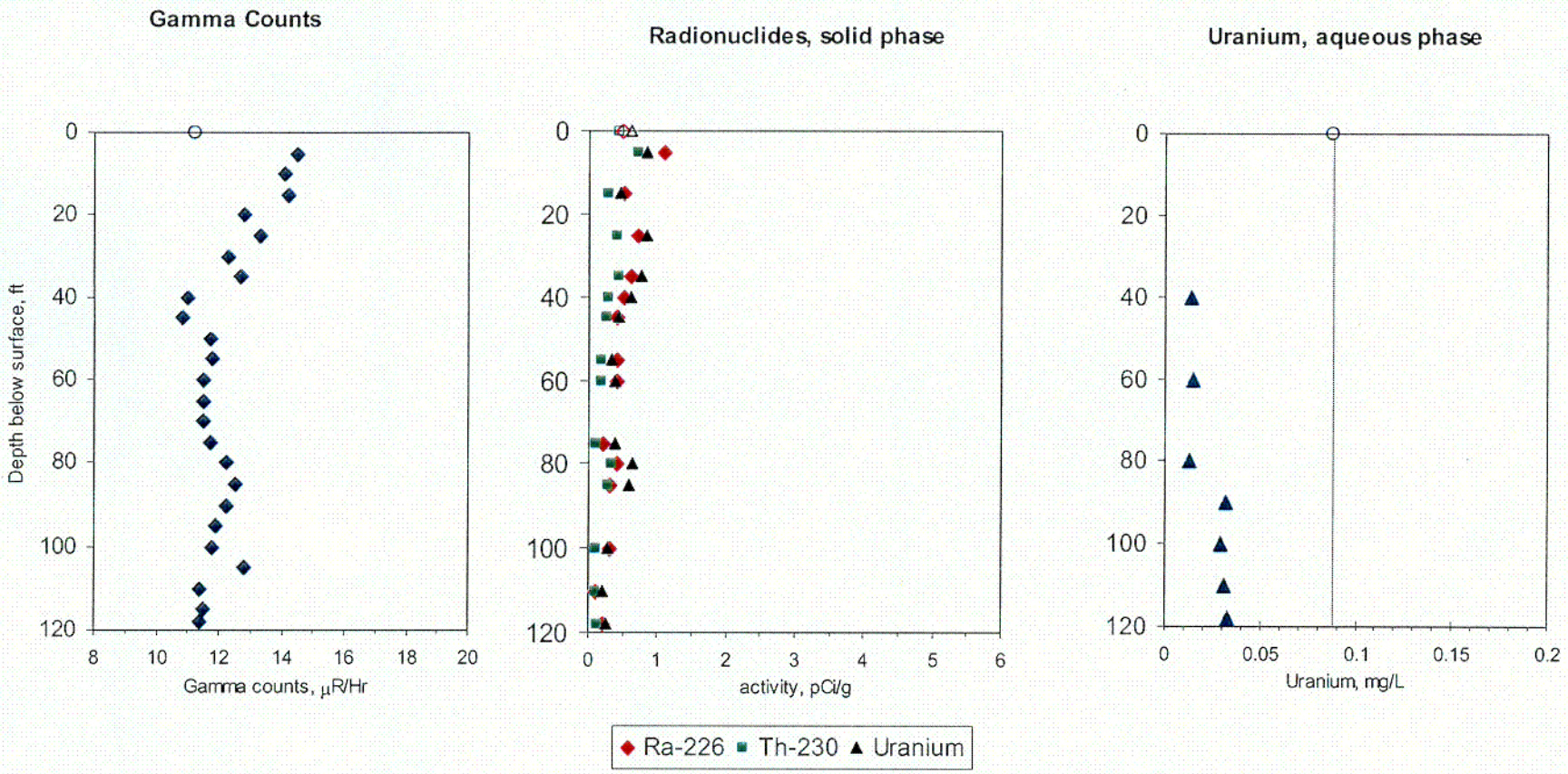
Note: open symbols represent background values

C-09

SHEPHERD MILLER
INCORPORATED

FIGURE 3-9
RADIONUCLIDES AND GAMMA COUNT WITH DEPTH SWEB-15

Date:	MAY 2002
Project:	P:\03-347\SCR2002
File:	RAD PLOTS.ppt



Note: open symbols represent background values

C-10

SHEPHERD MILLER
INCORPORATED

FIGURE 3-10
RADIONULCIDES AND GAMMA COUNT WITH DEPTH, SWEB-16

Date:	MAY 2002
Project:	P:\03-347\SCR2002
File:	RAD PLOTS.ppt

ATTACHMENT A

SUPPLEMENTAL DATA COLLECTION PROGRAM HEALTH AND SAFETY PLAN

B.b.5.0 HEALTH AND SAFETY CONSIDERATIONS

This section discusses health and safety considerations related to the well drilling, installation, and testing planned by the Hydrogeology Task Team in late 1995 and early 1996 at the site. This section serves as a supplement to the WNI Site Health and Safety Plan, which is administered by WNI under their source materials license from the NRC.

This section covers health and safety requirements specific to Hydrogeology Team activities at the site, including required monitoring, personal protective equipment, decontamination, general health and safety work rules, emergency response contact numbers, and training. Any health and safety concerns which are not directly addressed by this section should be directed to the WNI Site Radiation Safety Officer (RSO), Trinidad Herrera.

B.b.5.1 Introduction

This document discusses health and safety concerns related to the well drilling, installation and testing planned by the Hydrogeology Team of the Ground Water Protection Program in late 1995 and early 1996 at the Split Rock Site, near Jeffrey City, Wyoming. The Split Rock Site is an inactive Title II uranium mill tailing facility which is undergoing reclamation by the owner, Western Nuclear, Inc. (WNI). This document serves as a supplement to the Site Health and Safety Plan, which is administered by WNI under their source materials license SUA-56 from the U.S. Nuclear Regulatory Commission (NRC).

Any health and safety concerns which are not directly addressed by this document should be directed to the WNI Site Radiation Safety Officer (RSO), Trinidad Herrera.

The WNI RSO has authority to suspend, postpone, or modify any work activity that is potentially hazardous to workers or is a violation of NRC rules, license conditions or Radiation Work Permit (RWP) activity. *John Gearhart is the WNI Resident Agent in charge of the Split Rock Site* [1].

SMI project managers for the well drilling, installation and testing activities include Isobel McGowan, Hydrogeology Task Team Leader; Ralph Lindberg, GWPP Project Manager; and Lou Miller, Project Manager [1]. Phone numbers for these managers are listed in Section B.b.5.7. SMI field work will be directed by the SMI Field Supervisor at the site.

B.b.5.2 Hazards

Hazards at the Split Rock Site include industrial and physical hazards encountered in mining and construction operations in rough terrain, plus chemical and radioactive hazards associated with previous uranium milling operations at the site. Industrial and physical hazards include the following:

- Large-scale earth-moving equipment and debris on roads
- Drilling rigs and other potentially hazardous equipment operating nearby
- Underground utilities or buried materials in tailing
- Dust and noise generated by activities on site
- Steep slopes and natural tripping hazards
- Plants and particulate matter creating eye injury hazards
- Insect and snake bites

[1] See addendum for changes

- Heat or cold stress or other weather-related hazards
- Potential drowning hazards when measuring stream flow in the Sweetwater River.

Chemical and radioactive hazards associated with the Split Rock Site are listed below. Concentrations of these materials measured at the site are summarized in Table B-b-5. Ground water concentrations represent analyses current to 1995. However, recent analyses of tailing and soil samples are unavailable, as the tailing pond no longer exists, the mill buildings have been decommissioned, and most of the former mill and tailing areas have been reclaimed. Therefore, historic analyses of the tailing pond, tailing solid, and site soils are included in Table B-b-5.

The former mill and tailing areas are being reclaimed according to specifications approved by the NRC with the intention of limiting the flux of radon gas. Most of the former mill and tailing areas already have been capped with layers of low-permeability clay, sand, and rock armor designed to limit the flux of radon gas to 20 picocuries per square meter per second.

- Acid water - Low-pH water present in some wells at the site can present a hazard to the skin, eyes, and lungs through contact with the skin or eyes or if it is inhaled or ingested. Acute symptoms may include skin burns, eye and sinus irritation and nausea. If acute symptoms are detected, work is to stop and workers are to withdraw and rinse their eyes and skin. Workers will return to the location only after approval by the WNI RSO.

- Uranium - A primary emphasis of the WNI Site Health and Safety Plan is minimizing potential toxic hazards from soluble uranium in airborne particulates. Low levels of uranium have been detected in ground water as well as in airborne particulates at the site. If excessive amounts of uranium are inhaled, ingested or absorbed, acute symptoms may include coughing, nausea, vomiting, eye irritation, skin burns and dermatitis. Exposure to hazardous levels of uranium can affect the kidneys, liver, lungs, and blood system. Concentrations of uranium sufficiently high to produce chronic effects may not be detectable by unaided human senses.

- Radioactivity - Radiological hazards include exposure to external radiation (gamma) due to decay of naturally occurring radionuclides in the tailing, and alpha and beta radiation associated with inhalation and ingestion of airborne particulates. Chronic exposure to elevated levels of radon and its radioactive decay products may cause an increased risk of lung cancer. Radiation levels sufficiently high to increase the risk of cancer may not be detectable by unaided human senses.

In addition, well drilling, installation and testing activities planned at the site may involve working around or near hazardous materials such as inorganic acids or bases (used for sample preservation), and fuel and oil for portable equipment. WNI maintains the required material safety data sheets (MSDS) on file and available for all individuals to review prior to working with any such materials.

B.b.5.3 Monitoring

As specified in the WNI Site Health and Safety Plan, radiological contamination surveys and radiological monitoring will be performed by the Owner (WNI RSO) except for personal contamination monitoring which shall be performed by the workers themselves. Radiological monitoring is of most concern for activities conducted in or near the tailing impoundment, such as proposed drilling of a ground water well in the impoundment.

Per the WNI Site Health and Safety Plan, external gamma ray exposure rate surveys will be performed on a weekly basis by the WNI RSO, and then correlated with time studies to determine worker dose commitments. At least once per week, one worker will be outfitted by the WNI RSO with a lapel monitor to measure the activity of airborne uranium. The samples will be analyzed for gross alpha activity. Personal dosimeters for the measurement of external radiation exposure may be issued to SMI employees at the discretion of the SMI Health and Safety Officer.

SMI and other consultant and subcontractor employees must monitor themselves for contamination prior to leaving the property. A written procedure will be posted near the monitor and all workers will be instructed by the RSO in the proper use of the instrument. If radioactivity exceeds the action level of 1,000 disintegrations per minute (dpm) total alpha/100 cm^2, the instrument will sound a preset alarm, indicating that the worker must wash and perform a followup survey.

B.b.5.4 Personal Protective Equipment

Workers on the site must wear appropriate work clothing and personal protective equipment (PPE), including the following:

- Safety glasses or goggles
- Steel-toed boots
- Hard hat in permit area and for all drilling operations
- Orange safety vest
- Work clothes or coveralls
- Gloves, including chemical-resistant gloves for working with acid water and heavy work gloves for operating equipment
- Respirators with appropriate cartridges if required by the WNI RSO
- Earplugs as required (when working near drilling operations and when otherwise exposed to loud noises).

B.b.5.5 Decontamination

As specified in the WNI Site Health and Safety Plan, the WNI RSO will designate a support area and a decontamination area. The WNI RSO or Resident Agent will specify decontamination procedures and areas in which those involved in such drilling operations may eat, take breaks, and store work coveralls and boots, etc.

All equipment coming into contact with tailing shall be cleaned and surveyed and shall be certified free of contamination by the WNI RSO before it can be removed from the site or used at another (non-tailing) drilling location on-site. Decontamination should be completed in accordance with "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-Product or Source Materials," dated September 1984. Copies of these guidelines are available from the WNI RSO.

Additional guidelines for decontamination of equipment during well drilling, installation, and testing are contained in the Hydrogeology Task Work Plan and Standard Operating Procedures (SOPs).

B.b.5.6 General Health and Safety Work Rules

- Workers must wear appropriate work clothing and PPE in the work area, as specified in Section B.b.5.4.
- Workers must conduct personal monitoring (Section B.b.5.3) and comply with other health and safety requirements of the WNI RSO and SMI field supervisor.

- Workers will be required to attend "tail-gate" safety meetings prior to working each day. Meetings will be conducted by the drilling supervisor. A record will be kept of topics presented and of the names and signatures of those attending.

- Visitors to the site must obtain permission from the WNI RSO and must follow health and safety requirements, including wearing required PPE (Section B.b.5.4) and participating in radiation safety training (Section B.b.5.8).

- Because ingestion of contaminated particles (soil, tailing) is a potential hazard at the site, eating, drinking, smoking, and chewing gum or tobacco are allowed only outside the active work area. Likewise, workers should wash their hands and faces before eating or drinking.

- Workers who suffer a cut or abrasion on the job must suspend work and have the wound decontaminated/cleaned and properly covered before returning to work. Even minor skin cuts or abrasions must be covered, since open wounds could allow absorption of radionuclides or chemical contaminants.

- At the discretion of the WNI RSO, work on exposed tailing should be suspended when high winds cause significant resuspension of dust. Workers may be asked to don respirators if required by the WNI RSO.

- Working on or near drilling rigs presents many safety hazards. Workers should read and follow the guidelines in the "Drilling Safety Guide," which is reprinted as Supplement B.b.4.

- The SMI Field Supervisor is responsible for obtaining clearance (for safety, potential presence of underground utilities or buried materials, etc.) from the WNI RSO or Resident Agent for proposed drilling sites. For off-site locations, the SMI Field Supervisor must scout the area for signs warning of buried utilities and clear the proposed drilling site with the appropriate utility.

  (NOTE: There apparently is a buried telephone cable in the Sweetwater River floodplain near the site; the phone number to contact regarding buried cable is listed in Section B.b.5.7.)

- The SMI Field Supervisor and workers at the drilling site must watch for overhead power or utility lines when moving the drill rig and raising or lowering the mast. The minimum distance from any part of the drill rig to the overhead line must be 20 feet or more.

- Construction equipment always has the right-of-way over regular vehicles.

- Equipment operators shall watch for workers on the ground who may be in their path and provide warning to these workers before moving.

- Motor vehicle operators shall obey all posted traffic signs, signals, and speed limits and wear seat belts when vehicles are in motion.

- Workers must report all job-related injuries and illnesses to their supervisor promptly. This includes minor or slight injuries.

- Whenever possible, workers shall perform their job assignments according to the "buddy" system. The buddy provides his or her partner with assistance; monitors the partner for signs of chemical, heat or cold stress; and notifies the supervisor if emergency help is needed.

- During fall and winter months, adverse weather conditions including cold, wind and snow are likely. Workers should be prepared for possible adverse weather with layered and/or insulated clothing. The SMI Field Supervisor should be especially alert to the possibility of frosbite or hypothermia for workers who are sampling, logging core or carrying out other activities which may increase exposure to cold or wet conditions.

- The SMI Field Supervisor is responsible for suspending operations in case of extreme adverse weather. Drilling operations shall be suspended during electrical or lightning storms.

- Due to the remoteness of the site and possibility of adverse weather, field crews should arrange for mobile communications. Two-way radios are recommended for work on or near the site and within the range of the site base station, and cellular phones for road travel to and from the site.

- To prevent snakebite, in warm weather when snakes may be active, workers should avoid placing hands or feet into obscure areas (i.e., beneath rocks, well pads, and brush piles) and should wear protective clothing and footwear in areas likely to be inhabited by snakes.

- Workers should use insect repellant and wear protective clothing when working in insect-infested areas. Workers who are allergic to insect stings or bites must notify their supervisor and arrange to have appropriate medication available on site.

- Workers measuring stream flow in the Sweetwater River must wear life jackets and must be accompanied by a field partner.

B.b.5.7 Emergency Response

Contact the WNI RSO (Trinidad Herrera) immediately to help coordinate emergency response. If the WNI RSO is not immediately available, contact the WNI Resident Agent (*John Gearhart* [1]). If the Resident Agent is not available, emergency response will be coordinated by the SMI Field Supervisor or the SMI health and safety coordinator designated by the Field Supervisor. The following is provided as a format for the information which the SMI Field Supervisor is responsible for providing to the WNI RSO regarding emergency procedures:

	Phone Numbers:
WNI Resident Agent (*John Gearhart – home*)[1]	*857-2908*
Supervisors in charge:	
Buz Cotton, SMI Field Supervisor (WNI "staff house") [1]	*544-2412*
To Locate Buried Telephone Cable, Call:	1-800-489-8023 ("Jeffrey City")
Nearest Telephone or Mobile Radio	_____
Emergency Telephone Numbers:	
Fire Department	857-3030
Ambulance Service	Dial "911"
Sheriff's Office (also can dispatch ambulance)	332-5611
Types of Emergency Transportation Systems:	
Nearest hospital (for transport by private vehicle): Lander Valley Medical Center, Lander, Wyoming	332-4420

[1] See addendum for changes

To Reach Lander Valley Medical Center from site, drive south from site to Jeffrey City. At Jeffrey City, turn right (west) and take U.S. Highway 287 to Lander (about 58 miles). At first stoplight in Lander, turn left onto Buena Vista Avenue. Go straight up the hill on Buena Vista Avenue about a mile. Turn left onto Bishop Randall Drive to the hospital. See Figure B-b-3 for map of route to hospital.

Life Flight (for medical helicopter from Casper): 577-2222
(returns to Emergency Room of Wyoming Medical Center, Casper, Wyoming)

SMI/Project Contacts [1]*:*

Isobel McGowan, Hydrogeology Task Team Leader	*1-303-477-5338*
Ralph Lindberg, GWPP Project Manager	*1-303-477-5338*
Lou Miller, Project Manager	*1-970-223-9600*
Jan Johnson, Health Physicist	1-970-223-9600

Wyoming Road Conditions: 1-307-324-9966

B.b.5.8 Training

All workers and visitors must participate in radiation safety training conducted by the WNI RSO. At the completion of training, workers take a written test. WNI maintains results of the testing in each worker's file. In addition, workers will be trained regarding specific hazards identified when Radiation Work Permits are issued for individual projects.

[1] See addendum for changes

Addendum to Health and Safety Considerations

This section outlines the changes to Appendix B of the Split Rock Site Ground Water Protection Plan, Section B.b.5, "Health and Safely Consideration". The health and safety requirements specified in Section B.b.5 will apply to the field investigation planned by Shepherd Miller in 2002, except for the following changes:

Brad Dewaard is the WNI Resident Agent in charge of the Split Rock Site.

The project manager for the filed investigation program is Toby Wright. There is no GWPP project manager or Hydrogeology Task Team Leader for this project

	Phone Numbers
WNI Resident Agent (Brad Dewaard)	509-299-9001
Supervisors in charge:	
Joe Reed, SMI Field Supervisor (Mobile Phone)	970-481-0534
Best Western Inn, Lander	307-332-2847
SMI/Project Contacts:	
Toby Wright, Project Manager	970-223-9600

ATTACHMENT B

BORING LOGS AND WELL COMPLETION DIAGRAMS

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH01

PROJECT: WNI / SPLIT ROCK *PAGE:* 1 of 3
PROJECT NO.: 003347 *DATE:* 01/08/02
NORTHING: 5310.39 EASTING: 14422.27 *GROUND ELEVATION:* 6304.92
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* DUAL ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
0	07:48	EOLIAN		SP- SAND, VERY FINE TO COARSE, ANGULAR TO SUBROUNDED SAND, MOSTLY FROSTED QUARTZ W/ OCCASIONAL ROCK FRAGMENTS. INTERVAL NON-COHESIVE, DRY, LIGHT YELLOWISH BROWN (10YR 6/4).
5	07:50	EOLIAN		SP- SAND, VERY FINE TO FINE, SUBANGULAR TO SUBROUNDED SAND, MOSTLY FROSTED QUARTZ W/ OCCASIONAL FERROMAG MINERALS. INTERVAL NON-COHESIVE, SLIGHTLY MOIST, PALE YELLOW (2.5Y 7/40).
10	07:52	EOLIAN		SEE 5-10', EXCEPT W/ OCCASIONAL FINE, ANGULAR QUARTZ GRAVEL.
15	08:10	EOLIAN		SEE 10-15', EXCEPT NO GRAVEL.
20	08:12	EOLIAN		SEE 15-20'
25	08:14	USR		SANDSTONE- VERY FINE TO FINE SAND-SIZED CLASTS, SUBANGULAR TO SUBROUNDED SAND, MOSTLY FROSTED AND CLEAR QUARTZ W/ OCCASIONAL FERROMAG MINERALS. SANDSTONE FRIABLE, SLIGHTLY MOIST, GRAYISH BROWN (2.5Y 5/2).
30	08:16	USR		SEE 25-30'

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH01

PROJECT: WNI / SPLIT ROCK *PAGE:* 2 of 3
PROJECT NO.: 003347 *DATE:* 01/08/02
NORTHING: 5310.39 EASTING: 14422.27 *GROUND ELEVATION:* 6304.92
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* DUAL ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
35	08:30	USR		SANDSTONE. 90% SAND AND 10% SILT-SIZED CLASTS. SAND VERY FINE TO FINE, SUBANGULAR TO ROUNDED, 90% QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. SANDSTONE FRIABLE TO SLIGHTLY COHESIVE, MOIST, GRAYISH BROWN (2.5Y 5/2).
40	08:32	USR		SEE 35-40'
45	08:34	USR		SEE 40-45'
50	08:36	USR		SEE 45-50'
55	09:23	USR		SEE 50-55'
60	09:25	USR		SEE 55-60', EXCEPT SAND SUBANGULAR TO SUBROUNDED, INTERVAL SLIGHTLY COHESIVE TO MODERATELY COHESIVE AND WET.
65	09:27	USR		SEE 60-65'

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH01

PROJECT: WNI / SPLIT ROCK *PAGE:* 3 of 3
PROJECT NO.: 003347 *DATE:* 01/08/02
NORTHING: 5310.39 EASTING: 14422.27 *GROUND ELEVATION:* 6304.92
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* DUAL ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
70	09:29	USR		SEE 65-70'
75	10:20	USR		SEE 70-75'
80	10:22	USR		SEE 75-80'
85	10:24	USR		SANDSTONE. 60% SAND-SIZED CLASTS, 40% GRAVEL-SIZED CLASTS. SAND VERY FINE TO VERY COARSE, ANGULAR TO SUBROUNDED, 90 % QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. GRAVEL FINE, ANGULAR TO SUBANGULAR, MOSTLY QUARTZ. SANDSTONE FRIABLE, WET, GRAYISH BROWN (2.5Y 5/2).
90	10:26	USR		SEE 85-90', EXCEPT FINE TO COARSE GRAVEL.
95				TD
100				

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH02

PROJECT: WNI / SPLIT ROCK *PAGE:* 1 of 4
PROJECT NO.: 003347 *DATE:* 01/13/02
NORTHING: 2438.25 EASTING: 17784.35 *GROUND ELEVATION:* 6285.31
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
0	14:45	EOLIAN		SW- SAND, VERY FINE TO MEDIUM, SUBANGULAR TO SUBROUNDED, 95 % FROSTED QUARTZ, 5% ROCK FRAGMENTS. OCCASIONAL CALCAREOUS CLAY (STRONG HCL REACTION), FORMING SMALL, GRAVEL-SIZED BALLS. INTERVAL, DRY, BROWNISH YELLOW (10YR 6/6).
5	14:47	EOLIAN		SEE 0-5', EXCEPT VERY FINE TO FINE SAND WITH OCCASIONAL COARSE ANGULAR QUARTZ. INTERVAL PALE YELLOW (2.5Y 7/3).
10	14:49	EOLIAN		SEE 5-10', EXCEPT SLIGHTLY MOIST, LIGHT BROWNISH GRAY (2.5Y 6/2) EOLIAN DEPOSIT 14-15' SP- SAND, VERY FINE TO FINE, SUBANGULAR TO ROUNDED, 90 % QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. INTERVAL SLIGHTLY MOIST, GRAYISH BROWN (2.5Y 5/2).
15	15:10	USR		SEE 14-15'
20	15:12	USR		SEE 15-20'
25	15:14	USR		SEE 20-25'
30	15:16	USR		SANDSTONE. 95% SAND CLASTS, 5% CLAY CLASTS. SAND VERY FINE TO FINE, SUBANGULAR TO ROUNDED, 90% QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. SANDSTONE FRIABLE TO SLIGHTLY COHESIVE, WET, GRAYISH BROWN (2.5Y 5/2).

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH02

PROJECT: WNI / SPLIT ROCK *PAGE:* 2 of 4
PROJECT NO.: 003347 *DATE:* 01/13/02
NORTHING: 2438.25 EASTING: 17784.35 *GROUND ELEVATION:* 6285.31
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
35	15:30	USR		SEE 30-35'
40	15:32	USR		CLAYEY SANDSTONE, WITH 70% SAND AND 30% CLAY-SIZE CLASTS. SAND VERY FINE TO FINE, SUBROUNDED TO ROUNDED, 90% QUARTZ, 10% FERROMAG MINERALS. INTERVAL MODERATELY COHESIVE, WET, YELLOWISH BROWN (10YR 5/4).
45	15:45	USR		SEE 40-45', EXCEPT 60-70% SAND, 30-40% CLAY.
50	15:47	USR		SEE 45-50', DECREASING CLAY CONTENT DOWNWARD TO 10 % CLAY AT 55'.
55	16:10	USR		SANDSTONE. CLASTS SAND-SIZED VERY FINE TO FINE, SUBANGULAR TO SUBROUNDED, 90 % QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. SANDSTONE FRIABLE. INTERVAL WET, GRAYISH BROWN (2.5Y 5/2).
60	16:12	USR		SEE 55-60', EXCEPT SAND 80-90% CLAY 10-20%.
65	16:30	USR		SEE 60-65', EXCEPT SAND 90%, CLAY 10%.

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH02

PROJECT: WNI / SPLIT ROCK *PAGE:* 3 of 4
PROJECT NO.: 003347 *DATE:* 01/13/02 - 1/14/02
NORTHING: 2438.25 EASTING: 17784.35 *GROUND ELEVATION:* 6285.31
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
70	16:32 1/13	USR		SEE 65-70'
75	08:05 1/14	USR		SEE 70-75'
80	08:07	USR		SEE 75-80', EXCEPT SAND 80 %, CLAY 20%.
85	08:09	USR		SEE 80-85', EXCEPT SAND 90 %, CLAY 10%.
90	08:27	USR		SEE 85-90', EXCEPT LITTLE TO NO CLAY.
95	08:50	USR		SEE 90-95'
100	08:52	USR		SEE 95-100'

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH02

PROJECT: WNI / SPLIT ROCK *PAGE:* 4 of 4
PROJECT NO.: 003347 *DATE:* 01/14/02
NORTHING: 2438.25 EASTING: 17784.35 *GROUND ELEVATION:* 6285.31
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
105	08:54	USR		SEE 100-105'
110	08:56	USR		SEE 105-110'
115				TD
120				
125				
130				
135				

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH03

PROJECT: WNI / SPLIT ROCK *PAGE:* 1 of 4
PROJECT NO.: 003347 *DATE:* 01/15/02
NORTHING: 362.05 EASTING: 15152.61 *GROUND ELEVATION:* 6295.09
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
0	15:55	EOLIAN		SM- SILTY SAND, 90% SAND, 10% SILT. SAND VERY FINE, SUBANGULAR TO SUBROUNDED, 95 % FROSTED QUARTZ, 5% FERROMAG MINERALS. INTERVAL, DRY, STRONG HCL REACTION, LIGHT GRAY (2.5Y 7/2).
5	15:57	EOLIAN		SEE 0-5'
10	15:59	USR		FROM 10-12', SEE 5-10' DESCRIPTION FROM 12-15' SP- SAND, VERY FINE TO COARSE, ANGULAR TO SUBROUNDED, 95 % QUARTZ, 5% FERROMAG MINERALS. INTERVAL SLIGHTLY MOIST, LIGHT YELLOWISH BROWN (2.5Y 6/3).
15	16:42	USR		SP- SAND, VERY FINE TO FINE, ANGULAR TO SUBROUNDED, 95 % QUARTZ, 5% ROCK FRAGMENTS AND FERROMAG MINERALS. INTERVAL SLIGHTLY MOIST, GRAYISH BROWN (2.5Y 5/2).
20	16:44	USR		SEE 15-20, EXCEPT 95% SAND, 5% CLAY, INTERVAL SLIGHTLY COHESIVE, VERY MOIST.
25	16:46	USR		SANDSTONE WITH 90% SAND- AND 10% CLAY-SIZED CLASTS. SAND VERY FINE TO FINE, ANGULAR TO SUBROUNDED, 95% QUARTZ, 5% ROCK FRAGMENTS AND FERROMAG MINERALS. SANDSTONE FRIABLE TO SLIGHTLY COHESIVE, WET, GRAYISH BROWN (2.5Y 5/2).
30	16:48 1/15	USR		SEE 25-30'

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH03

PROJECT: WNI / SPLIT ROCK *PAGE:* 2 of 4
PROJECT NO.: 003347 *DATE:* 01/15/02
NORTHING: 362.05 EASTING: 15152.61 *GROUND ELEVATION:* 6295.09
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
35	08:14 1/16	USR		SEE 30-35'
40	08:16	USR		SANDSTONE, WITH 80% SAND- AND 20% CLAY-SIZE CLASTS. SAND VERY FINE TO FINE, SUBROUNDED TO ROUNDED, 95% QUARTZ, 5% ROCK FRAGMENTS AND FERROMAG MINERALS. INTERVAL MODERATELY COHESIVE, SLIGHTLY PLASTIC, WET, GRAYISH BROWN (2.5Y 5/2).
45	08:18	USR		SEE 40-45'
50	08:20	USR		SEE 45-50'
55	08:46	USR		SEE 50-55'
60	08:48	USR		SEE 55-60', EXCEPT SAND-SIZED CLASTS 70-80 % CLAY-SIZED CLASTS 20-30 %.
65	08:50	USR		SEE 60-65', EXCEPT <20% CLAY-SIZED CLASTS.

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH03

PROJECT: WNI / SPLIT ROCK *PAGE:* 3 of 4
PROJECT NO.: 003347 *DATE:* 01/15/02 - 1/16/02
NORTHING: 362.05 EASTING: 15152.61 *GROUND ELEVATION:* 6295.09
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
70	08:52	USR		SEE 65-70'
75	09:40	USR		SANDSTONE WITH 80% SAND-, 15% CLAY-, 5% GRAVEL-SIZED CLASTS. SAND VERY FINE TO VERY COARSE, ANGULAR TO SUBROUNDED, 90 % QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. GRAVEL FINE, ANGULAR TO SUBANGULAR, MOSTLY QUARTZ. INTERVAL SLIGHTLY COHESIVE, WET, GRAYISH BROWN (2.5Y 5/2).
80	09:42	USR		SANDSTONE WITH >95% SAND-, <5% CLAY-SIZED CLASTS. SAND VERY FINE TO FINE, SUBANGULAR TO SUBROUNDED, 90% QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. SANDSTONE FRIABLE, WET, GRAYISH BROWN (2.5Y 5/2).
85	09:44	USR		SEE 80-85'
90	09:46	USR		SEE 85-90'
95	10:05	USR		SEE 90-95'
100	10:07	USR		SEE 95-100'

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH03

PROJECT: WNI / SPLIT ROCK *PAGE:* 4 of 4
PROJECT NO.: 003347 *DATE:* 01/16/02
NORTHING: 362.05 EASTING: 15152.61 *GROUND ELEVATION:* 6295.09
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
105	10:09	USR		SEE 100-105'
110	10:11	USR		SEE 105-110'
115				TD
120				
125				
130				
135				

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH04

PROJECT: WNI / SPLIT ROCK *PAGE:* 1 of 4
PROJECT NO.: 003347 *DATE:* 01/16/02
NORTHING: 1039.04 EASTING: 15423.46 *GROUND ELEVATION:* 6297.08
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
0	14:02	EOLIAN		SM- SILTY SAND W/ 80% SAND, 20% SILT. SAND VERY FINE TO COARSE, SUBANGULAR TO ROUNDED, 90% FROSTED QUARTZ, 10% ROCK FRAGMENTS. INTERVAL, DRY, STRONG HCL REACTION, LIGHT YELLOWISH BROWN (2.5Y 6/3).
5	14:04	ALLUV.		SW- GRAVELLY SAND W/ 75% SAND AND 25% GRAVEL. SAND VERY FINE TO VERY COARSE, ANGULAR TO SUBROUNDED, 90% FROSTED QUARTZ, 10% ROCK FRAGMENTS. GRAVEL FINE, ANGULAR TO SUBANGULAR, 50% FROSTED QUARTZ, 50% ROCK FRAGMENTS. INTERVAL DRY, PALE YELLOW, (2.5Y 7/3).
10	14:06	EOLIAN		SP- SAND, VERY FINE TO FINE, SUBANGULAR TO ROUNDED, MOSTLY FROSTED QUARTZ, OCCASIONALLY FE OXIDE STAINED, WITH OCCASSSINAL FERROMAG MINERAL. INTERVAL DRY, LIGHT GRAY (92.5Y 7/2).
15	14:32	USR		SP- SAND, VERY FINE TO FINE, SUBROUNDED TO ROUNDED, 95 % FROSTED AND CLEAR QUARTZ, 5 % ROCK FRAGMENTS AND FERROMAG MINERALS. INTERVAL SLIGHTLY MOIST, GRAYISH BROWN (2.5Y 5/2). BEGINNING AT 17', INCREASING CLAY CONTENT TOWARDS BOTTOM OF INTERVAL, TO 5 % CLAY.
20	14:25	USR		SC- CLAYEY SAND W/ 90% SAND, 10% CLAY. SAND VERY FINE TO FINE, SUBANGULAR TO ROUNDED, 90% CLEAR AND FROSTED QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. INTERVAL SLIGHTLY COHESIVE, MOIST, GRAYISH BROWN (2.5Y 5/2).
25	14:27	USR		SEE 20-25'
30	14:29	USR		SEE 25-30', EXCEPT VERY MOIST.

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH04

PROJECT: WNI / SPLIT ROCK *PAGE:* 2 of 4
PROJECT NO.: 003347 *DATE:* 01/16/02
NORTHING: 1039.04 EASTING: 15423.46 *GROUND ELEVATION:* 6297.08
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
35	14:54	USR		SEE 30-35', EXCEPT WET.
40	14:56	USR		CLAYEY SANDSTONE W/ 75% SAND-, 25% CLAY-SIZED CLASTS. SAND VERY FINE TO FINE, SUBROUNDED TO ROUNDED, 90% QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. INTERVAL COHESIVE, WET, GRAYISH BROWN (2.5Y 5/2).
45	14:58	USR		SEE 40-45', EXCEPT 65% SAND, 35% CLAY.
50	15:00	USR		SANDSTONE W/ 80% SAND-, 20% CLAY-SIZED CLASTS. SAND VERY FINE TO FINE, SUBROUNDED TO ROUNDED, 90% QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. INTERVAL COHESIVE, WET, GRAYISH BROWN (2.5Y 5/2).
55	15:35	USR		SEE 50-55'
60	15:37	USR		SEE 55-60', EXCEPT 80% SAND, 20% CLAY, INTERVAL SLIGHTLY COHESIVE.
65	15:39	USR		SANDSTONE, WITH 95% SAND AND 5% CLAY-SIZE CLASTS. SAND VERY FINE TO FINE, SUBROUNDED TO ROUNDED, 90% QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. SANDSTONE FRIABLE, INTERVAL WET, GRAYISH BROWN (2.5Y 5/2).

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH04

PROJECT: WNI / SPLIT ROCK *PAGE:* 3 of 4
PROJECT NO.: 003347 *DATE:* 1/16/02
NORTHING: 1039.04 EASTING: 15423.46 *GROUND ELEVATION:* 6297.08
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
70	15:41	USR		SEE 65-70'
75	16:15	USR		SEE 65-70', EXCEPT LITTLE TO NO CLAY-SIZED CLASTS.
80	16:17	USR		SEE 75-80'
85	16:19	USR		SEE 80-85'
90	16:21	USR		SEE 85-90'
95	16:45	USR		SEE 90-95'
100	16:47	USR		SEE 95-100'

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH04

PROJECT: WNI / SPLIT ROCK *PAGE:* 4 of 4
PROJECT NO.: 003347 *DATE:* 01/16/02
NORTHING: 1039.04 EASTING: 15423.46 *GROUND ELEVATION:* 6297.08
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
105	16:49	USR		SEE 100-105'
110	16:51	USR		SEE 105-110'
115				TD
120				
125				
130				
135				

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH05

PROJECT: WNI / SPLIT ROCK *PAGE:* 1 of 4
PROJECT NO.: 003347 *DATE:* 01/17/02
NORTHING: 1973.01 EASTING: 17186.97 *GROUND ELEVATION:* 6290.09
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
0	10:50	EOLIAN		SP- SAND, VERY FINE TO COARSE, SUBANGULAR TO SUBROUNDED, 95 % FROSTED QUARTZ, 5% ROCK FRAGMENTS. INTERVAL DRY, LIGHT GRAY (2.5Y 7/2).
5	10:52	EOLIAN		SEE 0-5', EXCEPT SLIGHTLY MOIST.
10	10:54	ALLUV.		10-13' SEE 5-10' DESCRIPTION. 13-15' SW- GRAVELLY SAND W/ 90 % SAND AND 10% GRAVEL. SAND VERY FINE TO VERY COARSE, ANGULAR TO SUBROUNDED, 95 % FROSTED QUARTZ, 5% ROCK FRAGMENTS. GRAVEL FINE, ANGULAR TO SUBROUNDED, 50 % FROSTED QUARTZ, 50% ROCK FRAGMENTS, MOSTLY GRANITIC . INTERVAL SLIGHTLY MOIST, PALE YELLOW (2.5Y 7/4).
15	11:10	USR		SP- SAND, VERY FINE TO FINE, WITH < 5 % CLAY. SAND SUBANGULAR TO ROUNDED, 90 % CLEAR QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. INTERVAL MOIST, GRAYISH BROWN (2.5Y 5/2).
20	11:12	USR		SEE 15-20', W/ 5% CLAY.
25	11:14	USR		SEE 20-25'
30	11:16	USR		SANDSTONE, WITH 85% SAND- AND 15% CLAY-SIZED CLASTS. SAND VERY FINE TO FINE, SUBROUNDED TO ROUNDED, 90% QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. SANDSTONE FRIABLE TO SLIGHTLY COHESIVE, MOIST, GRAYISH BROWN (2.5Y 5/2).

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH05

PROJECT: WNI / SPLIT ROCK *PAGE:* 2 of 4
PROJECT NO.: 003347 *DATE:* 01/17/02
NORTHING: 1973.01 EASTING: 17186.97 *GROUND ELEVATION:* 6290.09
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
35	11:30	USR		SEE 30-35'
40	11:32	USR		CLAYEY SANDSTONE W/ 70% SAND-, 30% CLAY-SIZED CLASTS, SAND VERY FINE TO FINE, SUBROUNDED TO ROUNDED, 90% QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. INTERVAL COHESIVE, WET, GRAYISH BROWN (2.5Y 5/2).
45	11:34	USR		SEE 40-45', EXCEPT 60-75% SAND, 25-40% CLAY-SIZED CLASTS.
50	11:36	USR		SEE 45-50', EXCEPT DECREASING CLAY-SIZED CLASTS DOWNWARD THROUGH INTERVAL W/ < 20 % CLAY-SIZED CLASTS AT 55'.
55	12:20	USR		SEE 50-55'
60	12:22	USR		SEE 55-60', EXCEPT CLAY-SIZED CLASTS 25 %.
65	12:24	USR		SEE 60-65'

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH05

PROJECT: WNI / SPLIT ROCK *PAGE:* 3 of 4
PROJECT NO.: 003347 *DATE:* 01/17/02
NORTHING: 1973.01 EASTING: 17186.97 *GROUND ELEVATION:* 6290.09
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
70	12:26	USR		SEE 65-70'
75	13:00	USR		SEE 65-70', EXCEPT CLAY-SIZED CLASTS 15 %.
80	13:02	USR		SEE 75-80'
85	13:04	USR		SEE 80-85', EXCEPT 85% SAND-, 15% CLAY-SIZED CLASTS, SANDSTONE FRIABLE.
90	13:06	USR		SEE 85-90'
95	13:45	USR		SEE 90-95', EXCEPT <5% CLAY-SIZED CLASTS.
100	13:47	USR		SEE 95-100'

BORING LOG

SHEPHERD MILLER

BORING NO.
SMI-BH05

PROJECT: WNI / SPLIT ROCK *PAGE:* 4 of 4
PROJECT NO.: 003347 *DATE:* 01/17/02
NORTHING: 1973.01 EASTING: 17186.97 *GROUND ELEVATION:* 6290.09
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
105	13:49	USR		SEE 100-105'
110	13:51	USR		SEE 105-110'
115				TD
120				
125				
130				
135				

BORING LOG

SHEPHERD MILLER

BORING NO.
SWAB-40

PROJECT: WNI / SPLIT ROCK *PAGE:* 1 of 2
PROJECT NO.: 003347 *DATE:* 01/12/02
NORTHING: 1526.39 EASTING: 12992.63 *GROUND ELEVATION:* 6307.83
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
0	10:15	EOLIAN		SP- SAND, VERY FINE TO MEDIUM, SUBANGULAR TO ROUNDED, MOSTLY FROSTED QUARTZ. INTERVAL NON-COHESIVE, DRY, LIGHT YELLOWISH BROWN, (10YR 6/4).
5	10:17	EOLIAN		SEE 0-5'
10	10:19	EOLIAN		SEE 10-15', EXCEPT PALE YELLOW (2.5Y 7/3).
15	11:40	USR		SEE 10-15' TO 16' 16-20' SW- GRAVELLY SAND W/ 90% SAND AND 10% GRAVEL. SAND VERY FINE TO VERY COARSE, ANGULAR TO SUBROUNDED, 95% QUARTZ, 5% ROCK FRAGMENTS FERROMAG MINERALS. GRAVEL FINE TO COARSE, ANGULAR TO SUBANGULAR, MOSTLY QUARTZ, WITH OCCASIONAL GRANITIC FRAGMENTS. INTERVAL DRY, YELLOW (2.5Y 7/6)
20	11:42	USR		SEE 15-20', GRADING TO SP- SAND W/ NO GRAVEL TOWARDS BOTTOM OF INTERVAL. INTERVAL SLIGHTLY MOIST, GRAYISH BROWN (2.5Y 5/2).
25	11:44	USR		SANDSTONE. MOSTLY SAND-SIZED, VERY FINE TO FINE, SUBANGULAR TO SUBROUNDED, 90 % QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. SANDSTONE FRIABLE, INTERVAL MOIST, GRAYISH BROWN (2.5Y 5/2).
30	11:46	USR		SEE 25-30', EXCEPT WET.

BORING LOG

SHEPHERD MILLER

BORING NO.
SWAB-40

PROJECT: WNI / SPLIT ROCK *PAGE:* 2 of 2
PROJECT NO.: 003347 *DATE:* 01/12/02
NORTHING: 1526.39 EASTING: 12992.63 *GROUND ELEVATION:* 6307.83
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
35	11:48	USR		SEE 30-35'
40	11:50	USR		SEE 35-40'
45				TD
50				
55				
60				
65				

BORING LOG

SHEPHERD MILLER

BORING NO.
SWEB-15

PROJECT: WNI / SPLIT ROCK *PAGE:* 1 of 4
PROJECT NO.: 003347 *DATE:* 01/08/02
NORTHING: 1251.02 EASTING: 14662.06 *GROUND ELEVATION:* 6300.53
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
0	08:25	EOLIAN		SM- SILTY SAND W/ 90% AND 10% SILT. SAND VERY FINE TO MEDIUM, SUBANGULAR TO SUBROUNDED SAND, 90% FROSTED QUARTZ, 10% ROCK FRAGMENTS; AND 20% SILT. INTERVAL NON-COHESIVE, DRY, LIGHT YELLOWISH BROWN (10YR 6/4).
5	08:27	EOLIAN		SEE 0-5'
10	08:29	EOLIAN		SP- SAND, VERY FINE TO VERY COARSE, SUBANGULAR TO ROUNDED, 95 % FROSTED QUARTZ, 5% ROCK FRAGMENTS. INTERVAL NON-COHESIVE, DRY, PALE YELLOW, (2.5Y 8/4).
15	09:09	USR		SM-SC-CLAYEY SAND W/ 90% SAND AND 10% CLAY, WITH OCCASIONAL GRAVEL. SAND VERY FINE TO MEDIUM, SUBANGULAR TO ROUNDED, 90 % QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. GRAVEL FINE TO MEDIUM, ANGULAR TO SUBANGULAR, MOSTLY QUARTZ. INTERVAL SLIGHTLY COHESIVE, SLIGHTLY MOIST, YELLOWISH BROWN (10YR 5/6) TO GRAYISH BROWN (10YR 5/2).
20	09:11	USR		SEE 15-20', EXCEPT NO GRAVEL, COHESIVE, MOIST.
25	09:13	USR		SEE 20-25'
30	09:15	USR		SEE 25-30', EXCEPT WET.

BORING LOG

SHEPHERD MILLER

BORING NO.
SWEB-15

PROJECT: WNI / SPLIT ROCK *PAGE:* 2 of 4
PROJECT NO.: 003347 *DATE:* 01/08/02
NORTHING: 1251.02 EASTING: 14662.06 *GROUND ELEVATION:* 6300.53
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
35	09:43	USR		CLAYEY SANDSTONE W/-5% SAND AND 25% CLAY-SIZED CLASTS. SAND VERY FINE TO MEDIUM, SUBANGULAR TO ROUNDED, 80% QUARTZ, 20% ROCK FRAGMENTS AND FERROMAG MINERALS. INTERVAL MODERATELY COHESIVE, WET, GRAYISH BROWN (2.5Y 5/2).
40	09:47	USR		SEE 35-40'
45	09:49	USR		SANDSTONE W/ 90% SAND AND 10% CLAY. SAND VERY FINE TO MEDIUM, SUBANGULAR TO ROUNDED, 80% QUARTZ, 20% ROCK FRAGMENTS AND FERROMAG MINERALS. SANDSTONE FRIABLE TO SLIGHTLY COHESIVE, WET, GRAYISH BROWN (2.5Y 5/2).
50	09:51	USR		SEE 45-50'
55	10:20	USR		SANDSTONE W/ >95% SAND AND <5% CLAY. SAND VERY FINE TO FINE, SUBROUNDED TO ROUNDED, 80% QUARTZ, 20% ROCK FRAGMENTS AND FERROMAG MINERALS. SANDSTONE FRIABLE. WET, GRAYISH BROWN (2.5Y 5/2).
60	10:22	USR		SEE 55-60'
65	10:24	USR		SEE 60-65'

BORING LOG

SHEPHERD MILLER

BORING NO.
SWEB-15

PROJECT: WNI / SPLIT ROCK PAGE: 3 of 4
PROJECT NO.: 003347 DATE: 01/08/02
NORTHING: 1251.02 EASTING: 14662.06 GROUND ELEVATION: 6300.53
DRILLING COMPANY: RUEN DRILLING DRILLING METHOD: AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON LOGGED BY: E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
70	10:26	USR		SEE 65-70'
75	10:54	USR		SEE 70-75'
80	10:56	USR		SEE 75-80'
85	10:58	USR		SEE 80-85'
90	11:00	USR		SEE 85-90'
95	11:38	USR		SEE 90-95'
100	11:40	USR		SEE 95-100'

BORING LOG

SHEPHERD MILLER

BORING NO.
SWEB-15

PROJECT: WNI / SPLIT ROCK *PAGE:* 4 of 4
PROJECT NO.: 003347 *DATE:* 01/08/02
NORTHING: 1251.02 EASTING: 14662.06 *GROUND ELEVATION:* 6300.53
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
105	11:42	USR		SEE 100-105'
110	11:44	USR		SEE 105-110'
115	11:46	USR		SEE 110-115'
				TD
120				
125				
130				
135				

003347\LOGS\SWEB-15.dwg

BORING LOG

SHEPHERD MILLER

BORING NO.
SWEB-16

PROJECT: WNI / SPLIT ROCK *PAGE:* 1 of 4
PROJECT NO.: 003347 *DATE:* 01/09/02
NORTHING: 1329.51 EASTING: 13840.21 *GROUND ELEVATION:* 6303.54
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
0	15:55	EOLIAN		SM- SILTY SAND W/ 90% AND 10% SILT. SAND VERY FINE TO MEDIUM, SUBANGULAR TO SUBROUNDED SAND, 90% FROSTED QUARTZ, 10% ROCK FRAGMENTS; AND 20% SILT. INTERVAL NON-COHESIVE, DRY, LIGHT YELLOWISH BROWN (10YR 6/4).
5	15:57	EOLIAN		SP-SAND, VERY FINE TO VERY COARSE, SUBANGULAR TO ROUNDED, 95 % FROSTED QUARTZ, 5% ROCK FRAGMENTS AND FERROMAG MINERALS. INTERVAL DRY, PALE YELLOW (2.5Y 7/3) TO VERY PALE BROWN (10R 8/2).
10	15:59	EOLIAN		SEE 5-10'
15	16:20	USR		SAND W/ 90% SAND AND 10% CLAY. SAND VERY FINE TO FINE, SUBANGULAR TO ROUNDED, 80 % QUARTZ, 20% ROCK FRAGMENTS AND FERROMAG MINERALS. OCCASIONAL ANGULAR COARSE-GRAINED QUARTZ. INTERVAL MODERATELY COHESIVE, SLIGHTLY MOIST, SLIGHT HCL REACTION, GRAYISH BROWN (10YR 5/2).
20	16:22	USR		CLAYEY SANDSTONE WITH80 % SAND- AND 20% CLAY-SIZED CLASTS SAND VERY FINE TO FINE, SUBANGULAR TO ROUNDED, 80 % QUARTZ, 20% ROCK FRAGMENTS AND FERROMAG MINERALS. OCCASIONAL ANGULAR COARSE-GRAINED QUARTZ. INTERVAL MODERATELY COHESIVE, SLIGHTLY MOIST, SLIGHT HCL REACTION, GRAYISH BROWN, (10YR 5/2).
25	16:24	USR		SEE 20-25, EXCEPT < 20% CLAY, COHESIVE, VERY MOIST.
30	16:26	USR		SANDSTONE W/ 90% SAND AND 10% CLAY. SAND VERY FINE TO FINE, SUBROUNDED TO ROUNDED, 90% QUARTZ, 10% ROCK FRAGMENT AND FERROMAG MINERALS. INTERVAL SLIGHTLY COHESIVE, WET, YELLOWISH BROWN (10YR 5/6) TO GRAYISH BROWN (2.5Y 5/2).

BORING LOG

SHEPHERD MILLER

BORING NO.
SWEB-16

PROJECT: WNI / SPLIT ROCK *PAGE:* 2 of 4
PROJECT NO.: 003347 *DATE:* 01/10/02
NORTHING: 1329.51 EASTING: 13840.21 *GROUND ELEVATION:* 6303.54
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
35	07:40	USR		SANDSTONE W/ >95% SAND AND <5% CLAY. SAND VERY FINE TO FINE, SUBROUNDED TO ROUND, 90% QUARTZ, 10% ROCK FRAGMENTS AND FERROMAG MINERALS. SANDSTONE FRIABLE, INTERVAL WET, GRAYISH BROWN (2.5Y 5/2).
40	07:42	USR		SEE 35-40'
45	07:44	USR		SEE 40-45'
50	07:46	USR		SEE 45-50'
55	08:30	USR		SEE 50-55'
60	08:45	USR		SEE 55-60'
65	08:47	USR		SEE 60-65'

BORING LOG

SHEPHERD MILLER

BORING NO.
SWEB-16

PROJECT: WNI / SPLIT ROCK *PAGE:* 3 of 4
PROJECT NO.: 003347 *DATE:* 01/10/02
NORTHING: 1329.51 EASTING: 13840.21 *GROUND ELEVATION:* 6303.54
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
70	08:49	USR		SEE 65-70'
75	09:09	USR		SEE 70-75'
80	09:11	USR		SEE 75-80'
85	09:13	USR		SEE 80-85'
90	09:15	USR		SEE 85-90'
95	09:48	USR		SEE 90-95'
100	09:50	USR		SEE 95-100'

BORING LOG

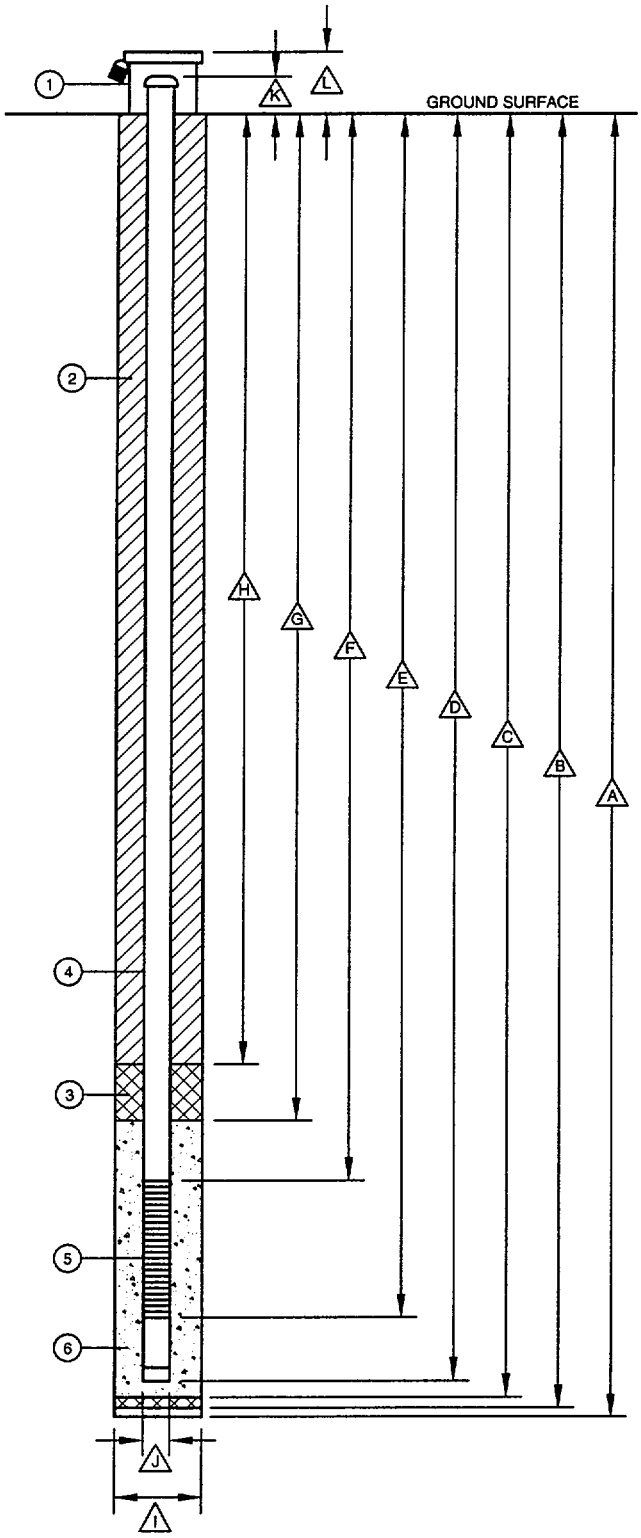
SHEPHERD MILLER

BORING NO.
SWEB-16

PROJECT: WNI / SPLIT ROCK *PAGE:* 4 of 4
PROJECT NO.: 003347 *DATE:* 01/10/02
NORTHING: 1329.51 EASTING: 13840.21 *GROUND ELEVATION:* 6303.54
DRILLING COMPANY: RUEN DRILLING *DRILLING METHOD:* AIR ROTARY ADV. CASING
DRILLER: MARTY WILSON *LOGGED BY:* E. MULLER

DEPTH (FT)	TIME	GEOLOGY UNIT	LITHOLOGY GRAPHIC	DESCRIPTION
105	09:52	USR		SEE 100-105'
110	09:54	USR		SEE 105-110'
115	09:56	USR		SEE 110-115'
				TD
120				
125				
130				
135				

WELL CONSTRUCTION LOG	PROJECT:	WNI SPLIT ROCK SUPPLEMENTAL	DATE DRILLED:	1/9-10/02
SHEPHERD MILLER	PROJECT NUMBER:	003347	DATE WELL COMPLETED:	1/11/02
	DRILLING COMPANY:	RUEN DRILLING, INC.	GROUND ELEVATION (FT MSL):	6303.54
	DRILLER:	MARTY WILSON	TYPE OF WELL INSTALLED:	TYPE 1 MONITORING WELL
SWEB-16	DRILLING METHOD:	AIR ROTORY/CASING ADVANCE	TOP OF CASING ELEVATION (FT MSL):	6305.80
LOGGED BY: ED MULLER	SITE COORDINATE NORTHING:	1329.51	GROUNDWATER ELEVATION (FT MSL)	6272.46
CHECKED BY/DATE: JOE REED	SITE COORDINATE EASTING:	13840.21	DATE MEASURED:	3/06/02



FORMATION(S) SCREENED

UPPER SPLIT ROCK

DIMENSIONS:

		DEPTH (FT.)	ELEV. (FT. MSL)
A	TOTAL DEPTH OF BORING	118.00	6185.54
B	TOTAL DEPTH OPEN BOREHOLE	113.40	6190.14
C	DEPTH TOP OF BOTTOM BENTONITE SEAL	100.30	6203.24
D	TOTAL DEPTH OF WELL	99.75	6203.79
E	WELL SCREEN BOTTOM	99.45	6204.09
F	WELL SCREEN TOP	79.40	6224.14
G	DEPTH TO TOP OF FILTER	76.70	6226.84
H	DEPTH TO TOP OF BENTONITE PELLET SEAL	74.70	6228.84
I	BOREHOLE DIAMETER	9.25 IN.	
J	WELL CASING DIAMETER	4 IN.	
K	HEIGHT OF WELL CASING	2.26	6305.80
L	HEIGHT OF PROTECTIVE CASING	2.50	6306.04

MATERIALS:

1. PROTECTIVE CASING TYPE: STEEL
2. ANNULAR SEAL TYPE: 3/8" CHIP BENTONITE
3. BENTONITE SEAL: CETCO VOLCLAY PURE GOLD 3/8" BENTONITE PELLETS
4. BLANK WELL CASING:
   - MATERIAL: PVC
   - WALL THICKNESS: SCHEDULE 40
   - MANUFACTURER: USF JOHNSON
5. WELL SCREEN:
   - MATERIAL: PVC
   - WALL THICKNESS: SCHEDULE 40
   - OPENING TYPE: FACTORY SLOT
   - SIZE OPENING: 0.02
   - MANUFACTURER: USF JOHNSON
6. FILTER MATERIAL TYPE: 10-20 OGLEBAY NORTON
7. BOTTOM SEAL TYPE: 3/8" CHIP BENTONITE

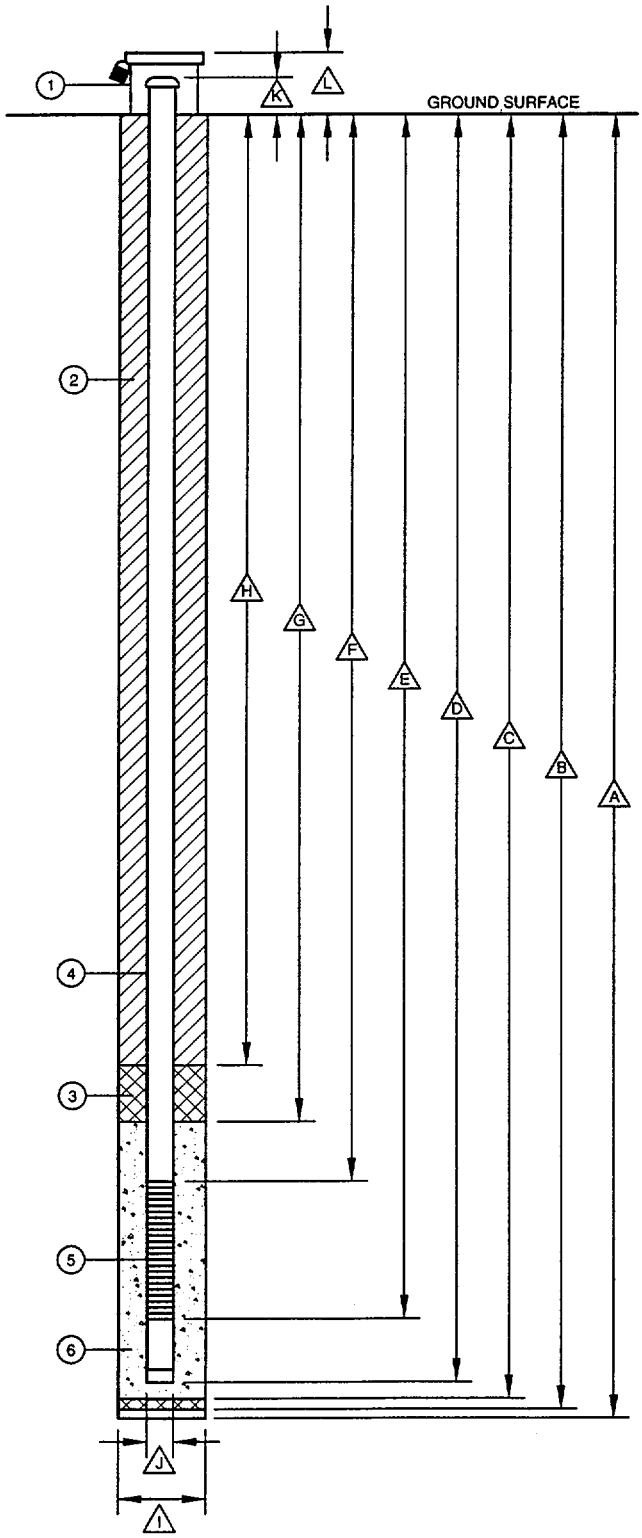
NOTES:

FORMATION HEAVE FROM 74.7 - 67.0 FEET BGS

AND 21 TO 14 FEET BGS - NO BENTONITE

E:\03-347\2002\WC_SWEB-16.DWG

WELL CONSTRUCTION LOG	PROJECT:	WNI SPLIT ROCK SUPPLEMENTAL	DATE DRILLED:	1/8/02
SHEPHERD MILLER	PROJECT NUMBER:	003347	DATE WELL COMPLETED:	1/9/02
	DRILLING COMPANY:	RUEN DRILLING, INC.	GROUND ELEVATION (FT MSL):	6300.53
	DRILLER:	MARTY WILSON	TYPE OF WELL INSTALLED:	TYPE 1 MONITORING WELL
SWEB-15	DRILLING METHOD:	AIR ROTORY/CASING ADVANCE	TOP OF CASING ELEVATION (FT MSL):	6302.74
LOGGED BY: ED MULLER	SITE COORDINATE NORTHING:	1251.20	GROUNDWATER ELEVATION (FT MSL)	6270.82
CHECKED BY/DATE: JOE REED	SITE COORDINATE EASTING:	14662.06	DATE MEASURED:	3/06/02



FORMATION(S) SCREENED

UPPER SPLIT ROCK

DIMENSIONS:

		DEPTH (FT.)	ELEV. (FT. MSL)
A	TOTAL DEPTH OF BORING	117.00	6183.53
B	TOTAL DEPTH OPEN BOREHOLE	115.40	6185.13
C	DEPTH TOP OF BOTTOM BENTONITE SEAL	99.00	6201.53
D	TOTAL DEPTH OF WELL	99.59	6200.94
E	WELL SCREEN BOTTOM	99.29	6201.24
F	WELL SCREEN TOP	79.29	6221.24
G	DEPTH TO TOP OF FILTER	76.30	6224.23
H	DEPTH TO TOP OF BENTONITE PELLET SEAL	74.30	6226.23
I	BOREHOLE DIAMETER	9.25 IN.	
J	WELL CASING DIAMETER	4 IN.	
K	HEIGHT OF WELL CASING	2.21	6302.74
L	HEIGHT OF PROTECTIVE CASING	2.60	6303.13

MATERIALS:

1. PROTECTIVE CASING TYPE: STEEL
2. ANNULAR SEAL TYPE: 3/8" CHIP BENTONITE
3. BENTONITE SEAL: CETCO VOLCLAY PURE GOLD 3/8" BENTONITE PELLETS
4. BLANK WELL CASING:
   - MATERIAL: PVC
   - WALL THICKNESS: SCHEDULE 40
   - MANUFACTURER: USF JOHNSON
5. WELL SCREEN:
   - MATERIAL: PVC
   - WALL THICKNESS: SCHEDULE 40
   - OPENING TYPE: FACTORY SLOT
   - SIZE OPENING: 0.02
   - MANUFACTURER: USF JOHNSON
6. FILTER MATERIAL TYPE: 10-20 OGLEBAY NORTON
7. BOTTOM SEAL TYPE: 3/8" CHIP BENTONITE

NOTES:

DUE TO BENTONITE BRIDGE, NO BENTONITE FROM 74.3 TO 38.0 FEET BGS (FORMATION CAVEED)

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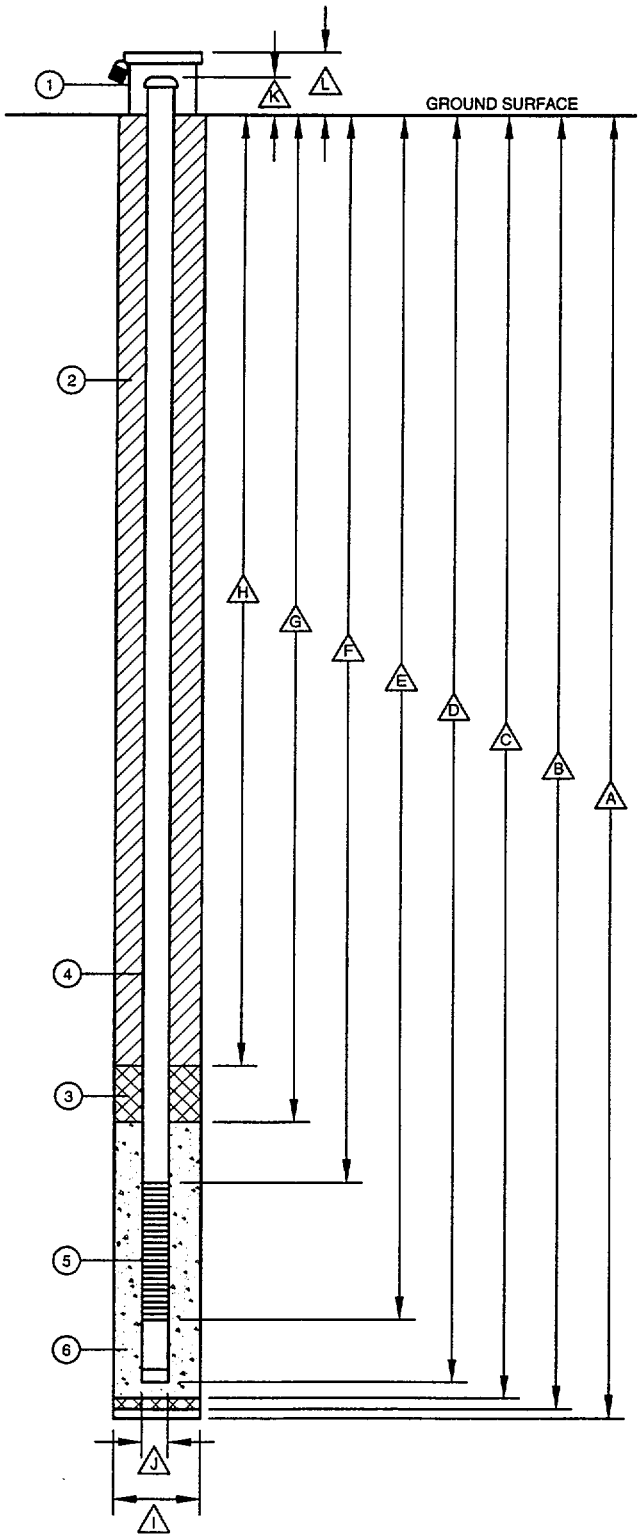
WELL CONSTRUCTION LOG	PROJECT:	WNI SPLIT ROCK SUPPLEMENTAL	DATE DRILLED:	1/12/02
SHEPHERD MILLER	PROJECT NUMBER:	003347	DATE WELL COMPLETED:	1/12/02
	DRILLING COMPANY:	RUEN DRILLING, INC.	GROUND ELEVATION (FT MSL):	6307.83
	DRILLER:	MARTY WILSON	TYPE OF WELL INSTALLED:	TYPE 1 MONITORING WELL
SWAB-40	DRILLING METHOD:	AIR ROTORY/CASING ADVANCE	TOP OF CASING ELEVATION (FT MSL):	6309.83
LOGGED BY: ED MULLER	SITE COORDINATE NORTHING:	1526.39	GROUNDWATER ELEVATION (FT MSL)	NA
CHECKED BY/DATE: JOE REED	SITE COORDINATE EASTING:	12992.63	DATE MEASURED:	3/06/02



FORMATION(S) SCREENED

UPPER SPLIT ROCK

DIMENSIONS:	DEPTH (FT.)	ELEV. (FT. MSL)
A TOTAL DEPTH OF BORING	48.45	6259.38
B TOTAL DEPTH OPEN BOREHOLE	48.45	6259.38
C DEPTH TOP OF BOTTOM BENTONITE SEAL	45.00	6262.83
D TOTAL DEPTH OF WELL	45.30	6262.53
E WELL SCREEN BOTTOM	45.00	6262.83
F WELL SCREEN TOP	35.00	6272.83
G DEPTH TO TOP OF FILTER	31.90	6275.93
H DEPTH TO TOP OF BENTONITE PELLET SEAL	29.70	6278.13
I BOREHOLE DIAMETER	7.25 IN.	
J WELL CASING DIAMETER	2 IN.	
K HEIGHT OF WELL CASING	2.00	6309.83
L HEIGHT OF PROTECTIVE CASING	2.70	6310.53

MATERIALS:

1. PROTECTIVE CASING TYPE: STEEL
2. ANNULAR SEAL TYPE: 3/8" CHIP BENTONITE
3. BENTONITE SEAL: CETCO VOLCLAY PURE GOLD 3/8" BENTONITE PELLETS
4. BLANK WELL CASING:
   - MATERIAL: PVC
   - WALL THICKNESS: SCHEDULE 40
   - MANUFACTURER: USF JOHNSON
5. WELL SCREEN:
   - MATERIAL: PVC
   - WALL THICKNESS: SCHEDULE 40
   - OPENING TYPE: FACTORY SLOT
   - SIZE OPENING: 0.02
   - MANUFACTURER: USF JOHNSON
6. FILTER MATERIAL TYPE: 10-20 OGLEBAY NORTON
7. BOTTOM SEAL TYPE: 3/8" CHIP BENTONITE

NOTES:

ENCOUNTERED SAND WITHIN CASING AT 7 FEET BGS

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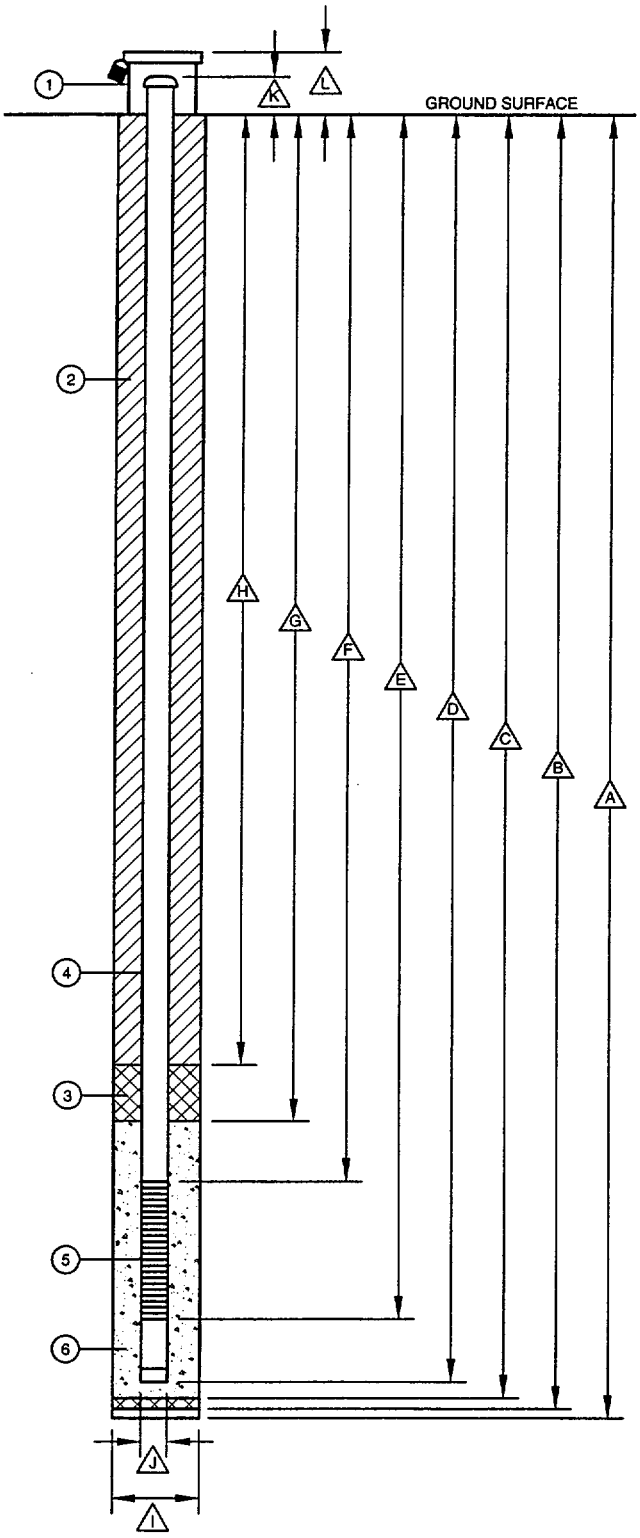
WELL CONSTRUCTION LOG	PROJECT:	WNI SPLIT ROCK SUPPLEMENTAL	DATE DRILLED:	1/11/02
SHEPHERD MILLER	PROJECT NUMBER:	003347	DATE WELL COMPLETED:	1/12/02
	DRILLING COMPANY:	RUEN DRILLING, INC.	GROUND ELEVATION (FT MSL):	6299.94
	DRILLER:	MARTY WILSON	TYPE OF WELL INSTALLED:	TYPE 1 MONITORING WELL
SWAB-39	DRILLING METHOD:	AIR ROTORY/CASING ADVANCE	TOP OF CASING ELEVATION (FT MSL):	6301.74
LOGGED BY: ED MULLER	SITE COORDINATE NORTHING:	1225.46	GROUNDWATER ELEVATION (FT MSL)	6271.25
CHECKED BY/DATE: JOE REED	SITE COORDINATE EASTING:	14661.99	DATE MEASURED:	3/06/02



FORMATION(S) SCREENED

UPPER SPLIT ROCK

DIMENSIONS:

		DEPTH (FT.)	ELEV. (FT. MSL)
A	TOTAL DEPTH OF BORING	44.10	6255.84
B	TOTAL DEPTH OPEN BOREHOLE	44.10	6255.84
C	DEPTH TOP OF BOTTOM BENTONITE SEAL	NA	NA
D	TOTAL DEPTH OF WELL	43.52	6256.42
E	WELL SCREEN BOTTOM	43.20	6256.74
F	WELL SCREEN TOP	33.20	6266.74
G	DEPTH TO TOP OF FILTER	29.50	6270.44
H	DEPTH TO TOP OF BENTONITE PELLET SEAL	25.30	6274.64
I	BOREHOLE DIAMETER	7.25 IN.	
J	WELL CASING DIAMETER	2 IN.	
K	HEIGHT OF WELL CASING	1.80	6301.74
L	HEIGHT OF PROTECTIVE CASING	2.20	6302.14

MATERIALS:

1. PROTECTIVE CASING TYPE: STEEL
2. ANNULAR SEAL TYPE: 3/8" CHIP BENTONITE
3. BENTONITE SEAL: CETCO VOLCLAY PURE GOLD 3/8" BENTONITE PELLETS
4. BLANK WELL CASING:
   - MATERIAL: PVC
   - WALL THICKNESS: SCHEDULE 40
   - MANUFACTURER: USF JOHNSON
5. WELL SCREEN:
   - MATERIAL: PVC
   - WALL THICKNESS: SCHEDULE 40
   - OPENING TYPE: FACTORY SLOT
   - SIZE OPENING: 0.02
   - MANUFACTURER: USF JOHNSON
6. FILTER MATERIAL TYPE: 10-20 OGLEBAY NORTON
7. BOTTOM SEAL TYPE: NA

NOTES:

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