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Date: MAR 1 6 2017
Symbol: EPC-DO: 17-051
LA-UR: 17-20364
Locates Action No.: U1501760

Ms. Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Subject: **Work Plan for the Treatment and Land Application of Groundwater from Technical Areas 09 and 16, DP-1793, Work Plan #6**

Dear Ms. Hunter:

On July 27, 2015, the New Mexico Environment Department (NMED) issued a Discharge Permit (DP-1793) to the U.S. Department of Energy and Los Alamos National Security, LLC (DOE/LANS) for the land application of treated groundwater from covered activities. Pursuant to Condition No. 3 of the above-referenced discharge permit, DOE/LANS are required to submit a detailed, project-specific work plan for approval by NMED before any activities are undertaken.

The enclosed work plan is for the proposed discharge of treated groundwater from three activities: (1) legacy water remaining from 2016 activities, (2) calendar year (CY2017) water generated related to well installations, and (3) routine monitoring well purging during sampling at monitoring wells for the Technical Area (TA)-16-260 monitoring group.

The activities listed above will be conducted as specified in the NMED-approved *Groundwater Investigation Work Plan for Consolidated Unit 16-021(c)-99, Including Drilling Work Plans for Wells R-68 and R-69* and the *Interim Facility-Wide Groundwater Monitoring Plan for the 2017 Monitoring Year, October 2016-September 2017.* Produced groundwater will be treated and discharged in accordance with the enclosed work plan and supporting information.

Please contact William J. Foley by telephone at (505) 665-8423 or by email at bfoley@lanl.gov if you have questions regarding this work plan.

Sincerely,

John C. Bretzke
Division Leader

Sincerely,

Cheryl L. Rodriguez
Program Manager, FPD-II

JCB/CLR/MTS/WJF:tav

Enclosures:

1) Work Plan for Treatment and Land Application of Groundwater from Technical Areas 09 and 16, DP-1793, Work Plan #6
2) Figures
3) TA-16 260 Monitoring Group Excerpts from the Interim Facility-Wide Groundwater Monitoring Plan for the 2017 Monitoring Year, October 2016-September 2017
4) As-Built Specifications for TA-16 260 Monitoring Group Wells
5) Topographic Map of Project Site
6) Water Quality Data from TA-16 260 Monitoring Group Wells
7) Granulated Activated Carbon Groundwater Treatment System Details
8) Granulated Activated Carbon Groundwater Treatment System 2016 Effluent Results Summary

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ENCLOSURE 1

Work Plan for Treatment and Land Application of Groundwater from Technical Areas 09 and 16, DP-1793, Work Plan #6

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ENCLOSURE 1
Work Plan for Treatment and Land Application of Groundwater from Technical Areas 09 and 16, DP-1793, Work Plan #6

Introduction. This Discharge Permit (DP) 1793 Work Plan (Work Plan #6) is for the proposed calendar year (CY) 2017 land application of treated groundwater from multiple activities in Technical Area 09 (TA-09) and TA-16, located in the southwest corner of Los Alamos National Laboratory (the Laboratory) (Location map, Figure 1 in Enclosure 2). These activities support (1) ongoing groundwater monitoring efforts in the TA-16 260 monitoring group and (2) ongoing investigation into the occurrence of, and potential remedial alternatives for, high explosives (HE) contamination in perched groundwater associated with the Consolidated Unit 16-021(c)-99, the former TA-16 260 Outfall (hereafter, the 260 Outfall).

The TA-16 260 monitoring group (Well location map, Figure 2 in Enclosure 2) was established for the upper Water Canyon/Cañon de Valle watershed to detect and monitor contaminants released from the 260 Outfall and other sites at TA-16. The TA-16 260 monitoring group includes springs, alluvial wells, and wells completed in several deep perched-intermediate groundwater zones and in the regional aquifer.

The primary contaminant in groundwater within the study area is RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine), an HE compound widely used in military and industrial applications. Low concentrations of other HE compounds and volatile organic compounds are also present in groundwater in the investigation area. The predominant source of contaminants detected in groundwater in the upper Water Canyon/Cañon de Valle watershed originated from historical discharges from the 260 Outfall (Figure 2 in Enclosure 2). Building 16-260, located on the north side of TA-16 (Figure 2 in Enclosure 2), has been used for processing and machining HE since 1951. Because water was used to machine the HE (which is slightly water soluble), wastewater from machining operations contained dissolved and particulate HE, in particular RDX. From 1951 to 1996, millions of gallons of wastewater were discharged to the 260 Outfall that drained into Cañon de Valle.

A conceptual site model has been developed for the northern portion of TA-16, with principal components being the outfall source areas, Cañon de Valle alluvial system, mesa vadose zone, and the perched and regional aquifers. Figure 3 (Enclosure 2) shows the conceptual site model with an emphasis on the outfall source region, the alluvial system, and the mesa vadose zone. The perched groundwater zone is defined as those zones of saturation located between approximately 650 ft and 1200 ft below ground surface (bgs) in the TA-16 area.

Although several contaminant migration routes are shown in Figure 3 (Enclosure 2), the primary migration pathway likely consists of discharge of HE compounds as effluent from the 260 Outfall, surface flow of effluent to Cañon de Valle via a small tributary drainage, down-canyon transport of contaminants by surface water flow and alluvial groundwater, infiltration through the vadose zone recharging perched groundwater zones, and infiltration of that water into the regional aquifer. The perched groundwater has the highest concentrations of HE, and perched groundwater also contains most of the HE mass.

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Work Plan for Treatment and Land Application of Groundwater from Technical Areas 09 and 16, DP-1793, Work Plan #6

The perched groundwater zones beneath TA-16 probably represent multiple zones with poor vertical hydraulic connection. Perched groundwater occurs in a variety of geologic units, including the Cerro Toledo interval, Otowi Member, and Puye Formation. These zones are potential sources of contaminated recharge to the regional aquifer. Figure 4 (Enclosure 2) shows the hypothesized extent of perched groundwater zones in the study area and the regional water table at TA-16.

During CY2016, Los Alamos National Laboratory (the Laboratory) completed aquifer testing activities under the "Work Plan for Intermediate Groundwater System Characterization at Consolidated Unit 16-021(c)-99," submitted to the New Mexico Environment Department (NMED) on August 7, 2015. That work plan was designed to evaluate the degree of hydraulic connectivity within the perched-groundwater system and to improve the general understanding of transport pathways for RDX and other contaminants to the perched groundwater zones. NMED approved the work plan on October 15, 2015. Groundwater generated was treated via granulated activated carbon (GAC) and land-applied under DP-1793 Work Plan #4, submitted to NMED on March 22, 2016. NMED issued an approval with modification for Work Plan # 4 on May 27, 2016.

During CY2017 the Laboratory will install regional aquifer monitoring well R-68 (and R-69, if required) in accordance with the NMED-approved "Groundwater Investigation Work Plan for Consolidated Unit 16-021(c)-99, including Drilling Work Plans for Wells R-68 and R-69", submitted to NMED on September 6, 2016. NMED approved the work plan on September 27, 2016.

In addition to the above-referenced activities the Laboratory conducts ongoing monitoring of wells, including in the TA-16 260 monitoring group. In CY2016 and CY2017, these activities were or will be completed in accordance with the NMED-approved "Interim Facility-Wide Groundwater Monitoring Plan for the 2016 Monitoring Year, October 2015–September 2016" (May 2015) and the NMED-approved "Interim Facility-Wide Groundwater Monitoring Plan for the 2017 Monitoring Year, October 2016–September 2017 (Includes replacement pages issued September 26, 2016, and November 8, 2016)" (November 2016) (collectively referred to as the IFGMP).

Objectives. Activities in this Work Plan #6 are for the proposed CY2017 discharge of treated groundwater from three activities. These activities consist of the following:

(1) Legacy water remaining from CY2016 activities:
    a. Groundwater generated during routine purging completed for sampling of contaminant-affected monitoring wells under the IFGMP for the TA-16 260 monitoring group during the fourth quarter CY2015 and CY2016, except as identified below.

b. Legacy CdV-9-1(i) development water remaining from NMED-approved DP-1793 Work Plan #4 CY2016 activities.

(2) CY2017 groundwater generated during routine purging completed for sampling of contaminant-affected monitoring wells under the IFGMP for the TA-16 260 monitoring group, except as identified below.

(3) CY2017 water generated from the installation of well R-68 (and R-69 if required).

Groundwater originating from the three activities in this Work Plan will be treated before land application under this Work Plan. Figure 5 (Enclosure 2) shows the treatment, storage, and land-application flow diagram. Although generated from three different activities, because the water quality of the groundwater is similar, it will be treated and combined before land application.

Volumes of water proposed for land application from the three activities planned in CY2017 are only estimates. Administrative controls will restrict the actual volume applied to less than the permitted volume of 350,000 gallons per day (gpd) total for all work plans submitted during this period under DP-1793.

Proposed Activities. Additional information related to the sources of water to be treated and land-applied as a result of the above activities is provided below. Table 1 provides a summary of the anticipated volume of treated water to be land applied under this Work Plan #6.

Table 1. Estimated Volume of Treated Groundwater to be Land Applied Under Work Plan #6.

Activity	Estimated Volume (gal.)
Activity No. 1: Legacy Water Remaining from 2016 Activities	32,000
Activity No. 2: Water from Monitor Well Purging During Sampling and Well Maintenance	20,300
Activity No. 3: Water Generated During CY2017 Related to Well Installation(s)	1,024,000
Total	**1,076,300**

Activity No. 1: Legacy Water Remaining from 2016 Activities. Legacy groundwater generated from sampling activities completed under the IFGMP during CY2016. In addition, legacy groundwater from CdV-9-1(i) development water that was not land-applied in CY2016 under NMED-approved DP-1793 Work Plan #4 is proposed for treatment and land application under this Work Plan #6.

Activity No. 2: Water from Monitoring Well Purging During Sampling and Well Maintenance activities. Groundwater monitoring wells at the Laboratory are routinely sampled in accordance with the NMED-approved IFGMP. Numerous monitoring wells in the TA-16 206 monitoring group are monitored quarterly. Several of these wells have the potential to show concentrations above the NMED Risk Assessment Guidance for Site Investigations and Remediation, Table A-1, Tap Water Soil Screening Level (Table A-1 Tap Water SSL) of 7.02 μg/L for RDX and therefore, discharge may require treatment before disposition via land application.

Groundwater monitoring is conducted quarterly within a group of monitoring wells within the TA-16 260 monitoring group under the annual IFGMP. Annual submittal of the IFGMP is required under the 2016 Compliance Order of Consent (Consent Order). The wells comprising the TA-16 260 monitoring group are situated within Cañon de Valle. Sampling during CY2017 is being carried out in accordance with the NMED-approved IFGMP. The monitoring locations, analytical suites, and frequency of monitoring reflect the technical and regulatory status of each area and are updated annually in the IFGMP. The description and monitoring plan for the TA-16 260 monitoring group in the monitoring year 2017 (October 2016–September 2017) IFGMP is provided as Enclosure 3.

Additional purging may also be conducted to meet well maintenance requirements or for the collection of non-routine groundwater samples. Purge water from these additional activities is similar to purge water generated during routine groundwater monitoring activities.

Purge water is stored at the well site pending the availability of analytical data characterizing the quality of the water in storage. If the purge water in storage meets the requirements of the NMED-approved Decision Tree for Land Application of Groundwater (Decision Tree), then the purge water may be land-applied without treatment. Purge water with contaminant concentrations exceeding Decision Tree limits for RDX only must be treated before land application. If other contaminant concentrations exceed Decision Tree limits the purge water will be dispositioned off-site. Under this Work Plan, purge water generated from groundwater monitoring and from other activities related to well maintenance which exceeds the Decision Tree requirements for RDX only will be treated by GAC to less than 90% of the Table A-1 Tap Water SSL for RDX, temporarily stored in containers, and land-applied. Table 2 lists the wells associated with this activity.

Table 2 also provides the as-built specifications for the wells within the TA-16 260 monitoring group from which land-applied groundwater may originate. Enclosure 4 provides as-built specifications for each of these wells, except wells CdV-9-1(i), CdV-16-4ip, and CdV-16-1(i). The as-built specifications for these wells were previously submitted under DP-1793 Work Plan #4.

Table 2. Specifications for TA-16 260 Monitoring Group Wells from which Treated Land-Applied Groundwater May Originate.

Well	Screen Intervals (ft bgs)	Aquifer	Depth to Water (ft bgs)	Total Depth (ft bgs)
16-26644	130-145	Perched intermediate	135	150
CDV-16-611937	3.0-8.0	Alluvial	1.3	8.5
CdV-9-1(i)	937.4–992.4	Perched intermediate	912	1067.9
CdV-16-1(i)	624-634	Perched intermediate	586	657.8
CdV-16-2(i)r	850-860	Perched intermediate	836	874.4
CdV-16-4ip S1	816-879	Perched intermediate	816	1146
CdV-37-1(i)	632-652.5	Perched intermediate	628	803
R-18	1358-1381	Regional	1288	1440
R-25 S1	737.6-758.4	Perched intermediate	711	1942
R-25 S2	882.6-893.4	Perched intermediate	711	1942
R-25 S4	1184.6-1194.6	Perched intermediate	711	1942
R-25 S5	1294.7-1304.7	Regional	1286	1942
R-25 S6	1404.7-1414.7	Regional	1286	1942
R-25 S7	1604.7-1614.7	Regional	1286	1942
R-25b	750-771	Perched intermediate	759	786
R-26 S1	652-670	Perched intermediate	604	1490.5
R-47(i)	840-861	Perched intermediate	832	1351
R-48	1500-1521	Regional	1353	1705
R-58	1257-1277	Regional	1238	1378
R-63	1325-1345	Regional	1260	1424

Activity No. 3: Water Generated During 2017 Related to Well Installation(s). The Laboratory is scheduled to install monitoring well(s) during 2017. Once installed, these well(s) will be developed and aquifer-tested. Groundwater produced from these activities will be characterized and temporarily stored on-site. If sample results exceed Decision Tree criteria then the water will be treated and land applied under this Work Plan.

Below is additional information, common to all three of the activities identified above, for the proposed discharge.

1. **Location**. Although Discharge Permit DP-1793 references 55 sections within the New Mexico State Plane Coordinate System at the Laboratory where treated groundwater may be discharged, the wells, piezometers, and proposed land-application sites referenced in this Work Plan are all located within the following sections:

   - (Township/Range/Section) T19N/R06E/S29, T19N/R06E/30, T19N/R06E/31, T19N/R06E/32; and T19N/R05E/S36.

- Figure 2 (Enclosure 2) shows the locations of these wells along with other monitoring wells in the area. Enclosure 5 shows the locations of land application. These land-application sections are consistent with those from DP-1793 Work Plan #4 and the modified NMED approval.

Enclosure 5 is a topographic map of the project site, including the location of all site monitoring areas (SMAs), solid waste management units (SWMUs), National Pollution Discharge Elimination System (NPDES) outfalls, groundwater discharge permits, areas of concern (AOCs) identified in the Consent Order, and surface drainage features in the vicinity. Neither drinking water wells or surface water impoundments are in the proposed project or land application areas.

2. **Depth to Groundwater and Groundwater Flow Direction.** The vadose zone at TA-16 is approximately 1000 ft to 1300 ft thick and is recharged by mountain-front precipitation and subsequent percolation along the Pajarito fault zone west of TA-16 and along canyons (e.g., percolation along upper Cañon de Valle). The vadose zone contains a shallow suite of perched water zones (less than 200 ft depth from the mesa top) and two significant deep perched-intermediate groundwater zones between approximately 650 ft and 1200 ft bgs. Water-level data from the monitoring wells indicate groundwater within the perched horizons generally flows from west to east. Enclosure 3 provides additional information related to the depth to groundwater and flow direction from the 2017 (October 2016–September 2017) IFGMP.

   The depth to regional groundwater beneath the proposed land-application sites is approximately 1200 ft. The direction of groundwater flow beneath the proposed land-application sites is generally to the southeast.

3. **Expected Contaminants**. The source of groundwater generated from all activities listed in this Work Plan is the intermediate and regional aquifer. Table 3 below provides the maximum concentration of RDX detected in samples collected in 2016 for all wells proposed for potential land application under this Work Plan. In addition, the information previously submitted for CdV-9-1(i) development water under the NMED-approved DP-1793 Work Plan #4 is also presented in Table 3 since this comprises a portion of the legacy water to be land-applied under this Work Plan #6 during CY2017. R-68 (and R-69 if required) will be completed during 2017 in the regional aquifer. Due to limited data in the immediate area for the regional aquifer regional aquifer monitoring well R-18 is presented as the proxy for both wells. However, monitoring well CdV-16-4ip, completed within the perched-intermediate aquifer, may also be used as a worst case water-quality proxy well to bound the potential upper RDX concentration. Enclosure 6 contains the RDX data for all the wells listed in Table 3.

Table 3. RDX Maximum Concentrations at TA-16 260 Monitoring Group Wells in 2016[1].

Well	RDX (μg/L)
16-26644	22.9
CDV-16-611937[2]	0.38
CdV-9-1(i)	33.9
CdV-16-1(i)	35.2
CdV-16-2(i)r	103
CdV-16-4ip S1	187.1
CdV-37-1(i)	0.278
R-18 (proxy for R-68 and R-69)	3.73
R-25 S1[3]	30.8
R-25 S2[3]	17.5
R-25 S4[3]	23.2
R-25 S5[3]	0.897
R-25 S6[3]	0.379
R-25 S7[3]	0.325
R-25b	0.144
R-26 S1	0.278
R-47(i)	0.263
R-48	0.266
R-58	0.287
R-63	1.48
CdV-9-1(i) Development Water	242
NMWQCC GW Std[4]	**7.02[5]**

[1] Data obtained from IntellusNM for period from January 1, 2016 through November 30, 2016.
[2] No data available for 2016 period. Data provided for period between January 1, 2009 and December 31, 2015.
[3] No data available for 2016 period. Data provided for period between January 1, 2012 and December 31, 2015.
[4]NMWQCC Regulation 3103 standards for groundwater, except as noted.
[5]NMED Risk Assessment Guidance for Site Investigations and Remediation, Table A-1, Tap Water Soil Screening Levels.

4. **Untreated Water Storage.** Purge water from Activity 2 and development water / groundwater produced under Activity 3 will be temporarily stored at the generation area in aboveground storage tanks.. Upon receipt of results, if the water requires treatment, it will be transported to the storage tanks via truck to one of the two GAC treatment systems currently located at CdV-9-1(i); both of which were used under Work Plan #4 in 2016.

5. **Treatment System.** Storage tanks will be plumbed into the treatment system(s) piping to provide temporary storage to the combined untreated groundwater and to feed the treatment system(s). Either of the GAC treatment systems will be used to remove RDX from

groundwater produced under the activities identified in this Work Plan #6. Enclosure 7 provides the schematics for the larger of the two GAC treatment systems at CdV-9-1(i). The GAC treatment systems will remove RDX to less than 6.3 μg/L, 90% of the Table A-1, Tap Water SSL of 7.02 μg/L.

Enclosure 8 provides the effluent results obtained from this unit under DP-1793 Work Plan #4. RDX concentrations in all of the treated effluent samples from both treatment units during 2016 were below detection limits.

6. **Sampling Plan.** To demonstrate compliance with the Table A-1, Tap Water SSL for RDX, grab samples of the treated water will be collected routinely and throughout the entirety of land application operations when treated groundwater will be land-applied in accordance with this Work Plan. These treated water grab samples will be collected at a minimum frequency of once per week when land application operations are occurring for RDX analysis by an off-site, independent National Environmental Laboratory Accreditation Program– (NELAP-)-accredited analytical laboratory.

   In addition, operational samples will be collected routinely and measured for RDX using the Geochemistry and Geomaterials Research Laboratory (GGRL) operated by LANL's EES-14 group for fast turn results to monitor treatment system performance. These treated water operational samples will be collected at a minimum frequency of three times per week when land application operations occur.

   Table 4 summarizes the proposed sampling plan.

Table 4. Proposed Sampling Plan for Treated Water from Work Plan #6 Activities

Parameter	Sample Type	Analytical Method	TAT[1]	Frequency	MDL[2]	Laboratory
RDX	Grab, unfiltered	SW-846:8321A	10 d	1 time/wk	0.1 μg/L	Off-site NELAP-accredited laboratory

[1] TAT indicates the analytical turnaround time.
[2] MDL indicates the method (or instrument) detection limit.

The following contingencies will be applied under this sampling plan:

- ✓ If RDX concentrations collected under the above sampling plan are less than 6.3 μg/L, then treated groundwater will move directly from treated water storage to land application.

- ✓ If an RDX result collected under the above sampling plan exceeds 6.3 μg/L in the treated groundwater, land application will cease immediately and the following actions initiated:

    1. A representative sample(s) from the storage tank(s) receiving treated water will be collected for RDX analysis.
    2. If an RDX result exceeds 6.3 μg/L in the treated groundwater, the upstream GAC vessel will be replaced by the downstream vessel and a new downstream GAC vessel will be installed. This GAC replacement process can also be conducted proactively, before RDX results exceed 6.3 μg/L, if RDX results are observed to be increasing or to meet other operational requirements.
    3. Once the new downstream GAC vessel has been installed, the water in the storage tank(s) will be resampled with samples obtained for both on-site and off-site laboratory analysis. If the RDX concentration from the on-site laboratory analysis exceeds land-application criteria the water will be re-treated and re-analyzed to verify RDX concentrations meet land-application criteria prior to land application. If the RDX concentration from the on-site laboratory analysis of the tank water is less than the 6.3 μg/L land application criteria, it will move directly from treated water storage to land application without re-treatment.
    4. Resumption of land application may occur following replacement of the GAC treatment vessel and verification that RDX concentrations meet land-application criteria.

7. **Treated Water Storage.** Treated development water and groundwater will be stored in storage tanks before land application.

8. **Land Application.** Treated groundwater from all activities and sources referenced in this Work Plan will be land-applied in accordance with requirements of Discharge Permit DP-1793 (July 2015) and the conditions listed below. The following three sections—Planning, Operational Controls, and Inspections—provide additional information on the land-application component of this Work Plan.

    - ➢ **Planning.** Land-application zones identified in Enclosure 5 were selected and will be utilized based on the following criteria specified in Condition No. 4 of Discharge Permit DP-1793 and NMED's modified approval of DP-1793 Work Plan #4:
        - ✓ Avoidance of watercourses, water bodies, and wetlands
        - ✓ Avoidance of AOCs
        - ✓ Avoidance of SWMUs and SMAs
        - ✓ Avoidance of cultural sites

- ✓ Application on areas with slopes <2% when groundcover is <50% and slopes <5% when groundcover is >50%

Spray application of treated groundwater will be suspended a minimum of 20 ft from boundaries of SWMUs, NPDES outfalls, AOCs identified in the Consent Order, drinking water wells, surface impoundments and surface drainage areas, or other areas that are not appropriate as identified in Condition No. 4 of the discharge permit.

Treated groundwater will be land-applied by water trucks (3000–10,000-gal. capacity) equipped with both standard rear-mounted dust control sprayers and multiple high-pressure water sprayers. The land-application area was divided into nine zones, as shown on the map in Enclosure 5. Designation of these zones will facilitate tracking of land-application activities.

Water trucks will be filled with treated water from the treated water storage tanks located adjacent to the treatment unit (currently next to CdV-9-1(i) (Figure 2 in Enclosure 2). A totalizing meter will record the volume of treated water loaded into each truck. The treated water discharged may be land-applied for dust control. The frequency and volume of treated water land-applied for dust control will be based on field conditions. The Operations Manager, or designee, will determine when an application of dust-suppression water is required. Maintaining a low-dust environment for field personnel is an important health and safety objective for the Operations Manager.

The road shoulders and adjacent land in zones 1–9 have been identified as suitable terrain for the land application of treated water by high-pressure water sprayers. When deployed by the truck driver, the high-pressure sprayer can land apply treated water up to 100 ft from the center of the road. The frequency and volume of land application in zones 1 through 9 will be directed by the Operations Manager, or designee, based on the history of discharges to each zone, a field assessment of soil moisture, and the proximity of the land-application zone to the treated effluent storage tanks.

- **Operational Controls.** Condition No. 4 of Discharge Permit DP-1793 establishes the following conditions for the land application of treated groundwater:
  - ✓ Land application cannot result in water flowing from an approved land-application site.
  - ✓ Land application cannot create ponds or pools or standing water.
  - ✓ Land application must be conducted in a manner that maximizes infiltration and evaporation.
  - ✓ Land application is restricted to daylight hours and for a maximum of 10 h/d.
  - ✓ Land application must be supervised.

✓ Land application cannot extend off Laboratory property without written permission from the land owner.

✓ Land application is prohibited while precipitation is occurring or when temperatures are below freezing.

To ensure compliance with the conditions listed above, the Laboratory will implement the following operational controls:

a. All field personnel involved with land application will complete training to the following internal Laboratory standard operating procedure and regulatory documents:
   - ENV-RCRA-QP-010.3, Land Application of Groundwater (internal Laboratory procedure)
   - NMED-issued Discharge Permit DP-1793, LANL Groundwater Projects (July 27, 2015)
   - DP-1793 Work Plan #6
   - NMED Ground Water Quality Bureau approval of DP-1793 Work Plan #6 (pending)

b. Operational personnel will participate in pre-job briefings/morning tailgate talks that will provide operational personnel with the following critical information: daily weather reports, daily land-application activities, system maintenance and repairs scheduled, and daily inspection schedule.

c. The beginning and end of each land-application zone will be clearly delineated using cones or other markers that will be deployed prior to land application. The cones or markers will serve as administrative controls to ensure treated water is properly land-applied to the correct zones.

d. Operational personnel will maintain written records of the volume and date of treated water land-applied to each zone.

e. The maximum daily discharge of groundwater under this and all other active work plans approved under DP-1793 will not exceed 350,000 gpd through administrative controls. Volumes will be monitored closely to ensure this volume limit is not exceeded, documented, and verified by the Operations Manager.

➢ **Inspections.** The following inspections will be conducted on days when land application is implemented to ensure compliance with the land-application criteria specified in Condition No. 4 of Discharge Permit DP-1793 and this Work Plan:

✓ Daily equipment inspections of land application equipment, e.g. dust-suppression sprayers, high-pressure sprayers, and water truck; and

- ✓ Daily inspection of the land application zones for evidence of standing or flowing water.

10. **Water Conservation and Reuse Options.** In lieu of using potable water for dust suppression, the treated water discharged may be land-applied to approximately 1.7 mi of dirt road in TA-16. Because of the project's location, other reuse options—such as using treated water at Laboratory cooling towers—would require transporting the treated water by truck; the resulting environmental impact was deemed unacceptable. To facilitate water conservation and reuse, the treated water may also be used for soil compaction for well pads in TA-16 or TA-9, and for road-building activities within the zones delineated on the topographic map of the project site (Enclosure 5).

11. **Project Schedule.** Land application will begin following approval of this Work Plan by NMED and will continue until as needed through December 2017.

12. **Reporting.** In accordance with requirements B.8 and B.9 of Discharge Permit DP-1793 (July 27, 2015), the Laboratory will submit to NMED annual monitoring reports by March 1 of each year and a final completion report within 60 d of completing discharges under this Work Plan.

ENCLOSURE 2

Figures

EPC-DO: 17-051

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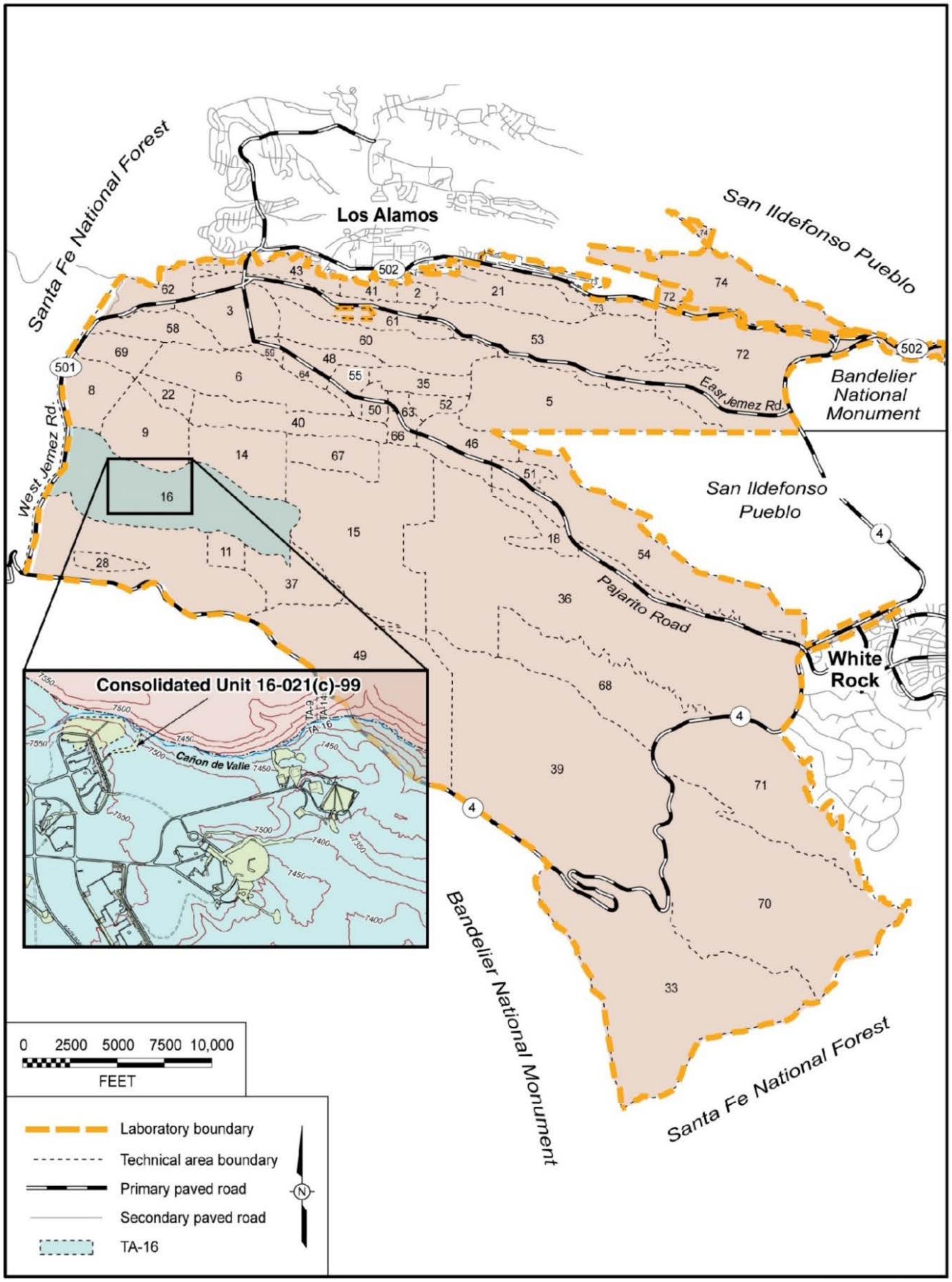

Figure 1 **Location of TA-16 and other Laboratory technical areas at Los Alamos National Laboratory**

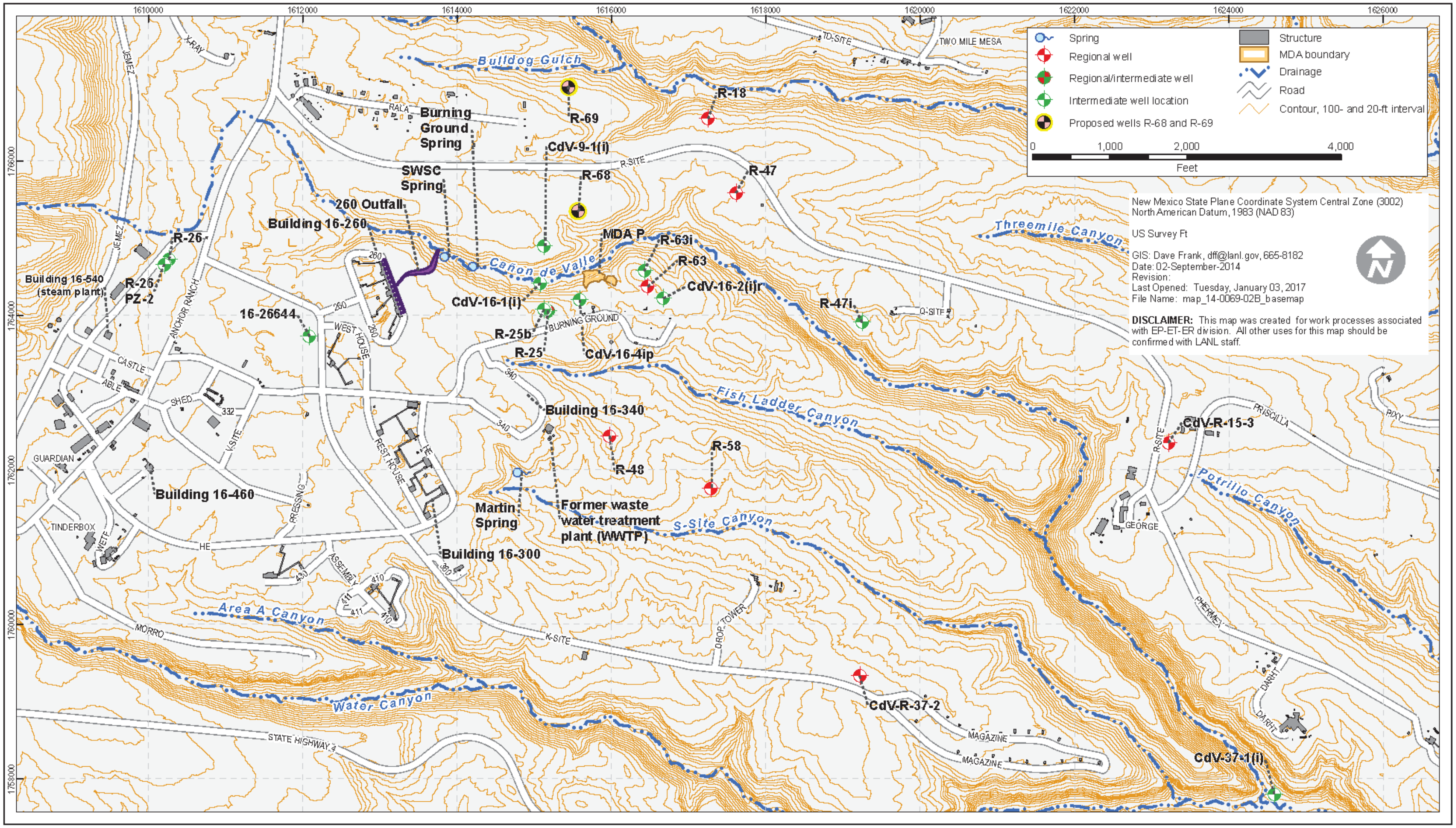

Figure 2 Location of TA-16 monitoring wells

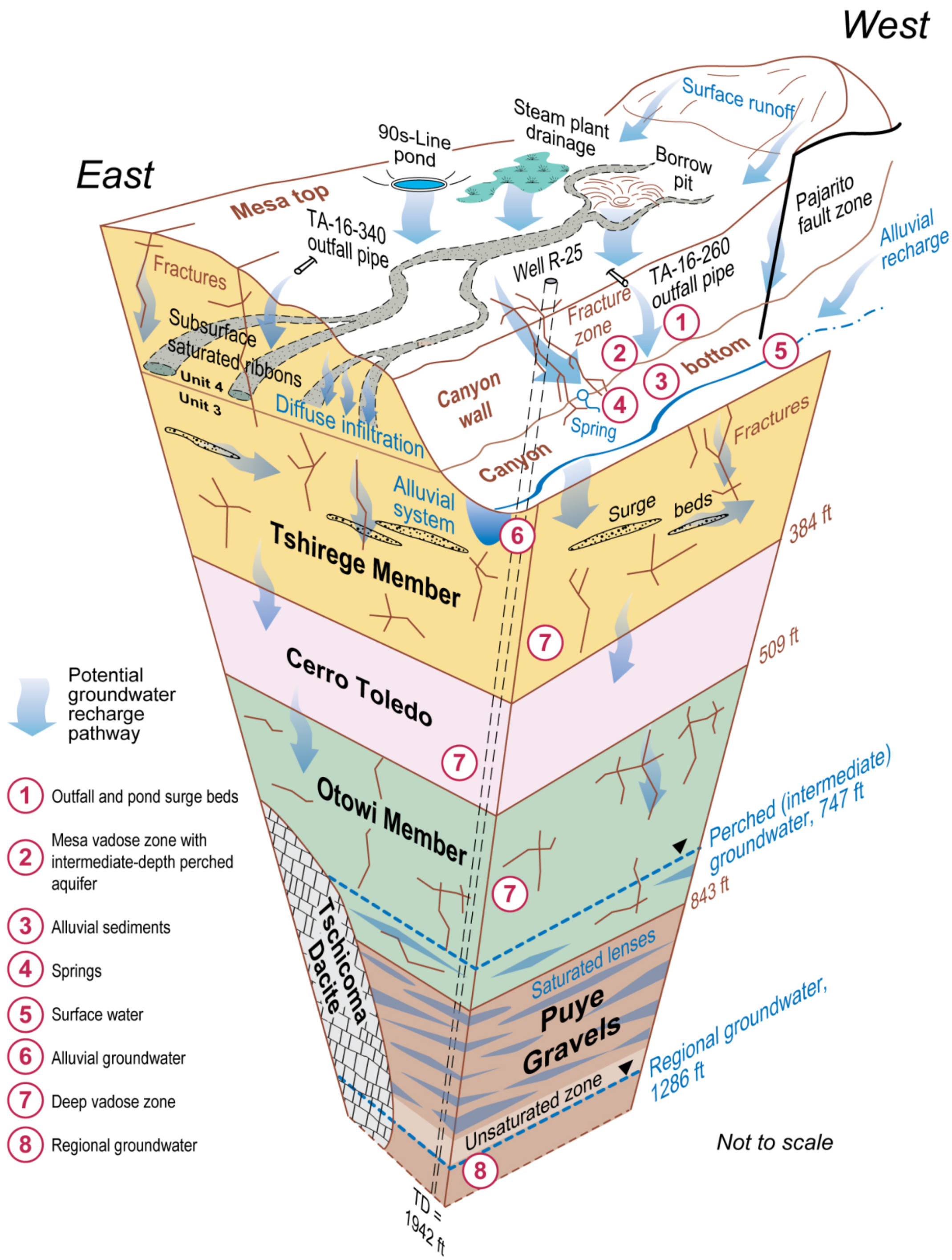

Figure 3 Conceptual site model for contaminant transport at TA-16, with focus on the outfall source region, alluvial system, and mesa vadose zone

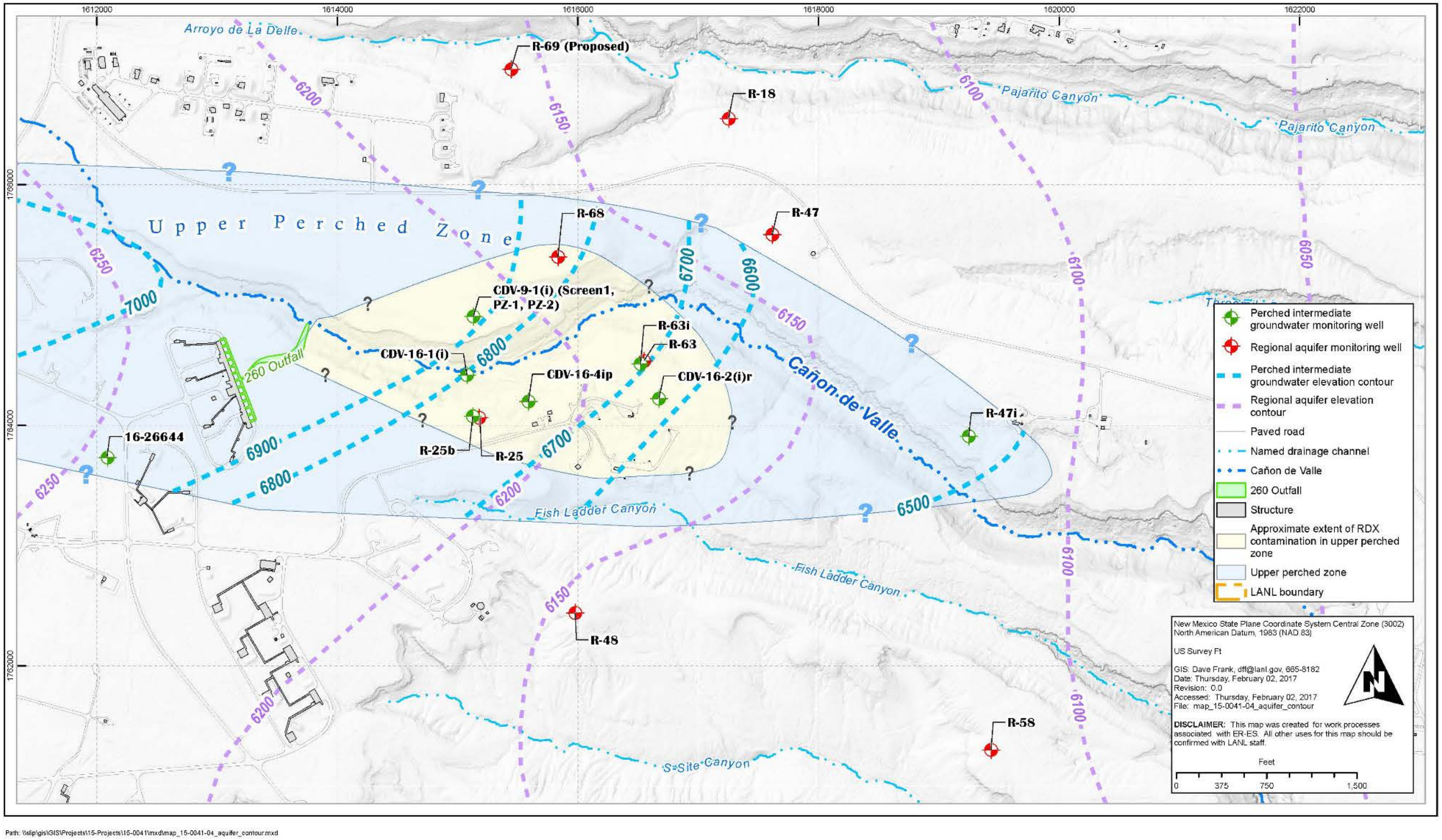

Figure 4 **Hypothesized extent of deep-perched groundwater zones in the study area and regional water table at TA-16**

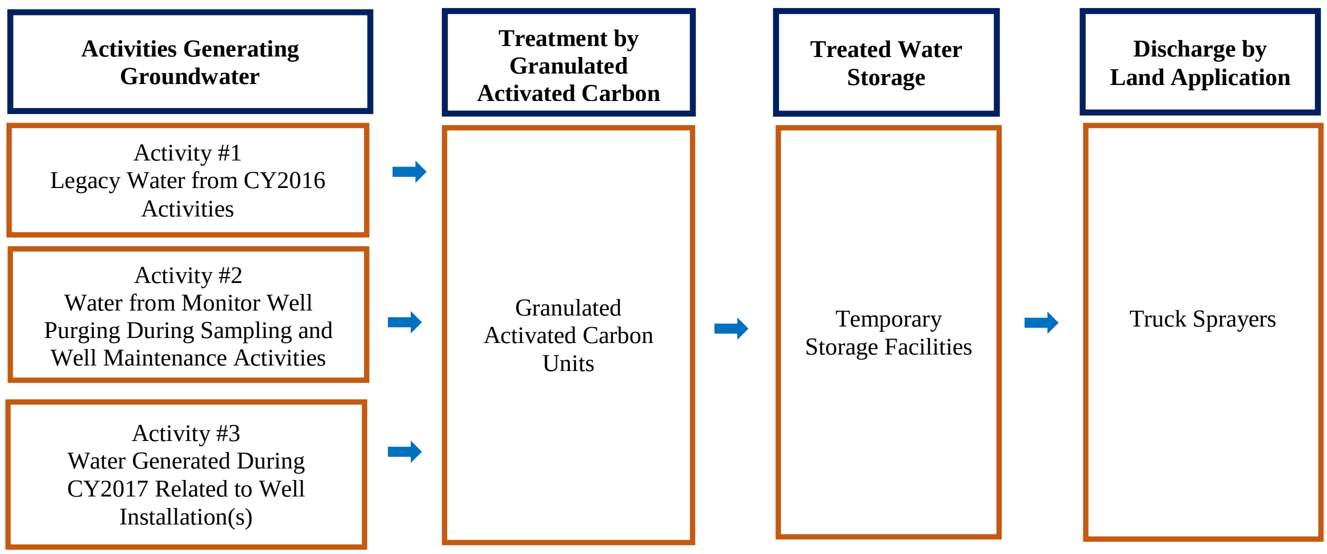

Figure 5 Block Flow Diagram of Multiple Activities Treatment, Storage, and Land-Application Systems

ENCLOSURE 3

TA-16 260 Monitoring Group Excerpts from the Interim Facility-Wide Groundwater Monitoring Plan for the 2017 Monitoring Year, October 2016-September 2017

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The monitoring at TA-54 provides the basis for accurately describing the groundwater conditions beneath TA-54. Base-flow and alluvial groundwater wells near and downgradient of TA-54 are not included in the TA-54 monitoring group because no evidence was found of a hydrologic connection between the subsurface contamination beneath TA-54 and adjacent canyons, as discussed in the Pajarito Canyon and Cañada del Buey IRs (LANL 2009, 106939; LANL 2009, 107497).

The regional monitoring-well network downgradient of the MDAs in TA-54 is a system that includes redundancy and is designed to provide reliable detection of contaminants reaching the regional aquifer. The wells are located both near the facility boundary and at more distal locations along the dominant regional flow direction as well as along potential local flow directions to the northeast. The locations of wells also address potential complex pathways for contaminants in the vadose zone. Because of the difficulties associated with monitoring groundwater that occurs in lavas beneath TA-54, the network is made up of two-screen wells with an upper well screen placed as close to the water table as possible to monitor the first arrival of contaminants in the aquifer and a lower screen placed in permeable aquifer sediments to monitor the primary groundwater pathways downgradient of the facility.

5.4 Scope of Activities

The TA-54 monitoring group consists of intermediate-perched and regional groundwater wells, many of which are dual-screened wells with Baski sampling systems. The TA-54 monitoring wells are shown in Figure 5.1-1.

Table 5.4-1 presents sampling locations, analytical suites, and monitoring frequencies for the TA-54 monitoring group. The analytical suites and frequencies specified are based on the results of previous investigations, CMEs, reviews of monitoring data, and direction from NMED, as stated in its approval with modifications for the 2011 Interim Plan, Revision 1 (LANL 2011, 208811; NMED 2012, 520410).

The wells in the TA-54 monitoring group are sampled quarterly or semiannually, with higher sampling frequencies for mobile constituents known to be present beneath MDAs at TA-54 (e.g., tritium and VOCs), and lower sampling frequencies for less mobile constituents or constituents not known to be present in significant quantities within the inventories of the TA-54 MDAs. The objectives for the sampling frequencies and analytical suites are presented in Table C-1.

Well screen R-40 Si shows impacts from drilling foam and is sampled only for metals, general inorganics, and low-level tritium.

Samples from monitoring well R-55i and the R-54 screen 1 show impacts from residual organic material introduced during drilling; collection of samples from these screens is limited to low-level tritium.

Regional well R-57 screen 1 and screen 2 has additional annual sampling requirements to meet a 1996 EPA authorization/agreement related to the disposal of PCBs at Area G. The 1996 agreement requires sampling for PCBs, pH, specific conductance, and chlorinated organics.

6.0 TA-16 260 MONITORING GROUP

6.1 Introduction

The TA-16 260 monitoring group (Figure 6.1-1) was established for the upper Water Canyon/ Cañon de Valle watershed to detect and monitor contaminants released from Consolidated Unit 16-021(c)-99, the TA-16 260 Outfall (hereafter, the 260 Outfall), and other sites at TA-16. The 260 Outfall is a former high explosives– (HE-) machining outfall that discharged HE-bearing water to Cañon de Valle from 1951 to 1996 and is the predominant source of contaminants detected in groundwater in the Water Canyon/Cañon de Valle area. These discharges contaminated the soils, sediments, surface waters, spring waters, and deep-perched and regional groundwater at TA-16.

The TA-16 260 monitoring group includes springs, alluvial wells, and wells completed in several deep perched-intermediate groundwater zones and in the regional aquifer. Shallow monitoring locations such as the springs and alluvial wells are included in this monitoring group because they contain HE, barium, and VOC contamination related to past activities at the 260 Outfall and other sites in the area.

TA-16 is located in the southwest corner of the Laboratory and was established to develop explosive formulations, cast and machine explosive charges, and assemble and test explosive components for the nuclear weapons program. A total of 410 SWMUs and AOCs are located within TA-16. TA-16 is bordered by Bandelier National Monument along NM 4 to the south and by the Santa Fe National Forest along NM 501 to the west. To the north and east, it is bordered by TA-08, TA-09, TA-11, TA-14, TA-15, TA-37, and TA-49. Water Canyon, a 200-ft-deep ravine with steep walls, separates NM 4 from active sites at TA-16. Cañon de Valle forms the northern border of TA-16.

6.2 Background

Surface water in the area is ephemeral, intermittent, and perennial. Perennial water derived from springs (particularly Burning Ground Spring) and storm water and snowmelt runoff that flows in canyon drainages, including Cañon de Valle, Fishladder Canyon, and Martin Spring (S-Site) Canyon. Fishladder Canyon also receives snowmelt and storm water runoff. Alluvial groundwater occasionally discharges at Fishladder Spring. The surface flow in Fishladder Canyon decreased significantly once the TA-16 340 Outfall was deactivated.

The TA-16 260 monitoring group includes alluvial monitoring wells in Cañon de Valle (e.g., CdV-16-02659), in Fishladder Canyon (FLC-16-25280), and in Martin Spring Canyon (MSC-16-06294). Groundwater in these alluvial systems is shallow, and water levels generally show responses to snowmelt runoff.

The vadose zone at TA-16 is approximately 1000 ft to 1300 ft thick and is recharged by mountain-front precipitation and subsequent percolation along the Pajarito fault zone west of TA-16 and along canyons (e.g., percolation along upper Cañon de Valle). The vadose zone contains a shallow suite of perched water zones (less than 200 ft depth from the mesa top) and two significant deep perched-intermediate groundwater zones between approximately 650 ft and 1200 ft bgs. The shallow perched zones are heterogeneous and controlled by fractures and surge beds near the contact of units 3 and 4 of the Tshirege Member. They manifest as three springs (SWSC, Burning Ground, and Martin); as intermittently saturated zones in several boreholes in the northern portions of TA-16; and in a continuously saturated zone in a borehole near the 90s Line Pond. The deep perched-intermediate groundwater zones are believed to extend from west to east for more than 6500 ft and from north to south for more than 3000 ft. Perched-intermediate groundwater was encountered at R-26 screen 1; R-25b, R-25 screens 1, 2, and 4; CdV-9-1(i); CdV-9-1(i) PZ-1; CdV-9-1(i) PZ-2, CdV-16-1(i); CdV-16-2(i)r; CdV-16-4ip; R-47i, and R-63i. No perched groundwater was observed at R-18, R-47, R-48, and R-58, limiting its north-south and east-west extent. The low-permeability Tschicoma dacite observed in R-48 (approximately 2000 ft south of Cañon de Valle) may impede the southward flow of water in the deep-perched system. The perched zones are present both within the Otowi Member of the Bandelier Tuff [R-25, R-25b, CdV-9-1(i) PZ-1, and CdV-16-1(i)] and within the Puye Formation [CdV-9-1(i) PZ-2, CdV-9-1(i), CdV-16-4ip, CdV-16-2(i)r] and R-63i. In the vicinity of CdV-16-4ip, the two perched zones are separated by 100 ft to 150 ft of Puye sediments under variable saturation (LANL 2011, 203711). To date, the degree of hydraulic connection between the perched horizons and the regional aquifer has not been fully analyzed but will be assessed in future reports.

Water-level data indicate groundwater within the perched horizons generally flows from west to east. Some evidence indicates a southerly component of flow within the Otowi Member of the Bandelier Tuff in the vicinity of R-25, possibly from recharge along Cañon de Valle. Water-level data from multiple screens in R-25 and from the two screens of CdV-16-4ip indicate water levels within the deep-perched system are lower with depth, suggesting significant vertical anisotropy, with vertical hydraulic conductivities perhaps orders of magnitude lower than horizontal hydraulic conductivities in some strata (LANL 2011, 203711). Water-level data from the recently installed well CdV-9-1(i), and the two CdV-9-1(i) piezometers show a significantly lower water level in the deeper primary screen of CdV-9-1(i) and nearly identical water levels in the two piezometers, completed above the primary screen in the Otowi and the Puye Formations.

The regional aquifer in the vicinity of northern TA-16 is predominantly unconfined, with the water table located within the Puye Formation at a depth of approximately 1108 ft to 1353 ft bgs (Appendix G). Groundwater flow in the shallow portion of the regional aquifer is generally eastward, with some perturbation near R-25, perhaps reflecting local recharge. Downgradient (east) of R-25, the regional groundwater flow direction incorporates a northerly component of flow near R-18 and R-17. Water levels in regional wells near TA-16 show little influence from transient effects of deeper water-supply pumping (LANL 2006, 091450).

Contaminant Sources and Distributions

Discharges from the former 260 Outfall at Consolidated Unit 16-021(c)-99 from 1951 to 1996 served as a primary source of source of HE and inorganic contamination found throughout the site (LANL 1998, 059891; LANL 2003, 085531; LANL 2011, 207069). Results of the intermediate and regional groundwater CME for the 260 Outfall (LANL 2007, 098734) show the drainage channel below the outfall and the canyon bottom as well as surface water, alluvial groundwater, and deep-perched groundwater, are contaminated with explosive compounds, including RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine); HMX (octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine); TNT (2,4,6-trinitrotoluene); and barium. In addition, the VOCs tetrachloroethene and TCE have been detected in springs, alluvial groundwater, and perched-intermediate groundwater. Low concentrations of tetrachloroethene have also been detected in the regional aquifer in R-25 (screen 5) and in R-18. RDX has also been detected in the regional aquifer in wells R-18, R-25 (in screens 5 and 6), and R-63.

The primary migration pathway for these contaminants is thought to consist of (1) discharge as effluent from the 260 Outfall, (2) surface flow to Cañon de Valle via a small tributary drainage, (3) downcanyon transport by surface-water flow and alluvial groundwater, (4) and percolation through the vadose zone as recharge to the deep-perched groundwater zones and potentially into the regional aquifer.

Groundwater in the perched horizons contains the largest inventory of HE in the environment on a mass basis, with estimates ranging from hundreds of kilograms of RDX to of thousands of kilograms of RDX.

Investigations of vadose zone and regional groundwater at TA-16 have been conducted during the past several years, and the results of these investigations are discussed in several reports (e.g., Longmire 2005, 088510; LANL 2006, 093798; LANL 2007, 096003; LANL 2007, 095787; LANL 2011, 203711; LANL 2011, 207069). HE-contaminated sediments below the outfall and in the drainage were removed during an IM in 2000 and 2001 and during a corrective measures implementation (CMI) for the surface and alluvial groundwater completed in 2010 (LANL 2002, 073706; LANL 2010, 108868; LANL 2010, 110508). During the IM and CMI, approximately 1300 yd^3 of sediment containing 8500 kg of HE was removed.

Recent data for deep groundwater show persistent elevated RDX concentrations in CdV-4ip (at ~150 µg/L), and increasing RDX concentrations in regional well R-18 (at ~3 µg/L) and in deep perched-intermediate well CdV-16-2(i). RDX concentrations in CdV-16-2(i) have more than doubled during the 10 yr since the well was installed, with the most recent sampling data showing RDX on the order of 130 µg/L. Elevated RDX concentrations have also been detected in perched-intermediate groundwater north of Cañon de Valle; RDX concentrations in screening samples collected during installation of CdV-9-1(i) range from ~80 µg/L to ~250 µg/L, while RDX concentrations in the primary screen of CdV-9-1(i) collected during routine groundwater sampling conducted for the MY2016 Interim Plan are on the order of ~25 µg/L

6.3 Monitoring Objectives

The monitoring objective for the TA-16 260 monitoring group is to further refine the nature and extent of contamination originating from the area and to monitor fate and transport for the detected contaminants. These data will support the planned revision to the intermediate and regional groundwater CME for the 260 Outfall (LANL 2007, 098734; LANL 2008, 103165). This group's monitoring focuses on HE and VOC contamination in the upper Cañon de Valle watershed.

Considerable planning effort has been undertaken to include test and monitoring activities that will provide sufficient data to complete the CME. These activities include the deployment of a tracer in 2015 and ongoing tracer monitoring in intermediate and regional groundwater (LANL 2015, 600535); cross-hole extended pumping tests in three monitoring wells planned for 2016 (LANL 2015, 600686); an in-depth technical evaluation of all geology, geochemistry, and geohydrology data to update the conceptual model for contamination at TA-16; a reassessment of the RDX inventory based on recent analytical data from new wells; laboratory studies of RDX degradation and development of a three-dimensional flow and transport model for the area.

Successful completion of these activities over the next few years should provide the data needed to analyze the corrective action alternatives for groundwater contamination at TA-16 and to complete the CME.

In 2015, tracers were deployed in deep perched groundwater monitoring wells R-25b, CdV-9-1(i), and CdV-16-1(i), and in piezometers CdV-9-1(i) PZ-1 and PZ-2 (LANL 2015, 600535). Tracer breakthrough sampling in these wells and in select downgradient wells will continue in FY2017. Sampling for tracers will be conducted during routine sampling conducted for the MY2017 Interim Plan.

6.4 Scope of Activities

Active monitoring locations in the TA-16 260 monitoring group include alluvial groundwater wells, perched-intermediate groundwater wells, regional groundwater wells, and springs. These locations are shown in Figure 6.1-1. Sampling locations, analytical suites, and monitoring frequencies for the TA-16 260 monitoring group are presented in Table 6.4-1.

Additional base-flow and alluvial groundwater monitoring is conducted as general surveillance in the watershed (section 8.6). Monitoring of deep groundwater from the perched-intermediate and regional aquifers represents a long-term data set that indicates what constituents are present and their trends and variability. Additional rounds are maintained for some constituents in the perched-intermediate groundwater as an early-detection location for potential migration of those constituents from secondary sources in the vadose zone.

The sampling frequency for most locations in the TA-16 260 monitoring group is quarterly to collect data to support the CME. Monitoring well R-63i has limited yield and will be monitored for water levels only. The objectives for the sampling frequencies and analytical suites are presented in Table C-1.

Table 6.4-1
Interim Monitoring Plan for TA-16 260 Group

Location	Watershed	Monitoring Group	Surface Water Body or Source Aquifer	Metals	VOCs	SVOCs	Low-MDL VOCs and SVOCs	PCBs	HEXMOD	Dioxins/Furans	Radionuclides	Tritium	Low-Level Tritium	General Inorganics	Tracers (TA-16 260 Study)
Canon de Valle below MDA P	Water	TA-16 260	Base flow	Q	S	B (2018)[a]	—[b]	V (2020)[c]	Q	V (2020)	B (2018)	—	—	Q	—
Between E252 and Water at Beta	Water	TA-16 260	Base flow	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
Water at Beta	Water	TA-16 260	Base flow	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
Pajarito below S&N Ancho E Basin Confluence	Pajarito	TA-16 260	Base flow	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
Bulldog Spring	Pajarito	TA-16 260	Spring	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
SWSC Spring	Water	TA-16 260	Spring	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
Burning Ground Spring	Water	TA-16 260	Spring	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
Martin Spring	Water	TA-16 260	Spring	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
FLC-16-25280	Water	TA-16 260	Alluvial	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
CdV-16-02656	Water	TA-16 260	Alluvial	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
CdV-16-02659	Water	TA-16 260	Alluvial	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
CdV-16-611923	Water	TA-16 260	Alluvial	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
MSC-16-06293	Water	TA-16 260	Alluvial	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
MSC-16-06294	Water	TA-16 260	Alluvial	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
PRB Alluvial Seep	Water	TA-16 260	Alluvial	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
CdV-16-611937	Water	TA-16 260	Alluvial	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	—	Q	—
16-26644	Water	TA-16 260	Intermediate	Q	S	B (2018)	—	—	Q	—	B (2018)	—	A	Q	—
CdV-9-1(i) S1	Water	TA-16 260	Intermediate	Q	Q	Q	—	A	Q	A	A	—	S	Q	Q
CdV-16-1(i)	Water	TA-16 260	Intermediate	Q	S	B (2018)	—	—	Q	—	B (2018)	—	A	Q	Q
CdV-16-2(i)r	Water	TA-16 260	Intermediate	Q	S	B (2018)	—	—	Q	—	B (2018)	—	A	Q	Q
CdV-16-4ip S1	Water	TA-16 260	Intermediate	Q	S	B (2018)	—	V (2020)	Q	V (2020)	B (2018)	—	A	Q	Q
CdV-37-1(i)	Water	TA-16 260	Intermediate	S	S	B (2018)	—	—	S	—	B (2018)	—	A	S	—
R-25 S1	Water	TA-16 260	Intermediate	Q	S	—	—	—	Q	—	—	—	A	Q	Q
R-25 S2	Water	TA-16 260	Intermediate	Q	S	—	—	—	Q	—	—	—	A	Q	Q
R-25 S4	Water	TA-16 260	Intermediate	Q	S	—	—	—	Q	—	—	—	A	Q	Q
R-25b	Water	TA-16 260	Intermediate	Q	S	B (2018)	—	—	Q	—	B (2018)	—	A	Q	Q
R-26 PZ-2	Water	TA-16 260	Intermediate	Q	Q	B (2018)	—	—	S	—	B (2018)	—	A	Q	—

Table 6.4-1 (continued)
Interim Monitoring Plan for TA-16 260 Group

Location	Watershed	Monitoring Group	Surface Water Body or Source Aquifer	Metals	VOCs	SVOCs	Low-MDL VOCs and SVOCs	PCBs	HEXMOD	Dioxins/Furans	Radionuclides	Tritium	Low-Level Tritium	General Inorganics	Tracers (TA-16 260 Study)
R-26 S1	Water	TA-16 260	Intermediate	S	S	B (2018)	—	—	S	—	B (2018)	—	A	S	—
R-47i	Water	TA-16 260	Intermediate	Q	S	B (2018)	—	—	Q	—	B (2018)	—	A	Q	Q
R-47	Water	TA-16 260	Regional	Q	Q	Q	—	A	Q	A	A	—	S	Q	Q
CdV-R-15-3 S4	Water	TA-16 260	Regional	S	S	B (2018)	—	—	S	—	B (2018)	—	A	S	—
CdV-R-37-2 S2	Water	TA-16 260	Regional	—	—	—	—	—	A	—	—	—	A	—	—
R-18	Pajarito	TA-16 260	Regional	Q	Q	B (2018)	—	—	Q	—	B (2018)	—	A	Q	Q
R-25 S5	Water	TA-16 260	Regional	Q	S	—	—	—	Q	—	—	—	A	Q	Q
R-25 S6	Water	TA-16 260	Regional	Q	S	—	—	—	Q	—	—	—	A	Q	—
R-25 S7	Water	TA-16 260	Regional	Q	S	—	—	—	Q	—	—	—	A	Q	—
R-48	Water	TA-16 260	Regional	Q	S	B (2018)	—	—	Q	—	B (2018)	—	A	Q	Q
R-58[d]	Water	TA-16 260	Regional	Q1	Q1	Q1	—	Q1	Q1	Q1	Q1	—	Q1	Q1	Q1
R-58[e]	Water	TA-16 260	Regional	Q	Q	Q	—	A	Q	A	A	—	S	Q	Q
R-63	Water	TA-16 260	Regional	Q	S	B (2018)	—	—	Q	—	B (2018)	—	A	Q	Q

Notes: Sampling suites and frequencies: Q = quarterly (4 times/yr); S = semiannual (2 times/yr); A = annual (1 time/yr); B = biennial (1 time/2 yr); T = triennial (1 time/3 yr); V = quinquennial (1 time/5 yr) Q1 = Monitor Year 2017 Q1 only.

[a] 2018 = Samples scheduled to be collected during implementation of MY2018 Interim Plan.

[b] — = This analytical suite is not scheduled to be collected for this type of water at locations assigned to this monitoring group.

[c] 2020 = Samples scheduled to be collected during implementation of MY2020 Interim Plan.

[d] R-58 sampling plan for MY2017 Q1 only. This Q1 sampling plan for R-58 produces the fourth "full analytical suite" sampling round (out of four required) for this new regional well.

[e] R-58 sampling frequencies for MY2017 Q2, Q3 and Q4. Use the specified sampling frequencies in conjunction with Table 1.7-1 to develop the R-58 sampling plan for Q2, Q3 and Q4.

Table 7.4-1
Interim Monitoring Plan for MDA AB Monitoring Group

Location	Watershed	Monitoring Group	Surface Water Body or Source Aquifer	Metals	VOCs	SVOCs	Low-MDL VOCs and SVOC	PCBs	HEXP	Dioxins/Furans	Radionuclides	Tritium	Low-Level Tritium	General Inorganics
R-27i	Water	MDA AB	Intermediate	A	A	A	—*	—	—	—	A	—	A	A
R-27	Water	MDA AB	Regional	A	A	A	—	—	—	—	A	—	A	A
R-29	Ancho	MDA AB	Regional	S	S	S	—	—	S	—	S	—	S	S
R-30	Ancho	MDA AB	Regional	S	S	S	—	—	S	—	S	—	S	S

Notes: Sampling suites and frequencies: Q = quarterly (4 times/yr); S = semiannual (2 times/yr); A = annual (1 time/yr); B = biennial (1 time/2 yr); T = triennial (1 time/3 yr); V = quinquennial (1 time/5 yr).

* — = This analytical suite is not scheduled to be collected for this type of water at locations assigned to this monitoring group.

ENCLOSURE 4

As-Built Specifications for
TA-16 260 Monitoring Group Wells

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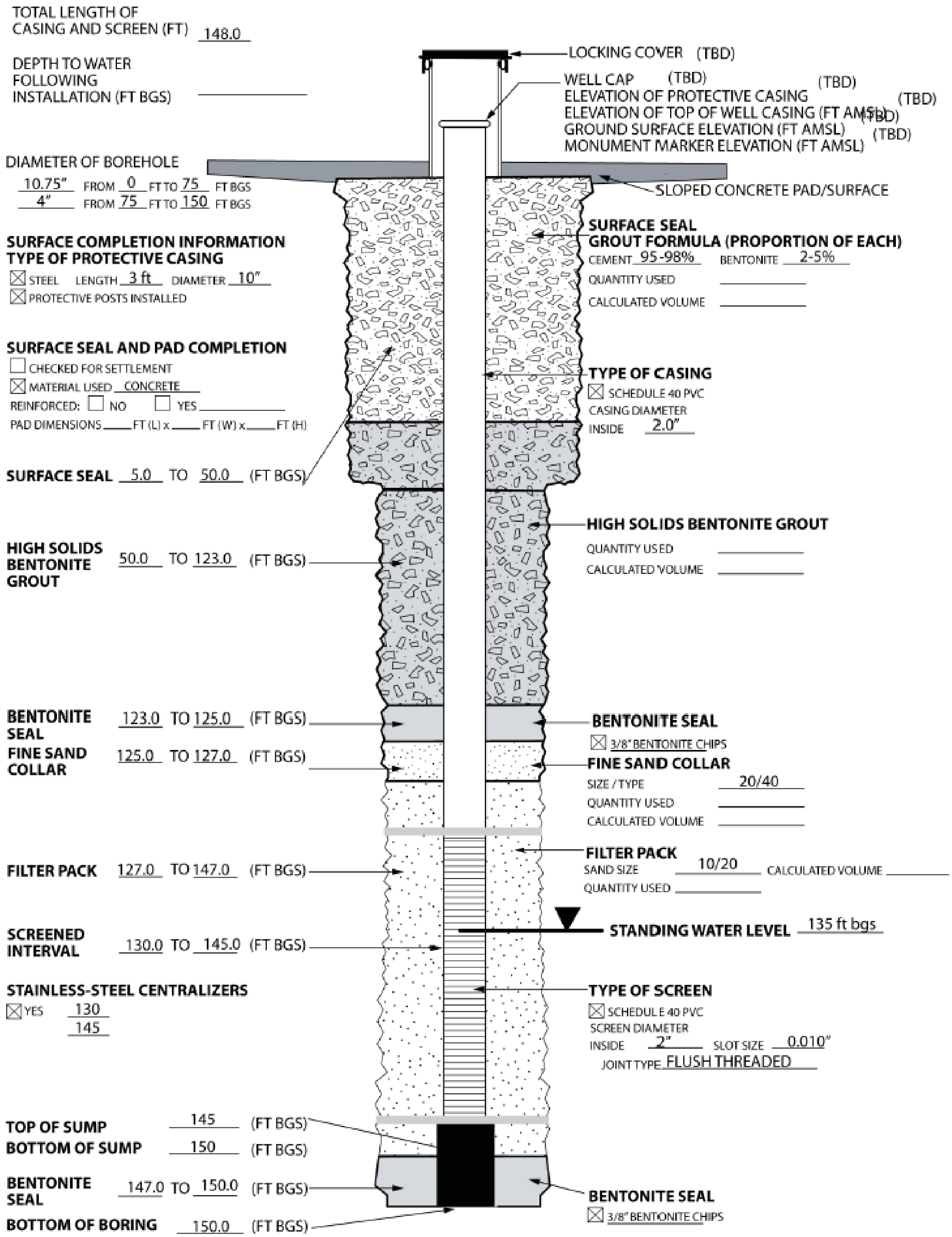
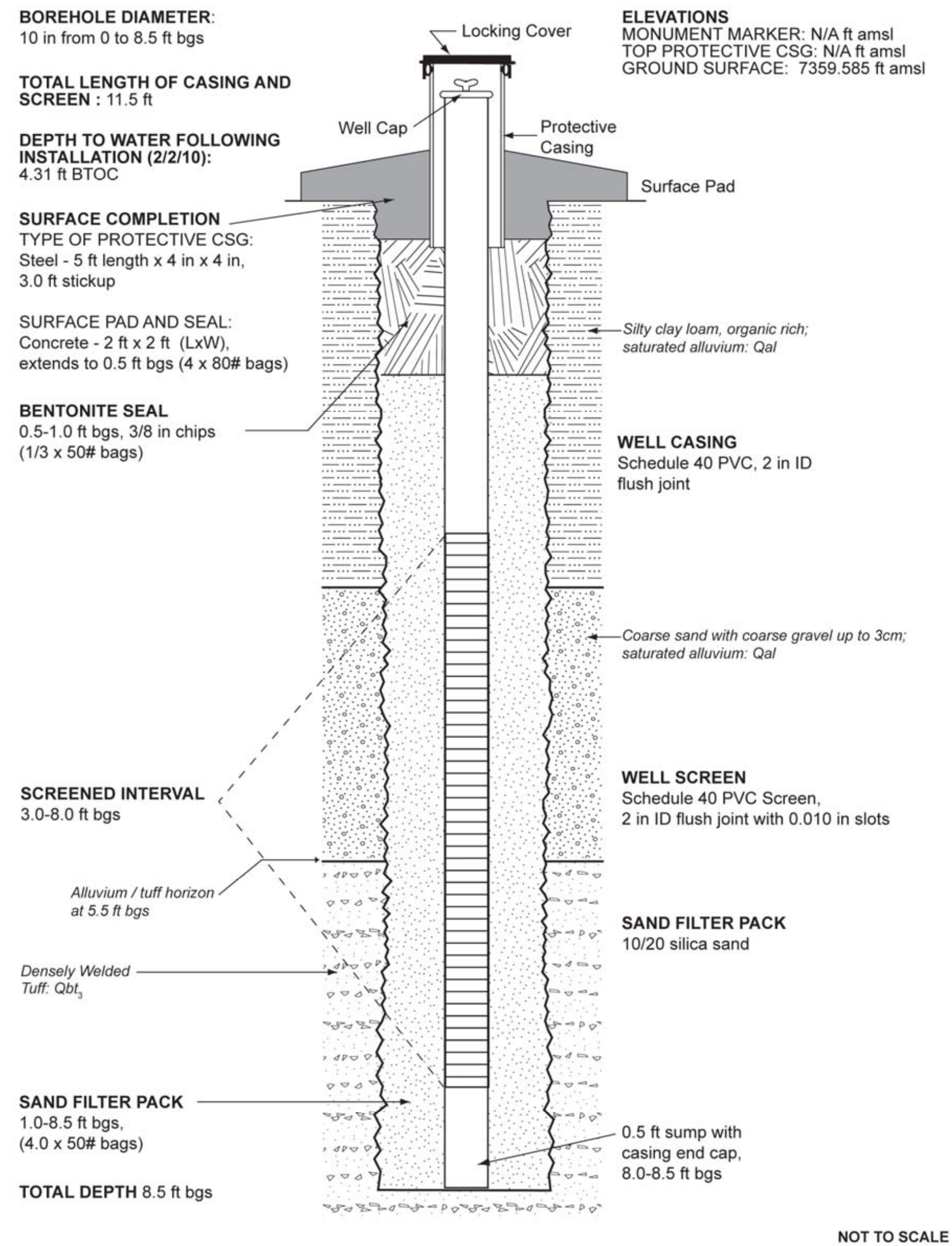


Figure A-25 16-26644 well design

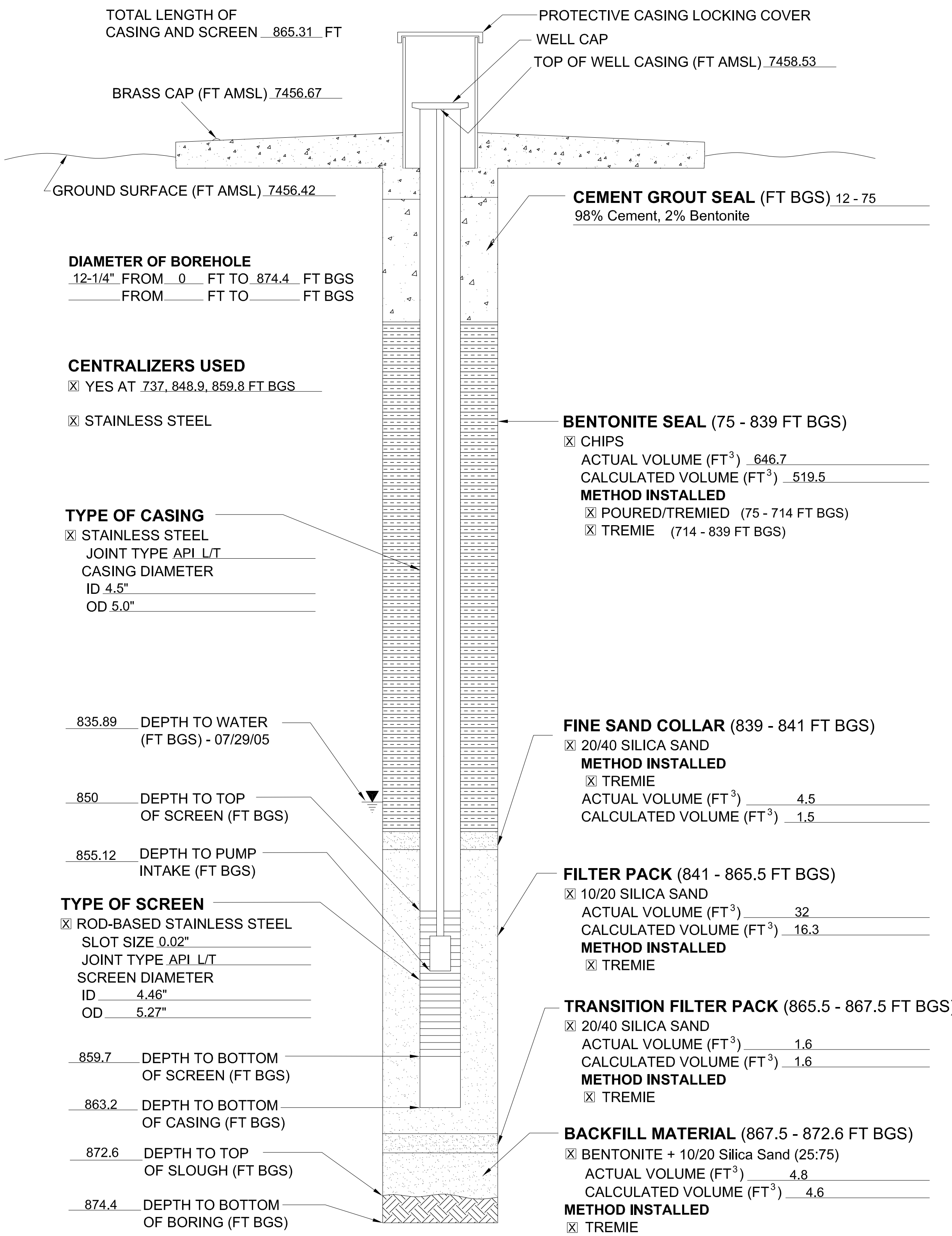
Table 2.0-1
Summary of PRB Monitoring Wells and Piezometers and Recommended Disposition for Each Location

Location	Alternate Name	Total Depth (ft bgs)	Recommended Disposition	Notes
Upgradient Alluvial Wells				
CdV-16-611919	MW-2	8.0	No longer exists	Washed away during August 21, 2011, flood
CdV-16-611920	MW-5	12.5	P&A	
CdV-16-611921	MW-4	14.4	P&A	
CdV-16-611922	MW-3	13.3	P&A	
CdV-16-611923	MW-12	8.7	Retain for long-term monitoring	MY2016 and MY2017 Interim Facility-Wide Groundwater Monitoring Plan location. Retain for long-term monitoring.
Upgradient Piezometers				
16-611924	MW-13, PZ-13	~ 10 to 15	Retain	Piezometer damaged by August 3, 2011, floodwater and debris
16-611925	MW-14, PZ-14	~ 10 to 15	Retain	
16-611926	MW-15, PZ-15	~ 10 to 15	Retain	
16-611927	MW-16, PZ-16	~ 10 to 15	Retain	
Downgradient Alluvial Wells				
CdV-16-611928	MW-6	13.0	P&A	
CdV-16-611929	MW-7	13.1	P&A remaining portion of piezometer	Well broken off during August 21, 2011, flood
CdV-16-611930	MW-8	13.0	P&A remaining portion of piezometer	Well broken off during August 21, 2011, flood
CdV-16-611931	MW-9	12.0	P&A	Surface completion and well housing destroyed during August 21, 2011, flood, leaving only PVC well casing
CdV-16-611932	MW-10	13.0	P&A	
CdV-16-611933	MW-17	9.0	P&A	
CdV-16-611934	MW-18	8.0	No longer exists	Alluvial well washed away during August 21, 2011, flood.
CdV-16-611935	MW-11	12.0	P&A	
CdV-16-611936	MW-19	7.5	No longer exists	Alluvial well washed away during August 21, 2011, flood.
CdV-16-611937	MW-20	8.5	Retain for long-term monitoring	MY2017 Interim Facility-Wide Groundwater Monitoring Plan monitoring location. Retain for long-term monitoring.
CdV-16-611938	MW-1	8.5	No longer exists	Alluvial well washed away during August 21, 2011, flood.

Note: All PRB monitoring wells and piezometers are 2-in.-I.D. PVC.



TerranearPMC	Drafted By: A. Stocker Date: February 10, 2010	PRB ALLUVIAL MONITORING WELL SCHEMATIC: MW-20 Technical Area 16 Los Alamos National Laboratory, Los Alamos, New Mexico



WELL DEVELOPMENT INFORMATION

WELL COMPLETION BEGAN
DATE 7/25/05 TIME 11:42
WELL COMPLETION FINISHED
DATE 7/30/05 TIME 18:00

WELL DEVELOPMENT BEGAN
DATE 08/02/05 TIME 11:42
WELL DEVELOPMENT FINISHED
DATE 08/22/05 TIME 07:25

DEVELOPMENT METHOD
☒ SWABBING ☒ BAILING
☒ PUMPING
TOTAL PURGE VOLUME 11,320 GALLONS

PARAMETER MEASUREMENTS
pH 7.40
TEMPERATURE 19.15 °C
SPECIFIC CONDUCTANCE 132.2 µS
TURBIDITY 10.5 NTU

KLEINFELDER

Drawn By: C. Bhongir	Date: November 2005
Project No.: 49436	Filename: 49436_03_0.dwg
Scale: not-to-scale	Revision: Rev 0

WELL SCHEMATIC
Characterization Well CdV-16-2(i)r
Cañon de Valle
Los Alamos National Laboratory
Los Alamos, New Mexico

FIGURE
7.2-1

G:\Environ\49436 - DOE Mortandad Canyon\DOE-LANL_2005-06_Drilling\Project Plans\Fact Sheets\CdV-16-2(i)r\Report Figures\49436_03_0.dwg

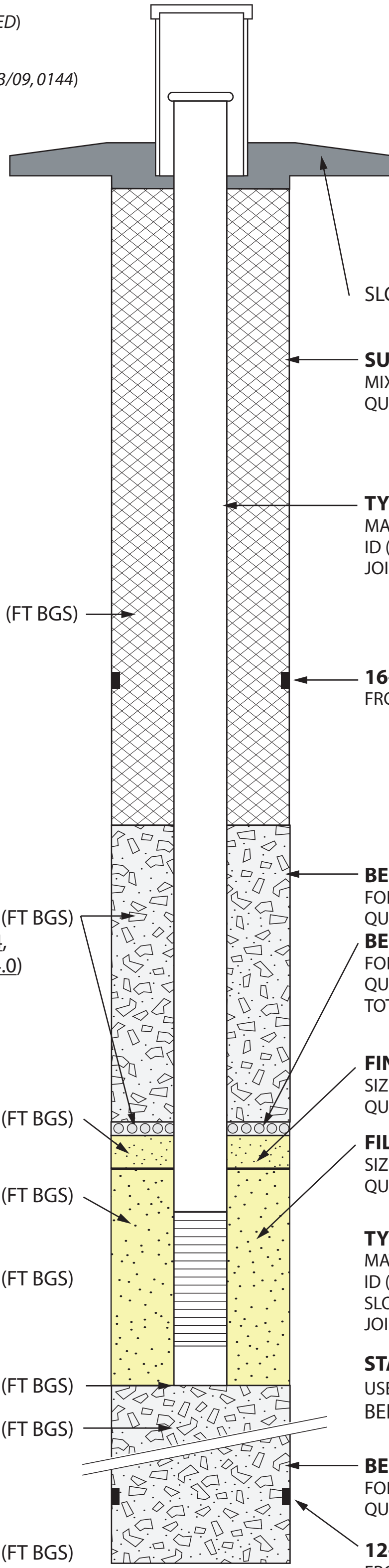
TOTAL LENGTH
OF CASING AND SCREEN (FT) 661.8 (*UNTRIMMED*)

DEPTH TO WATER
FOLLOWING INSTALLATION (FT BGS) 627.9 (*12/03/09, 0144*)

DIAMETER OF BOREHOLE
16.75 (IN) FROM 0.0 TO 395.0 (FT BGS)
12.75 (IN) FROM 395.0 TO 803.0 (FT BGS)

SURFACE COMPLETION (*PROPOSED*)
PROTECTIVE CASING
TYPE STEEL SIZE (IN) 10
PROTECTIVE POSTS INSTALLED YES
SURFACE SEAL AND PAD
CHECK FOR SETTLEMENT YES
PAD MATERIAL CONCRETE
REINFORCED WIRE MESH
PAD DIMENSIONS (FT) 10 (L) 10 (W) 0.5 (H)

LOCKING COVER



ELEVATIONS (FT AMSL)
WELL CAP TBD
PROTECTIVE CASING TBD
GROUND SURFACE TBD
MONUMENT MARKER TBD

WELL COMPLETION BEGAN
DATE 11/06/09 TIME 2130
WELL COMPLETION FINISHED
DATE 12/02/09 TIME 0410

SLOPED CONCRETE PAD/SURFACE

SURFACE SEAL
MIX (WT%) CEMENT 100
QUANTITY USED 795.5 FT^3 CALC 583.0 FT^3

TYPE OF CASING
MATERIAL STAINLESS-STEEL
ID (IN) 5.00 OD (IN) 5.56 (5 9/16)
JOINT TYPE THREADED/COUPLED

SURFACE SEAL 3.0 TO 457.9 (FT BGS)

16-IN CASING/SHOE
FROM 388.7 TO 395.0 (FT BGS)

BENTONITE SEAL (*UPPER PORTION*)
FORM 3/8 IN CHIP
QUANTITY USED CHIPS 93.7 FT^3
BENTONITE SEAL (*LOWER PORTION*)
FORM 1/4 IN PELLETS
QUANTITY USED PELLETS 8.0 FT^3
TOTAL BENTONITE USED 101.7 FT^3 CALC 121.2 FT^3

BENTONITE SEAL 457.9 TO 624.0 (FT BGS)
(CHIPS 457.9 TO 612.4,
PELLETS 612.4 TO 624.0)

FINE SAND COLLAR
SIZE/TYPE 20/40 SILICA
QUANTITY USED 1.5 FT^3 CALC 1.5 FT^3

FILTER PACK SAND
SIZE/TYPE 10/20 SILICA
QUANTITY USED 34.5 FT^3 CALC 23.3 FT^3

FINE SAND COLLAR 624.0 TO 625.9 (FT BGS)

FILTER PACK 625.9 TO 657.8 (FT BGS)

SCREENED INTERVAL 632.0 TO 652.5 (FT BGS)

TYPE OF SCREEN
MATERIAL STAINLESS-STEEL
ID (IN) 5.00 OD (IN) 5.88 (5 7/8)
SLOT SIZE (IN) 0.020
JOINT TYPE THREADED/COUPLED

STAINLESS-STEEL CENTRALIZERS
USED YES AT 2.0 ft ABOVE AND
BELOW WELL SCREEN

BOTTOM OF CASING 657.8 (FT BGS)

BACKFILL 657.8 TO 803.0 (FT BGS)

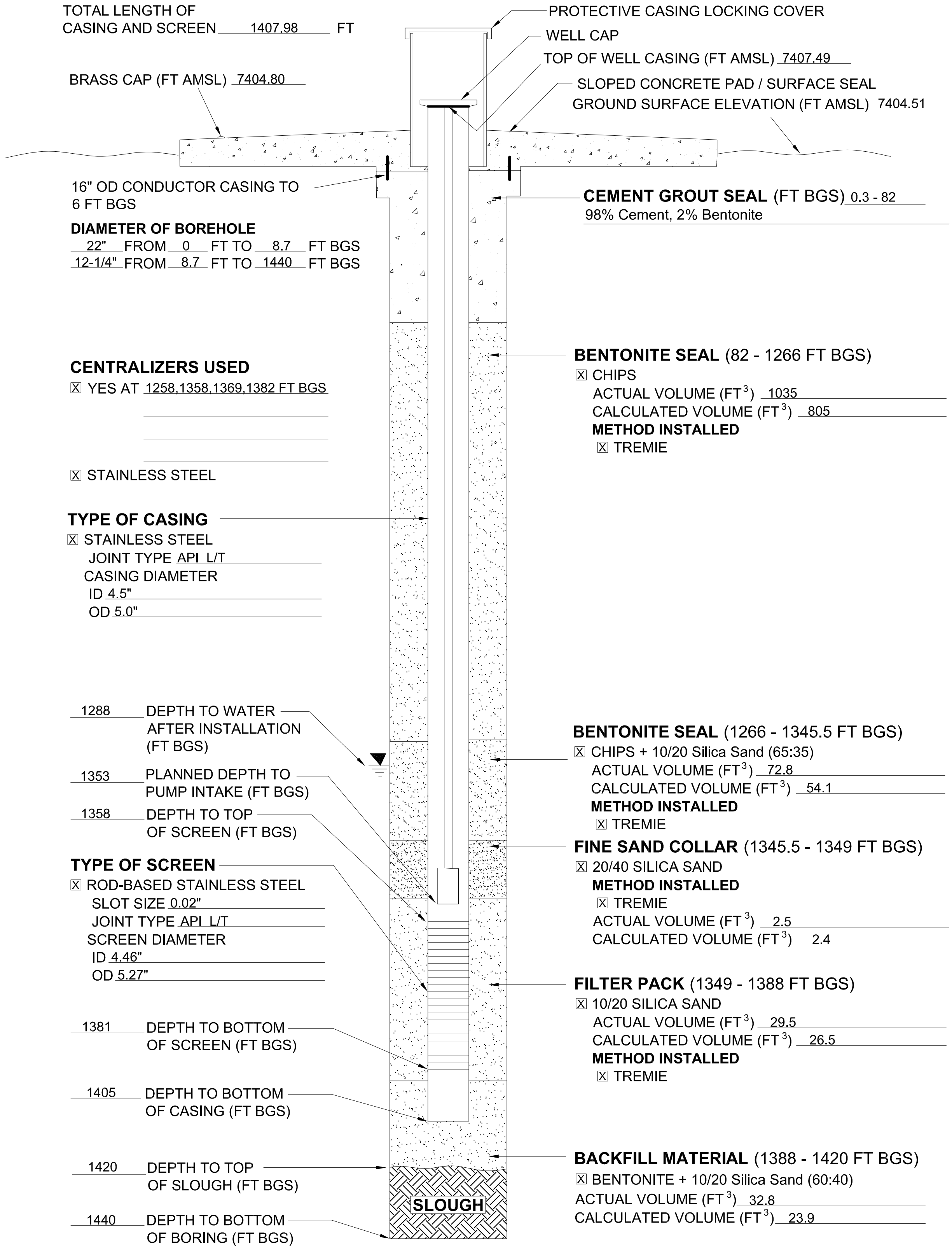
BENTONITE BACKFILL
FORM 3/8 IN CHIP
QUANTITY USED 121.4 FT^3 CALC 106.7 FT^3

BOTTOM OF BORING 803.0 (FT BGS)

12-IN CASING/SHOE
FROM 675.0 TO 678.0 (FT BGS)

TerranearPMC

Drafted By: TPMC Project Number: 80055	Date: December 16, 2009 File Name: CdV37-1i_AsBuilt_FactSheet	**WELL CDV-37-1i AS-BUILT WELL CONSTRUCTION** Canyon de Valle/Water Canyon Confluence Los Alamos National Laboratory Los Alamos, New Mexico	**Fact Sheet** **NOT TO SCALE**



WELL COMPLETION BEGAN
DATE 12/05/04 TIME 16:40

WELL COMPLETION FINISHED
DATE 12/14/04 TIME 10:40

WELL DEVELOPMENT INFORMATION
DEVELOPMENT METHOD
☒ SWABBING ☒ BAILING
☒ PUMPING
TOTAL PURGE VOLUME 18,930 GALLONS

FINAL PARAMETER MEASUREMENTS
pH 8.02
TEMPERATURE 14 °C
SPECIFIC CONDUCTANCE 67 µS
TURBIDITY 2.26 NTU

KLEINFELDER

Drawn By: C. Landon
Project No.: 37151
Date: April 2005
Filename: Figure 2.dwg

WELL SCHEMATIC
Characterization Well R-18
Pajarito Canyon
Los Alamos National Laboratory
Los Alamos, New Mexico

FIGURE 7.2-1

G:\Environ\37151 - DOE Deep Wells\R-18\Fact Sheets\Figure 7.2-1.dwg

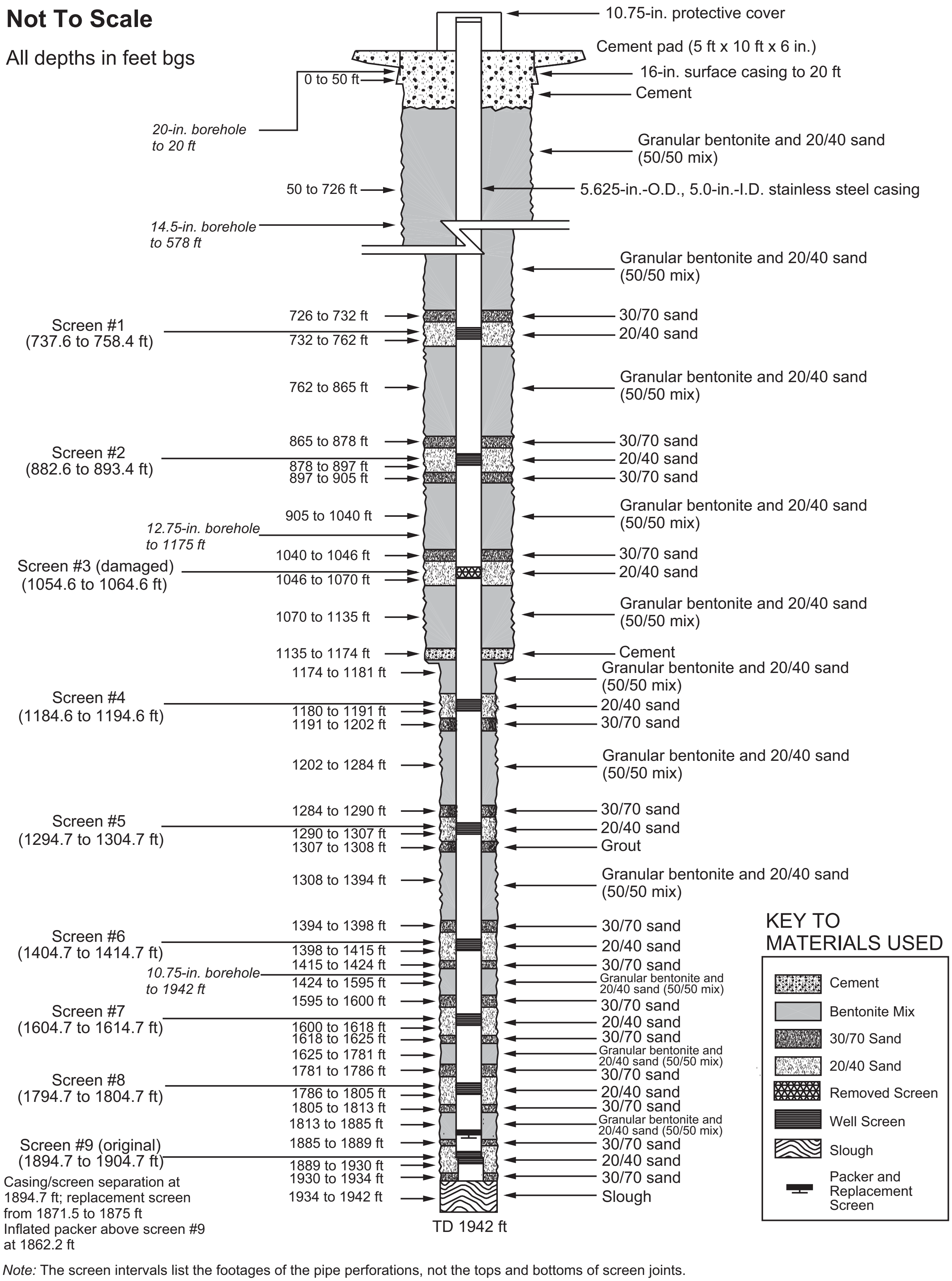


Figure 3.2-1. As-built well-completion diagram of well R-25

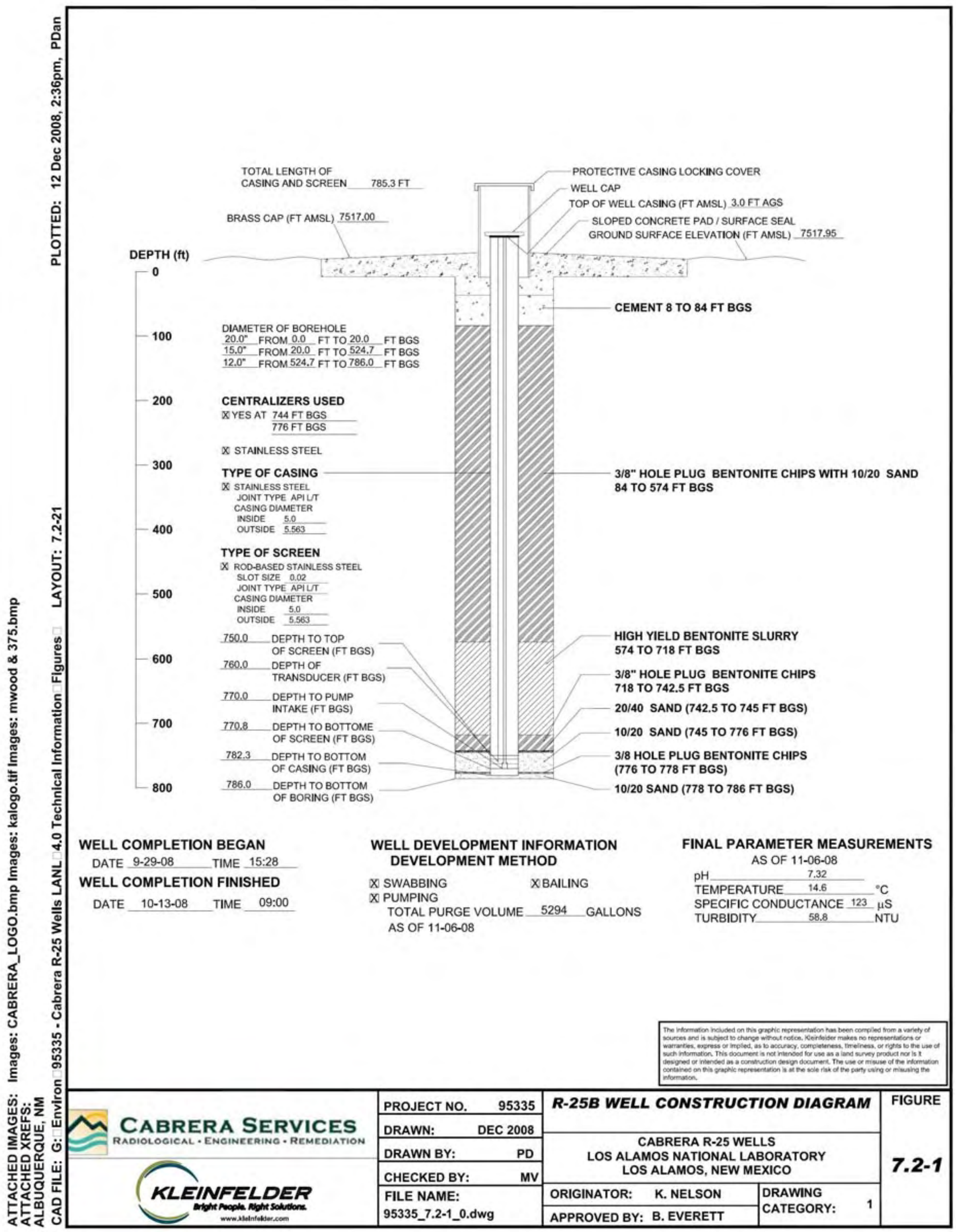
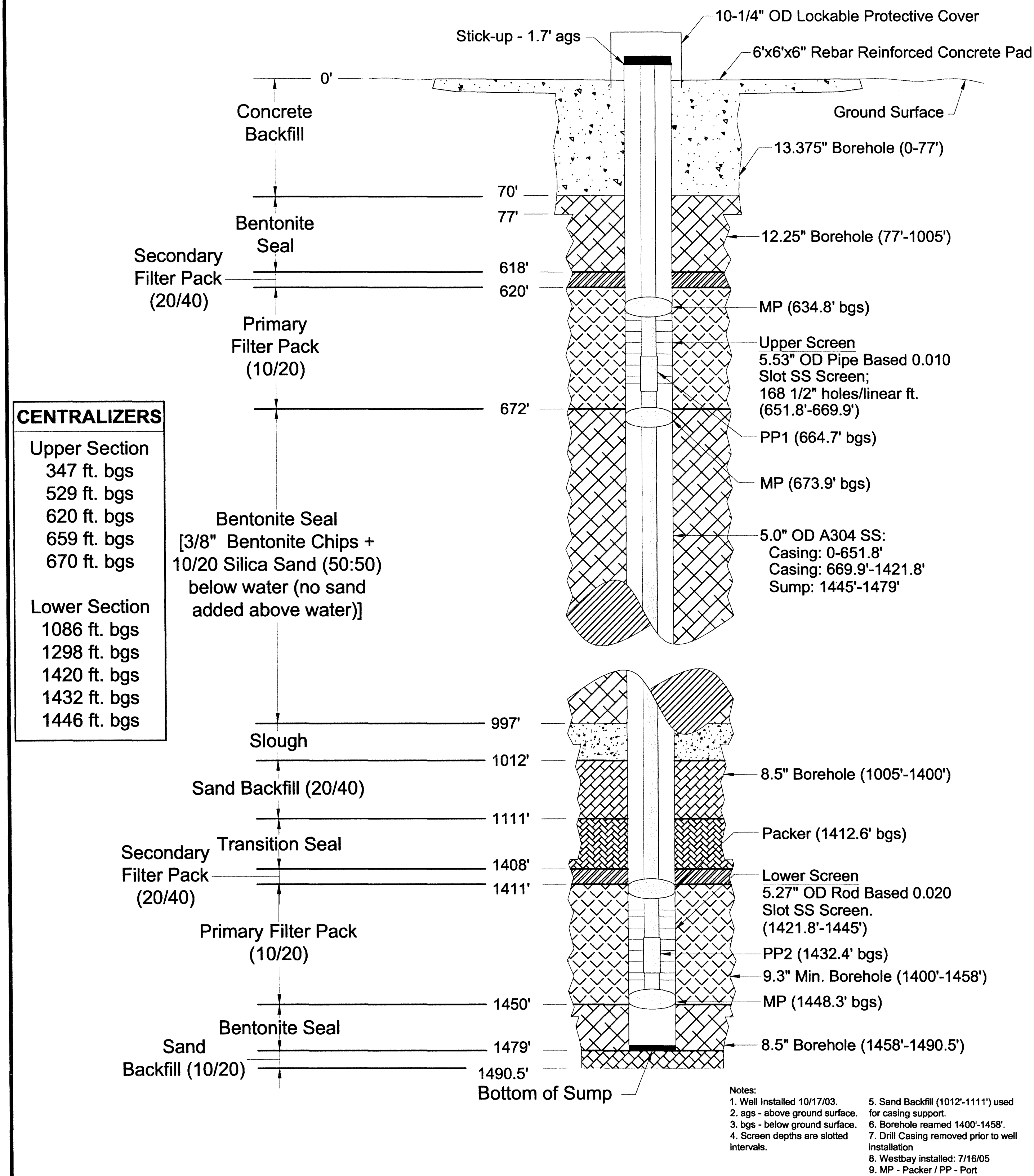


Figure 7.2-1 R-25b well construction diagram



KLEINFELDER

Drawn By: C. Landon	Date: January 2005
Project No.: 37151	Filename: Figure 7.2–1.dwg
Scale: not–to–scale	Revision: 0

WELL SCHEMATIC DIAGRAM
Well R-26
Los Alamos National Laboratory
Los Alamos, New Mexico

FIGURE
7.2-1

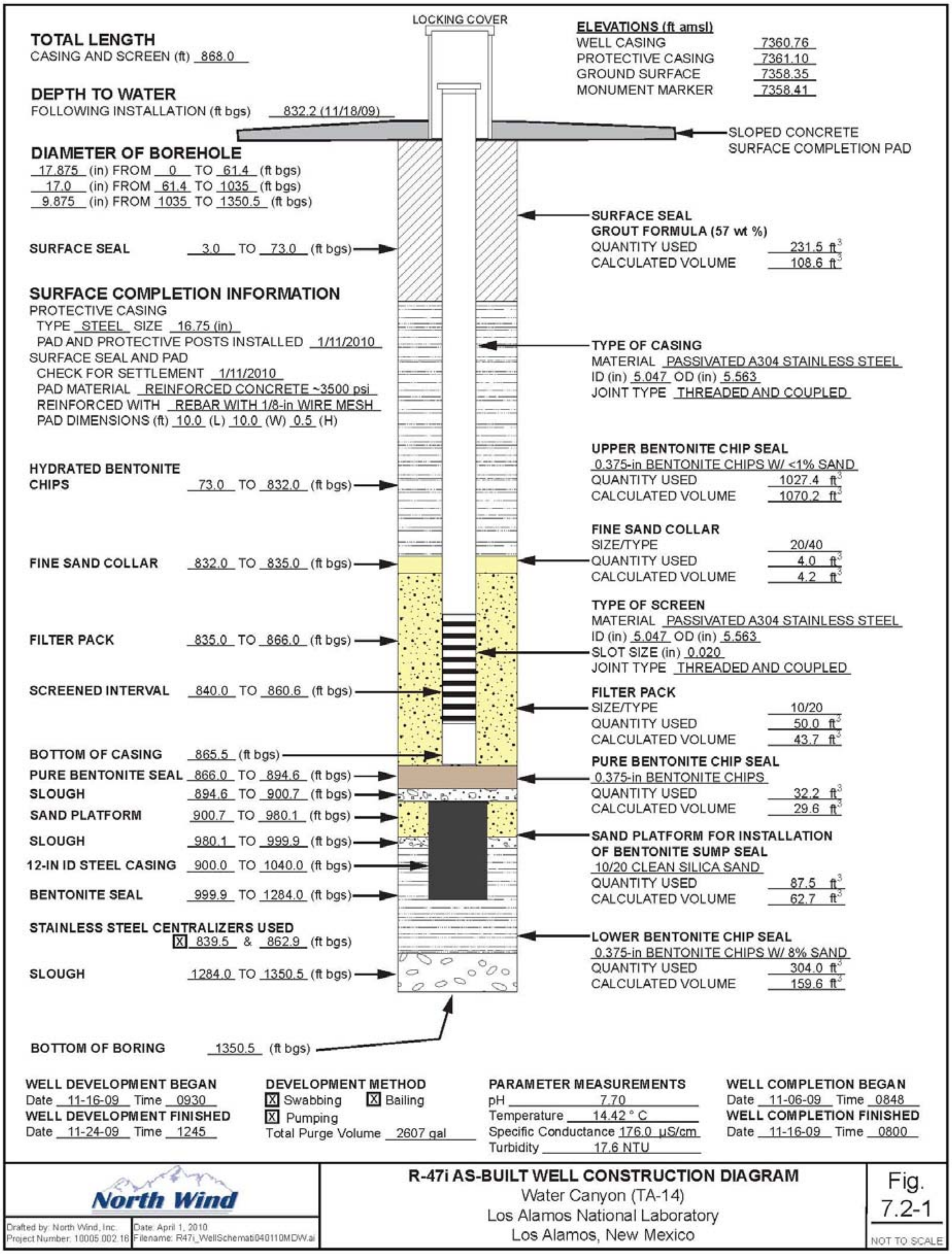
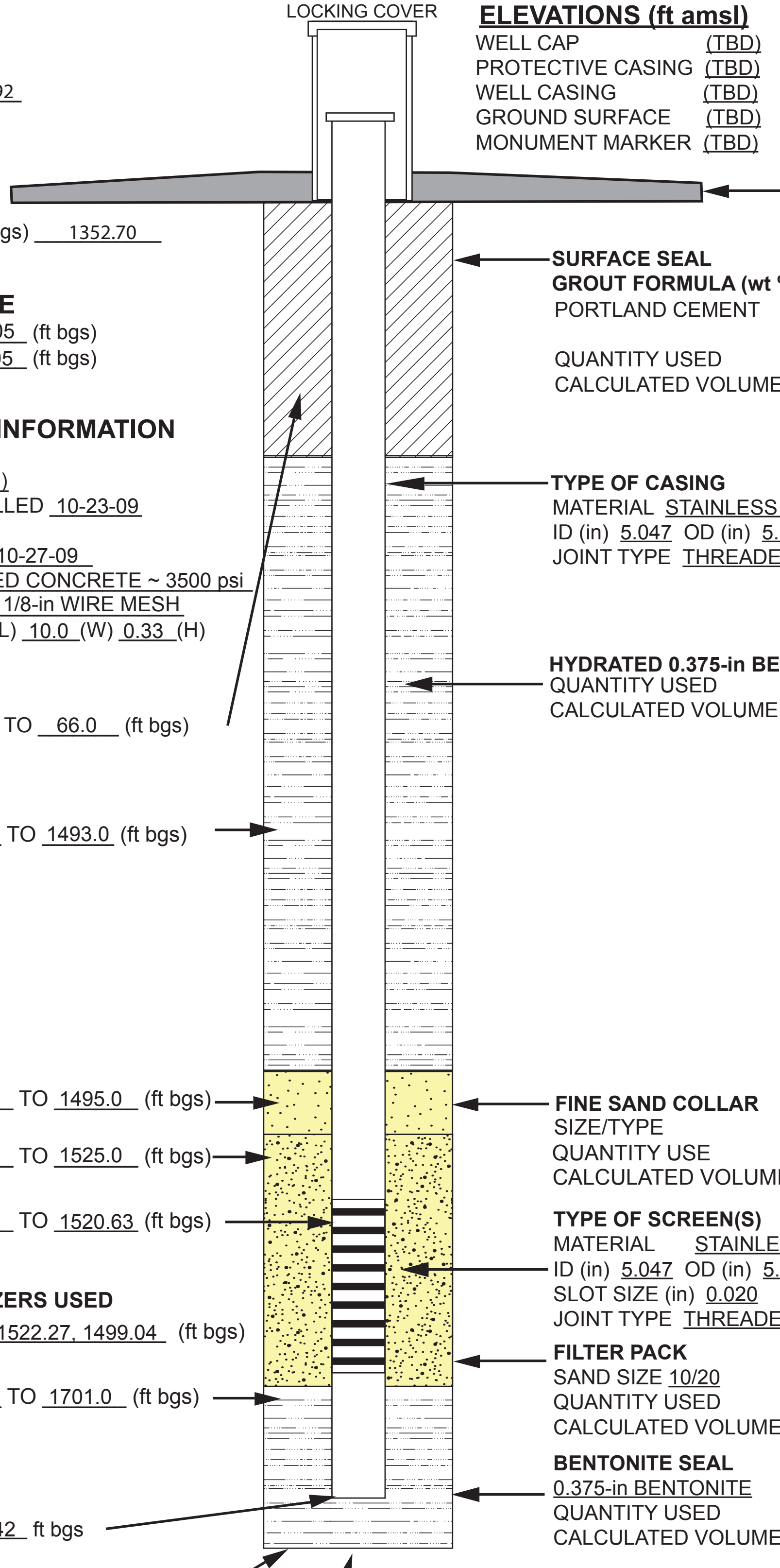


Figure 7.2-1 Monitoring well R-47i as-built well construction diagram



ELEVATIONS (ft amsl)

WELL CAP (TBD)
PROTECTIVE CASING (TBD)
WELL CASING (TBD)
GROUND SURFACE (TBD)
MONUMENT MARKER (TBD)

TOTAL LENGTH

CASING AND SCREEN (ft) 1544.92

DEPTH TO WATER

FOLLOWING INSTALLATION (ft bgs) 1352.70

DIAMETER OF BOREHOLE

12.25 (in) FROM 0 TO 1405 (ft bgs)
9 .875 (in) FROM 1405 TO 1705 (ft bgs)

SURFACE COMPLETION INFORMATION

PROTECTIVE CASING
TYPE STEEL SIZE 10.75 (in)
PROTECTIVE POSTS INSTALLED 10-23-09
SURFACE SEAL AND PAD
CHECK FOR SETTLEMENT 10-27-09
PAD MATERIAL REINFORCED CONCRETE ~ 3500 psi
REINFORCED REBAR WITH 1/8-in WIRE MESH
PAD DIMENSIONS (ft) 10.0 (L) 10.0 (W) 0.33 (H)

SURFACE SEAL 5.0 TO 66.0 (ft bgs)

HYDRATED BENTONITE CHIPS 66.0 TO 1493.0 (ft bgs)

FINE SAND COLLAR 1493.0 TO 1495.0 (ft bgs)

FILTER PACK 1495.0 TO 1525.0 (ft bgs)

SCREENED INTERVAL 1500.0 TO 1520.63 (ft bgs)

STAINLESS STEEL CENTRALIZERS USED
☒ YES AT 1541.00, 1522.27, 1499.04 (ft bgs)

BENTONITE SEAL 1525.0 TO 1701.0 (ft bgs)

BOTTOM OF CASING 1542.42 ft bgs

SLOUGH 1701.0 TO 1705.0 (ft bgs)

BOTTOM OF BORING 1705.0 (ft bgs)

SURFACE SEAL
GROUT FORMULA (wt %)
PORTLAND CEMENT (1) 94 LB BAG MIXED WITH (1) IDP-381 2 LB BAG
QUANTITY USED 51.0 ft^3
CALCULATED VOLUME 41.3 ft^3

TYPE OF CASING
MATERIAL STAINLESS STEEL
ID (in) 5.047 OD (in) 5.563
JOINT TYPE THREADED AND COUPLED

HYDRATED 0.375-in BENTONITE CHIP SEAL
QUANTITY USED 1007.01 ft^3
CALCULATED VOLUME 909.17 ft^3

FINE SAND COLLAR
SIZE/TYPE 20/40
QUANTITY USE 0.73 ft^3
CALCULATED VOLUME 0.73 ft^3

TYPE OF SCREEN(S)
MATERIAL STAINLESS STEEL
ID (in) 5.047 OD (in) 5.563
SLOT SIZE (in) 0.020
JOINT TYPE THREADED AND COUPLED

FILTER PACK
SAND SIZE 10/20
QUANTITY USED 14.50 ft^3
CALCULATED VOLUME 10.95 ft^3

BENTONITE SEAL
0.375-in BENTONITE
QUANTITY USED 107.87 ft^3
CALCULATED VOLUME 109.60 ft^3

WELL DEVELOPMENT BEGAN
Date 10-2-09 Time 0835
WELL DEVELOPMENT FINISHED
Date 10-8-09 Time 1701

DEVELOPMENT METHOD
☒ Swabbing ☒ Bailing
☒ Pumping
Total Purge Volume 9663.8 gal

PARAMETER MEASUREMENTS
pH 7.86
Temperature 21.69°C
Specific Conductance 0.1 μS·cm^{-1}
Turbidity 21.1 NTU

WELL COMPLETION BEGAN
Date 09-13-2009 Time 0820
WELL COMPLETION FINISHED
Date 09-26-2009 Time 1025

North Wind

Drafted by: North Wind, Inc.
Project Number:10005.002.20

Date: Oct 26, 2009
Filename: R-48_Well Schematic

R-48 WELL CONSTRUCTION DIAGRAM (AS BUILT)

TA-16
Los Alamos National Laboratory
Los Alamos, New Mexico

FACT SHEET

NOT TO SCALE

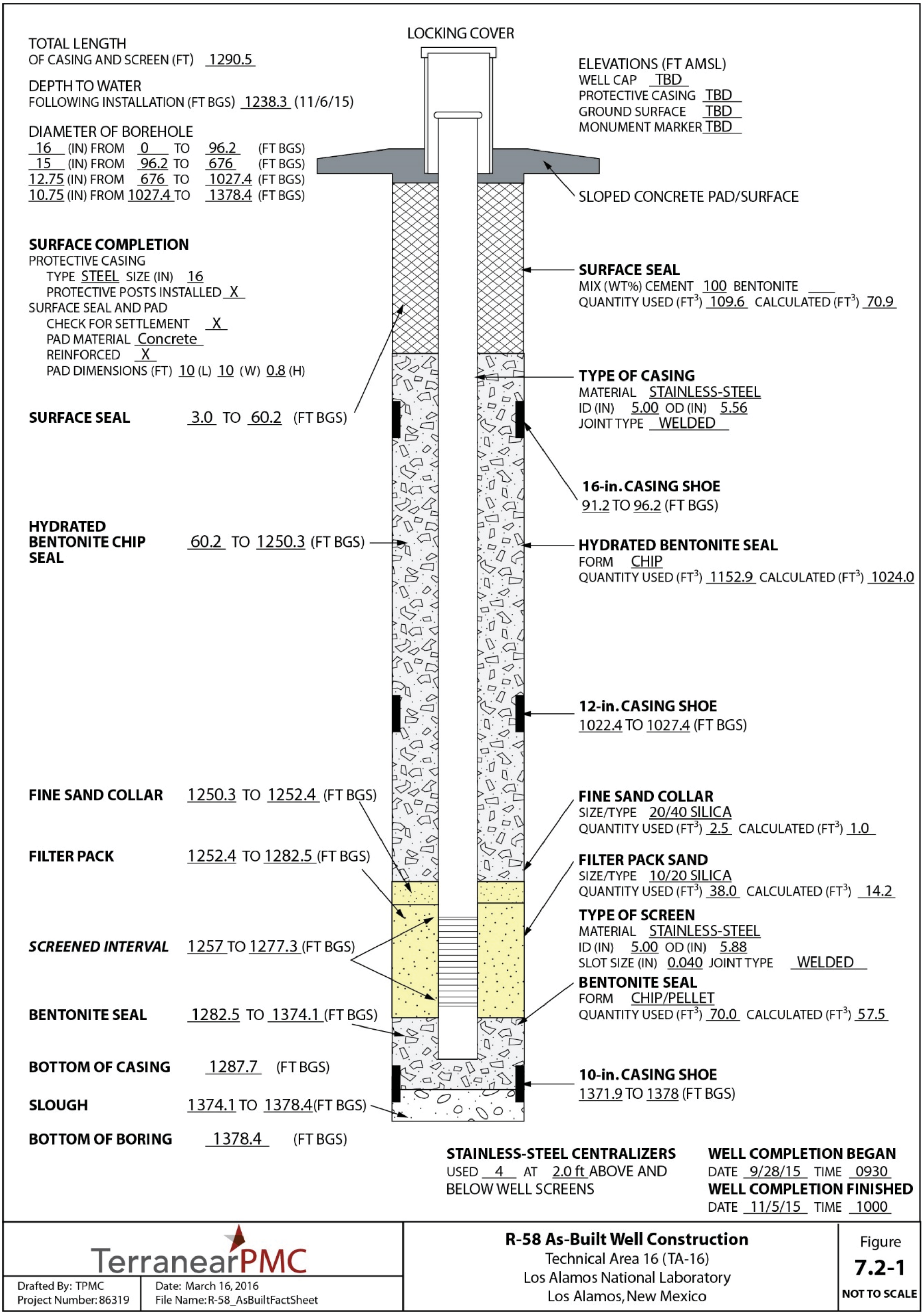


Figure 7.2-1 Monitoring well R-58 as-built well construction diagram

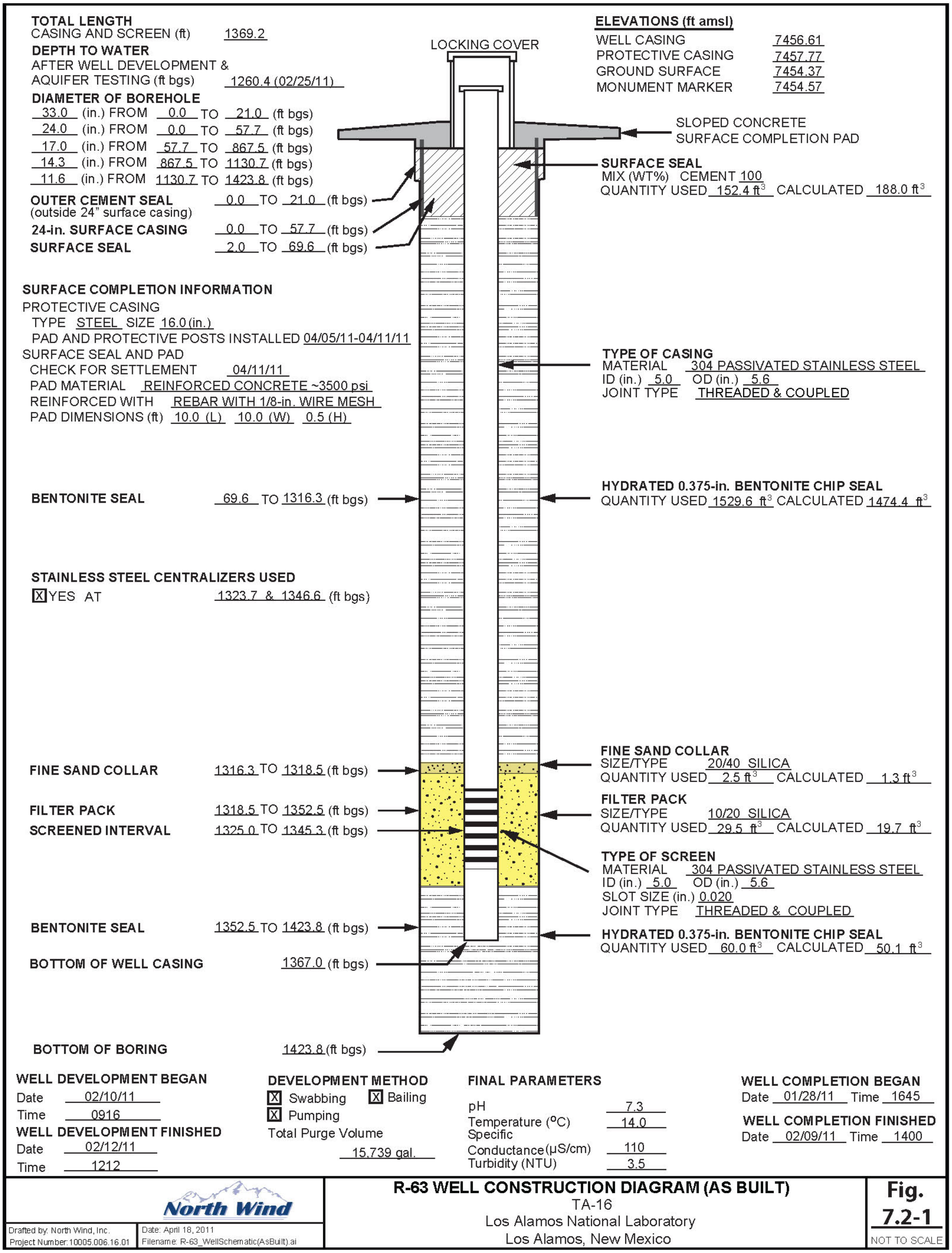


Figure 7.2-1 As-built construction diagram for well R-63

ENCLOSURE 5

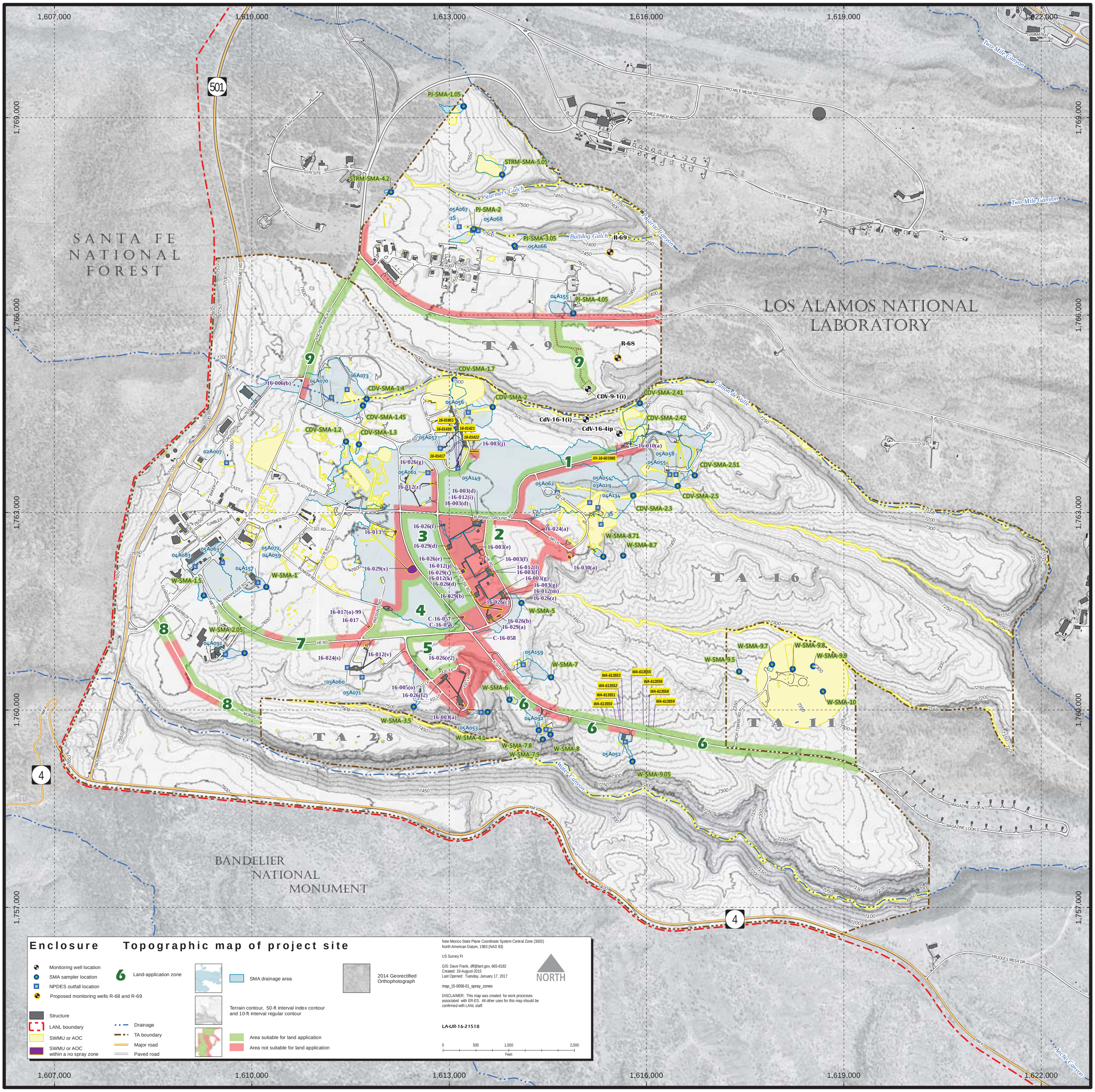
Topographic Map of Project Site

EPC-DO: 17-051

LA-UR-17-20364

U1501760

Date: MAR 1 6 2017



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ENCLOSURE 6

Water Quality Data from
TA-16 260 Monitoring Group Wells

EPC-DO: 17-051

LA-UR-17-20364

U1501760

Date: MAR 1 6 2017

Table E6-1
Water Quality Data from TA-16 260 Monitoring Group Wells
January 2016 - November 2016

Field Sample ID	Location ID	Sample Date	Parameter Name	Report Result	Report Units	Lab Qualifier	Detected	Filtered	Lab Method	Report Detection Limit
CAWA-16-110737	CdV-16-1(i)	03-24-2016	RDX	26.2	ug/L		Y	N	SW-846:8321A_MOD	1.34
CAWA-16-121755	CdV-16-1(i)	05-26-2016	RDX	26.2	ug/L		Y	N	SW-846:8321A_MOD	1.39
VS-16-1i-16-121431	CdV-16-1(i)	08-02-2016	RDX	32.1	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-121431	CdV-16-1(i)	08-02-2016	RDX	28.8	ug/L		Y	N	SW-846:8321A_MOD	1.36
VS-16-1i-16-121430	CdV-16-1(i)	08-03-2016	RDX	30.1	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-121433	CdV-16-1(i)	08-05-2016	RDX	30.8	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-121435	CdV-16-1(i)	08-08-2016	RDX	30.2	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-121434	CdV-16-1(i)	08-10-2016	RDX	30.2	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-121434	CdV-16-1(i)	08-10-2016	RDX	27.6	ug/L		Y	N	SW-846:8321A_MOD	1.32
VS-16-1i-16-121436	CdV-16-1(i)	08-12-2016	RDX	28.1	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-121432	CdV-16-1(i)	08-15-2016	RDX	26.3	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-124788	CdV-16-1(i)	08-17-2016	RDX	25.3	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-124788	CdV-16-1(i)	08-17-2016	RDX	18.8	ug/L		Y	N	SW-846:8321A_MOD	1.32
VS-16-1i-16-121438	CdV-16-1(i)	08-18-2016	RDX	23.7	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-124789	CdV-16-1(i)	08-22-2016	RDX	22.1	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-124785	CdV-16-1(i)	08-24-2016	RDX	21.1	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-124785	CdV-16-1(i)	08-24-2016	RDX	24.3	ug/L		Y	N	SW-846:8321A_MOD	1.33
VS-16-1i-16-121437	CdV-16-1(i)	08-26-2016	RDX	27.2	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-124786	CdV-16-1(i)	08-29-2016	RDX	22.6	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-124787	CdV-16-1(i)	08-30-2016	RDX	22.8	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-124787	CdV-16-1(i)	08-30-2016	RDX	24.1	ug/L		Y	N	SW-846:8321A_MOD	1.3
VS-16-1i-16-124783	CdV-16-1(i)	08-31-2016	RDX	24.5	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-124784	CdV-16-1(i)	09-02-2016	RDX	30.7	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-124784	CdV-16-1(i)	09-02-2016	RDX	24.2	ug/L	Q	Y	N	SW-846:8321A_MOD	1.37
VS-16-1i-16-124782	CdV-16-1(i)	09-06-2016	RDX	27.8	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-126189	CdV-16-1(i)	09-15-2016	RDX	30.9	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-126189	CdV-16-1(i)	09-15-2016	RDX	35.2	ug/L	Q	Y	N	SW-846:8321A_MOD	1.34
VS-16-1i-16-126588	CdV-16-1(i)	09-23-2016	RDX	32.6	ug/L		Y	N	SW-846:8330	NR
VS-16-1i-16-126588	CdV-16-1(i)	09-23-2016	RDX	27.4	ug/L		Y	N	SW-846:8321A_MOD	1.33
CACV-16-116666	CdV-16-2(i)r	03-10-2016	RDX	34	mg/kg		Y	N	SW-846:8321A_MOD	2.44

Table E6-1
Water Quality Data from TA-16 260 Monitoring Group Wells
January 2016 - November 2016

Field Sample ID	Location ID	Sample Date	Parameter Name	Report Result	Report Units	Lab Qualifier	Detected	Filtered	Lab Method	Report Detection Limit
CAWA-16-110738	CdV-16-2(i)r	03-30-2016	RDX	103	ug/L		Y	N	SW-846:8321A_MOD	13.0
CAWA-16-121756	CdV-16-2(i)r	05-26-2016	RDX	99	ug/L		Y	N	SW-846:8321A_MOD	6.51
CAWA-16-110739	CDV-16-4ip S1	03-14-2016	RDX	134.0	ug/L		Y	N	SW-846:8321A_MOD	6.51
CAWA-16-121757	CDV-16-4ip S1	05-26-2016	RDX	134.0	ug/L		Y	N	SW-846:8321A_MOD	6.44
CAWA-16-125191	CDV-16-4ip S1	09-06-2016	RDX	130.0	ug/L		Y	N	SW-846:8321A_MOD	6.65
VS-4ip-16-121416	CDV-16-4ip S1	09-06-2016	RDX	157.3	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-121416	CDV-16-4ip S1	09-06-2016	RDX	118.0	ug/L		Y	N	SW-846:8321A_MOD	6.58
VS-4ip-16-121415	CDV-16-4ip S1	09-07-2016	RDX	165.4	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-121412	CDV-16-4ip S1	09-09-2016	RDX	169.7	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-121414	CDV-16-4ip S1	09-12-2016	RDX	187.1	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-121419	CDV-16-4ip S1	09-14-2016	RDX	185.2	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-121419	CDV-16-4ip S1	09-14-2016	RDX	145.0	ug/L		Y	N	SW-846:8321A_MOD	6.61
VS-4ip-16-121420	CDV-16-4ip S1	09-16-2016	RDX	174.5	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-121418	CDV-16-4ip S1	09-19-2016	RDX	186.8	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-126247	CDV-16-4ip S1	09-21-2016	RDX	153.9	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-126247	CDV-16-4ip S1	09-21-2016	RDX	144.0	ug/L		Y	N	SW-846:8321A_MOD	6.79
VS-4ip-16-126245	CDV-16-4ip S1	09-23-2016	RDX	167.3	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-126246	CDV-16-4ip S1	09-26-2016	RDX	172.9	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-121413	CDV-16-4ip S1	09-28-2016	RDX	171.6	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-121413	CDV-16-4ip S1	09-28-2016	RDX	128.0	ug/L		Y	N	SW-846:8321A_MOD	6.51
VS-4ip-16-121417	CDV-16-4ip S1	09-30-2016	RDX	165.0	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-126248	CDV-16-4ip S1	10-03-2016	RDX	170.7	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-126240	CDV-16-4ip S1	10-05-2016	RDX	174.9	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-126240	CDV-16-4ip S1	10-05-2016	RDX	154.0	ug/L		Y	N	SW-846:8321A_MOD	6.61
VS-4ip-16-126239	CDV-16-4ip S1	10-07-2016	RDX	171.8	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-126242	CDV-16-4ip S1	10-11-2016	RDX	172.4	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-126242	CDV-16-4ip S1	10-11-2016	RDX	142.0	ug/L		Y	N	SW-846:8321A_MOD	6.51
VS-4ip-16-126243	CDV-16-4ip S1	10-12-2016	RDX	172.7	ug/L		Y	N	SW-846:8330	NR
VS-4ip-16-126244	CDV-16-4ip S1	10-14-2016	RDX	132.0	ug/L		Y	N	SW-846:8321A_MOD	6.94
VS-4ip-16-126241	CDV-16-4ip S1	10-17-2016	RDX	174.4	ug/L		Y	N	SW-846:8330	NR

Table E6-1
Water Quality Data from TA-16 260 Monitoring Group Wells
January 2016 - November 2016

Field Sample ID	Location ID	Sample Date	Parameter Name	Report Result	Report Units	Lab Qualifier	Detected	Filtered	Lab Method	Report Detection Limit
VS-4ip-17-126990	CDV-16-4ip S1	10-20-2016	RDX	187.1	ug/L		Y	N	SW-846:8330	NR
VS-4ip-17-126990	CDV-16-4ip S1	10-20-2016	RDX	156.0	ug/L		Y	N	SW-846:8321A_MOD	6.58
VS-4ip-17-126992	CDV-16-4ip S1	10-24-2016	RDX	177.8	ug/L		Y	N	SW-846:8330	NR
VS-4ip-17-126991	CDV-16-4ip S1	10-27-2016	RDX	179.1	ug/L		Y	N	SW-846:8330	NR
VS-4ip-17-126991	CDV-16-4ip S1	10-27-2016	RDX	134.0	ug/L		Y	N	SW-846:8321A_MOD	6.61
VS-4ip-17-127321	CDV-16-4ip S1	10-31-2016	RDX	174.7	ug/L		Y	N	SW-846:8330	NR
VS-4ip-17-127321	CDV-16-4ip S1	10-31-2016	RDX	162.0	ug/L		Y	N	SW-846:8321A_MOD	6.61
CAWA-16-110692	CDV-9-1(i) S1	03-17-2016	RDX	0.3	ug/L	U	N	N	SW-846:8321A_MOD	0.272
CAWA-16-110696	CDV-9-1(i) S1	03-17-2016	RDX	24.2	ug/L		Y	N	SW-846:8321A_MOD	1.35
CAWA-16-110742	CDV-9-1(i) S1	03-17-2016	RDX	25.4	ug/L		Y	N	SW-846:8321A_MOD	1.29
CAWA-16-121860	CDV-9-1(i) S1	06-07-2016	RDX	28.1	ug/L		Y	N	SW-846:8321A_MOD	3.19
VS-9-1i-16-121401	CDV-9-1(i) S1	06-08-2016	RDX	30.9	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-121401	CDV-9-1(i) S1	06-08-2016	RDX	31.9	ug/L		Y	N	SW-846:8321A_MOD	1.3
VS-9-1i-16-121395	CDV-9-1(i) S1	06-15-2016	RDX	33.2	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-121395	CDV-9-1(i) S1	06-15-2016	RDX	28.6	ug/L		Y	N	SW-846:8321A_MOD	1.3
VS-9-1i-16-121394	CDV-9-1(i) S1	06-17-2016	RDX	30.8	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-121402	CDV-9-1(i) S1	06-20-2016	RDX	29.1	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-123102	CDV-9-1(i) S1	06-22-2016	RDX	27.6	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-123102	CDV-9-1(i) S1	06-22-2016	RDX	25.3	ug/L	Q	Y	N	SW-846:8321A_MOD	2.6
VS-9-1i-16-121396	CDV-9-1(i) S1	06-24-2016	RDX	27.4	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-121400	CDV-9-1(i) S1	06-27-2016	RDX	26.5	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-123103	CDV-9-1(i) S1	06-29-2016	RDX	32.1	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-123103	CDV-9-1(i) S1	06-29-2016	RDX	23.2	ug/L		Y	N	SW-846:8321A_MOD	1.3
VS-9-1i-16-123110	CDV-9-1(i) S1	07-01-2016	RDX	27.7	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-123111	CDV-9-1(i) S1	07-05-2016	RDX	26.5	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-123106	CDV-9-1(i) S1	07-06-2016	RDX	27.2	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-123106	CDV-9-1(i) S1	07-06-2016	RDX	29.5	ug/L		Y	N	SW-846:8321A_MOD	1.3
VS-9-1i-16-123112	CDV-9-1(i) S1	07-08-2016	RDX	31.1	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-123113	CDV-9-1(i) S1	07-11-2016	RDX	28.5	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-123105	CDV-9-1(i) S1	07-12-2016	RDX	29.5	ug/L		Y	N	SW-846:8330	NR

Table E6-1
Water Quality Data from TA-16 260 Monitoring Group Wells
January 2016 - November 2016

Field Sample ID	Location ID	Sample Date	Parameter Name	Report Result	Report Units	Lab Qualifier	Detected	Filtered	Lab Method	Report Detection Limit
VS-9-1i-16-123105	CDV-9-1(i) S1	07-12-2016	RDX	27.7	ug/L		Y	N	SW-846:8321A_MOD	1.3
VS-9-1i-16-123114	CDV-9-1(i) S1	07-13-2016	RDX	31.4	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-123107	CDV-9-1(i) S1	07-15-2016	RDX	31.6	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-123107	CDV-9-1(i) S1	07-15-2016	RDX	23.4	ug/L		Y	N	SW-846:8321A_MOD	1.3
VS-9-1i-16-123104	CDV-9-1(i) S1	07-20-2016	RDX	31.7	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-123104	CDV-9-1(i) S1	07-20-2016	RDX	33.9	ug/L		Y	N	SW-846:8321A_MOD	1.34
VS-9-1i-16-123109	CDV-9-1(i) S1	07-25-2016	RDX	32.3	ug/L		Y	N	SW-846:8330	NR
VS-9-1i-16-123109	CDV-9-1(i) S1	07-25-2016	RDX	29.9	ug/L		Y	N	SW-846:8321A_MOD	1.29
CAWA-16-110751	R-26 S1	03-23-2016	RDX	0.262	ug/L	U	N	N	SW-846:8321A_MOD	0.262
CAWA-16-125148	R-26 S1	09-20-2016	RDX	0.278	ug/L	U	N	N	SW-846:8321A_MOD	0.278
CAWA-16-125203	R-26 S1	09-20-2016	RDX	0.269	ug/L	U	N	N	SW-846:8321A_MOD	0.269
CAWA-16-110749	R-25b	03-16-2016	RDX	0.144	ug/L	J	Y	N	SW-846:8321A_MOD	0.266
CAWA-16-110751	R-26 S1	03-23-2016	RDX	0.262	ug/L	U	N	N	SW-846:8321A_MOD	0.262
CAWA-16-125148	R-26 S1	09-20-2016	RDX	0.278	ug/L	U	N	N	SW-846:8321A_MOD	0.278
CAWA-16-125203	R-26 S1	09-20-2016	RDX	0.269	ug/L	U	N	N	SW-846:8321A_MOD	0.269
CAWA-16-125205	R-47i	09-12-2016	RDX	0.263	ug/L	U	N	N	SW-846:8321A_MOD	0.263
CAWA-16-110756	R-48	03-22-2016	RDX	0.266	ug/L	U	N	N	SW-846:8321A_MOD	0.266
CAWA-16-125206	R-48	09-15-2016	RDX	0.260	ug/L	U	N	N	SW-846:8321A_MOD	0.26
CAWA-16-108134	R-58	01-19-2016	RDX	0.258	ug/L	U	N	N	SW-846:8321A_MOD	0.258
CAWA-16-110757	R-58	03-21-2016	RDX	0.266	ug/L	U	N	N	SW-846:8321A_MOD	0.266
CAWA-16-121741	R-58	06-15-2016	RDX	0.287	ug/L	U	N	N	SW-846:8321A_MOD	0.287
CAWA-16-121766	R-58	06-15-2016	RDX	0.287	ug/L	U	N	N	SW-846:8321A_MOD	0.287
CAWA-16-125207	R-58	09-16-2016	RDX	0.272	ug/L	U	N	N	SW-846:8321A_MOD	0.272
CAWA-16-110758	R-63	03-29-2016	RDX	1.42	ug/L		Y	N	SW-846:8321A_MOD	0.266
CAWA-16-125149	R-63	09-12-2016	RDX	1.26	ug/L		Y	N	SW-846:8321A_MOD	0.266
CAWA-16-125208	R-63	09-12-2016	RDX	1.48	ug/L		Y	N	SW-846:8321A_MOD	0.269
CAWA-16-110731	16-26644	03-15-2016	RDX	22.9	ug/L		Y	N	SW-846:8321A_MOD	1.28
CAWA-16-121736	16-26644	06-13-2016	RDX	0.3	ug/L	U	N	N	SW-846:8321A_MOD	0.263
CAWA-16-121740	16-26644	06-13-2016	RDX	8.6	ug/L		Y	N	SW-846:8321A_MOD	0.289
CAWA-16-121749	16-26644	06-13-2016	RDX	11.1	ug/L		Y	N	SW-846:8321A_MOD	0.284

Table E6-1
Water Quality Data from TA-16 260 Monitoring Group Wells
January 2016 - November 2016

Field Sample ID	Location ID	Sample Date	Parameter Name	Report Result	Report Units	Lab Qualifier	Detected	Filtered	Lab Method	Report Detection Limit
CAWA-16-125183	16-26644	09-19-2016	RDX	10.3	ug/L		Y	N	SW-846:8321A_MOD	0.266
CAWA-16-110741	CDV-37-1(i)	03-18-2016	RDX	0.278	ug/L	U	N	N	SW-846:8321A_MOD	0.278
CAPA-16-110847	R-18	03-15-2016	RDX	2.62	ug/L		Y	N	SW-846:8321A_MOD	0.275
CACV-16-116671	R-18	04-26-2016	RDX	1.09	mg/kg	J	Y	N	SW-846:8321A_MOD	2.04
CAPA-16-121787	R-18	06-08-2016	RDX	3.73	ug/L		Y	N	SW-846:8321A_MOD	0.263
CAPA-16-125246	R-18	09-14-2016	RDX	3.36	ug/L		Y	N	SW-846:8321A_MOD	0.265

Notes:
U - in the lab qualifier column means analyte is classified as not detected.
Q in the lab qualifier comment means one or more quality control criteria have not been met.
H - in the lab qualifier comment means the analytical holding time was exceeded.
J - in the lab qualifier comment means the analyte is classified as estimated.
NR - in the report detection limit column means a report detection limit was not provided.

ENCLOSURE 7

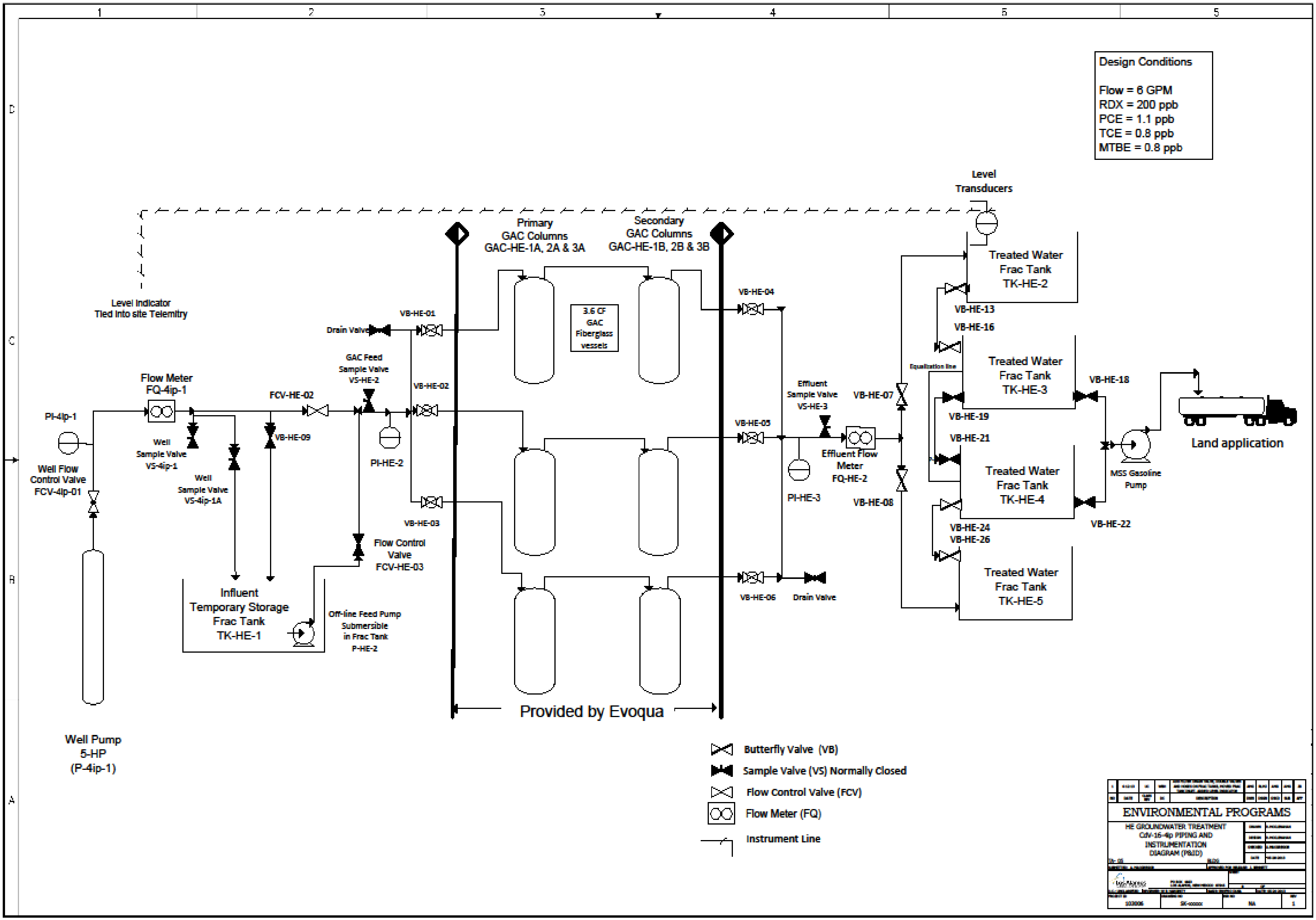
Granulated Activated Carbon
Groundwater Treatment System Details

EPC-DO: 17-051

LA-UR-17-20364

U1501760

Date: MAR 1 6 2017



Details of large granular activated carbon treatment system for use at CdV-9-1(i) and CdV-16-4ip

EVOQUA
WATER TECHNOLOGIES

AQUACARB® S SERIES GRANULAR REACTIVATED CARBON
AQUACARB® NS, AQUACARB® RS & AQUACARB® RSD CARBONS

FOR INDUSTRIAL AND REMEDIAL WATER TREATMENT

Description

AquaCarb® S Series carbons are produced through thermal reactivation of approved grades of spent carbon at one of our state-of-the-art ISO 14001 certified reactivation facilities. Through careful control of the residence time in the reactivation furnace, reactivation temperature, and reactivation gas composition, adsorbed contaminants on the spent carbon are removed and destroyed, and the carbon's internal pore structure is maintained as close to virgin condition as possible. AquaCarb® S Series reactivated carbons are pooled from a variety of sources, ensuring consistent product properties. The resulting carbon serves as an excellent economic alternative to virgin carbon for the removal of a broad range of organic contaminants from wastewater, process water, and groundwater streams.

Applications

Cost effective AquaCarb® S Series reactivated carbons have been demonstrated to provide excellent performance in a variety of liquid phase treatment applications, including the following:

- Removal of organic contaminants
- Pesticide removal
- Groundwater remediation
- Wastewater treatment
- Industrial process water treatment
- Biological activated carbon support

Quality Control

Evoqua's laboratories are fully equipped to provide complete quality control analysis using ASTM standard test methods in order to assure the consistent quality of all Westates® actived carbons.

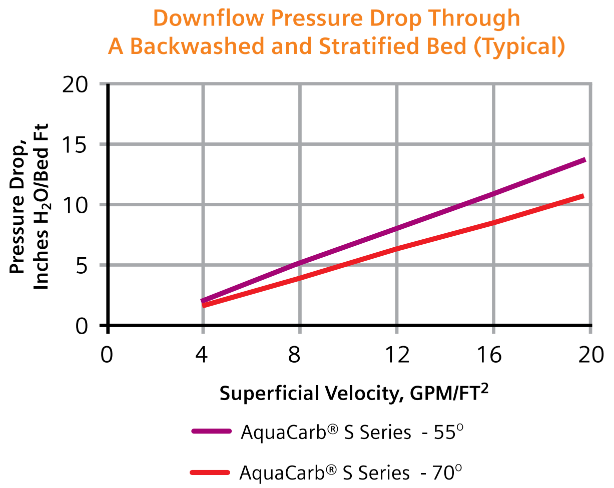
Our technical staff offers hands-on guidance in selecting the most appropriate system, operating conditions and carbon to meet your needs. For more information contact your nearest Evoqua representative.

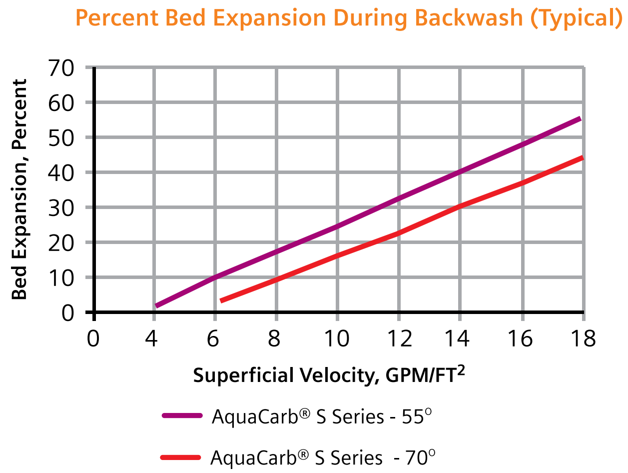
FEATURES AND BENEFITS:

- Reactivated carbons serve as an economical alternative to virgin carbon in many applications
- Use of reactivated carbons reduce the volume of spent carbon sent to landfill and encourages responsible usage of natural resources
- A detailed quality assurance program guarantees consistent quality from lot to lot and shipment to shipment
- Pooled reactivated carbons provide consistent properties and performance
- Reactivated carbons produced at ISO 14001 certified reactivation facilities, ensuring minimization of environmental liability and continued benchmarking against best practice standards for environmental management

TYPICAL PROPERTIES

Parameter	AquaCarb® S Carbon
Carbon Type	Reactivated Coconut/Coal
Mesh Size, U.S. Sieve	8 x 30
Iodine No., mg I2/g	800 -1000
Apparent Density, g/cc	0.46 - 0.60
Moisture as Packed, Wt. %	2





Safety Note: Under certain conditions, some compounds may oxidize, decompose or polymerize in the presence of activated carbon causing a carbon bed temperature rise that is sufficient to cause ignition. Particular care must be exercised when compounds that have a peroxide-forming tendency are being adsorbed. In addition the adsorption of VOCs will lead to the generation of heat within a carbon bed. These heats of reaction and adsorption need to be properly dissipated in order to fully assure the safe operation of the bed.

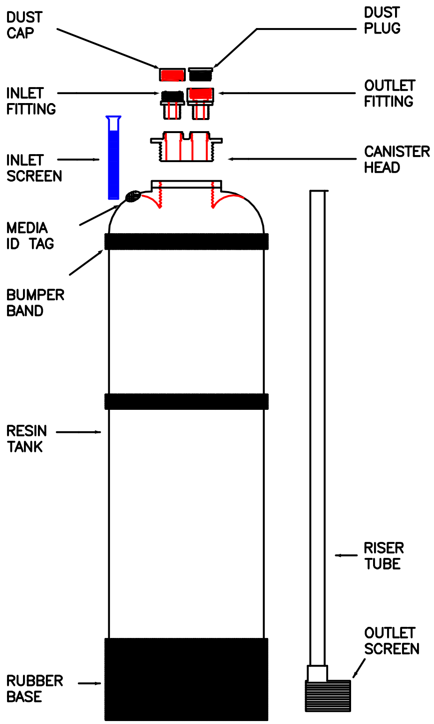
Wet activated carbon readily adsorbs atmospheric oxygen. Dangerously low oxygen levels may exist in closed vessels or poorly ventilated storage areas. Workers should follow all applicable state and federal safety guidelines for entering oxygen depleted areas.

evoqua
WATER TECHNOLOGIES

4800 North Point Parkway, Suite 250, Alpharetta, GA 30022

+1 (866) 926-8420 (toll-free) **+1 (978) 614-7233** (toll) **www.evoqua.com**

STD: BORDER-0106-8X11A | INTL REF: | BAR = 1" AT PLOT SCALE



TANK BODY MAT. OF. CONST.:	FIBERGLASS
HEIGHT:	50in
DIAMETER:	14in
SERVICE FLOW RATE:	2–10gpm
MAX. OPERATING PRESSURE:	75psig
MAX. OPERATING TEMPERATURE:	120°F
WEIGHT (EMPTY):	(APPROX.)40lbs
WEIGHT (FULL/DRY):	(APPROX.)195lbs
WEIGHT (FULL/WET):	(APPROX.)305lbs

DESIGNER GDA	DATE 7/1/08
CHECKER	DATE
ENGINEER	DATE
MANAGER	DATE
FILE:	
SCALE:	

TITLE
3.6ft3 FIBERGLASS WASTEWATER ION EXCHANGE TANK

CLIENT

SIEMENS

Water Technologies
Roseville, MN
651–638–1300 Fax 651–633–5074

PROJECT	CODE	DRAWING	SHEET	REV
			1 OF 1	

ENCLOSURE 8

Granulated Activated Carbon Groundwater Treatment System 2016 Effluent Results Summary

EPC-DO: 17-051

LA-UR-17-20364

U1501760

Date: MAR 1 6 2017

Table E8-1
Granulated Activated Carbon Groundwater Treatment System
2016 Effluent Results Summary

Sample	ollection Dat	Field Prep	Method	Analyte	Detect Flag	Result	Units	Lab Qualifier Code	Validation Qualifier Code	tion Reasor	Lab1	MDL	PQL
VS-HE-4-16-121482	5/19/2016	UF	SW-846:8321A_MOD	RDX	N	0.5	ug/L	U	U	U_LAB	GELC	0.16	0.5
VS-HE-4-16-121479	6/8/2016	UF	SW-846:8321A_MOD	RDX	N	0.258	ug/L	U	U	U_LAB	GELC	0.0825	0.258
VS-HE-4-16-121476	6/15/2016	UF	SW-846:8321A_MOD	RDX	N	0.266	ug/L	U	U	U_LAB	GELC	0.0851	0.266
VS-HE-4-16-123138	6/22/2016	UF	SW-846:8321A_MOD	RDX	N	0.26	ug/L	U	U	U_LAB	GELC	0.0833	0.26
VS-HE-4-16-123139	6/29/2016	UF	SW-846:8321A_MOD	RDX	N	0.26	ug/L	U	U	U_LAB	GELC	0.0833	0.26
VS-HE-4-16-123140	7/6/2016	UF	SW-846:8321A_MOD	RDX	N	0.256	ug/L	U	U	U_LAB	GELC	0.0821	0.256
VS-HE-4-16-123145	7/12/2016	UF	SW-846:8321A_MOD	RDX	N	0.26	ug/L	U	U	U_LAB	GELC	0.0833	0.26
VS-HE2-03-16-124405	8/3/2016	UF	SW-846:8321A_MOD	RDX	N	0.26	ug/L	U	U	U_LAB	GELC	0.0833	0.26
VS-HE2-03-16-124404	8/10/2016	UF	SW-846:8321A_MOD	RDX	N	0.263	ug/L	U	UJ	HE9	GELC	0.0842	0.263
VS-HE2-03-16-124798	8/17/2016	UF	SW-846:8321A_MOD	RDX	N	0.26	ug/L	U	UJ	HE9	GELC	0.0833	0.26
VS-HE2-03-16-124800	8/24/2016	UF	SW-846:8321A_MOD	RDX	N	0.263	ug/L	U	U	U_LAB	GELC	0.0842	0.263
VS-HE2-03-16-124799	8/30/2016	UF	SW-846:8321A_MOD	RDX	N	0.263	ug/L	U	UJ	HE9	GELC	0.0842	0.263
VS-HE2-03-16-124406	9/2/2016	UF	SW-846:8321A_MOD	RDX	N	0.275	ug/L	UQ	U	U_LAB	GELC	0.0879	0.275
VS-HE-4-16-125287	9/6/2016	UF	SW-846:8321A_MOD	RDX	N	0.0833	ug/L	U	U	U_LAB	GELC	0.0833	0.26
VS-HE2-03-16-126031	9/9/2016	UF	SW-846:8321A_MOD	RDX	N	0.269	ug/L	U	U	U_LAB	GELC	0.086	0.269
VS-HE-4-16-125294	9/14/2016	UF	SW-846:8321A_MOD	RDX	N	0.0884	ug/L	U	U	U_LAB	GELC	0.0884	0.276
VS-HE-4-16-126272	9/21/2016	UF	SW-846:8321A_MOD	RDX	N	0.087	ug/L	U	U	U_LAB	GELC	0.087	0.272
VS-HE-4-16-125290	9/28/2016	UF	SW-846:8321A_MOD	RDX	N	0.0851	ug/L	U	U	U_LAB	GELC	0.0851	0.266
VS-HE-4-16-126277	10/5/2016	UF	SW-846:8321A_MOD	RDX	N	0.086	ug/L	U	UJ	HE9	GELC	0.086	0.269
VS-HE-4-16-126275	10/11/2016	UF	SW-846:8321A_MOD	RDX	N	0.0833	ug/L	U	U	U_LAB	GELC	0.0833	0.26
VS-HE2-02-17-127030	10/26/2016	UF	SW-846:8321A_MOD	RDX	N	0.0842	ug/L	U	U	U_LAB	GELC	0.0842	0.263
VS-HE2-03-17-127042	10/26/2016	UF	SW-846:8321A_MOD	RDX	N	0.0842	ug/L	U	U	U_LAB	GELC	0.0842	0.263
VS-HE2-02-17-127027	11/2/2016	UF	SW-846:8321A_MOD	RDX	N	0.0842	ug/L	U	U	U_LAB	GELC	0.0842	0.263
VS-HE2-03-17-127039	11/2/2016	UF	SW-846:8321A_MOD	RDX	N	0.0909	ug/L	U	U	U_LAB	GELC	0.0909	0.284
VS-HE-4-17-128828	11/30/2016	UF	SW-846:8330	RDX	N	2	ug/L	U	U	U_LAB	EES6	2	NR
VS-HE-4-17-128832	12/7/2016	UF	SW-846:8330	RDX	N	2	ug/L	U	U	U_LAB	EES6	2	NR
VS-HE-4-17-128829	12/8/2016	UF	SW-846:8330	RDX	N	2	ug/L	U	U	U_LAB	EES6	2	NR
VS-HE-4-17-128830	12/14/2016	UF	SW-846:8330	RDX	N	2	ug/L	U	U	U_LAB	EES6	2	NR

Table E8-1
Granulated Activated Carbon Groundwater Treatment System
2016 Effluent Results Summary

Notes:
UF - unfiltered.
N - in the detect flag column means the analyte was undetected.
U means the analyte is classified as not detected.
U - in the lab qualifier column means analyte is classified as not detected.
U - in the validation qualifier column means analyte is classified as not detected.
J - in the validation qualifier comment means the analyte is classified as estimated.
Q - in the lab qualifier coment means one or more quality control criteria was not met.
U_LAB - in the validation reason column means the analyte is classified as not detected.
HE9 - means the hold time was >1 and <=2 times the applicable holding time requirements.
NR - in the PQL column means value not reported