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Date: MAR 2 2 2017
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John Kieling, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Plugging and Abandonment Summary Report for Wells and Boreholes in Mortandad Canyon for Fiscal Year 2016

Dear Mr. Kieling:

Enclosed please find two hard copies with electronic files of Plugging and Abandonment Summary Report for Wells and Boreholes in Mortandad Canyon for Fiscal Year 2016. This report summarizes the methods Los Alamos National Laboratory used to plug and abandon 25 wells and boreholes in Mortandad Canyon.

If you have any questions, please contact Ted Ball at (505) 665-3996 (tedball@lanl.gov) or Karen Armijo at (505) 665-57314 (karen.armijo@nnsa.doe.gov).

Sincerely,

Bruce Robinson, Program Director
Environmental Remediation Program
Los Alamos National Laboratory

Sincerely,

Karen Armijo, Permitting & Compliance Program Manager
National Nuclear Security Administration
Los Alamos Field Office

BR/PM/TB:sm

Enclosures: Two hard copies with electronic files – Plugging and Abandonment Summary Report for Wells and Boreholes in Mortandad Canyon for Fiscal Year 2016 (EP2017-0018)

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March 2017
EP2017-0018

Plugging and Abandonment Summary Report for Wells and Boreholes in Mortandad Canyon for Fiscal Year 2016

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Associate Directorate for Environmental Management

EP2017-0018

Plugging and Abandonment Summary Report for Wells and Boreholes in Mortandad Canyon for Fiscal Year 2016

March 2017

Responsible project manager:

Printed Name	Signature	Title	Organization	Date
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Responsible DOE representative:

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Karen Armijo		Permitting and Compliance Program Manager	DOE-NA-LA	3/15/17

EXECUTIVE SUMMARY

This report details the methods and procedures Yellow Jacket Drilling Services, LLC (YJD) implemented for Los Alamos National Laboratory (LANL or the Laboratory) to plug and abandon 25 wells in Mortandad Canyon: MT-1, MT-2, MT-3, MT-4, MCWB-4, MCWB-5.5A, MCWB-5.5B, MCWB-6.2B, MCWB-6.2C, MCWB-6.5C, MCWB-6.5D, MCWB-6.5E, MCWB-6.6, MCWB-7A, MCWB-7B, MCWB-7.2, MCWB-7.4A, MCWB-7.4B, MCWB-7.7A, MCWB-7.7B, MCWB-8.1A, MCWB-8.1B, MCWB-8.1C, MCWB-9A, and MCWB-9B. The wells were plugged and abandoned in accordance with direction from the New Mexico Environment Department (NMED) and the Laboratory's work plans to plug and abandon wells and boreholes and according to YJD's field implementation plan for plugging and abandoning wells and boreholes in Mortandad Canyon, dated April 2016.

Plugging and abandonment activities occurred from May 2 to September 22, 2016. Before abandonment, a two-person crew used a Pulstar 12T development/pump rig to remove all above- and belowground appurtenances, where present. Water-level and the total depth of the well measurements were verified using a downhole measuring line, water-level meter, and/or Laboratory video equipment before abandonment. Where water was present, wells were purged and sampled before abandonment activities were undertaken.

Twenty-four wells—MT-1, MT-2, MT-3, MT-4, MCWB-5.5A, MCWB-5.5B, MCWB-6.2B, MCWB-6.2C, MCWB-6.5C, MCWB-6.5D, MCWB-6.5E, MCWB-6.6, MCWB-7A, MCWB-7B, MCWB-7.2, MCWB-7.4A, MCWB-7.4B, MCWB-7.7A, MCWB-7.7B, MCWB-8.1A, MCWB-8.1B, MCWB-8.1C, MCWB-9A, and MCWB-9B—were plugged and abandoned using a CME-85 HD hollow-stem auger (HSA) truck-mounted drill rig. Well MCWB-4 was plugged and abandoned using a limited-access Pulstar L-12-T track-mounted HSA drill rig. The upper 20 ft of polyvinyl chloride pipe of each well was overdrilled and thus removed, after which Portland Type I/II neat cement grout was used to plug and abandon the wells to full depth. All well monuments and surface completions were removed in full.

The wells were cement-grouted to approximately 1 ft below ground surface, and a small concrete surface plug was installed near ground surface. An aluminum survey marker was emplaced in the surface plug, and the surface completion of each well was then surveyed.

Waste accumulated during plugging and abandonment activities was staged on-site and characterized according to the waste characterization strategy form for further handling and disposal. Upon receipt of analytical results, all waste will be disposed of per federal and state requirements.

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1.0 INTRODUCTION

This report summarizes field activities associated with the plugging and abandonment (P&A) of 25 water balance and tests wells located in Mortandad Canyon, Los Alamos National Laboratory (LANL or the Laboratory), Los Alamos County, New Mexico (Figure 1.0-1). The wells included in this work included four test wells (MT-1, MT-2, MT-3, and MT-4) and 21 water balance wells (MCWB-4, MCWB-5.5A, MCWB-5.5B, MCWB-6.2B, MCWB-6.2C, MCWB-6.5C, MCWB-6.5D, MCWB-6.5E, MCWB-6.6, MCWB-7A, MCWB-7B, MCWB-7.2, MCWB-7.4A, MCWB-7.4B, MCWB-7.7A, MCWB-7.7B, MCWB-8.1A, MCWB-8.1B, MCWB-8.1C, MCWB-9A, and MCWB-9B).

2.0 BACKGROUND SUMMARY

Yellow Jacket Drilling Services, LLC (YJD) was contracted by Los Alamos National Security, LLC (LANS) Associate Directorate for Environmental Management to plug and abandon the 25 wells. Four wells have been designated as MT test wells, 21 wells have been designated as water-balance wells. All wells are located within Mortandad Canyon at the Laboratory. The objective was to plug and abandon the wells to prevent the migration of surface water and potential contaminants within the wells.

The water-balance wells, designated MCWB-4 through MCWB-9B, drilled in 1994, were constructed of 3-in. Schedule 40 polyvinyl chloride (PVC) casing up to depths of 80 ft below ground surface (bgs). Test wells, drilled in 1988 and designated MT-1 through MT-4, were constructed of 2-in. Schedule 40 PVC up to depths of 75 ft bgs were also plugged and abandoned. The work was performed under the statement of work (SOW) provided by proposal number 1578464, dated February 26, 2016, and the New Mexico Environment Department– (NMED-) approved “Work Plans for the Plugging and Abandonment of Wells for Fiscal Year 2016” (LANL 2016, 601140; NMED 2016, 601272). A complete list of well construction details is provided in Table 2.0-1.

In general, the 25 wells were decommissioned according to the following process: all pumps and downhole equipment were removed; any water present was removed and contained; the wells were video logged as required, followed by water sample collection 24 h later, as required; any aboveground well features were removed as required; and the wells were grouted in place by tremie pumping materials, followed by over drilling of the upper 20 ft of PVC well casing and cementing in the upper 20 ft of hole. After well plugging actives were completed, any aboveground well features were removed as required. Upon completion of all decommissioning activities, a monument was emplaced, surveyed, and marked with the appropriate information.

YJD provided the means and oversight for the investigation-derived waste (IDW) containment, on-site management, and sampling. All State of New Mexico Office of the State Engineer (NMOSE) P&A documentation was submitted to DOE/LANS and the NMOSE as required (Appendix A).

As stated in the approved 2016 work plans (LANL 2016, 601140; NMED 2016, 601272), the purpose of this report is to summarize activities required to complete the scope of work that established the provision for the technical functions and expertise required to plug and abandon the wells. These services were performed in accordance with the NMOSE.

3.0 PREABANDONMENT ACTIVITIES

The following activities were conducted before well P&A activities were undertaken. All work was performed in accordance with the field implementation plan (FIP) for well servicing, including pump removal, water bailing and collection, video logging, and well P&A (Yellow Jacket Drilling 2016, 601273).

3.1 Removal of Appurtenances

Utilizing a Pulstar 12T development/pump rig with a two-person crew, YJD was tasked to remove all above- and belowground appurtenances, including pumps, transducers, data loggers, and control panels, if present. No wells were found to have belowground appurtenances. The aboveground concrete well pads were removed by jackhammering the concrete into small-enough pieces that could be picked up and placed in waste accumulation areas.

3.2 Downhole Video, Water Level, and Total Depth Measurements

Laboratory personnel removed all dedicated sample pumps and video logged all 25 wells to document downhole conditions. Water level and total depth measurements were collected before P&A of each well or borehole. If groundwater was present in any of the wells, YJD was required to bail the wells dry and collect a sample of the water for laboratory analysis. At test wells MT-1 and MT-3 and balance wells MCWB-7A, MCWB-7.4A, MCWB-7.4B, MCWB-7.7A, and MCWB-7.7B, groundwater was present and thus the wells were bailed, allowed to recharge for 24 h, and then sampled for analysis. All other wells were reported to be dry (or have only sump water present). No additional bailing or sampling of these wells was required

All preabandonment activities were conducted from June 17 to September 22, 2016. Upon completion of the preabandonment activities YJD demobilized the Pulstar P12 pump rig and crew from the site. A complete list of findings and well descriptions including depths to water is provided in Table 3.2-1.

4.0 WELL AND BOREHOLE ABANDONMENT

Upon completion of all preabandonment activities, the 25 wells were plugged and abandoned in accordance with the approved April 2016 FIP (Yellow Jacket Drilling 2016, 602067). In addition, all work followed the approved work plans (LANL 2016, 601140; NMED 2016, 601272) as a guide for field operations to ensure all objectives were met. This process included tremie pumping materials from the bottom of the well up to the surface to ensure displacement of any water and provide a complete seal without any voids. After the well had been grouted in place, overdrilling of the upper 20 ft of PVC casing was performed, after which a cement seal was placed within the overdrilled borehole to complete sealing of the abandoned well. Twenty-four wells were plugged and abandoned using the truck mounted HSA rig, and one well was plugged and abandoned with a limited access track-mounted HSA drill rig.

The P&A procedures utilized were in compliance with NMOSE well or borehole abandonment regulations. Additionally, the P&A procedures used comply with 19.27.4 New Mexico Administrative Code rules and regulations governing well driller licensing, construction, repair, and plugging of wells.

A well plugging plan of operations was submitted and approved by the NMOSE for each well before P&A.

Waste accumulated during these activities was staged on-site and characterized as determined by the waste characterization strategy form (WCSF) for handling and disposal.

4.1 Test Wells MT-1, MT-2, MT-3, and MT-4

4.1.1 Well Construction

Test wells MT-1 through MT-4 were located in Mortandad Canyon in Technical Area 35 (TA-35) and were drilled in 1988. Well construction information (well depth, well diameter, screen interval, construction material) is presented in Table 2.0-1. Test Well MT-1 was drilled to a depth of 70 ft bgs and constructed of 2-in. PVC well casing with a screen interval of approximately 41 ft–61 ft bgs and an 8.7-ft sump below

the screened interval. Well MT-2 was drilled to a depth of 66 ft bgs and constructed of 2-in. PVC well casing with a screen interval of approximately 46 ft–56 ft bgs and a 9.7-ft sump below the screened interval. Well MT-3 was drilled to a depth of 75 ft bgs and constructed of 2-in. PVC well casing with a screen interval of approximately 46 ft–66 ft bgs and an 8.8-ft sump below the screened interval. Well MT-4 was drilled to a depth of 60 ft bgs and constructed of 2-in. PVC well casing with a screen interval of approximately 57 ft–60 ft bgs and no sump below the screened interval.

A generic well-construction diagram for the test wells is provided in Figure 4.1-1.

4.1.2 Plugging and Abandonment

Before P&A activities were conducted, all dedicated sample pumps were removed, and the wells were video logged, and water levels and total depths were measured and recorded. At well MT-1, groundwater was observed at 48.9 ft bgs. It was purged and sampled before it was abandoned; however, not enough water was present to sample. Well MT-2 was dry. At well MT-3, groundwater was observed at 53.5 ft bgs (Table 4.1-2). It was purged and sampled before it was abandoned. At well MT-4 groundwater was observed at 60.1 ft bgs. It was blocked or bridged off because insect material was found in the well and could not be purged and sampled before it was abandoned.

A truck-mounted CME-85 HSA drill rig was used to install 1-in.–inside diameter (I.D.) polyethylene PVC tremie pipe to approximately full depth of each well, after which each well was pressure grouted with cement grout from total depth to ground surface. Subsequently, all wells were overdrilled with 4.25-in. I.D./8-in.–outside diameter (O.D.) HSAs to 20 ft bgs and then grouted from 20 ft bgs to surface with approximately 100 gal. of cement grout. Following abandonment, the top 1 ft of borehole was plugged with neat cement grout, and an aluminum survey marker was embedded in the concrete and labeled accordingly.

P&A activities took place at these locations from July 5 to July 7, 2016.

4.2 MCWB-6.5E, MCWB-7A, MCWB-7B, MCWB-7.4A, and MCWB-7.7B

4.2.1 Well Construction

All water balance wells were located in Mortandad Canyon in TA-35 and were drilled in 1994. MCWB-6.5E was drilled to a depth of 52 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 37–47 ft bgs and a 4.7-ft sump below the screened interval. MCWB-7A was drilled to a depth of 51 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 39-49 ft bgs and a 2.4-ft sump below the screened interval. MCWB-7B was drilled to a depth of 47 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 33–43 ft bgs and a 3.8-ft sump below the screened interval. MCWB-7.4A was drilled to a depth of 72 ft bgs, constructed of 3-in. PVC well casing with a screen interval of approximately 47–68 ft bgs and a 4.5-ft sump below the screened interval. MCWB-7.7B was drilled to a depth of 72 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 58–67 ft bgs and a 5.4-ft sump below the screened interval. A generic well construction diagram for the water-balance wells is provided in Figure 4.2-1.

4.2.2 Plugging and Abandonment

Before P&A activities were performed, all dedicated sample pumps were removed, and the wells were video logged, and water levels and total depths were measured and recorded. Well MCWB-6.5E was considered dry because only a little sump water was present. At well MCWB-7A, groundwater was present at 46.5 ft bgs. It was purged and sampled before it was abandoned. Well MCWB-7B was considered dry because only a little sump water was present. At well MCWB-7.4A, groundwater was

present at 49.5 ft bgs, and it was purged and sampled before it was abandoned. At well MCWB-7.7B, groundwater was present at 60.3 ft bgs, and it was purged and sampled before it was abandoned (Table 4.2-1).

A truck-mounted CME-85 HSA rig was used to install 1-in.-I.D. PVC tremie pipe inside each well to total depth. Each well was then pressure grouted through the PVC tremie pipe with cement grout from total depth to ground surface. Each well was then overdrilled with 4.25-in.-I.D./8-in.-O.D. HSAs to 20 ft bgs, after which the borehole was sealed with approximately 100 gal. of cement grout pumped through 1-in. PVC tremie pipe from total depth upward to 1 ft bgs as the augers were removed. Following abandonment, the top 1 ft of each borehole was plugged with neat cement, and an aluminum survey marker was embedded in the concrete and labeled accordingly.

P&A activities for wells MCWB-6.5E, MCWB-7A, MCWB-7B, MCWB-7.4A, and MCWB-7.7B occurred from June 28 to June 29, 2016.

4.3 MCWB-6.6, MCWB-6.5D, MCWB-5.5A, MCWB-5.5B, MCWB-6.2B, and MCWB-6.2C

4.3.1 Well Construction

All water-balance wells were located in Mortandad Canyon in TA-35 and were drilled in 1994. MCWB-6.6 was drilled to a depth of 50 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 35 ft–44 ft bgs and a 5.8-ft sump below the screened interval. MCWB-6.5D was drilled to a depth of 37 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 34-37 ft bgs and a 0.0-foot sump below the screened interval. MCWB-5.5A was drilled to a depth of 37.5 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 23–33 ft bgs and a 4.0-ft sump below the screened interval. MCWB-5.5B was drilled to a depth of 38 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 22.5 ft–33.5 ft bgs and a 4.7-ft sump below the screened interval. MCWB-6.2B was drilled to a depth of 44 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 29–38 ft bgs and a 5.5-ft sump below the screened interval. MCWB-6.2C was drilled to a depth of 31 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 26–30 ft bgs and a 0.6-ft sump below the screened interval. A generic well construction diagram for the water-balance wells is provided in Figure 4.2-1.

4.3.2 Plugging and Abandonment

Before P&A activities were performed, all dedicated sample pumps were removed, and the wells were video logged, water levels and total depths were measured and recorded. Well MCWB-6.6 was dry. Well MCWB-6.5D was considered dry because it had filter pack filling in the lower portion of the well. It could not be purged and sampled before it was abandoned. Wells MCWB-5.5A, MCWB-5.5B, MCWB-6.2B, and MCWB-6.2C were dry.

A truck-mounted HSA rig was used to install 1-in.-I.D. PVC tremie pipe inside each well to total depth. Each well was then pressure grouted through the PVC tremie pipe with cement grout from total depth to ground surface. Each well was then overdrilled with 4.25-in.-I.D./8-in.-O.D. HSAs to 20 ft bgs, after which the borehole was sealed with approximately 100 gal. of cement grout pumped through 1-in. PVC tremie pipe from total depth upward to 1 ft bgs as the augers were removed. Following abandonment, the top 1 ft of each borehole was plugged with neat cement, and an aluminum survey marker was embedded in the concrete and labeled accordingly.

P&A activities for wells MCWB-6.6, MCWB-6.5D, MCW5.5A, MCWB-5.5B, MCWB-6.2B, and MCWB-6.2C occurred from June 30 to July 1, 2016.

4.4 MCWB-6.5C, MCWB-7.2, MCWB-7.7A, and MCWB-7.4B

4.4.1 Well Construction

All water-balance wells were located in Mortandad Canyon in TA-35 and were drilled in 1994. MCWB 6.5C was drilled to a depth of 47 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 35 ft–44.5 ft bgs and a 2.1-ft sump below the screened interval. MCWB-7.2 drilled to a depth of was 70 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 44.5–65 ft bgs and a 5.7-ft sump below the screened interval. MCWB-7.7A was drilled to a depth of 70 ft bgs and, constructed of 3-in. PVC well casing with a screen interval of approximately 55–64 ft bgs and a 5.9-ft sump below the screened interval. MCWB-7.4B was drilled to a depth of 70 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 47.5 ft–70 ft bgs and a 3.7-ft sump below the screened interval. A generic well construction diagram for the water-balance wells is provided in Figure 4.2-1.

4.4.2 Plugging and Abandonment

Before P&A activities were performed, all dedicated sample pumps were removed, and the wells were video logged, and water levels and total depths were measured and recorded. Wells MCWB-6.5C and MCWB-7.2 were considered dry because only sump water was present. Well MCWB-7.7A had groundwater at 69 ft bgs. It was purged and sampled before it was abandoned. Well MCWB-7.4B had groundwater at 51 ft bgs. It was purged and sampled before it was abandoned.

A truck-mounted HSA rig was used to install 1-in.-I.D. PVC tremie pipe inside each well to total depth. Each well was then pressure grouted through the PVC tremie pipe with cement grout from total depth to ground surface. Each well was then overdrilled with 4.25-in.-I.D./8-in.-O.D. HSAs to 20 ft bgs, after which the borehole was sealed with approximately 100 gal. of cement grout pumped through 1-in PVC tremie pipe from total depth upward to 1 ft bgs as the augers were removed. Following abandonment, the top 1 ft of each borehole was plugged with neat cement, and an aluminum survey marker was embedded in the concrete and labeled accordingly.

P&A activities for wells MCWB-6.5C, MCWB-7.2, MCWB-7.7A, and MCWB-7.4B occurred from July 5 to July 7, 2016.

4.5 MCWB-8.1A, MCWB-8.1B, MCWB-8.1C, MCWB-9A, and MCWB-9B

4.5.1 Well Construction

All water-balance wells were located in Mortandad Canyon in TA-35 and were drilled in 1994. MCWB-8.1A was drilled to a depth of 78 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 52.5 ft–72 ft bgs and a 5.8-ft sump below the screened interval. MCWB-8.1B was drilled to a depth of 75ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 50–69 ft bgs and a 5.8-ft sump below the screened interval. MCWB-8.1C was drilled to a depth of 83 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 58 ft–77 ft bgs and a 5.8-ft sump below the screened interval. MCWB-9A was drilled to a depth of 75 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 50 ft–69 ft bgs and a 5.7-ft sump below the screened interval. MCWB-9B was drilled to a depth of 84 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 58 ft–78 ft bgs and a 5.7-ft sump below the screened interval. A generic well construction diagram for the water-balance wells is provided in Figure 4.2-1.

4.5.2 Plugging and Abandonment

Before P&A activities were performed, all dedicated sample pumps were removed, and the wells were video logged, and water levels and total depths were measured and recorded. Well MCWB-8.1A was considered dry because only sump water was present. Well MCWB-8.1B was considered dry and the casing was deformed just below the concrete pad. Wells MCWB-8.1C, MCWB-9A, and MCWB-9B were determined to be dry.

A truck-mounted HSA rig was used to install 1-in. I.D. PVC tremie pipe inside each well to total depth. Each well was then pressure grouted through the PVC tremie pipe from total depth to ground surface with cement grout. Each well was then over-drilled with 4.25-in. I.D./8-in. O.D. HSAs to 20 ft bgs, after which the borehole was sealed with approximately 100 gal. of cement grout pumped through 1-in. PVC tremie pipe from total depth upward to 1 ft bgs, as augers were removed. Following abandonment, the top 1 ft of each borehole was plugged with neat cement, and an aluminum survey marker was embedded in the concrete and labeled accordingly.

P&A activities for wells MCWB-8.1A, MCWB-8.1B, MCWB-8.1C, MCWB-9A, and MCWB-9B occurred from July 5 to July 8, 2016.

4.6 MCWB-4

4.6.1 Well Construction

All water-balance wells were located in Mortandad Canyon in TA-35 and were drilled in 1994. MCWB-4 was drilled to a depth of 15 ft bgs and constructed of 3-in. PVC well casing with a screen interval of approximately 10–15 ft bgs and no sump below the screened interval. A generic well construction diagram for the water-balance wells is provided in Figure 4.2-1.

4.6.2 Plugging and Abandonment

Before P&A activities were performed, well MCWB-4 was video logged, and the water level and total depth were measured and recorded. Well MCWB-4 was dry.

A limited-access track-mounted HSA rig was used to install 1-in.-I.D. PVC tremie pipe inside each well to total depth. The well was then pressure grouted through the PVC tremie pipe with cement grout from total depth to ground surface. The well was then over-drilled with 4.25-in.-I.D./8-in.-O.D. HSAs to 20 ft bgs, after which the borehole was sealed with approximately 100 gal. of cement grout pumped through 1-in. PVC tremie pipe from total depth upward to 1 ft bgs as the augers were removed. Following abandonment, the top 1 ft of each borehole was plugged with neat cement, and an aluminum survey marker was embedded in the concrete and labeled accordingly.

Plugging and abandonment activities for wells MCWB-4 occurred from September 21 to September 22, 2016.

5.0 SURFACE COMPLETIONS

During well abandonment activities, well monuments and surface completions were removed in full. Wells were grouted to full depth, the upper 20 ft was overdrilled, and the wells were then grouted with cement grout to 1 ft bgs. Subsequently, the top 1 ft of each location was filled with Portland Type I/II neat cement and mounded above existing grade with an aluminum survey marker embedded in the concrete plug. All surface completion materials were segregated into three piles based on composition: metals, concrete, or

plastics. All completion debris was then staged on Visqueen sheeting at each well location for analysis and disposal.

6.0 WATER SAMPLING

Static water-level measurements taken before P&A activities indicated water was present at the following locations: test wells MT-1 (49 ft bgs) and MT-3 (53.5 ft bgs) and water-balance wells MCWB-7A (46.5 ft bgs), MCWB-7.4A (49.5 ft bgs), MCWB-7.4B (51 ft bgs), MCWB-7.7A (58 ft bgs), and MCWB7.7B (60 ft bgs). These seven wells were bailed dry or up to 3 casing volumes. Purge water was drummed and staged for later disposal. All purging and recharging were performed from June 17 to June 18, 2016.

Upon completion of purging and recharging of wells, each well was then sampled by pumping. All samples were collected and submitted to the Sample Management Office (SMO) for analysis. All sample collection and submissions was performed from June 25 to June 26, 2016.

Wells MCWB6.5C, MCWB-6.5E, MCWB-7B, and MCWB-7.2 exhibited trace amounts of water, either sump water or condensation. As a result of the minimal quantity of water at these locations, sample collection and analysis were not required.

7.0 WASTE MANAGEMENT

After well abandonment activities were completed, waste generated was sampled in accordance with the project WCSF. At all well locations, samples were collected and submitted to the SMO for analysis from June 24 to July 9, 2016.

Waste generated from the P&A project included drill cuttings, fluids and typical construction waste, such as soil, water, paper, metal, concrete, and plastics. All materials generated were either containerized in 55-gal. U.S. Department of Transportation–approved steel drums or segregated into three piles based on composition: metals, concrete, or plastics. All soils and fluids generated were placed into drums and all other materials were staged at each well location on bermed Visqueen. YJD provided sampling and transportation of samples to the SMO for analysis. All staged materials left at well sites were tested or sampled for disposal. Upon completion of analytical testing, YJD will categorize the materials to be disposed.

All waste was managed in accordance with WCSF (LANL 2016, 601140) and ER-DIR-SOP-10012, Characterization of Environmental Waste.

8.0 GEODETIC SURVEY

Geodetic surveys were conducted on the surface completions with a Trimble R10 global navigation satellite system global positioning system. All coordinates are expressed relative to the New Mexico State Plane Coordinate System Central Zone (North American Datum [NAD] 83); elevation is expressed relative to feet above mean sea level using the National Geodetic Vertical Datum of 1929. The survey point was the aluminum survey marker placed in the concrete plug and labeled with well identification and appropriate information. Surveying was conducted on September 12, 2016. A complete listing of all survey coordinates is presented in Table 8.0-1.

9.0 DEVIATIONS FROM PLANNED ACTIVITIES

Two deviations were required to complete this phase of work. The first was the omission of abandonment for well 50-603060. This well/borehole was found to have been plugged and abandoned previously and thus was not required for this project. The second was the abandonment of MCWB-4, which required the

use of the limited-access, track-mounted drill rig. Originally scheduled to be completed during the initial phase of work in June 2016, the increase in work scope and the addition of wells to be abandoned in a second phase that also required the use of a limited-access rig, the abandonment of MCWB-4 was delayed slightly to occur during the second phase of work and thus was abandoned in September 2016.

10.0 SUMMARY

All abandonment activities, with the exception of abandonment of MCWB-4, were conducted from May to July 2016. MCWB-4 was abandoned in September 2016. All sampling activities occurred from June to July 2016. All project activities were performed per the SOW Exhibit D, the approved work plans (LANL 2016, 601140; NMED 2016, 601272), YJD's FIP, and the WCSF. All above- and belowground appurtenances were removed. Wells with water present were purged and sampled. Well abandonment was completed with a CME-85 HT truck-mounted auger rig and/or a Pulstar L-12-T limited-access track-mounted auger rig. All wells were plugged with Portland Type I/II cement grout via tremie tubing. Over drilled to 20 ft bgs, the top 1 ft of each borehole was plugged with neat cement, and the surface completions were removed. Concrete surface plugs were emplaced with aluminum pins and surveyed. All waste generated was staged accordingly, sampled, and characterized. Upon receipt of analytical results, the Laboratory will be responsible for removing and disposing of all waste generated.

11.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID or ESHID. This information is also included in text citations. ERIDs were assigned by the Environmental Programs Directorate's Records Processing Facility (IDs through 599999), and ESHIDs are assigned by the Environment, Safety, and Health (ESH) Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory's Electronic Document Management System and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the ESH Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

LANL (Los Alamos National Laboratory), January 2016. "Works Plans for the Plugging and Abandonment of Wells for Fiscal Year 2016," Los Alamos National Laboratory document LA-UR-16-20224, Los Alamos, New Mexico. (LANL 2016, 601140)

NMED (New Mexico Environment Department), March 1, 2016. "Approval, Work Plans for the Plugging and Abandonment of Wells for Fiscal Year 2016," New Mexico Environment Department letter to D. Hintze (DOE-EM-LA) and M. Brandt (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2016, 601272)

Yellow Jacket Drilling, March 3, 2016. "IWD [Integrated Work Document] for Drilling and Installation of LANL Vertical Chromium Injection Wells," Los Alamos, New Mexico. (Yellow Jacket Drilling 2016, 601273)

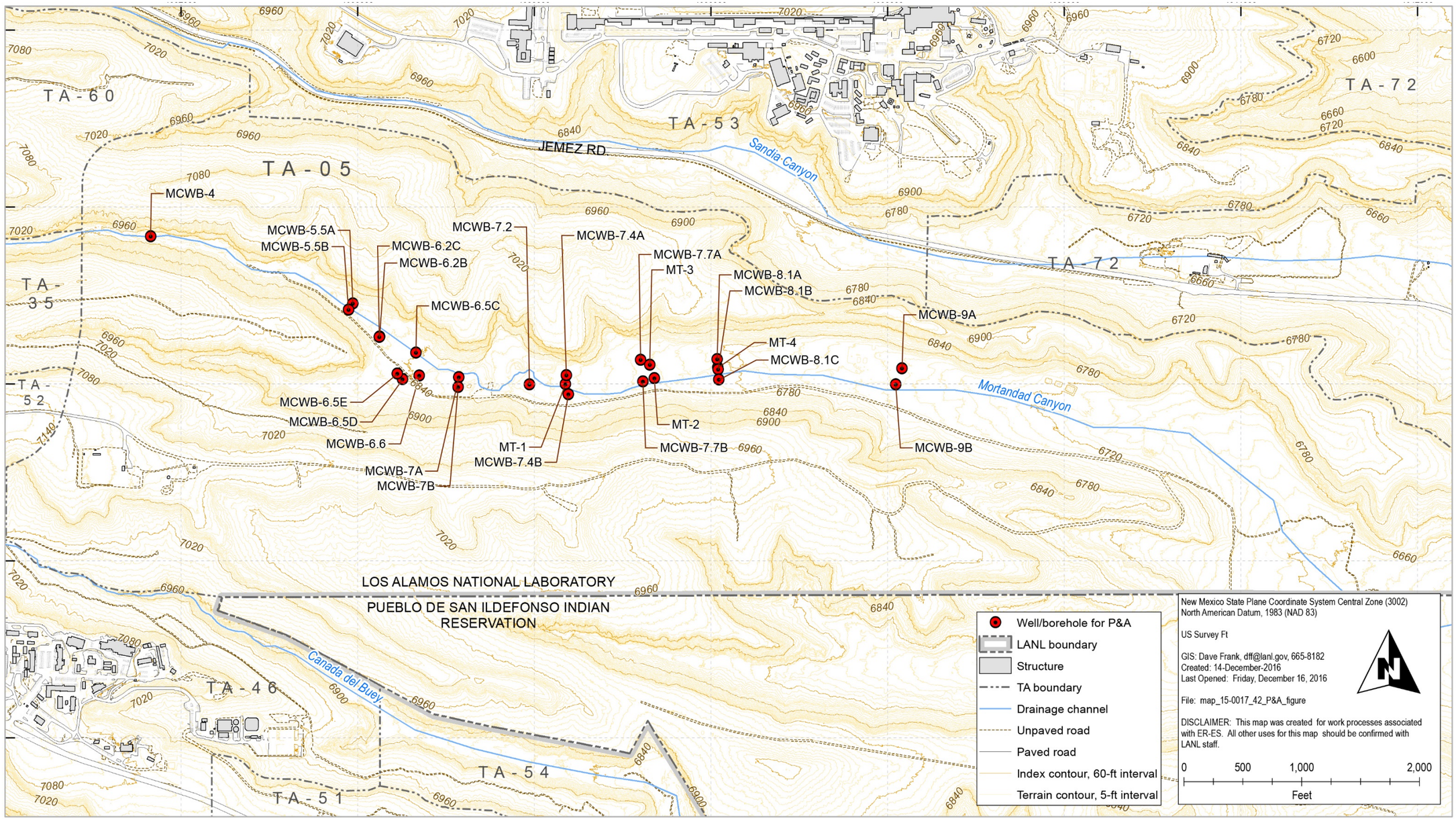

Figure 1.0-1 Site map with well locations

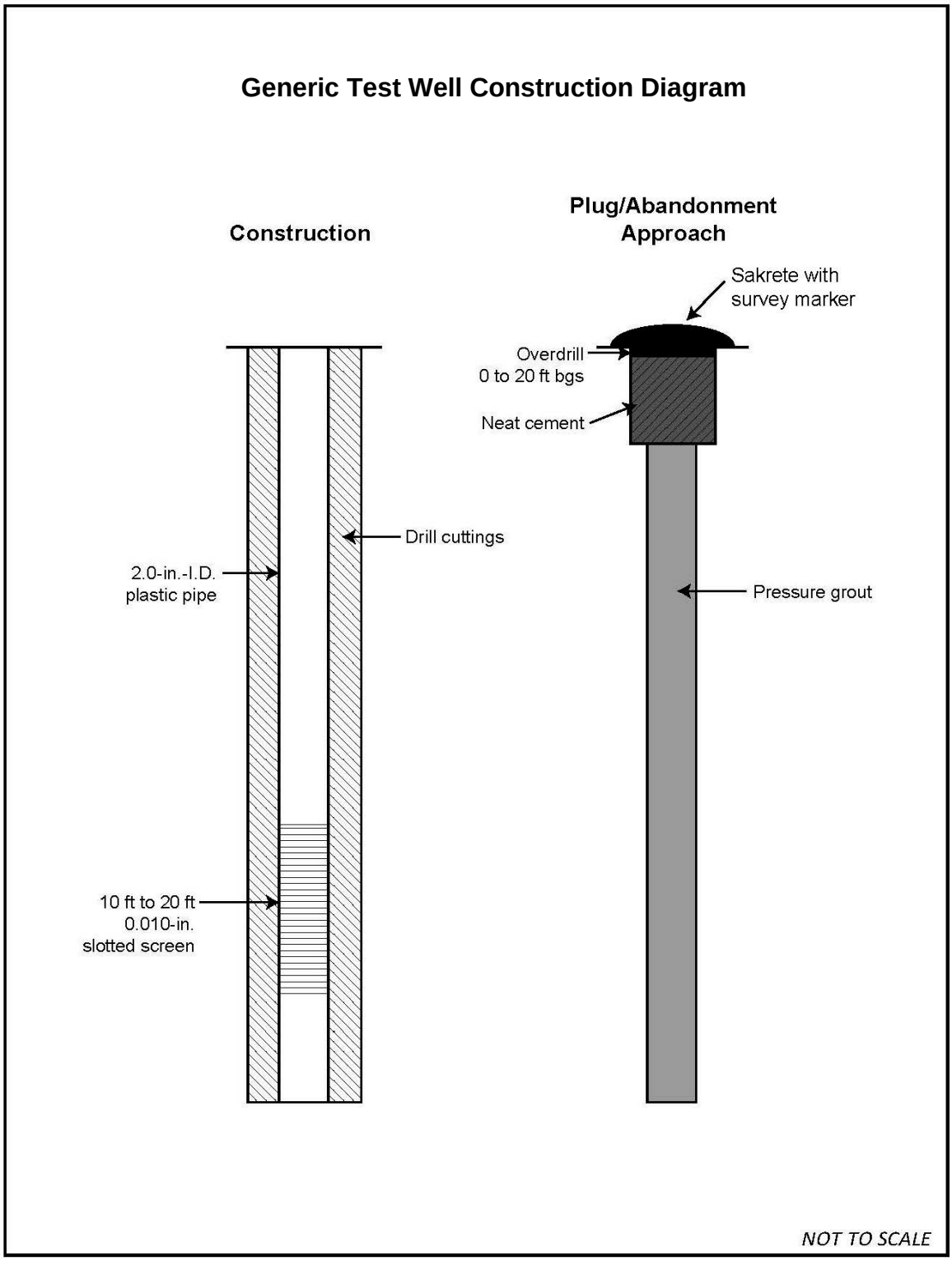

Figure 4.1-1 Generic test well construction diagram

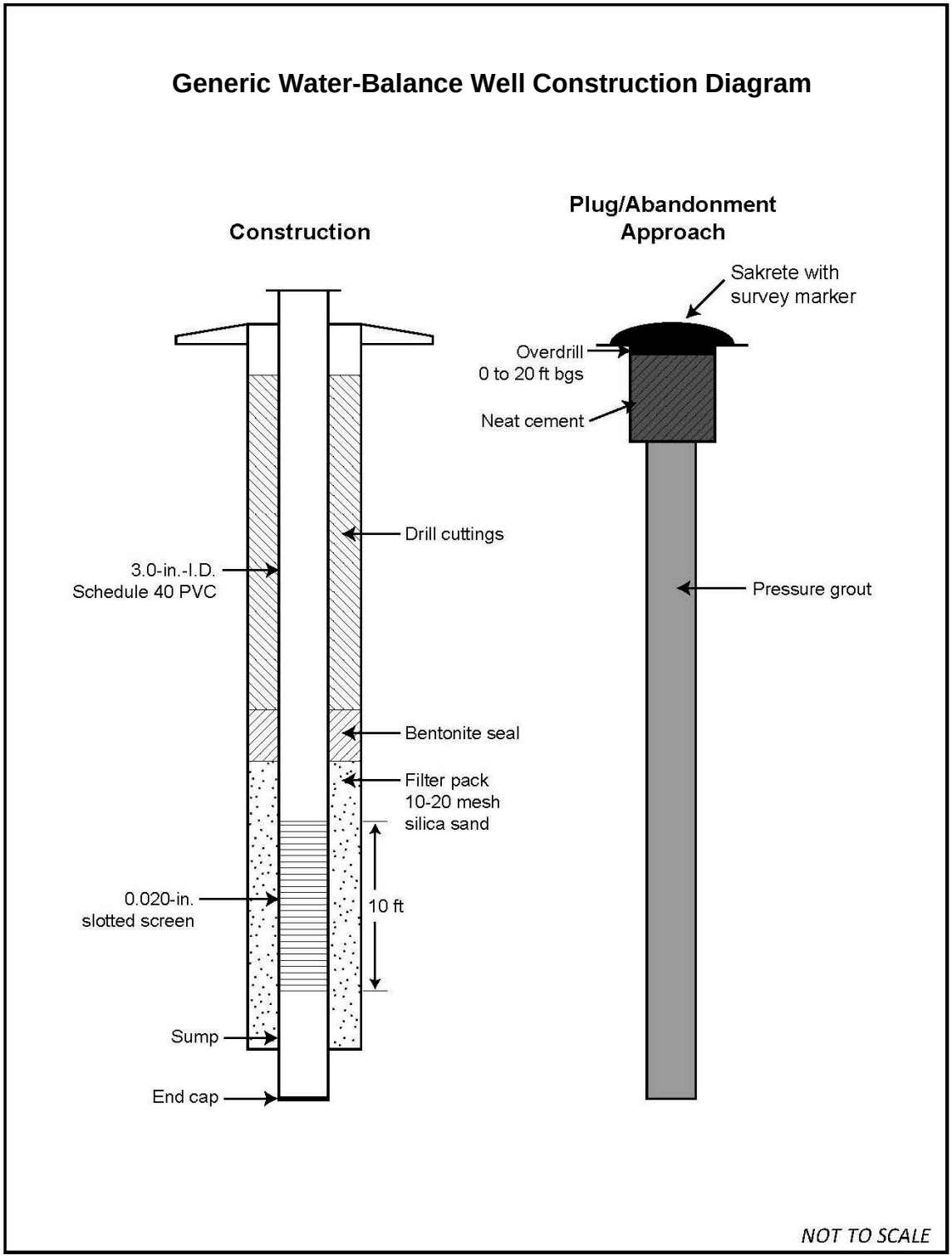

Figure 4.2-1 Generic water-balance well construction diagram

Table 2.0-1
Mortandad Canyon Well List for 2016 P&A

Well Name	Depth (ft)	Diameter (in.)	Number of Screens	Screen Length* (ft)	Screen Interval	Construction Material	Depth to Water (ft)	Easting	Northing	Elevation	Install Date
MT-1	70	2	1	20	41–61	PVC	49	1635262.86	1768493.96	6811.63	11/01/1988
MT-2	66	2	1	10	46–56	PVC	Dry	1636019.79	1768544.59	6796.2	11/01/1988
MT-3	75	2	1	20	46–66	PVC	53.5	1635980.95	1768657.83	6796.65	11/01/1988
MT-4	60	2	1	10	57–60	PVC	60	1636558.75	1768634.37	6783.59	11/01/1988
MCWB-4	15	3	1	A	10–15	PVC	12.5	1631740.56	1769745.66	6893.42	12/06/1994
MCWB-5.5A	37.5	3	1	B	23–33	PVC	Dry	1633455.53	1769176.95	6858.36	12/22/1994
MCWB-5.5B	38	3	1	B	22.5–33.5	PVC	Dry	1633420.54	1769125.78	6856.89	12/22/1994
MCWB-6.2B	44	3	1	B	29-38	PVC	Dry	1633685.09	1768897.84	6848.01	12/07/1994
MCWB-6.2C	31	3	1	A	26–30	PVC	Dry	1633682.27	1768893.49	6847.98	12/22/1994
MCWB-6.5C	47	3	1	B	35–44.5	PVC	Dry	1633993.33	1768759.41	6841.02	12/08/1994
MCWB-6.5D	37	3	1	A	34–37	PVC	Dry	1633878.05	1768536.19	6843.2	12/08/1994
MCWB-6.5E	52	3	1	B	37–47	PVC	46	1633833.36	1768583.81	6843.8	12/21/1994
MCWB-6.6	50	3	1	B	35–44	PVC	Dry	1634020.98	1768565.73	6839.35	12/20/1994
MCWB-7A	51	3	1	B	39–49	PVC	46.5	1634356.62	1768551.02	6831.17	12/12/1994
MCWB-7B	47	3	1	B	33–43	PVC	44	1634350.16	1768469.73	6832.45	12/13/1994
MCWB-7.2	70	3	1	C	44.5–65	PVC	68	1634956.96	1768491.86	6818.86	12/13/1994
MCWB-7.4A	72	3	1	C	47–68	PVC	Dry	1635270.33	1768569.46	6812.4	12/19/1994
MCWB-7.4B	70	3	1	C	47.5–70	PVC	51	1635287.73	1768407.84	6813.07	12/20/1994
MCWB-7.7A	70	3	1	B	55–64	PVC	69	1635902.25	1768700.71	6798.31	12/09/1994
MCWB-7.7B	72	3	1	B	58–67	PVC	60	1635921.84	1768517.26	6798.97	12/09/1994
MCWB-8.1A	78	3	1	C	52.5–72	PVC	Dry	1636552.36	1768704.12	6785.95	12/14/1994
MCWB-8.1B	75	3	1	C	50–69	PVC	Dry	1636559.97	1768618.31	6783.8	12/19/1994
MCWB-8.1C	83	3	1	C	58–77	PVC	Dry	1636565.71	1768531.74	6785.63	12/14/1994

Table 2.0-1 (continued)

Well Name	Depth (ft)	Diameter (in.)	Number of Screens	Screen Length* (ft)	Screen Interval	Construction Material	Depth to Water (ft)	Easting	Northing	Elevation	Install Date
MCWB-9A	75	3	1	C	50–69	PVC	Dry	1638123.04	1768627.67	6752.11	12/15/1994
MCWB-9B	84	3	1	C	58–78	PVC	Dry	1638069	1768490.99	6753.6	12/15/1994

*Screen lengths: A = 5-ft screen above end cap; B = 5-ft blank casing above end cap, then 10-ft screen; C = 5-ft blank casing above end cap, then 20-ft screen.

Table 3.2-1
Mortandad Canyon P&A Video Survey Summary

Well Name	Lock	Well Casing Diameter (in.)	Pump Removed	Video Logged	Protective Casing Stickup (ft)	Well Casing Stickup (in.)	Total Depth (ft)	Screen Interval (ft)	Sump (ft)	Depth to Water	Comments
MT-1	ESH-401/Removed	2	Yes	Yes	2.6	1.7	70	41–61	8.7	49	Groundwater
MT-2	No lock	2	n/a*	Yes	2.6	1.75	66	46–56	9.7	n/a	Dry
MT-3	No lock	2	Yes	Yes	1.5	1.25	75	46–66	8.8	53.5	Groundwater
MT-4	ESH-403/Removed	2	n/a	Yes	1.6	1.5	60	57–60	0	60	Bridged off because of insect material.
MCWB-4	ESH-403/Removed	3	n/a	No	n/a	n/a	15	10–15	n/a	n/a	Dry
MCWB-5.5A	ESH-401/Removed	3	Yes	Yes	2.6	2.4	37.5	23–33	4.0	n/a	Dry
MCWB-5.5B	ESH-403/Removed	3	Yes	Yes	2.8	2.6	38	22.5–33.5	4.7	n/a	Dry
MCWB-6.2B	ESH-403/Removed	3	n/a	Yes	2.6	2.1	44	29-38	5.5	n/a	Dry
MCWB-6.2C	ESH-242/Unlocked	3	n/a	Yes	2.6	2.1	31	26–30	0.6	n/a	Dry
MCWB-6.5C	No lock	3	Yes	Yes	2.7	2.3	47	35–44.5	2.1	45	Sump water
MCWB-6.5D	No lock	3	n/a	Yes	2.5	2.1	37	34–37	0	n/a	Dry; bottom of well filled in by filter pack sand.
MCWB-6.5E	No lock	3	Yes	Yes	2.7	2.4	52	37–47	4.7	51	Sump water
MCWB-6.6	No lock	3	n/a	Yes	2.6	2.1	50	35–44	5.8	n/a	Dry
MCWB-7A	ESH-403/Removed	3	Yes	Yes	2.7	2.2	51	39–49	2.4	46.5	Groundwater
MCWB-7B	No lock	3	Yes	Yes	2.7	2.1	47	33–43	3.8	44.2	Sump water
MCWB-7.2	ESH-403/Removed	3	Yes	Yes	2.6	2.1	70	44.5–65	5.7	65.7	Sump water
MCWB-7.4A	ESH-403/Removed	3	Yes	Yes	2.7	2.5	72	47–68	4.5	49.5	Groundwater
MCWB-7.4B	ESH-403/Removed	3	Yes	Yes	2.7	2.3	70	47.5–70	3.7	51	Groundwater
MCWB-7.7A	ESH-401/Removed	3	n/a	Yes	2.7	2.1	70	55–64	5.9	58	Groundwater
MCWB-7.7B	ESH-403/Removed	3	Yes	Yes	2.6	2.4	72	58–67	5.4	60	Groundwater

Table 3.2-1 (continued)

Well Name	Lock	Well Casing Diameter (in.)	Pump Removed	Video Logged	Protective Casing Stickup (ft)	Well Casing Stickup (in.)	Total Depth (ft)	Screen Interval (ft)	Sump (ft)	Depth to Water	Comments
MCWB-8.1A	ESH-401/Removed	3	n/a*	Yes	2.7	2.2	78	52.5–72	5.8	76	Sump water
MCWB-8.1B	No lock	3	n/a	Yes	2.6	2.2	75	50–69	5.8	n/a	Dry; casing deformed just below concrete pad
MCWB-8.1C	ESH-401/Removed	3	n/a	Yes	2.6	2.1	83	58–77	5.8	n/a	Dry
MCWB-9A	ESH-403/Removed	3	n/a	Yes	2.75	2.1	75	50–69	5.7	n/a	Dry
MCWB-9B	ESH-403/Removed	3	n/a	Yes	2.6	2.0	75	58–78	5.7	n/a	Dry

Notes: Based on well video logging performed before P&A activities. Datum for all depth measurements is from the top of the concrete well pad or ground surface. All locks have been removed and protective casings flagged. All dedicated sample pumps have been removed. Seven wells were identified as having groundwater to sample.

* n/a = Not applicable.

Table 4.2-1
Water Sampling for Mortandad Canyon Wells

Well	Waste Type	Total Volume (gal.)	Date of Generation	Event ID	Sample ID	Sample Date
MT-3	Development water	17	06/18/2016	10792	WSTMO-16-123363-66	06/25/2016
MCWB-7.7B	Development water	52	06/17/2016	10777	WSTMO-16-123245-48	06/24/2016
MCWD 7.4A	Development water	40	06/17/2016	10790	WSTMO-16-123355-58, WSTMO-16-123369-70	06/25/2016
MCWD 7.4B	Development water	27	06/25/2016	10791	WSTMO-16-123359-62	06/25/2016

Table 8.0-1
Geodesic Coordinates List

ID	Northing (U.S. survey foot)	Easting (U.S. survey foot)	Elevation (U.S. survey foot)
B5201	1767831.976	1632361.834	7092.000
MCWB-5.5A	1769176.459	1633454.639	6857.306
MCWB-5.5B	1769132.175	1633427.802	6855.516
MCWB-6.2B	1768903.643	1633696.795	6846.641
MCWB-6.2C	1768901.389	1633697.048	6846.737
MCWB-6.5C	1768761.798	1633978.513	6840.468
MCWB-6.5D	1768536.492	1633877.296	6842.113
MCWB-6.5E	1768585.182	1633832.359	6842.410
MCWB-6.6	1768566.768	1634019.669	6838.279
MCWB-7.2	1768490.599	1634959.329	6817.788
MCWB-7.4A	1768568.121	1635270.291	6811.714
MCWB-7.4B	1768470.029	1635287.622	6812.079
Mcwb-7.7a	1768699.743	1635901.891	6797.354
MCWB-7.7B	1768516.224	1635921.388	6797.929
MCWB-7A	1768543.986	1634361.439	6830.121
MCWB-7B	1768468.968	1634349.590	6831.462
Mcwb-8.1A	1768617.250	1636599.824	6782.651
Mcwb-8.1b	1768703.875	1636552.147	6784.489
Mcwb-8.1c	1768530.754	1636565.335	6784.628
Mcwb-9a	1768627.167	1638121.530	6751.166
Mcwb-9b	1768490.541	1638068.195	6752.553
MT-1	1768495.268	1635263.393	6811.437
MT-2	1768546.651	1636020.512	6796.162
MT-3	1768659.565	1635981.472	6796.333
MT-4	1768634.719	1636556.660	6782.831