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Los Alamos
NATIONAL LABORATORY
EST. 1943

Associate Director for ESH
Environment, Safety, and Health
P.O. Box 1663, MS K491
Los Alamos, New Mexico 87545
505-667-4218/Fax 505-665-3811

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MAR 17 2015
NMED
Hazardous Waste Bureau

National Nuclear Security Administration
Los Alamos Field Office, MS A316
Environmental Projects Office
Los Alamos, New Mexico 87544
(505) 667-4255/FAX (505) 606-2132

Date: MAR 17 2015
Refer To: ADESH-15-046
LAUR: 15-20937
Locates Action No.: N/A

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

Subject: Submittal of the Work Plans for the Plugging and Abandonment of Wells and Boreholes for Fiscal Year 2015

Dear Mr. Kieling:

Enclosed please find two hard copies with electronic files of the Work Plans for the Plugging and Abandonment of Wells and Boreholes for Fiscal Year 2015. These work plans summarize the methods Los Alamos National Laboratory (the Laboratory) proposes to use in plugging and abandoning these wells and boreholes. This work continues the effort by the Laboratory to plug and abandon unused penetrations on Laboratory property.

Field work will be completed during fiscal year 2015 and a summary report submitted by March 30, 2016.

If you have any questions, please contact Ted Ball at (505) 665-3996 (tedball@lanl.gov) or Woody Woodworth at (505) 665-5820 (lance.woodworth@nnsa.doe.gov).

Sincerely,

Alison M. Dorries, Division Leader
Environmental Protection Division
Los Alamos National Laboratory

Sincerely,

Peter Maggiore, Assistant Manager
Environmental Projects Office
Los Alamos Field Office

AMD/PM/DJM/TTB:sm

Enclosures: Two hard copies with electronic files – Work Plans for the Plugging and Abandonment of Wells and Boreholes for Fiscal Year 2015 (EP2015-0020)

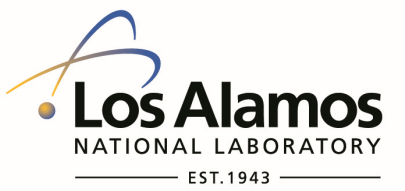
Cy: (w/enc.)
Ted Ball, ADEP ER Program, MS M992
Public Reading Room (EPRR)
ADESH Records

Cy: (Letter and CD and/or DVD)
Laurie King, EPA Region 6, Dallas, TX
Woody Woodworth, DOE-NA-LA, MS A316
Steve Yanicak, NMED-DOE-OB, MS M894
PRS Database

Cy: (w/o enc./date-stamped letter emailed)
lasomailbox@nnsa.doe.gov
Annette Russell, DOE-NA-LA
David Rhodes, DOE-NA-LA
Kimberly Davis Lebak, DOE-NA-LA
Issac Valdez, LASO-NS-LP
Kenneth Schlindwein, OI-PO
Dave McInroy, ADEP ER Program
Randy Erickson, ADEP
Tony Grieggs, ADESH-ENV-CP
Alison Dorries, ADESH-ENV-DO
Michael Brandt, ADESH
Amy De Palma, PADOPS
Michael Lansing, PADOPS

LA-UR-15-20937
March 2015
EP2015-0020

Work Plans for the Plugging and Abandonment of Wells and Boreholes for Fiscal Year 2015



Prepared by the Environmental Programs Directorate

EP2015-0020

Work Plans for the Plugging and Abandonment of Wells and Boreholes for Fiscal Year 2015

March 2015

Responsible project manager:

Printed Name	Signature	Title	Organization	Date
Ted Ball	Ted Ball	Project Manager	Environmental Programs	3/5/15

Responsible LANS representative:

Printed Name	Signature	Title	Organization	Date
Randall Erickson	R Erickson	Acting Associate Director	Environmental Programs	3/6/15

Responsible DOE representative:

Printed Name	Signature	Title	Organization	Date
Peter Maggiore	Peter Maggiore	Assistant Manager	DOE-NA-LA	3/13/15

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1.0 INTRODUCTION

This document contains information for the plugging and abandonment of 13 wells and boreholes at Los Alamos National Laboratory (LANL or the Laboratory) and is part of the Laboratory's ongoing efforts to plug and abandon legacy wells and boreholes on and adjacent to Laboratory property.

The work plans describe plugging and abandonment procedures that comply with Section X.D (Well Abandonment) of the Compliance Order on Consent (the Consent Order) as well as the New Mexico Office of the State Engineer (NMOSE) well or borehole abandonment regulations. Additionally, the plugging and abandonment procedures used comply with 19.27.4 New Mexico Administrative Code Rules and Regulations Governing Well Driller Licensing; Construction, Repair and Plugging of Wells. The Plugging Plans of Operation will be submitted to NMOSE before abandonment.

This document includes seven stand-alone work plans and associated figures, as shown in Table 1.0-1. References for the work plans are provided at the end of this document.

Table 1.0-1
Organization of Work Plans

Work Plan	Page Number
Work Plan to Plug and Abandon Well MCOI-1 Figure 3.1-1, MCOI-1 abandonment schematic	4
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Work Plan to Plug and Abandon TA-33 Boreholes Figure 3.6-1, TA-33 abandonment schematics	9
Work Plan to Plug and Abandon TA-49 Boreholes Figure 3.7-1, TA-49 abandonment schematics	10

2.0 BACKGROUND INFORMATION AND RATIONALE

Prioritization of wells and boreholes to be abandoned is based on criteria that determine their potential for providing a pathway for contaminants to reach the regional aquifer. These criteria include the depth of the well, its location (canyon bottom versus mesa top), its condition (the hole is wet or dry), its proximity to known sources of contamination, its age, its construction, and its accessibility to the public. In addition, recent experience from work performed from 2010 to 2014 has added some practical criteria to maximize cost savings and stay within allotted budgets. These criteria include grouping wells and boreholes within a given location to minimize mobilization costs and required permitting and combining difficult and thus expensive wells and boreholes with less difficult ones. The information available about legacy boreholes can be inaccurate, and unexpected conditions may be encountered. Field reconnaissance will be conducted at the wells and boreholes to verify construction details of each well. These include possible

obstructions, ease of site access, condition of surface well pad, surface casing and well head security, verification of total well depth, depth of groundwater (if present), location of any potential obstructions, and other issues that may hamper the abandonment work plan.

The locations of wells and boreholes to be abandoned are shown in Figure 2.0-1. The rationale for plugging and abandoning each hole is provided below.

2.1 Well MCOI-1

Groundwater monitoring well MCOI-1 was drilled as a corehole and completed as a 1-in. piezometer in January 2005 (Kleinfelder 2006, 092494). The corehole was drilled to 843.2 ft below ground surface (bgs). A single screen was installed from 825.5 to 815 ft bgs. This piezometer has been dry since it was installed. Soundings for water in 2006 and 2007 encountered sand at a total depth of only 814 ft bgs, suggesting the 10-ft-long screen may have been damaged. This piezometer is located in a canyon bottom and was drilled to determine if contaminant releases from the Technical Area 50 (TA-50) outfall have impacted intermediate-perched water in upper Mortandad Canyon. The location and condition of this piezometer make it a priority for plugging and abandonment.

2.2 Wells BCO-1 and BCM-1

Groundwater monitoring well BCO-1 was drilled to a total depth of 70 ft bgs in November 1994 and a well completed in it to a depth of 68 ft bgs (Koch and Schmeer 2010, 108926). The well is currently dry. The location and condition of this well make it a priority for plugging and abandonment. Groundwater monitoring well BCM-1 was drilled to a total depth of 94 ft bgs in October 1994 and a well completed in it to a depth of 50 ft bgs. The well is currently dry. The location and condition of this well also make it a priority for plugging and abandonment. These wells are located 15 ft apart in Bayo Canyon on Los Alamos County property.

2.3 Piezometers POTO-4 and POTO-5

Two test holes, POTO-4 and POTO-5, were drilled in Potrillo Canyon in 1991 and completed as piezometers (Purtymun 1995, 045344). POTO-4 has three screened zones at various depths separated from each other by bentonite and cement. POTO-5 has two screened zones separated by bentonite and cement. The screened zones are packed with sand. The piezometers were completed as part of a study to determine whether recharge to the alluvium and underlying tuff was occurring and transporting depleted uranium from the intermittent stream in Potrillo Canyon in TA-36 (Purtymun 1995, 045344). The piezometers were installed to study the chemistry and radiochemistry of infiltrating water at different depths. These studies have been completed. The location and age of these piezometers make them a priority for plugging and abandonment. These piezometers are in an area contaminated with uranium on the surface, and some additional precautions and training may be required.

2.4 Piezometers R-4 East and West

Two temporary piezometers (designated east and west) were installed in 2004 in the corehole drilled on the R-4 pad during drilling activities. Each piezometer consists of flush-threaded connecting joints with 2-in.–outside diameter (O.D.), schedule 40 polyvinyl chloride (PVC) well casing and a 10-ft section of schedule 40 PVC 0.010-in. slotted screen. The west and east piezometers were screened from 125 to 115 ft bgs and from 231 to 221 ft bgs, respectively.

These temporary piezometers are no longer used and should be plugged and abandoned to remove potential pathways for contaminants to reach shallow groundwater.

2.5 TA-16 Boreholes

Boreholes 16-P-0 and 16-P-12A are located on the east side of the burning grounds at TA-16 (Brown et al. 1988, 006871). Borehole 16-P-0 is thought to be 135 ft deep, and 16-P-12A is thought to be 200 ft deep. These boreholes were installed in 1987 as part of a moisture content study of the Bandelier Tuff in the area of Material Disposal Area (MDA) P. Both wells are dry and are no longer in use. Therefore, they should be plugged and abandoned to remove potential pathways for contaminants.

2.6 TA-33 Boreholes

Boreholes 33-01230, 33-01231, and 33-01232 were drilled at TA-33 in 1993 as part of the MDA K investigation (LANL 1995, 050113). The boreholes were drilled to determine (1) the lateral and vertical extent of the tritium plume at this MDA, (2) if contaminants other than tritium were present, and (3) if perched water existed in the area.

The boreholes have a 5-in.-diameter steel casing set in cement/bentonite to 30 ft bgs. The boreholes were then drilled open hole using an air-rotary rig to the specified depths. Borehole 33-01230 is 235 ft deep and was dry at the time of drilling. Borehole 33-01231 is 315 ft deep and was dry at the time of drilling. Borehole 33-01232 is 246 ft deep and was also dry at the time of drilling.

The boreholes were not plugged and abandoned after samples were collected. Therefore, they should be plugged and abandoned to remove potential pathways for contaminants to reach shallow groundwater. These boreholes are located in an area contaminated with tritium and so may require some additional training and precautions.

2.7 TA-49 Boreholes

Boreholes 49-2-150-1 (also known as 49-2906) and 49-2-150-2 (also known as 49-2907) were drilled in 1994 as part of an investigation at MDA AB. They are 150 ft deep and open hole with a PVC surface casing protruding through the biobarrier installed in 1998. These boreholes are no longer in use and should be plugged and abandoned to remove potential pathways for contaminants.

3.0 WORK PLANS FOR PLUGGING AND ABANDONMENT

3.1 Work Plan to Plug and Abandon Piezometer MCOI-1

Primary Purpose	The purpose for plugging and abandoning this piezometer is to prevent the migration of surface water in the piezometer to depth. This work plan summarizes the plugging and abandonment methods the Laboratory proposes for intermediate piezometer MCOI-1 (also known as I-1), located in TA-35 in Mortandad Canyon. Abandonment will be consistent with Section X.D (Well Abandonment) of the Consent Order and NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	Piezometer MCOI-1 was drilled as a corehole using a track-mounted rig and completed as a piezometer in January 2005 (Kleinfelder 2006, 092494). The corehole was advanced using air-rotary techniques with no drilling fluids. The hole was dry when drilled and has continuously been dry since. The corehole was drilled to 843.2 ft bgs. A single-screen piezometer was installed in the corehole from 825.5 to 815 ft bgs. Slough fills the hole from 843.2 to 828.5 ft bgs, and bentonite chips were used between 828.5 and 826.5 ft bgs (Figure 3.1-1). The diameter of the corehole is as follows: • 7.375 in. from 0–220 ft bgs • 6.0 in. from 220–260 ft bgs • 4.38 in. from 260–517.5 ft bgs • 3.895 from 517.5–843.2 ft bgs A piezometer was installed using nominal 1-in.-O.D. stainless-steel casing. A 10-ft screen fabricated from two coupled 5-ft perforated, wire-wrapped screens with 0.010-in. slot size is located from 825.5 to 815 ft bgs. The annular space consists of the following: • Grout from 1–77 ft bgs • 3/8-in. bentonite chips from 77–265 and 495–807 ft bgs • Formation collapse from 265–495 ft bgs • Filter pack 20/40 silica sand from 807–826.5 ft bgs • 3/8-in. bentonite chips from 826.5–828.5 ft bgs • Formation slough from 826.5–843.2 ft bgs
Abandonment Methods	All surface and subsurface appurtenances will be removed from the piezometer before abandonment. The piezometer is too small in diameter to be video surveyed. The road to the site has been cleared and improved so it is accessible by a track mounted rig. Because of the small diameter, the casing cannot be perforated. The piezometer will be pressure grouted from 825.5 ft to ground surface. The casing will be cut at ground surface.
Surface Completion	A neat-cement mound with a brass marker will be installed over the piezometer at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states pertinent structures may be horizontally located with a global positioning system with an accuracy of ±0.5 ft.
Waste Disposal	A waste characterization strategy form (WCSF) will be prepared to guide disposal of any wastes generated during abandonment.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

3.2 Work Plan to Plug and Abandon BCO-1 and BCM-1

Primary Purpose	The purpose for plugging and abandoning these wells is to prevent the migration of surface water in the well to depth. This work plan summarizes the plugging and abandonment methods the Laboratory proposes for shallow groundwater wells BCO-1 and BCM-1, located on Los Alamos County property in Bayo Canyon. Abandonment will be consistent with Section X.D (Well Abandonment) of the Consent Order and NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	Well BCO-1 was drilled to a depth of 70 ft bgs and completed as a well at 68 ft bgs. The well is thought to be constructed as shown in Figure 3.2-1. Well BCM-1 was drilled to a depth of 94 ft bgs and completed as a well at 50 ft bgs. The well is thought to be constructed as shown in Figure 3.2-2.
Abandonment Methods	All surface and subsurface appurtenances will be removed from the BCO-1 and BCM-1 before abandonment. Both wells will be video and gamma logged if well conditions and diameters allow. Both wells will be pressure grouted from total depth to 20 ft bgs. Both wells will be over drilled to 20 ft bgs and the overdrilled volume filled with neat cement grout. A schematic diagram of well abandonment is shown in Figures 3.2-1 and 3.2-2.
Surface Completion	A neat-cement mound with brass marker will be installed over the wells at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states pertinent structures may be horizontally located with a global positioning system with an accuracy of ±0.5 ft.
Waste Disposal	A WCSF will be prepared to guide disposal of any wastes generated during abandonment. Cuttings from the over-drilling will be sampled and managed accordingly. Materials removed from the well will be reused or recycled if possible. Non-recyclable materials will be disposed in accordance with the WCSF.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

3.3 Work Plan to Plug and Abandon POTO-4A, B, C and POTO-5A, B

Primary Purpose	The purpose for plugging and abandoning these piezometers is to prevent migration of water and contaminants downward. This work plan summarizes the plugging and abandonment methods the Laboratory proposes for POTO-4A, B, C and POTO-5A in Potrillo Canyon in TA 36. Abandonment will be consistent with Section X.D (Well Abandonment) of the Consent Order and NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	POTO-4 and POTO-5 were drilled in 1991 as part of an infiltration investigation. The piezometers were drilled to 174 ft bgs and 77.5 ft bgs, respectively. POTO-4 contains a cluster of three 2-in.-diameter PVC pipe piezometers screened at 164 to 154 ft bgs, 89 to 79 ft bgs, and 38 to 28 ft bgs. The screened intervals have sand packs. The intervals between the screens are filled with bentonite, cuttings, and cement. POTO-5 contains a cluster of two 2-in.-diameter PVC pipe piezometers screened at 67.5 to 57.5 ft bgs and 17 to 7 ft bgs. The screened intervals have sand packs. The intervals between the screens are filled with bentonite, cuttings, and cement.
Abandonment Methods	All surface and subsurface appurtenances will be removed from the piezometers before abandonment. The piezometers will be video and gamma logged if well conditions and diameters allow. Each piezometer will be individually pressure grouted from total depth to 20 ft bgs. The clusters at POTO-4 and POTO-5 will then be overdrilled to 20 ft bgs and the overdrilled volume filled with neat cement. A schematic diagram of well abandonment is shown in Figures 3.3-1 and 3.3-2. These piezometers are in an area contaminated with uranium on the surface, and some additional precautions and training may be required.
Surface Completion	A neat-cement mound with brass marker will be installed over the piezometers at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states that pertinent structures may be horizontally located with a global positioning system with an accuracy of ±0.5 ft.
Waste Disposal	A WCSF will be prepared to guide disposal of any wastes generated during abandonment. Materials removed from the piezometer will be reused or recycled if possible. Non-recyclable materials will be disposed in accordance with the WCSF.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

3.4 Work Plan to Plug and Abandon R-4 Piezometers East and West

Primary Purpose	The purpose for plugging and abandoning these piezometers is to prevent migration of water and contaminants. This work plan summarizes the plugging and abandonment methods the Laboratory proposes for the R-4 piezometers located in Pueblo Canyon. Abandonment will be consistent with Section X.D (Well Abandonment) of the Consent Order and NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	A corehole was drilled next to well R-4 in 2004 with rotary equipment using mud as a drilling fluid. The corehole is 231 ft deep. Two temporary piezometers (designated west and east) were installed in the corehole. Each piezometer consists of flush-threaded connecting joints with O-rings of 2-in.-O.D., schedule 40 PVC well casing and a 10-ft section of schedule 40 PVC 0.01-in. slotted screen. The west and east piezometers were screened from 125 to 115 ft bgs and from 231 to 221 ft bgs, respectively. The east piezometer has a filter pack of 10/20 sand from 231 to 214 ft bgs. A bentonite seal, hydrated 3/8-in. bentonite chips, was placed from 214 to 128 ft bgs. The west piezometer has a filter pack of 10/20 sand from 128 to 106.5 ft bgs. A bentonite seal, hydrated 3/8-in. bentonite chips, was placed from 106.5 to ground surface (Figure 3.4-1).
Abandonment Methods	All surface and subsurface appurtenances will be removed from the piezometers before abandonment. The piezometers will be video and gamma logged if well conditions and diameters allow. Each piezometer will be individually pressure grouted from total depth to 20 ft bgs. The cluster will then be overdrilled to 20 ft bgs and the overdrilled volume filled with neat cement. A schematic diagram of piezometer abandonment is shown in Figure 3.4-1.
Surface Completion	A neat-cement mound with brass marker will be installed over the piezometers at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states that pertinent structures may be horizontally located with a global positioning system with an accuracy of ±0.5 ft.
Waste Disposal	A WCSF will be prepared to guide disposal of any wastes generated during abandonment. Materials removed from the piezometers will be reused or recycled if possible. Non-recyclable materials will be disposed in accordance with the WCSF.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

3.5 Work Plan to Plug and Abandon TA-16 Boreholes

Primary Purpose	The purpose for plugging and abandoning these boreholes is to prevent the migration of water and contaminants. This work plan summarizes the plugging and abandonment methods the Laboratory proposes for 16-P-0 and 16-P-12A, located on the east side of the burning grounds at TA-16. Abandonment will be consistent with Section X.D (Well Abandonment) of the Consent Order and NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	These boreholes were drilled as part of a moisture content study of the Bandelier Tuff in the area of MDA P in 1987 (Brown et al. 1988, 006871). Borehole 16-P-0 is thought to be 135 ft deep, and 16-P-12A is thought to be 200 ft deep. Both boreholes appear to be 4 in. in diameter. Both boreholes are dry.
Abandonment Methods	All surface and subsurface appurtenances will be removed from the boreholes before abandonment. The boreholes will be video and gamma logged if well conditions and diameters allow. Both wells will be pressure grouted from total depth to 20 ft bgs. Both boreholes will be over drilled to 20 ft bgs and the overdrilled volume filled with neat cement grout. Schematic diagrams of borehole abandonment are shown in Figures 3.5-1 and 3.5-2.
Surface Completion	A neat-cement mound with brass marker will be installed over the boreholes at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states that pertinent structures may be horizontally located with a global positioning system with an accuracy of ±0.5 ft.
Waste Disposal	A WCSF will be prepared to guide disposal of any wastes generated during abandonment. Materials removed from the boreholes will be reused or recycled if possible. Non-recyclable materials will be disposed in accordance with the WCSF.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

3.6 Work Plan to Plug and Abandon TA-33 Boreholes

Primary Purpose	The purpose for plugging and abandoning these boreholes is to prevent the migration of water and contaminants. This work plan summarizes the plugging and abandonment methods the Laboratory proposes for 33-01230, 33-01231, and 33-01232 in TA-33. Abandonment will be consistent with Section X.D (Well Abandonment) of the Consent Order and NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	These boreholes were drilled in 1993 as part of an investigation of MDA K at TA-33. The objective of the investigation was to verify the presence of tritium, determine the concentration and extent of tritium contamination, determine if other contaminants were present, and determine if perched water existed in the tuff. Tritium was detected throughout the site. No volatile organic compounds or elevated levels of radioactivity (other than tritium) were detected for any samples taken at MDA K. The three boreholes were drilled to a depth of 30 ft bgs with a hollow-stem auger. The boreholes were then cased with 5-in.–inside diameter steel pipe that was cemented in place. The remainder of each borehole was then drilled open hole using an air-rotary rig to the specified depths. Borehole 33-01230 is 235 ft deep and was dry at the time of drilling. Borehole 33-01231 is 315 ft deep and was dry at the time of drilling. Borehole 33-01232 is 246 ft deep and was also dry at the time of drilling.
Abandonment Methods	All surface and subsurface appurtenances will be removed from the boreholes before abandonment. All removed items will be scanned for tritium before they are removed from the site. Given the potential for the presence of tritium contamination in the boreholes, they will not be video and gamma surveyed. The boreholes will be pressure grouted from total depth to the surface. A schematic diagram of borehole abandonment is shown in Figure 3.6-1. These boreholes are located in an area contaminated with tritium and so may require some additional training and precautions.
Surface Completion	A neat-cement mound with brass marker will be installed over the boreholes at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states that pertinent structures may be horizontally located with a global positioning system with an accuracy of ±0.5 ft.
Waste Disposal	A WCSF will be prepared to guide disposal of any wastes generated during abandonment. Materials removed from the boreholes will be reused or recycled if possible. Non-recyclable materials will be disposed in accordance with the WCSF.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

3.7 Work Plan to Plug and Abandon TA-49 Boreholes

Primary Purpose	The purpose for plugging and abandoning these boreholes is to prevent the migration of water and contaminants. This work plan summarizes the plugging and abandonment methods the Laboratory proposes for 49-2-150-1 (also known as 49-2906) and 49-2-150-2 (also known as 49-2907), located inside the nuclear environmental site on Frijoles Mesa in TA-49. Borehole abandonment will be consistent with Section X.D (Well Abandonment) of the Consent Order and NMOSE regulations. A plugging plan will be submitted to NMOSE before abandonment.
Construction	Boreholes 49-2-150-1 and 49-2-150-2 were drilled in 1994 as part of an investigation at Solid Waste Management Units 49-001(b, c, d, and g). They are 150 ft deep and open hole with a PVC surface casing protruding through the biobarrier installed in 1998. The 1998 RFI work plan for placement of the biobarrier at the site states the boreholes have adequate seals and will be left in place during the placement of the biobarrier over the site, to be used for later moisture monitoring (LANL 1998, 059166). Borehole 49-2-150-2 was located during a field visit in 2012. Borehole 49-2-150-1 has not yet been located.
Abandonment Methods	Boreholes 49-2-150-1 and 49-2-150-2 will be abandoned by cutting the 2-in. PVC casing as flush as practicable with ground surface and filling the borehole with neat cement from the bottom at 150 ft bgs to surface. A schematic diagram of well abandonment is shown in Figure 3.7-1.
Surface Completion	A neat-cement mound with brass marker will be installed over each borehole at ground surface. The marker will be surveyed in accordance with Section IX.B.2.f of the Consent Order, which states that pertinent structures may be horizontally located with a global positioning system with an accuracy of ±0.5 ft.
Waste Disposal	A WCSF will be prepared to guide disposal of any wastes generated during abandonment. Materials removed from the boreholes will be reused or recycled if possible. Non-recyclable materials will be disposed in accordance with the WCSF.
Summary Report	A report will be prepared detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in the report.

4.0 REFERENCES

The following list includes all documents cited in this document. Parenthetical information following each reference provides the author(s), publication date, and ER ID or ESH ID. This information is also included in text citations. ER IDs were assigned by the Environmental Programs Directorate's Records Processing Facility (IDs through 599999), and ESH IDs 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.

Brown, F.H., W.D. Purtymun, A.K. Stoker, and A. Barr, February 1988. "Site Geology and Hydrology of Technical Area 16, Area P," Los Alamos National Laboratory report LA-11209-MS, Los Alamos, New Mexico. (Brown et al. 1988, 006871)

Kleinfelder, April 2006. "Final I Wells Completion Report, 2004-05 Mortandad Canyon Drilling Program," report prepared for Los Alamos National Laboratory, Project No. 49436, Albuquerque, New Mexico. (Kleinfelder 2006, 092494)

Koch, R.J., and S. Schmeer, March 2010. "Groundwater Level Status Report for 2009, Los Alamos National Laboratory," Los Alamos National Laboratory report LA-14416-PR, Los Alamos, New Mexico. (Koch and Schmeer 2010, 108926)

LANL (Los Alamos National Laboratory), September 29, 1995. "RFI Report for MDA K, PRSs 33-002(a,b,c,d,e)," Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 1995, 050113)

LANL (Los Alamos National Laboratory), June 1998. "Stabilization Plan for Installing Best Management Practices at Potential Release Sites 49-001 (b, c, d, and g)," Los Alamos National Laboratory document LA-UR-98-1534, Los Alamos, New Mexico. (LANL 1998, 059166)

Purtymun, W.D., January 1995. "Geologic and Hydrologic Records of Observation Wells, Test Holes, Test Wells, Supply Wells, Springs, and Surface Water Stations in the Los Alamos Area," Los Alamos National Laboratory report LA-12883-MS, Los Alamos, New Mexico. (Purtymun 1995, 045344)

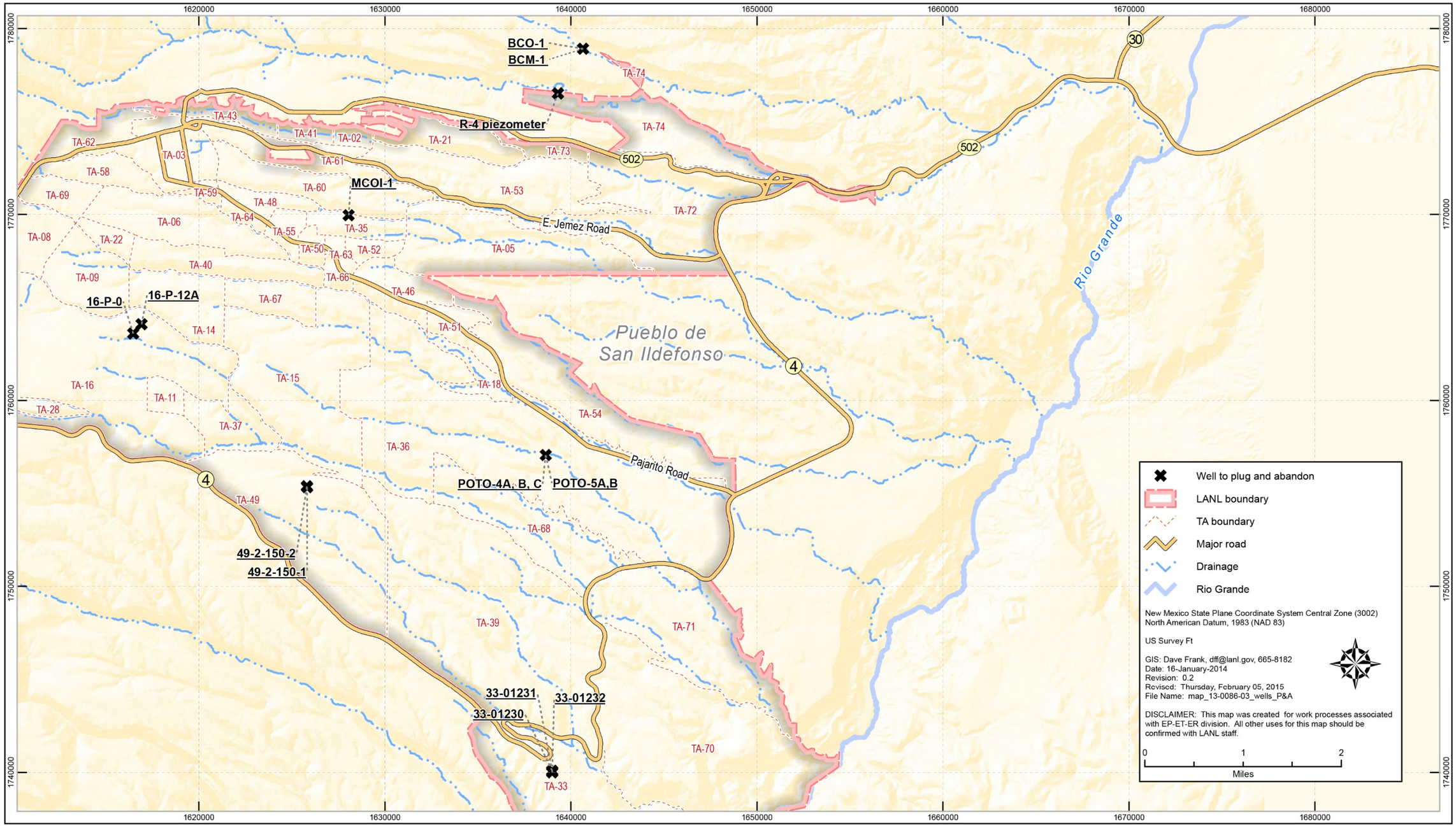

Figure 2.0-1 Locations of wells and boreholes to be abandoned

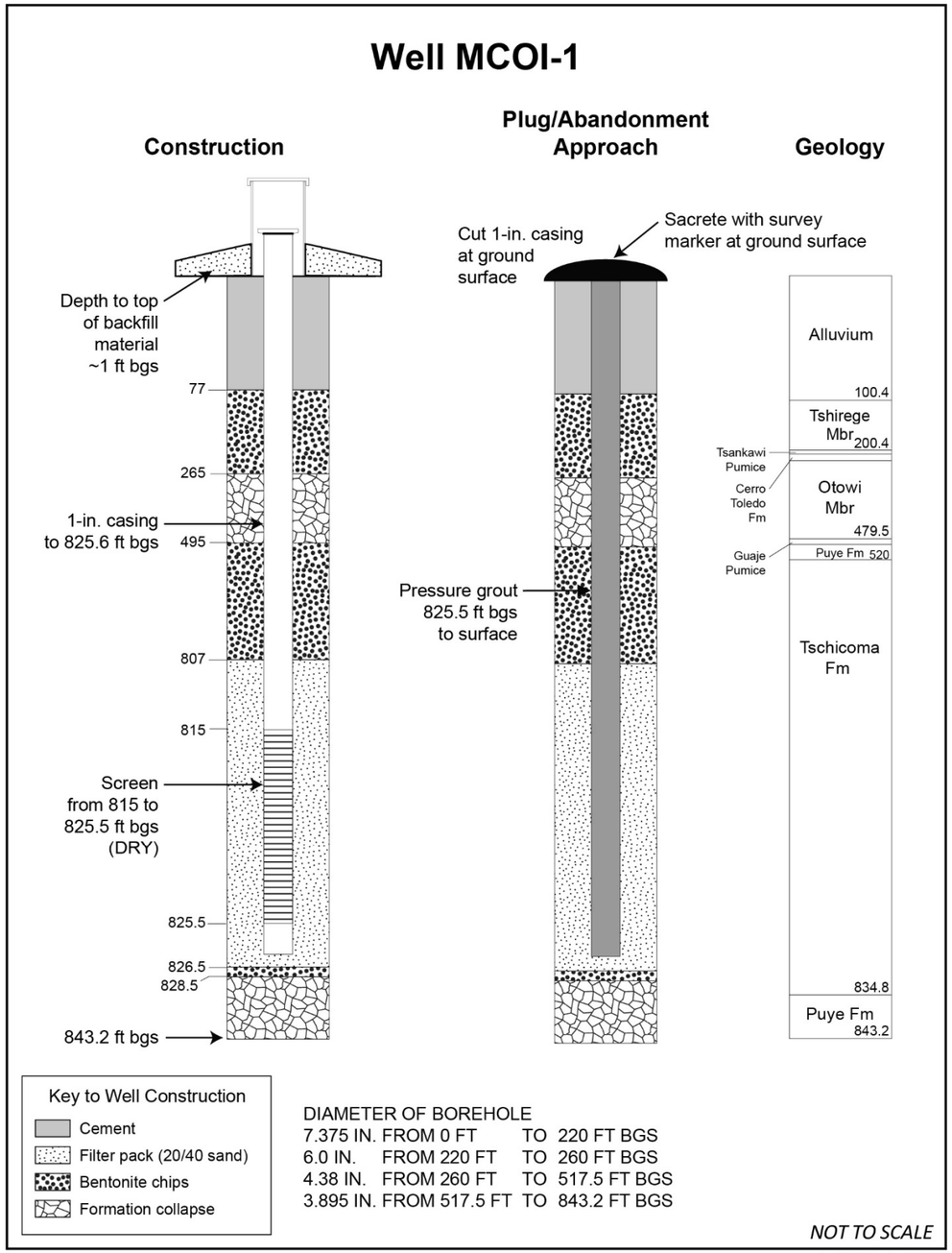

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Figure 3.1-1 MCOI-1 abandonment schematic

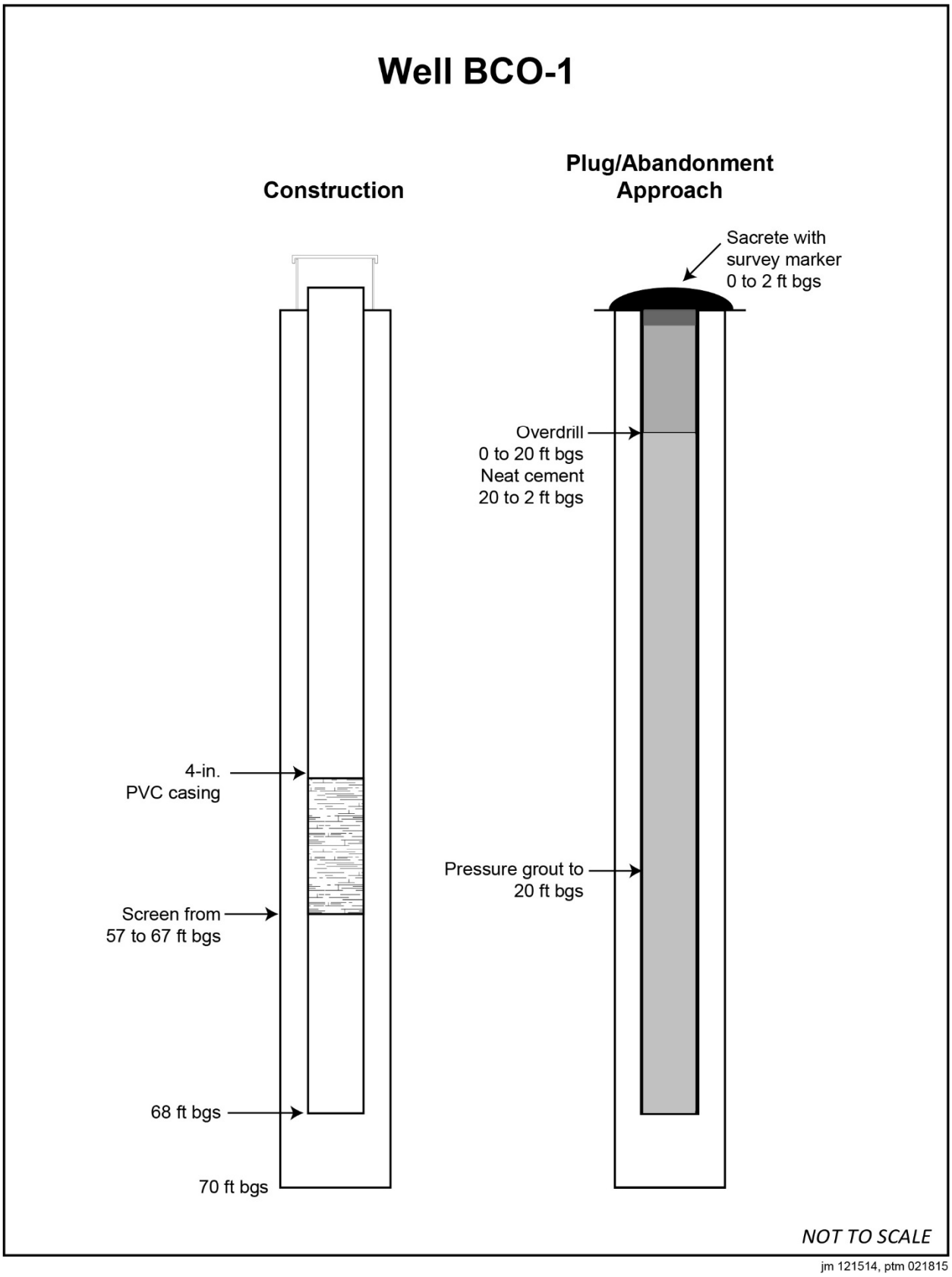

Figure 3.2-1 BCO-1 abandonment schematic

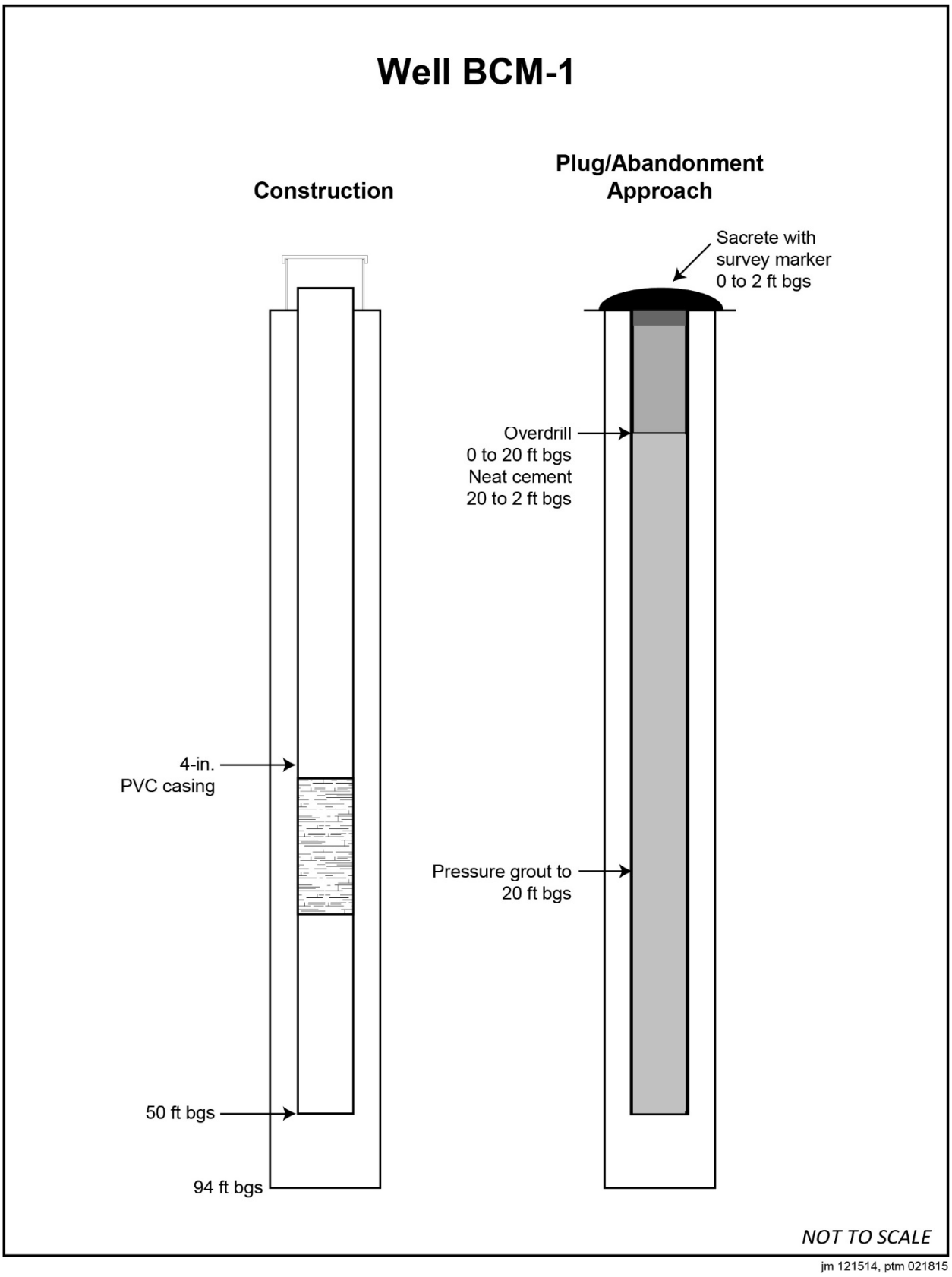

Figure 3.2-2 BCM-1 abandonment schematic

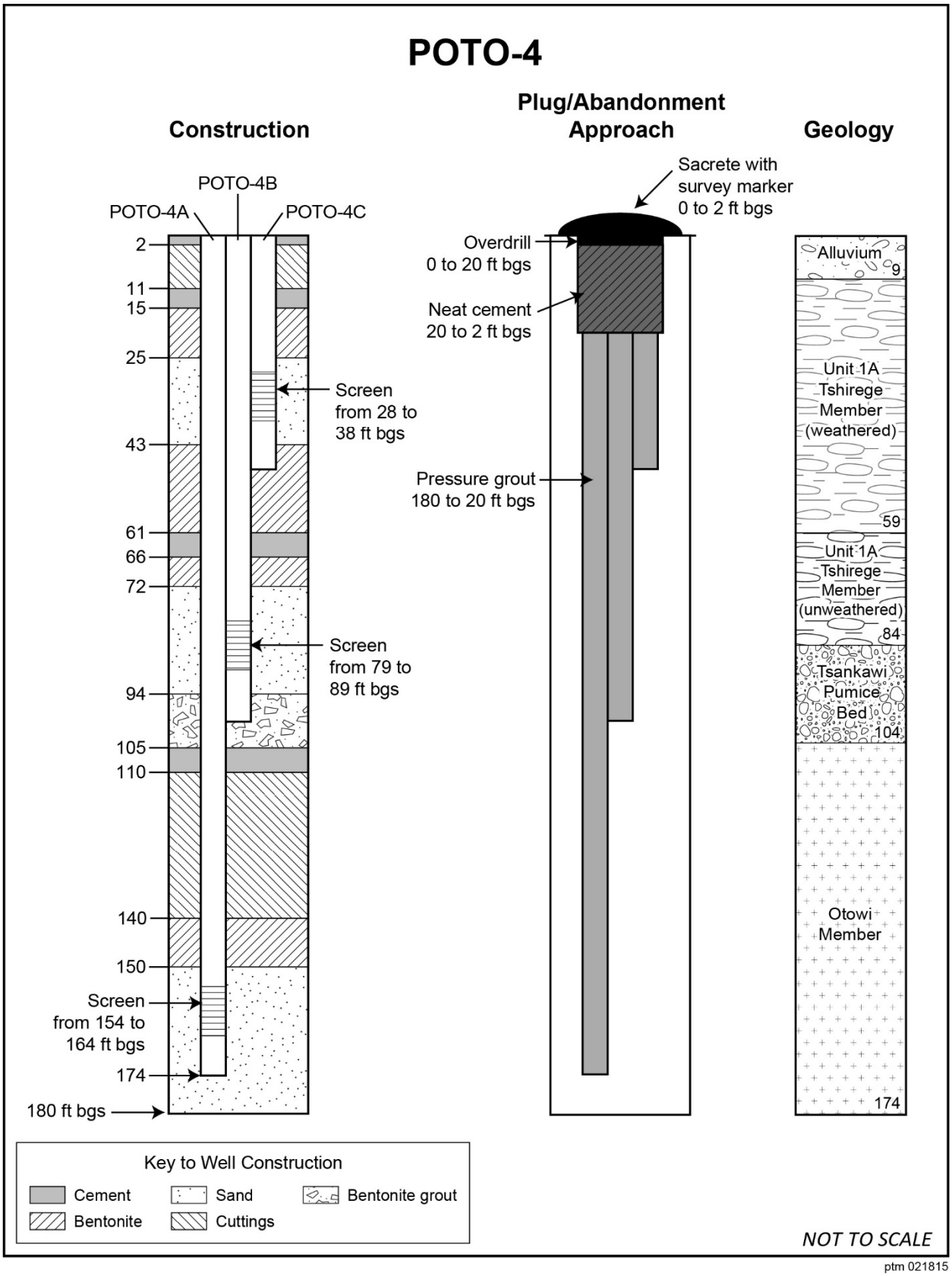

Figure 3.3-1 POTO-4 abandonment schematic

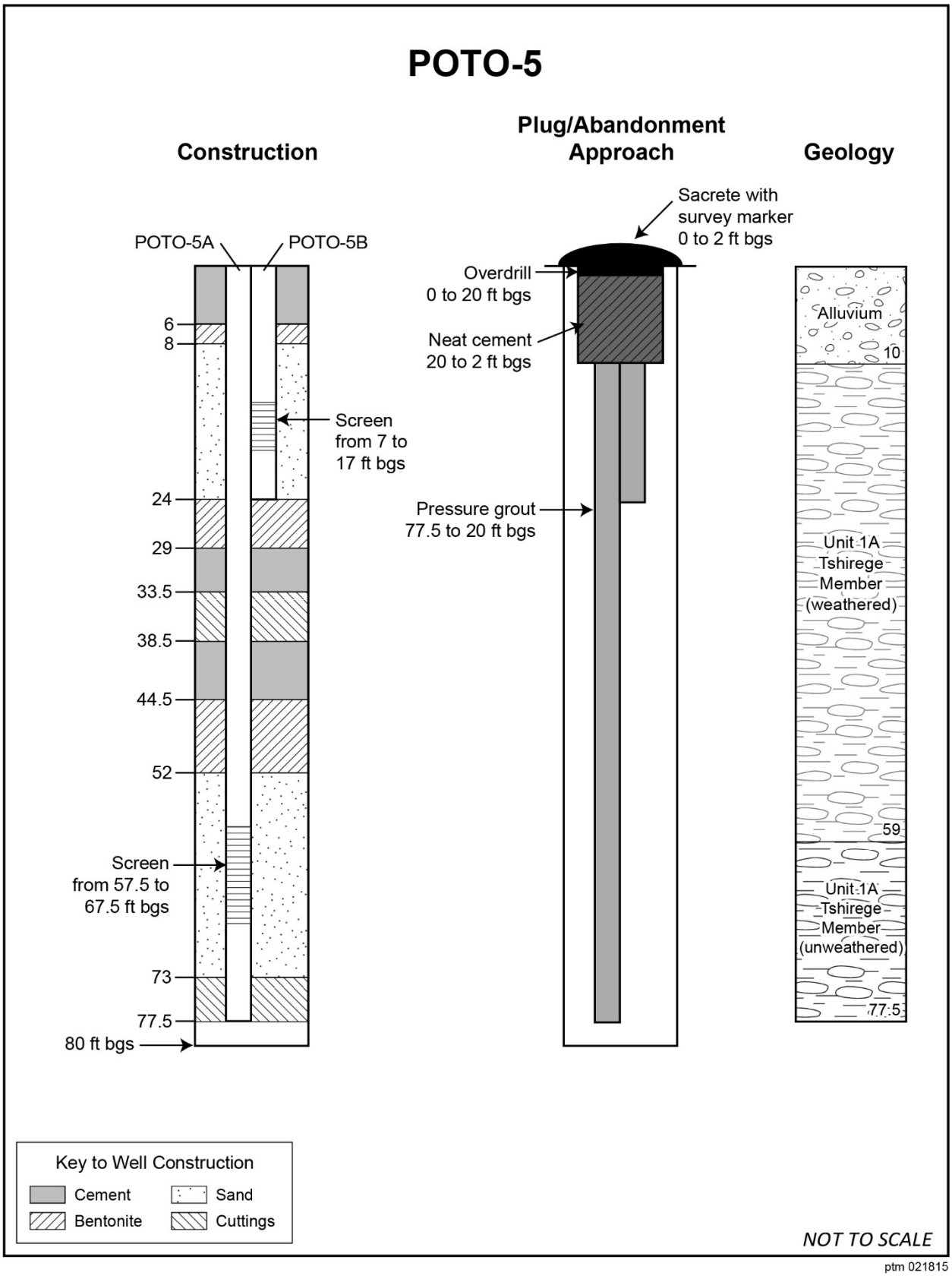

Figure 3.3-2 POTO-5 abandonment schematic

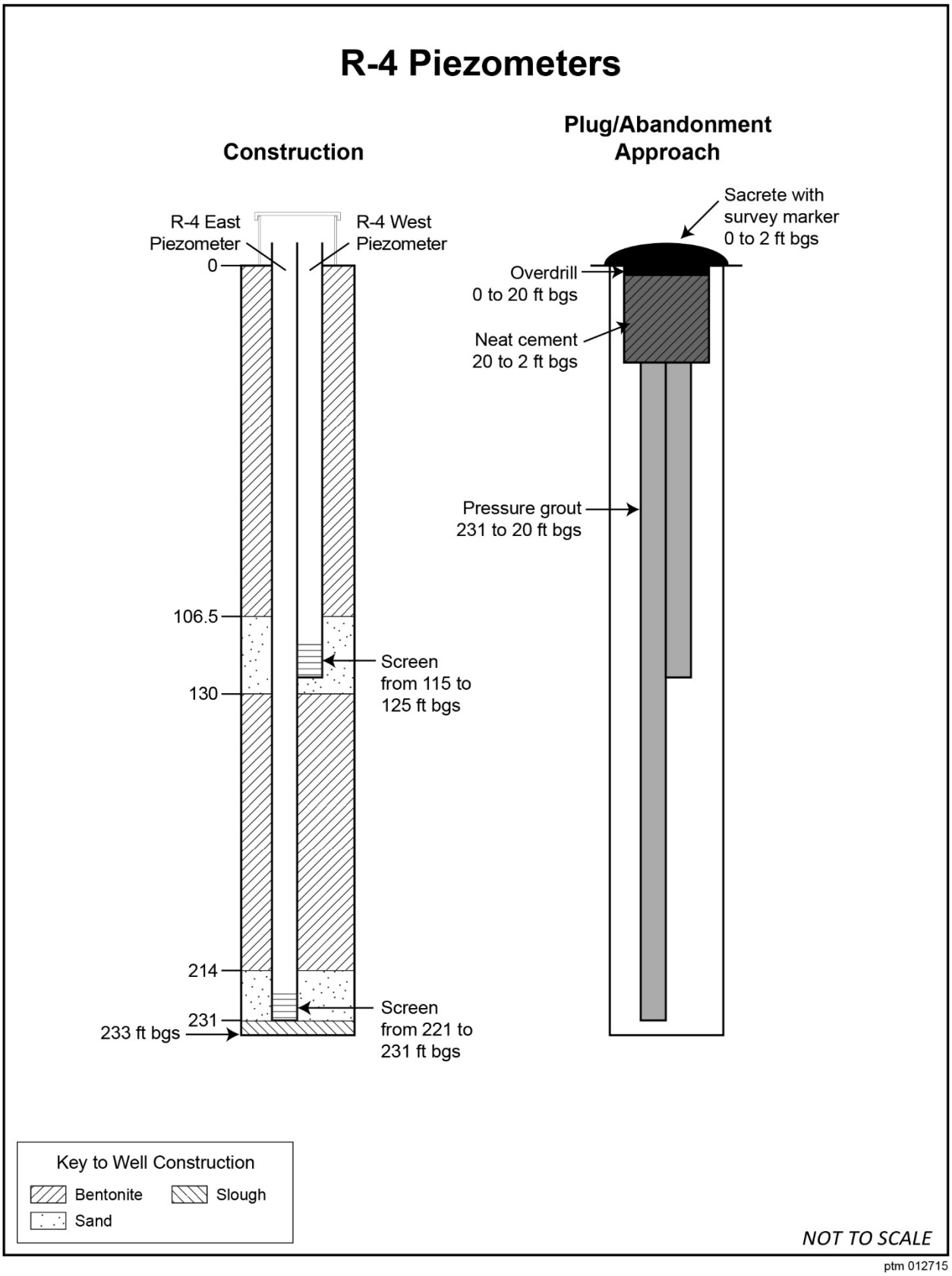

Figure 3.4-1 R-4 piezometer abandonment schematics

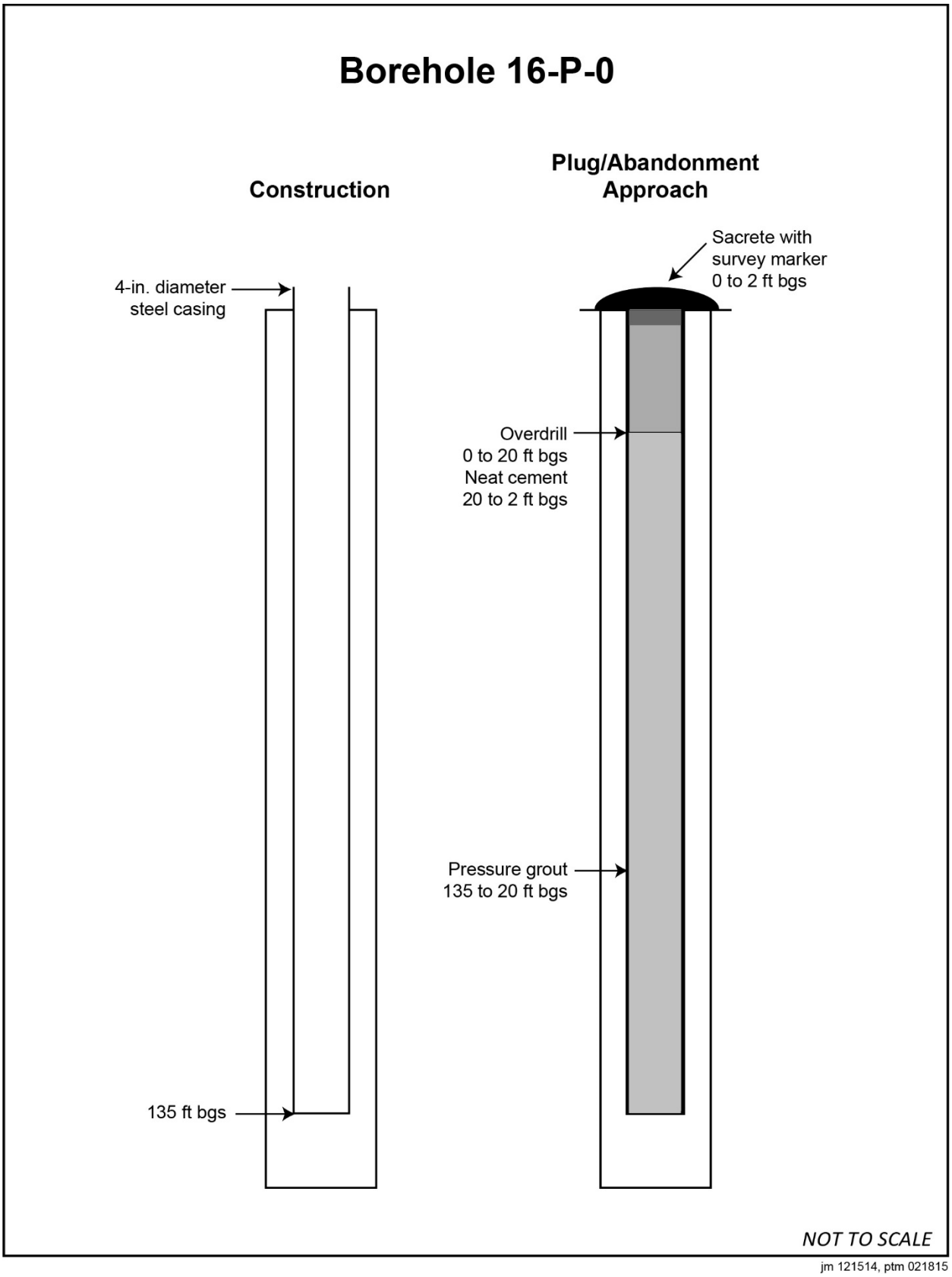

Figure 3.5-1 16-P-0 abandonment schematic

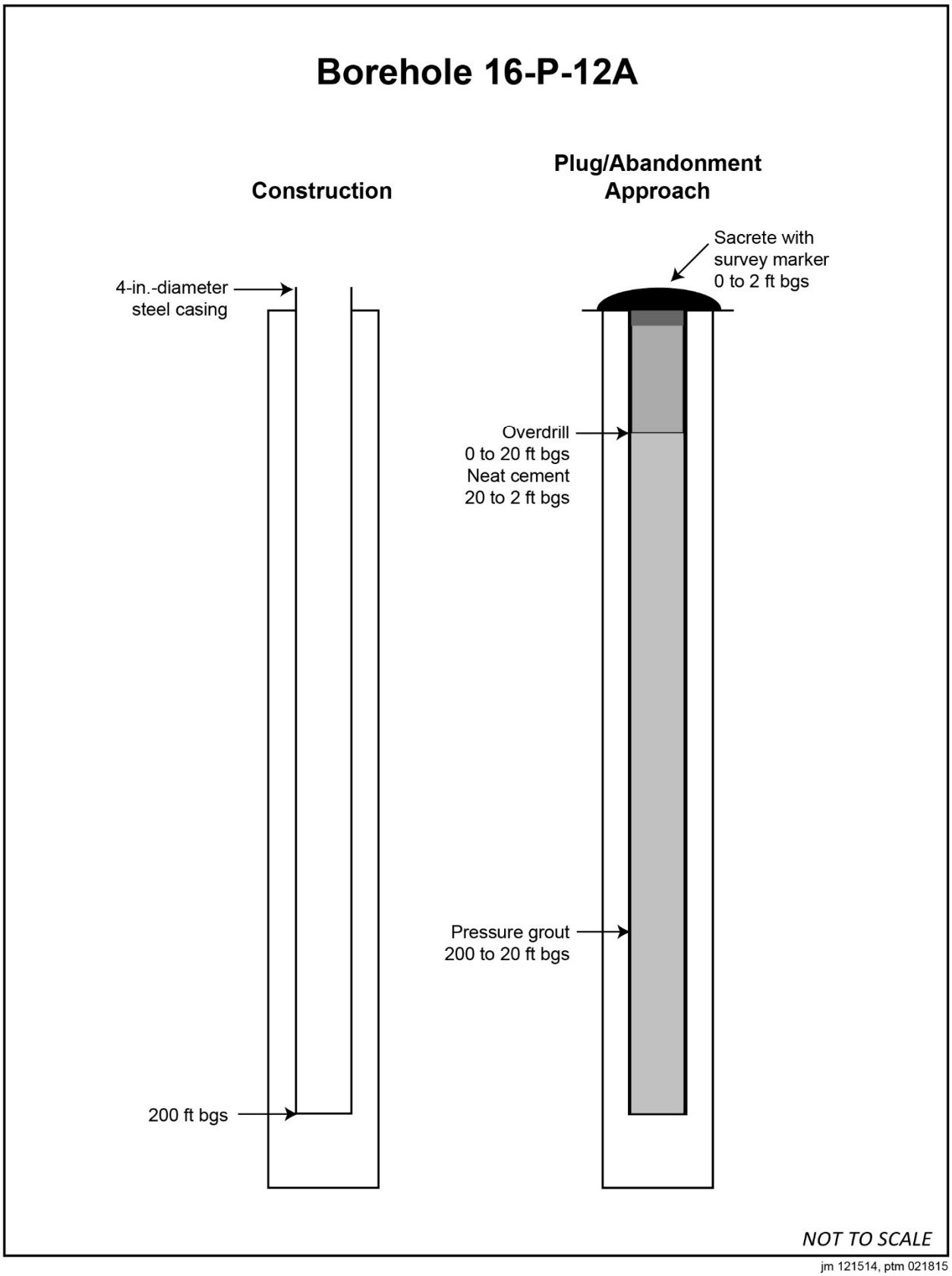

Figure 3.5-2 16-P-12A abandonment schematic

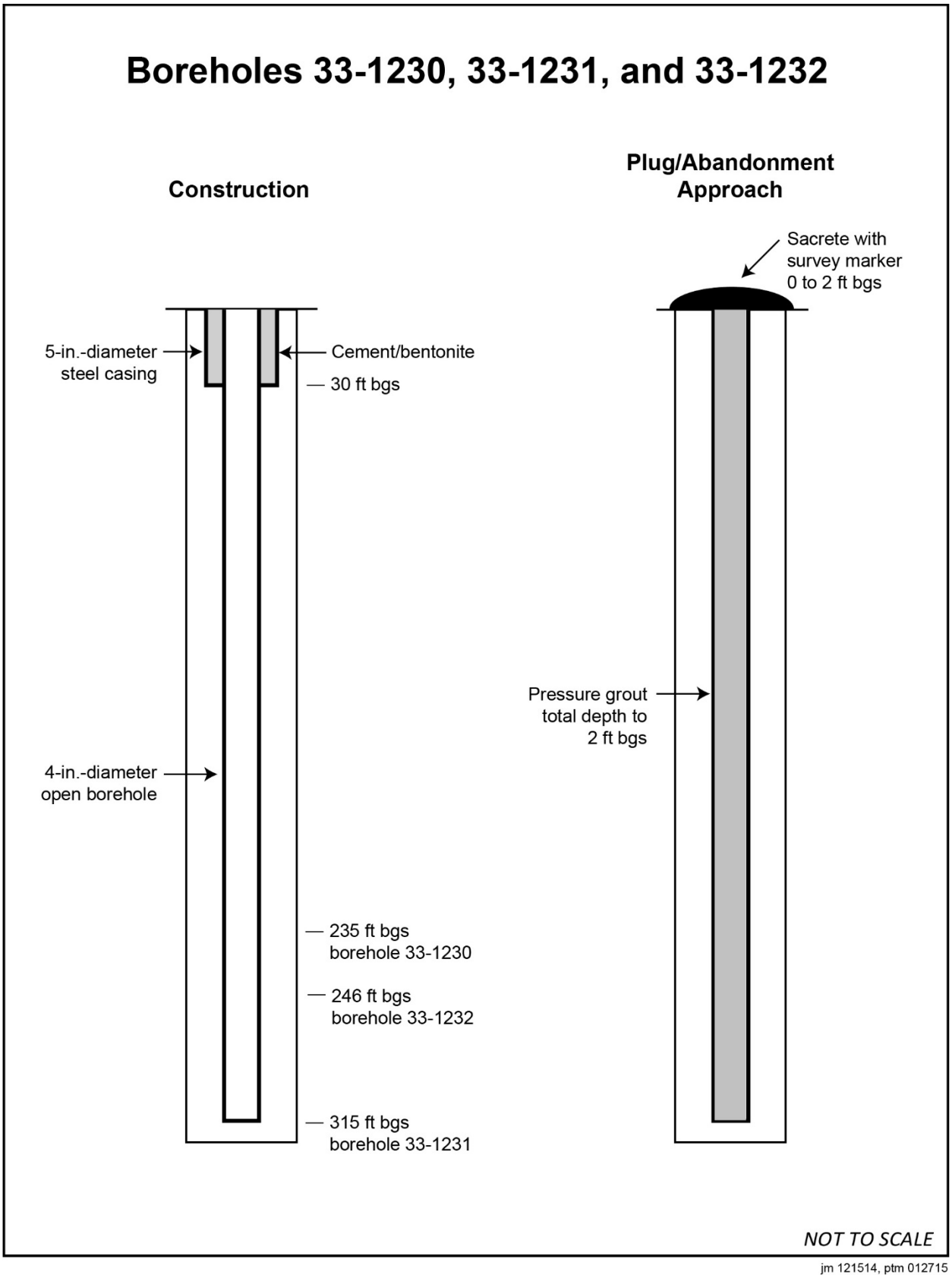

Figure 3.6-1 TA-33 abandonment schematics

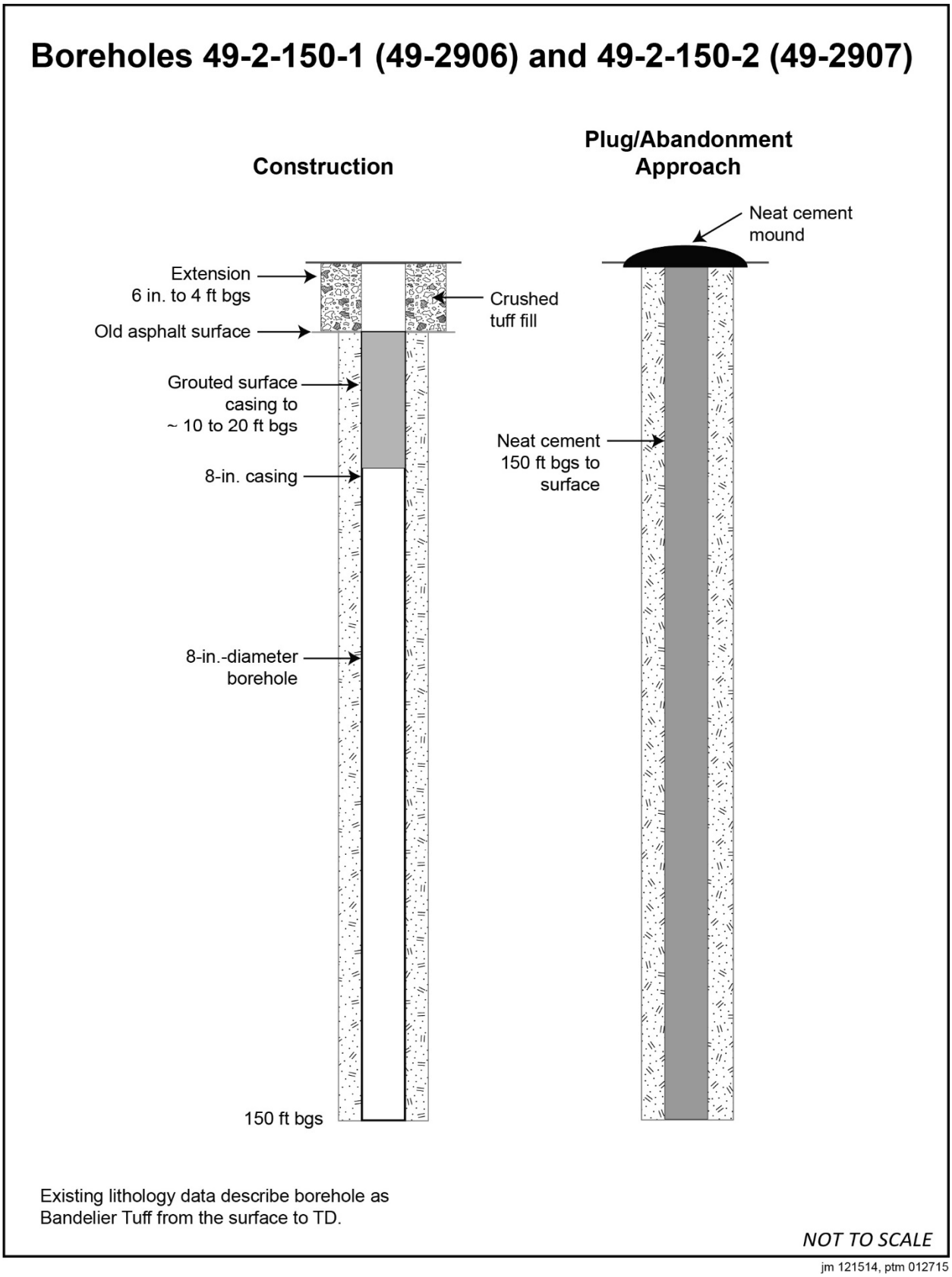

Figure 3.7-1 TA-49 abandonment schematics